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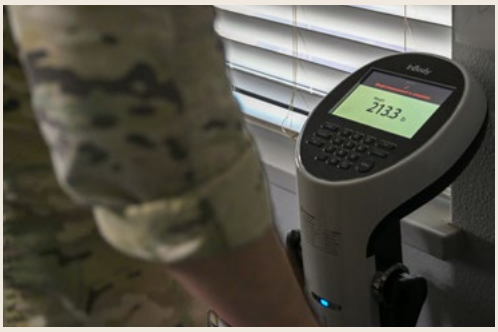

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Ivermectin Prescription Fill Rates Among U.S. Military Members During the Coronavirus Disease 2019 (COVID-19) Pandemic

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This report describes ivermectin prescription fill rates among U.S. active component service members (ACSM) over time during the early phases of the COVID-19 pandemic. Information about the unsubstantiated benefits of ivermectin for coronavirus 2019 (COVID-19) prevention and treatment was widely available online early in the COVID-19 pandemic. Ivermectin prescription fill rates increased among ACSM during periods of Alpha and Delta coronavirus variant predominance, but not during the predominance of the Omicron variant. At the peak of the fill rate curve, in August 2021, rates were higher among men compared to women, older compared to younger age groups, senior officers compared to junior officers, senior enlisted compared to junior enlisted service members, and those with a bachelor's or advanced degree compared to those without a bachelor's degree. Ivermectin prescriptions were more likely to have been filled at a retail pharmacy than at a military hospital or clinic. During the COVID-19 pandemic fill rates for ivermectin prescriptions among ACSM increased, including those without a qualifying diagnosis. Rates peaked in August 2021 but subsequently declined. The decrease in ivermectin fill rates was coincident with vigorous efforts to correct previous misinformation and implement pre-authorization requirements for prescriptions. Research on the impact of unproven online claims about clinical and public health interventions has potential to curtail future unnecessary and potentially harmful treatments.

What are the new findings?

Ivermectin prescription fill rates increased among active component service members early in the COVID-19 pandemic when misinformation about the effectiveness of ivermectin for prevention and treatment of COVID-19 was widespread.

What is the impact on readiness and force health protection?

This study contributes to the understanding of ivermectin prescription uptake among U.S. military members during the early phases of the COVID-19 pandemic, a period of abundant online information purporting its benefit but insufficient evidence to support its use for COVID-19 prevention and treatment. This study supports the call by the U.S. Surgeon General to expand research that deepens our understanding of health misinformation, who is most susceptible, and which strategies are effective in addressing it.

Ivermectin, an anti-parasitic drug, was identified as a potential treatment for coronavirus disease 2019 (COVID-19) early in the pandemic. Numerous non-peer-reviewed publications touted the benefit of ivermectin, and it was heavily promoted online.[1] Many of these studies were subsequently found to have methodological flaws, and some were withdrawn because of data fraud—but not before their widespread circulation. A large study that purported ivermectin mortality reduction of up to 99% was viewed online more than 150,000 times, cited more than 30 times, and was included in several meta-analyses before it was retracted.[2-4]

Despite multiple studies that found insufficient evidence to support ivermectin use for COVID-19 prevention or treatment,[5-8] and alerts discouraging its use,[9, 10] national ivermectin prescription monitoring showed that retail dispensing of ivermectin increased significantly during the COVID-19 pandemic.[11-12] Increased calls to U.S. poison control centers for adverse ivermectin reactions were also reported. On August 26, 2021, the U.S. Centers for Disease Control and Prevention (CDC) issued a Health Alert Network notice, "Rapid Increase in Ivermectin Prescriptions and Reports of Severe Illness Associated with Use of Products Containing Ivermectin to Prevent or Treat COVID-19," that indicated a 24-fold increase in ivermectin dispensing from U.S. outpatient retail pharmacies compared to the pre-pandemic baseline. The CDC notice reminded prescribers that the U.S. Food and Drug Administration (FDA) did not approve ivermectin for COVID-19 prevention or treatment.[13] The following week, the American Medical Association, American Pharmacists Association, and American Society of Health-System Pharmacists published a statement strongly opposing ivermectin ordering, prescribing, and dispensing to prevent or treat COVID-19 outside a clinical trial. Many medical facilities and organizations

including the U.S. Military Health System (MHS) instituted pre-authorization requirements for ivermectin prescriptions soon thereafter. This measure reinforced the Department of Defense (DOD)'s March 2021 COVID-19 Practice Management Guide recommending against use of ivermectin for treatment of COVID-19, except in a clinical trial.[14]

Misinformation has various definitions in the medical literature.[15] This article uses the definition proposed by Johns Hopkins University: Medical misinformation is misleading information that is contrary to the best available evidence.[16] This definition recognizes that what qualifies as misinformation may change over time as new evidence emerges.

Medical misinformation is not a new phenomenon, but it has gained added significance since the dawn of the internet, which allows the spread of misinformation at unprecedented speed, and on an unparalleled scale.[17] The U.S. Surgeon General considers health misinformation a serious threat to public health due to its ability to cause confusion, promulgate mistrust, harm people's health, and undermine public health efforts.[18] The DOD warns that adversaries are becoming more assertive in use of disinformation, which is defined as false or misleading information shared with malicious intent, in their attempts to sow distrust and disrupt world order.[19] These efforts target all sectors of government, including public health.[20] Examples include efforts by the former Soviet Union to attribute the HIV pandemic to U.S. government efforts to develop biological weapons,[21] and Russian internet troll activity between 2014 and 2017 that "weaponized" content about vaccines to fuel political and social discord.[22] During the COVID-19 pandemic, both Russia and China sponsored conspiracy narratives that included endorsement of ivermectin as an effective treatment for COVID-19, but which asserted that this was withheld from the public by a "Big Pharma cabal."[23]

The MHS serves approximately 9.6 million beneficiaries including 1.4 million active duty service members.[24] In addition to promoting the health of its beneficiaries, the mission of the MHS is to ensure service members are prepared to defend the nation, and that uniformed medical personnel are trained to provide medical care in support of military operations.

The purpose of this study was to determine whether ivermectin prescriptions increased among active component service members (ACSM) during the COVID-19 pandemic, whether fill rates varied by subpopulation, and how fill rates changed over time as information that discouraged ivermectin use for COVID-19 prevention or treatment increased. This study supports the call by the U.S. Surgeon General to expand research that deepens our understanding of health misinformation, who is most susceptible, and which strategies are effective in addressing it.[18]

Methods

This study was determined to qualify as Not Research by the DHA Director of the Office of Research Protections on February 7, 2022. The surveillance period was January 1, 2017 to March 31, 2022. The study population included all ACSM in the Army, Navy, Air Force, and Marine Corps who served at least 1 day on active duty during the surveillance period. All data used in this analysis were derived from records maintained in the Defense Medical Surveillance System (DMSS). These records document both ambulatory encounters and hospitalizations of ACSM of the U.S. Armed Forces in fixed military and civilian (if reimbursed through MHS) treatment facilities. In addition, DMSS contains data from the Pharmacy Data Transaction Service (PDTS), which includes dispensed outpatient prescriptions for service members at military hospitals and clinics, as well as civilian purchased care.

To identify dispensed outpatient ivermectin prescriptions, records where the drug name included "IVERMECTIN" or "STROMECTOL" were identified in DMSS. Only prescriptions for oral tablets were included; ointments and creams were excluded. Rates of dispensed oral ivermectin prescriptions were calculated as the number of prescriptions per 100,000 person-years (p-years) and results were stratified by demographic characteristics.

To determine the rate of ivermectin prescriptions among those without an ivermectin-qualifying diagnosis (e.g., helminthiasis, lice, scabies), inpatient and outpatient records that contained a diagnosis for any International Classification of Diseases, 10th Revision (ICD-10) code listed in **Table 1**, in any diagnostic position, were extracted from DMSS. Service members were considered to have an ivermectin-qualifying diagnosis if the diagnosis occurred within 90 days preceding the ivermectin prescription. A service member was considered to have a prior diagnosis of COVID-19 if a medical record of ICD-10 code U07.1 in any diagnostic position during an inpatient or outpatient encounter, a positive PCR or antigen test, or a reportable medical event (RME)

TABLE 1. Ivermectin-qualifying Diagnoses

Diagnosis	ICD-10-CM code
Onchocerciasis	B73*
Strongyloidiasis	B78*
Ascariasis	B77*
Gnathostomiasis	B83.1
Hookworm-related cutaneous larva migrans	B76.8, B76.9
Lice (pediculosis and phthiriasis)	B85*
Mansonelliasis	B74.4
Scabies	B86
Trichuriasis	B79

Abbreviation: ICD-10-CM, International Classification of Diseases, 10th Revision, Clinical Modification.

*Indicates all subsequent digits/characters are included.

for COVID-19 were documented on or before the date of the ivermectin prescription. Data from laboratory test results and RMEs were derived from the Armed Forces Health Surveillance Division (AFHSD) "master positive list" of COVID-19 cases, which consolidates COVID-19 cases based on diagnosis, laboratory results, and RMEs, and has been used by AFHSD to track COVID-19 cases among MHS beneficiaries since the beginning of the COVID-19 pandemic.

Results

The annual rate of dispensed prescriptions was stable from calendar years 2017 through 2020, at 25.6 prescriptions per 100,000 p-years in 2017, 22.7 in 2018, 27.2 in 2019, and 22.7 in 2020 **(data not shown)**. In 2021 the annual prescription rate more than doubled: to 52.8 per 100,000 p-years. Ivermectin prescription rates peaked in August 2021, during the period of Delta variant predominance, at 185.3 per 100,000 p-years, then declined through the end of 2021 **(Figure 1)**.

A large peak in ivermectin prescriptions between January 2022 (59.9 per 100,000 p-yrs) and February 2022 (496.4 per 100,000 p-yrs) was driven by Navy service members receiving prescriptions at Naval Training Center (NTC) Great Lakes. Communication with the NTC Great Lakes Public Health Emergency Officer revealed a scabies outbreak among approximately 500 recruits during this period, and the entire recruit population had been prophylactically treated with oral ivermectin. These data are presented in the dotted line in **Figure 1**. Prescriptions filled at NTC Great Lakes during January and February 2022 were excluded from further analysis due to their identified outbreak-related purpose.

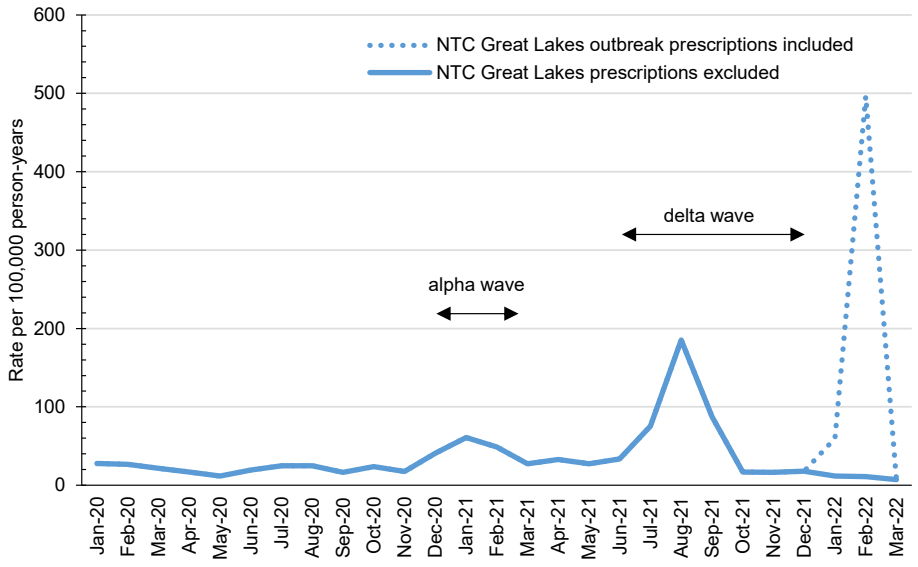
After the NTC Great Lakes prescriptions were removed, a total of 2,018 oral ivermectin prescriptions were dispensed among 1,656 individuals between January 1, 2017 and March 31, 2022 **(Table 2)**. The prescription rate declined sharply after August 2021 and remained low and steady from October 2021 until the end of the study period. A total of 1,400 individuals had only 1 oral ivermectin prescription between January 2017 and March 2022, while 256 individuals had 2 or more **(data not shown)**.

Between January 2017 and March 2022, most prescriptions for ivermectin were filled at military hospitals or clinics, compared to mail order, retail, in-theater, and Veterans Administration pharmacies. Prescription rates from 2017 until March 2022 were similar between men and women **(Table 2)**. Prescription rates increased steadily with increasing age, from 12.8 per 100,000 p-years among service members less than 20 years old, to 66.8 per 100,000 p-years among service members 45 years and older. Rates were slightly higher in the Air Force, followed by the Navy, Army, and Marine Corps. Rates were highest among non-Hispanic White Service members and lowest among non-Hispanic Black Service members. Rates were also higher among senior officers compared to senior enlisted, junior officers, and junior enlisted service members. Compared to those in other military occupations, rates were highest for health care personnel, followed by pilot/air crew. Rates were highest in the South and Midwest compared to other regions of the U.S.

To compare patterns in ivermectin prescription rates prior to the COVID-19 pandemic with rate patterns at the height of the Delta wave, rates from January 2017 to December 2019 and August 2021 were examined separately. Several differences were noted **(Table 2)**. In August 2021, most prescriptions were filled at a retail pharmacy (165.1 per 100,000 p-yrs compared to 17.6 per 100,000 p-yrs filled at a military hospital or clinic). Between January 2017 and December 2019 the prescription fill rate was 8.4 per 100,000 p-years at retail pharmacies compared to 16.1 per 100,000 p-years at military hospitals or clinics. In August 2021, men had a higher ivermectin prescription fill rate (197.6 per 100,000 p-yrs) compared to women (126.6 per 100,000 p-yrs), whereas rates were similar between men and women, 25.1 and 25.6 per 100,000 p-years, respectively, from January 2017 to December 2019.

In both August 2021 and the period preceding 2020, the ivermectin prescription rate increased with increasing age, but the pattern was more marked in August 2021. The August 2021 rate among those older than 45 years was 640.7 per 100,000 p-years—the rate among those younger than 20 years was 36.2 per 100,000 p-years. During January 2017 through December 2019 period, the rate among those older than 45 years was 49.3 per 100,000 p-years, while the rate among those younger than 20 years was 13.5 per 100,000 p-years.

FIGURE 1. Monthly Rate of Dispensed Outpatient Oral Ivermectin Prescriptions, Active Component, U.S. Armed Forces, January 2020–March 2022



Warrant officers had much higher prescription fill rates than senior or junior officers in August 2021 (685.7 per 100,000 p-yrs among warrant officers vs. 83.7 per 100-000 p-yrs in junior officers, and 225.6 per 100-000 p-yrs among senior officers). Senior enlisted ACSM had a higher rate from January 2017 through December 2019 (25.4 per 100,000 p-yrs), while warrant officers had the lowest fill rate (16.4 per 100,000 p-yrs). Among those for whom educational attainment is known, ivermectin prescription fill rates increased with higher educational levels in both August 2021 and the January 2017 through December 2019 period: 300.5 per 100-000 p-years among those with a bachelor's degree or an advanced degree compared to 127.3 per 100-000 p-years among those with a high school diploma or less in August 2021; 37.1 per 100-000 p-years among those with a bachelor's degree or an advanced degree compared to 19.7 per 100-000 p-years among those with a high school diploma or less in the prior period.

Table 2 includes additional information related to comparative rates based on race, service affiliation, military occupational specialty, and region of assignment.

Nearly two-thirds (n=1,308, 64.8%) of the 2,018 ivermectin prescriptions dispensed during the January 2017 through March 2022 surveillance period occurred among individuals without a qualifying ivermectin diagnosis within the 90 days preceding their ivermectin prescription **(data not shown)**. The annual rate of ivermectin prescriptions without a qualifying diagnosis remained relatively stable between 2017 and 2020 but nearly quadrupled in 2021, from 11.4 per 100,000 p-years in 2020 to 44.7 per 100,000 p-years **(data not shown)**. The monthly prescription rate peaked in January 2021 (i.e., Alpha wave) at 47.6 per 100,000 p-years and then peaked at the highest rate observed during the surveillance period in August 2021 (i.e., Delta wave), at 178.3 per 100,000 p-years **(Figure 2)**.

Among the 2,018 ivermectin prescriptions dispensed during the study period, 978 were dispensed following the declaration of the COVID-19 pandemic in March 2020 by the World Health Organization **(data not shown)**. Among those

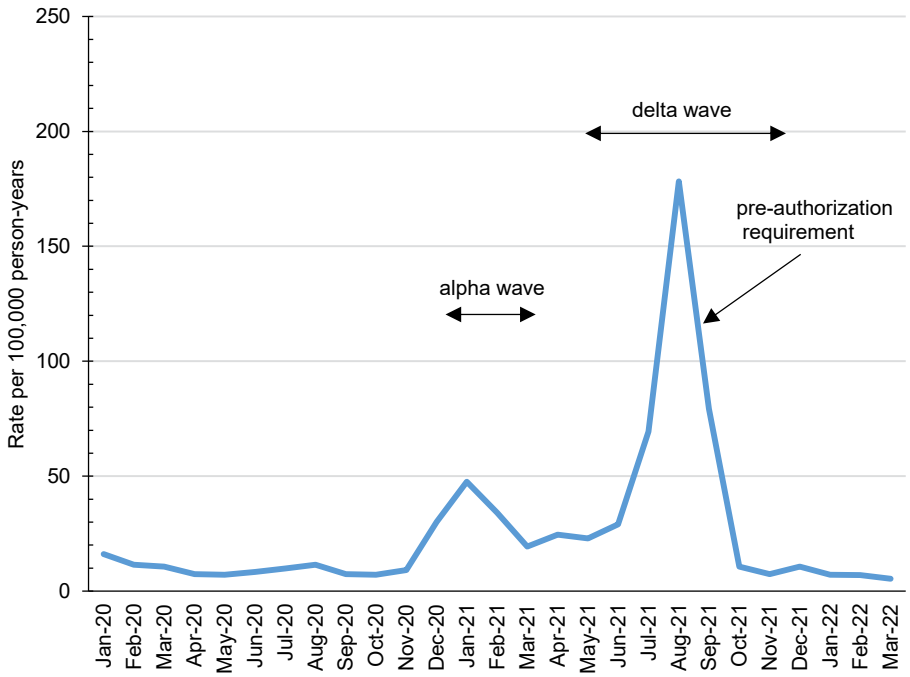
TABLE 2. Rate of Dispensed Outpatient Oral Ivermectin Prescriptions per 100,000 Person-Years, Active Component, U.S. Armed Forces, January 2017–March 2022

	Jan. 2017-Mar. 2022		Jan. 2017-Dec. 2019 (prior to start of COVID-19 pandemic)		Aug. 2021 (peak of ivermectin dispensing)	
	No.	Rate	No.	Rate	No.	Rate
Total	2,018	29.3	981	25.2	211	185.3
Prescription category						
Mail order	8	0.1	2	0.1	3	2.6
Military hospital or clinic	1,026	14.9	628	16.1	20	17.6
Retail	960	14.0	329	8.4	188	165.1
In-Theater	20	0.3	18	0.5	0	0.0
VA	4	0.1	4	0.1	0	0.0
Sex						
Male	1,710	29.9	817	25.1	186	197.6
Female	308	26.6	164	25.6	25	126.6
Age, years						
<20	66	12.8	41	13.5	3	36.2
20-24	442	20.0	247	19.8	34	93.1
25-29	391	24.6	190	21.2	38	144.0
30-34	392	35.9	198	32.0	41	227.2
35-39	341	42.2	136	30.2	45	329.7
40-44	217	52.8	97	42.1	24	346.0
45+	169	66.8	72	49.3	26	640.7
Service						
Army	709	28.6	317	22.6	85	206.4
Navy	533	30.7	291	29.9	41	139.9
Air Force	559	32.8	269	27.9	68	241.5
Marine Corps	217	22.6	104	18.7	17	111.7
Race and ethnicity						
Non-Hispanic White	1,287	33.6	644	29.4	137	219.9
Non-Hispanic Black	174	15.7	75	11.9	19	103.6
Hispanic	297	26.0	142	22.8	27	134.0
Other/unknown	260	32.7	120	26.6	28	213.8
Rank						
Junior enlisted (E1-E4)	585	19.7	316	18.7	41	83.7
Senior enlisted (E5-E9)	837	31.0	386	25.4	101	225.6
Warrant officer (WO1-WO5)	37	38.3	9	16.4	11	685.7
Junior officer (O1-O3)	263	38.5	127	32.8	29	256.3
Senior officer (O4-O10)	296	67.7	143	57.9	29	401.6
Marital status						
Single, never married	705	23.4	387	23.1	42	81.6
Married	1,184	33.6	535	26.4	159	280.1
Other/unknown	129	37.8	59	30.8	10	176.2
Education level						
High school or less	967	22.2	485	19.7	92	127.3
Some college	302	35.5	146	29.6	33	246.2
Bachelor's or advanced degree	686	44.7	318	37.1	78	300.5
Other/unknown	63	47.0	32	41.7	8	353.4
Military occupation						
Combat-specific	284	30.1	136	25.6	32	203.1
Motor transport	48	23.4	24	21.0	5	141.9
Pilot/air crew	93	38.0	43	30.8	16	398.7
Repair/engineering	526	25.8	251	21.8	59	173.1
Communications/ intelligence	471	32.1	213	25.7	54	221.5
Health care	260	43.7	152	44.5	14	147.3
Other/unknown	336	24.2	162	20.5	31	137.1
Geographic region						
Northeast	45	22.7	23	20.3	7	214.8
Midwest	149	33.5	89	35.4	12	161.1
South	1,179	37.3	520	29.1	145	277.2
West	387	21.9	205	20.6	31	105.2
Overseas	160	20.9	93	21.5	10	78.8
Unknown/missing	98	18.1	51	16.1	6	68.8

Abbreviation: VA, Veterans Administration.

978 prescriptions, 324 (33%) were filled for individuals with a prior diagnosis of COVID-19. A higher proportion of prescriptions with a prior COVID-19 diagnosis were dispensed to those who did not have a qualifying ivermectin diagnosis (295/739=40%) compared to those with a qualifying ivermectin diagnosis (29/239=12%).

FIGURE 2. Rate of Dispensed Outpatient Ivermectin Prescriptions Among Those Without an Ivermectin-qualifying Diagnosis Within 90 Days Prior to Prescription



Discussion

This study revealed increased ivermectin prescription fill rates among U.S. ACSM during coronavirus Alpha and Delta variant waves, including increased use among those without a qualifying diagnosis. The highest ivermectin fill rates among U.S. ACSM occurred during the period of Delta variant predominance in the U.S., from July 2021 through September 2021. During this period, there was a 7.3-fold increase in prescription fill rates compared to the baseline period (January 2017–December 2019), which correlates with the highest rate of U.S. online interest in ivermectin recorded by Google Trends.[25] During the week that ended on August 13, 2021, there was a 24-fold increase in ivermectin prescrition fills in the U.S. compared to the U.S. baseline. The second-highest ivermectin fill rates occurred from December 2020 until early March 2021, during the Alpha variant wave, when online interest in ivermectin also increased above baseline. Despite online interest, ivermectin prescription fill rates did not increase during Omicron variant predominance, when daily COVID-19 case rates reached the highest level recorded in the U.S.[25]

The reason ivermectin prescription fill rates did not increase among ACSM during the Omicron wave is likely multifactorial. Retractions of invalid early studies, along with increased availability of evidence demonstrating lack of ivermectin efficacy against COVID-19, as well as vigorous efforts by private and governmental organizations to call attention to false claims and risks associated with off-label use of ivermectin likely contributed.[4-8] It is also possible the requirement for prescription pre-authorization, implemented by the military after the Delta wave and prior to Omicron, played a role. A significant proportion of ivermectin prescriptions were filled at retail pharmacies in August 2021—while the reverse was true from January 2017 to December 2019—making the impact of the pre-authorization requirement unclear. In addition, this analysis did not evaluate those providers who wrote prescriptions for ivermectin. It is unclear what proportion of prescriptions were provided by providers within the MHS and what proportion were written by civilian providers outside the MHS.

During the peak of the Delta variant wave, in August 2021, comparatively higher rates of ivermectin prescription fills were seen among men compared to women; by comparison, rates according to sex were similar from January 2017 to December 2019. Rates of ivermectin prescription fills were also much higher among older than younger service members in August 2021, whereas the difference in fill rates by age was less marked prior to August 2021. Given that rank and education typically increase with age, it is not surprising that warrant officers had significantly higher fill rates than junior and senior enlisted service members, and those with a bachelor's or advanced degree had significantly higher fill rates in August 2021 than those with less formal education, compared to previous years.

The findings related to education and ivermectin fill rates are interesting, given that the groups with higher levels of education are traditionally considered less susceptible to medical misinformation. In particular, Scherer et al. found that less educational attainment was consistently associated with greater misinformation susceptibility.[26] Pan et al. also found that increasing education, as well as age, were protective against acceptance of misinformation.[27] Interestingly, data presented here are consistent with more recent data reported by Perlis et al., who also found that men, those with a college degree (compared to less education), and those among the highest age group, compared to younger individuals, were all more likely to use non-evidence-based treatments during the COVID-19 pandemic.[28]

A possible explanation for these findings is that older, more senior, and

higher-educated individuals have a greater sense of self-efficacy when interpreting online information, and were more proactive in their requests for ivermectin during interactions with health care providers. While it may be assumed that greater educational attainment is protective against misinformation, this may not be true. Studies show that misinformation can go unrecognized by consumers, regardless of educational status, and that even short exposures to misinformation or disinformation can significantly affect unconscious behavior.[29]

The relatively higher fill rates in August 2021 among non-Hispanic Whites (compared to other racial categories), among airmen compared to other ACSM, pilots compared to other military occupations, and those living in the South, compared to other regions, is unclear. Further stratification of these groups and additional studies could offer insight into these findings.

Medical misinformation has resulted in significant insurance subsidization of ineffective care,[30] despite the Federation of State Medical Boards' efforts to discipline practitioners who spread misinformation and disinformation related to COVID-19 management.[31] Direct-to-consumer advertising of prescription drugs, for-profit interventions, and patient reliance on online medical information are expected to increase.[32] These trends have the potential to affirmatively influence patients' use of media-based medicine, and dissuade their use of evidence-based medicine.

State-sponsored online disinformation, including that targeting public health, has increased in recent years.[33] The availability of social media, increasingly sophisticated algorithms, and rapidly evolving artificial intelligence all increase capacity for conflict escalation within the digital realm that can undermine evidence-based public health responses.[34] These efforts can directly discredit credible interventions, such as efficacious vaccines, as well as indirectly sow mistrust and delegitimize public health and other governmental institutions.

Potential population-level and organizational countermeasures against misinformation and disinformation include debunking and pre-bunking,[35] increased investment in research on misinformation,[18] and modernization of public health communications, including implementation of infodemic surveillance systems.[36] The National Strategy for the COVID-19 Response and Pandemic Preparedness outlines the federal government's commitment to mitigating misinformation and disinformation by ensuring Americans have access to science-based information, and developing capacities for quickly identifying disinformation and misinformation.[37] While recognizing constitutional concerns related to free speech,[38] Johns Hopkins University Bloomberg School of Public Health calls for expansion of the federal strategy, including improved resources for public verification of questionable content and increased coordination among constituencies to establish a multiagency national security response effort prioritizing management of public health disinformation from both domestic and international sources.[37] The urgency of managing misinformation and disinformation is highlighted in DOD's *Strategy for Operations in the Information Environment*.[19] While this document does not specifically address health-related misinformation and disinformation, the findings here suggest that it should.

This report is subject to several limitations. First, this is a descriptive study of a small population, and conclusions based on these findings require further validation. Second, prescriptions filled outside the MHS and not reimbursed through TRICARE, as well as those obtained without a prescription, were not captured in this analysis. Third, prescription fill rates do not necessarily equate to prescription use; fill rates may both under- and overestimate actual drug use. Fourth, qualifying diagnoses were based on encounter data only. Inclusion of laboratory or other diagnostic data to identify qualifying diagnosis may have increased the number of individuals with a qualifying diagnosis. Fifth, the 90-day period for qualifying ivermectin-qualifying diagnoses was meant to identify as many individuals as possible and is somewhat arbitrary. Shortening or lengthening this period could potentially decrease or increase, respectively, individuals with a qualifying diagnosis. Finally, Google Trends is not a measure of increased exposure to misinformation or disinformation, and any suggestion of a relationship between ivermectin fill rates and misinformation or disinformation herein should be considered exploratory.

As with their civilian counterparts, U.S. military members' ivermectin prescription fill rates increased during the early phases of the COVID-19 pandemic. This trend was coincident with significant online information espousing ivermectin benefits, but during a period when there was lack of scientific evidence to support its use and no FDA approval of ivermectin for COVID-19 prevention or treatment. Older and more educated individuals had relatively high prescription fill rates, counter to the assumption that age and education protect against online misinformation.

Misinformation and disinformation have assumed increasing significance in the digital information age, with direct relevance to both pandemic preparedness and military operations. Bernard et al. suggest we are entering a new era of biowarfare, one that relies less on a biological weapon and more on the ability to weaponize natural outbreaks, with the goal destabilizing social, political, and economic systems.[33] Understanding how medical misinformation and disinformation affect the military and how these impacts vary among and within subpopulations is important for ensuring the health of military members as well as national security.[18]

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Weight Loss Medication Prescription Prevalence in the Active Component, 2018–2023

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The U.S. military has witnessed rising obesity among active component service members. The Department of Defense authorized coverage of weight loss medications in 2018, but no study has evaluated prescription prevalence within the active component. This descriptive retrospective cohort study analyzed data from active component U.S. military service members from January 2018 through June 2023. The study used data from the Defense Medical Surveillance System to determine prescription period prevalence of weight loss medication. Data on demographics, body mass index, and history of diabetes were considered. The study revealed a 100-fold increase in the prescription period prevalence of weight loss agents in the active component from their initial authorization date. Demographics associated with higher prescription period prevalence were non-Hispanic Black race and ethnicity, female sex, and older age. Service members in the health care occupations and the Navy had higher prevalence compared to other service branches and occupations. The findings indicate a significant rise in the period prevalence of weight loss prescriptions over time. Further research is recommended to assess the effectiveness, safety, and use in austere military environments.

What are the new findings?

Following their approval for active component use in 2018, the prevalence of weight loss prescriptions within the active component increased nearly 100-fold, from 1.2 to 104.1 per 100,000 service members. Increased weight loss medication prescription rates were associated with demographic categories including female sex, older age, non-Hispanic Black race or ethnicity, Naval service, and health care-associated occupations.

What is the impact on readiness and force health protection?

Use of weight loss medications will likely continue to increase due to the ongoing obesity epidemic in the U.S. Further study evaluating their real world effectiveness in weight management and safety for use among service members in austere and deployed environments should be considered.

In 2000, the World Health Organization designated obesity a global epidemic.[1] The U.S. faces an increasing prevalence of obesity, which affects both the general population and the armed forces.[2] The prevalence of obesity among active component service members (ACSM) rose from 16.1% in 2018 to 18.8% in 2021.[3] Furthermore, the combined prevalence of both obesity and overweight increased from 65.5% in 2018 to 67.3% in 2021.[3] Obesity within military ranks not only compromises readiness and functional capabilities but also correlates with various musculoskeletal injuries and mental health disorders, leading to increased health care provision.[4-8]

In 2018, the Defense Health Agency (DHA) added 4 weight loss agents (phentermine, benzphetamine, diethylpropion, and phendimetrazine) to the TRICARE Formulary, following authorization from the 2017 National Defense Authorization Act.[9] Additionally, coverage of brand name and specially ordered medication (non-formulary) with prior authorization was expanded to include approved long-term therapies: liraglutide, lorcaserin, naltrexone/bupropion, orlistat, and phentermine/topiramate.[9] In 2021, semaglutide, a GLP-1 receptor agonist originally developed for diabetes management, was included in the list of covered medications following U.S. Food and Drug Administration (FDA) approval.[10-14] While the DHA approved the agents for weight management, consensus indicates these agents remain adjunctive to a comprehensive lifestyle intervention, and prescribers must consider their compatibility with an individual service member's professional duties and personal lifestyle.[9,10,13,15,16]

With limited information available on prescription weight loss medication usage among military members, it is important to explore its prevalence for better understanding of obesity management within the military. Describing period prevalence serves as a precursor to further investigation of real world effectiveness, side effects, and cost to the Military Health System. The objective of this descriptive epidemiologic study is to describe weight loss prescription medication prevalence among ACSM from January 2018 through June 2023.

Methods

This retrospective cohort study included all active component U.S. military

service members in the Army, Navy, Air Force, and Marine Corps from January 1, 2018 to June 30, 2023. This report is based on summaries of medical administrative data routinely provided to the U.S. Armed Forces Health Surveillance Division (AFHSD) and integrated within the Defense Medical Surveillance System (DMSS) for health surveillance purposes. Periodic Health Assessment (PHA), medical encounter, and demographic data were obtained from DMSS, the central repository of longitudinal medical surveillance data for directly and privately purchased medical care within the U.S. military. Records of prescribed and dispensed weight loss medications from the Pharmacy Data Transaction Service (PDTS) were also obtained from DMSS.

All dispensed formulary and non-formulary weight loss medications covered by DHA were identified in PDTS through a drug name search for medications listed in **Table 1**; over-the-counter formulations were not analyzed. Both generic and trade names were searched, apart from Qsymia and Contrave, which were identified only by trade name to avoid capturing prescriptions for neurologic treatments. Quarterly prevalence was calculated as the number of service members with a dispensed weight loss medication during the quarter of interest per 100,000 service members in service at any point during the quarter.

Covariates included sex, age, service, race and ethnicity, rank, occupation, history of type 2 diabetes diagnosis, and body mass index (BMI). A case of diabetes was defined by a record of 2 or more inpatient or outpatient medical encounters within 90 days of each other, with a diagnosis of type 2 diabetes mellitus in the first (primary) diagnostic position (International Classification of Diseases, 9th Revision [ICD-9]: beginning with '250' and fifth digit '0' or '2'; International Classification of Diseases, 10th Revision [ICD-10]: E11). Cases with a prior diagnosis for type 1 diabetes (ICD-9: beginning with '250' and fifth digit '1' or '3'; ICD-10: E10*) listed in the primary diagnostic position were excluded as a case of type 2 diabetes, as the type could not be determined.

To calculate BMI, records of height and weight were obtained from annual electronic PHA documentation. The greatest weight measurement within the 2 years prior to the medication dispensation date was included to describe the maximum recorded BMI for service members who were dispensed a weight loss medication in the last quarter of the surveillance period. Weight records for women with a pregnancy or birth-related diagnosis (ICD-10 code beginning with 'O') in any diagnostic position in an inpatient or outpatient record within 9 months before or after the date of their weight measurement, were excluded from the analysis. BMI was calculated in kg/m^2 [(weight (lbs.) / (height {in})^2) * 703].

TABLE 1. Prescription Weight Loss Medications Analyzed

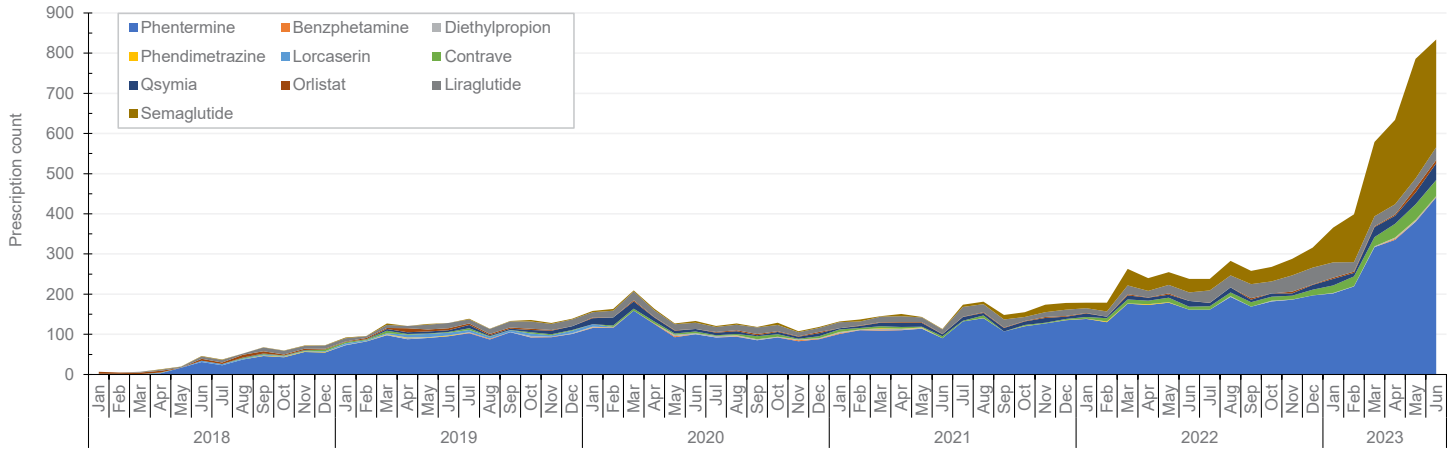
Generic Name	Trade Name	Special Prior Authorization Requirements
Phentermine HCL	*Lomaira*—8 mg (non-formulary)	---
	Adipex-P—37.5 mg (formulary)	---
Benzphetamine HCL	Didrex (brand name discontinued)	---
	Regimex (brand name discontinued)	---
Diethylpropion HCL	Tenuate (brand name discontinued)	---
	Dospan	---
Phendimetrazine Tartrate	Phendiet	---
	Melfiat	---
	Anorex-SR	---
	Pleine	---
	Bontril	---
Lorcaserin	*Belviq*	---
	Belviq XR	---
Naltrexone / Bupropion SR	*Contrave*	Failure to lose weight while on phentermine, or a contraindication to its use.
Orlistat	*Xenical*	Failure to lose weight while on, or contraindication to use, Contrave or phentermine.
Phentermine / Topiramate ER	*Qsymia*	Failure to lose 5% of baseline weight following 12 weeks of phentermine use.
Liraglutide	*Saxenda*	Tried and failed with use of, or has a contraindication to, ALL of the following: phentermine, Qsymia, and Contrave.
Semaglutide	*Wegovy*	Tried and failed with use of, or has a contraindication to, ALL of the following: phentermine, Qsymia, and Contrave.
	Ozempic	

Note: Italicized trade names are non-formulary within the Military Health System.

Results

The number of monthly prescriptions of weight loss agents in the active component increased from 7 prescriptions in January 2018 to 816 prescriptions in June 2023 **(Figure 1)**. Phentermine constituted the largest number of prescriptions throughout the surveillance period, while semaglutide comprised a significant proportion following its FDA approval in June 2021. The vast majority

FIGURE 1. Weight Loss Prescription Counts in the Military Health System Among the Active Component, U.S. Armed Forces, 2018–2023



of prescriptions (n=12,037, 99.9%) during the study period were dispensed with a supply of 90 days or less.

Initial analysis by agent revealed similar prevalence trends by demographic category **(data not shown)** and were collapsed to summarize findings as prevalence of all weight loss medications. The quarterly prevalence of ACSM who received any weight loss prescription (per 100,000 persons) increased from 1.2 in the first quarter (Q1) of 2018 to 104.4 in the second quarter (Q2) of 2023 **(Figure 2)**. Female service members received prescriptions for weight loss at a higher prevalence than their male counterparts during the surveillance period, with a ratio of 339.2 compared to 54.5 in Q2 of 2023 **(Table 2)**. Prevalence ratios increased with increasing age; those in the 50 years and older category had a prevalence of 470.6 in Q2 of 2023. Stratification by age and sex clearly delineated higher prevalence among women in all age groups than men of the same age, with an increasing prevalence with increased age.

Prescription prevalence was consistently higher among Navy ACSM than among other services, at 157.1 in Q2 of 2023, 72% higher than those in the Army (91.3), 54.5% higher than those in the Air Force (101.7), and 363% higher than the Marine Corps (43.2).

After excluding those whose race or ethnicity was 'Unknown,' non-Hispanic Black ACSM had the highest prescription prevalence, at 147.3 in Q2 of 2023. By comparison, non-Hispanic White ACSM had a prevalence of 95.9, Hispanic ACSM 93.0, and the "Other" race and ethnicity ACSM category 86.4 per 100,000 in Q2 of 2023. Stratified analysis by race and ethnicity and age showed highest prevalence among non-Hispanic Black personnel in all age categories, with the exception of Hispanic personnel in the 25-39 age category.

Covariate analysis showed increasing prevalence of prescriptions. By rank, senior officers and senior enlisted ACSM had the highest prescription prevalence, reaching their highest rates in Q2 of 2023, 307 and 145.7 per 100,000, respectively. Comparing occupations, ACSM in a health care field had the greatest prescription prevalence over the study period, while those in pilot and air crew positions maintained lowest prevalence. Service members with a prior history of diabetes had significantly higher prescription prevalence, at 2,124.6 per 100,000 in Q2 of 2023.

Data **(not shown)** from Q2 of 2023 revealed that 62.1% of weight loss agents were prescribed to those with obesity (BMI ≥30 kg/m^2), 16.9% of prescribed agents were for those with an overweight BMI (25–30 kg/m^2), and 2.1% of agents were prescribed to those with a BMI less than 25 kg/m^2; 18.9% of personnel on weight loss prescriptions did not have a calculable BMI from the corresponding PHA.

Discussion

The U.S. Preventive Service Task Force reports that lifestyle change programs are evidence-based and should remain the primary focus for weight loss in adults while data on long-term weight maintenance after discontinuation of weight loss agents are lacking.[17] The current joint Department of Veterans Affairs and Department of Defense Clinical Practice Guidelines for weight loss medication administration require that patients start lifestyle modifications (i.e., physical training programs and reduced caloric intake) prior to initiating a weight loss medication. After 12 weeks of phentermine use, or in the presence of a contraindication to its use, a patient may be moved to a non-formulary weight loss agent.[18]

The results of this study demonstrate a substantial increase in the number of monthly prescriptions of weight loss agents among ACSM since initial approval in September 2017, with a 4-fold increase in prescribing rates starting in 2022. Phentermine consistently constituted the largest number of prescriptions throughout the study period, which is similar to previous studies of weight loss medication use in civilian populations.[19] The introduction of semaglutide following FDA approval in June 2021, however, resulted in increases in that agent's prevalence, but its increase is not consistent with linear adoption patterns in the general U.S. population,

TABLE 2. Prevalence During Second Quarter 2023 of Dispensed Weight Loss Agents Among Active Component, U.S. Armed Forces

	No.	Ratio[a]
Total	1,337	104.4
Sex		
Male	575	54.5
Female	762	339.2
Age group, years		
<20	0	0.0
20-24	89	22.3
25-29	190	62.6
30-34	251	117.9
35-39	352	217.1
40-44	269	319.1
45-49	113	358.6
50+	73	470.6
Service		
Army	419	91.3
Navy	515	157.1
Air Force	330	101.7
Marine Corps	73	43.2
Race and ethnicty		
Non-Hispanic White	655	95.9
Non-Hispanic Black	307	147.3
Hispanic	223	93.0
Other	113	86.4
Unknown	39	211.8
Rank		
Junior enlisted (E1-E4)	159	30.2
Senior enlisted (E5-E9)	756	145.7
Warrant officer (WO1-WO5)	27	144.2
Junior officer (O1-O3)	133	101.8
Senior officer (O4-O10)	260	307.0
Unknown	2	247.2
Military occupation		
Combat-related[b]	55	31.2
Armor/motor transport	20	53.2
Pilot/air crew	10	21.8
Repair/engineering	228	62.3
Communications/intelligence	334	120.1
Health care	475	445.4
Other	215	79.7
History of type 2 diabetes		
No history	1,278	100.0
Previous diagnosis	59	2,124.6

[a]Prevalence ratio per 100,000 individuals.
[b]Infantry/artillery/combat-engineering/armor.

and may be a result of the sequential process of obtaining semaglutide for weight loss in the military and inter-service variability in prescribing practices.[20] Alternatively, such results may demonstrate secondary effects on prescribing practices and treatment of obesity as a chronic disease as obesity prevalence increases within the Armed Forces and service members and providers become more aware of treatment options involving these medications.

The demographic profile of weight loss prescription ratios corresponds to previous observations of demographic factors associated with obesity prevalence in the U.S. military.[3] Non-Hispanic Black and older (40+) service members received weight loss prescriptions at higher rates than their counterparts, which is consistent with findings in the general U.S. population.[19,21] Navy ACSM consistently maintained higher prescription prevalence compared to all other service branches, which correlated with the Navy's higher rates of obesity compared to all other services.[3]

There were some differences between the previous surveillance of obesity and prevalence of weight loss prescriptions identified in this study. Women had higher prevalence of weight loss medications despite the higher prevalence of obesity among men in the military.[3] Service members in health care fields had the highest prescription prevalence throughout the study period although obesity is more prevalent in repair/engineering occupations.[3] These findings may indicate the influence of professional factors and health care knowledge on medication use, general comfort with the concept of using a medication for weight management, improved access to medications through system or institutional knowledge, or increased awareness of overweight or obese status among health care workers. The increased prevalence of dispensed weight loss medications among service members in health care occupations requires further study.

This analysis relied on electronic health records, which may have inherent biases and limitations, including missing or incomplete data and data entry inaccuracies. Data from PHAs may not truly reflect accurate height and weight data; many health care providers conducted PHAs during the COVID-19 pandemic via telehealth, resulting in self-reported data that more commonly results in weight underestimation. Additionally, BMI is an imperfect measure for distinguishing lean versus fat body mass. While the TRICARE health benefit is intended to be the primary health care coverage for all ACSM, there is the infrequent possibility a service member acquires weight loss medications outside the MHS, which would not appear in this analysis. Over-the-counter formulations of the covered weight loss medications were not considered in this analysis, resulting in estimates that may be lower than true prevalence. Additionally, this study focused on ACSM, limiting the generalizability of the findings to other military populations or civilian contexts.

In 2022 the U.S. Centers for Disease Control and Prevention estimated that increased obesity prevalence in military members costs a potential $1.5 billion annually in obesity-related health care and 658,000 lost work days.[8] The trend in use of weight loss medication in the military should continue to be monitored, as these therapies represent a novel tool to manage obesity in this population. Future efforts should evaluate weight loss medications' real world effectiveness, effects on health outcomes and comorbidities, safety for use in austere and deployed environments, impacts on readiness and retention, and cost-benefit and utility analyses.

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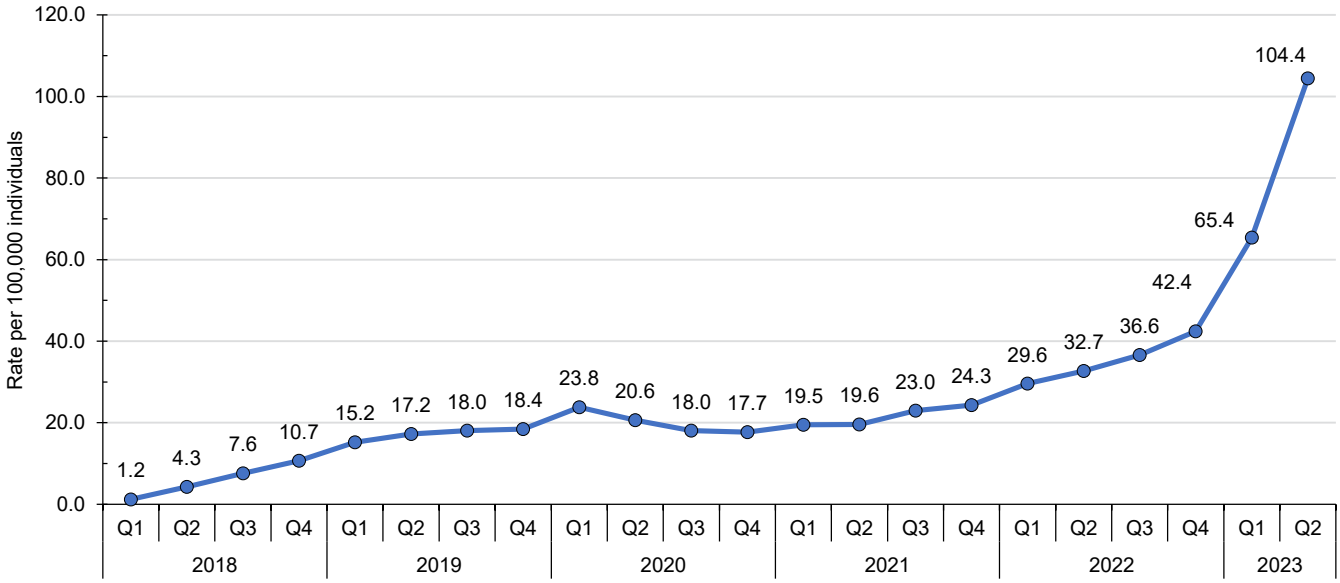
FIGURE 2. Weight Loss Prescription Prevalence Among the Active Component, U.S. Armed Forces, 2018–2023[a]



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Brief Report

The Four Most Frequently Diagnosed Vector-borne Diseases Among Service Member and Non-Service Member Beneficiaries in the Geographic Combatant Commands, 2010–2022

Ralph A. Stidham, DHSc, MPH; Ronald Cole, MPH, RN PHNA-BC; Sithembile L. Mabila, PhD, MSc

Vector-borne diseases (VBDs) may pose an increased risk for U.S. service members during recurring military training exercises, operations, and response missions, in addition to residence in endemic regions within and outside the continental U.S.[1,2] Prior *MSMR* reports address VBD surveillance, described by surveillance data for 23 reportable medical events (RMEs), among active duty and reserve component service members.[3,4] This report covers a 13-year surveillance period, from January 2010 to December 2022, and provides linear trends of selected VBDs among Armed Forces service and non-service member beneficiaries diagnosed at installations within the Northern Command (NORTHCOM), Africa Command (AFRICOM), Central Command (CENTCOM), European Command (EUCOM), Indo-Pacific Command (INDOPACOM), or Southern Command (SOUTHCOM). Trends of only the 4 most-frequently reported VBDs were evaluated, as Lyme disease, malaria, Rocky Mountain Spotted Fever (RMSF), and dengue fever comprised 90% (n=5,199) of all 23 VBDs (n=5,750) among Military Health System (MHS) beneficiaries documented as RMEs during the surveillance period.

Methods

This study includes all MHS beneficiaries from January 2010 through December 2022. Data were acquired from RME records of 23 VBDs from the Defense Medical Surveillance System (DMSS), limited to the 4 most-diagnosed VBDs in DMSS during the surveillance period; a full listing of VBD RMEs are available in a prior *MSMR* report.[3] A VBD case was defined as an individual identified through a RME report, classified as "confirmed," "probable," or "suspect" by having met specified laboratory or epidemiologic criteria.[5]

Demographic information including military component (active, reserve, guard), beneficiary status (service members or non-service member), and U.S. Combatant Command (CCMD) at time of diagnoses were included. Non-service member beneficiaries included dependents, former service members, and retirees. MHS beneficiaries diagnosed as a case before the surveillance period were excluded. An individual could qualify as a case once for each RME type. Incidence date was the earliest event date, with classification determined by utilizing all available data, prioritizing confirmed over probable or suspect records.

Results

A total of 5,199 confirmed, probable, and suspect cases of Lyme disease (n=3,400), RMSF (n=893), malaria (n=679), and dengue fever (n=227) were identified among MHS beneficiaries from January 2010 through December 31, 2022 **(Table)**. Of those confirmed, probable, and suspect cases, 2,343 were diagnosed in service members and 2,918 were diagnosed in non-service member beneficiaries **(data not shown)**. Lyme disease and RMSF, both caused by tick-borne pathogens, accounted for 83% of cases, while malaria and dengue fever, transmitted by mosquito vectors, comprised the remainder.

Since Lyme disease was the most common VBD of the 4 diseases evaluated during the surveillance period, trends of confirmed and probable cases of Lyme disease over time by CCMD are presented in the **Figure**. Confirmed Lyme disease cases peaked in 2012 (n=455) and then gradually decreased over the study period to a low of 75 cases in 2022; probable cases peaked in 2017 (n=53) and steadily decreased to a low of 15 cases in 2022; suspect cases peaked in 2016 (n=73) and progressively declined to a low of 8 cases in 2022 **(data not shown)**. Cases from NORTHCOM represented the greatest number of confirmed and probable Lyme disease cases during the entire surveillance period **(Figure)**. The annual number of confirmed and probable Lyme disease cases from EUCOM were greatest in 2011 and lowest in 2017; Lyme cases were very low in all other CCMDs, ranging from 0 to 6 cases annually **(data not shown)**.

The Atlantic and central regions of the U.S contributed 85% of NORTHCOM's reported RMSF cases **(data not shown)**. NORTHCOM averaged 30 RMSF cases annually between 2010 and 2016, dramatically increasing to an average of 149 cases between 2017 and 2019 **(data not shown)**. NORTHCOM was only able to confirm 32% of RMSF cases reported during the surveillance period **(Table)**.

Discussion

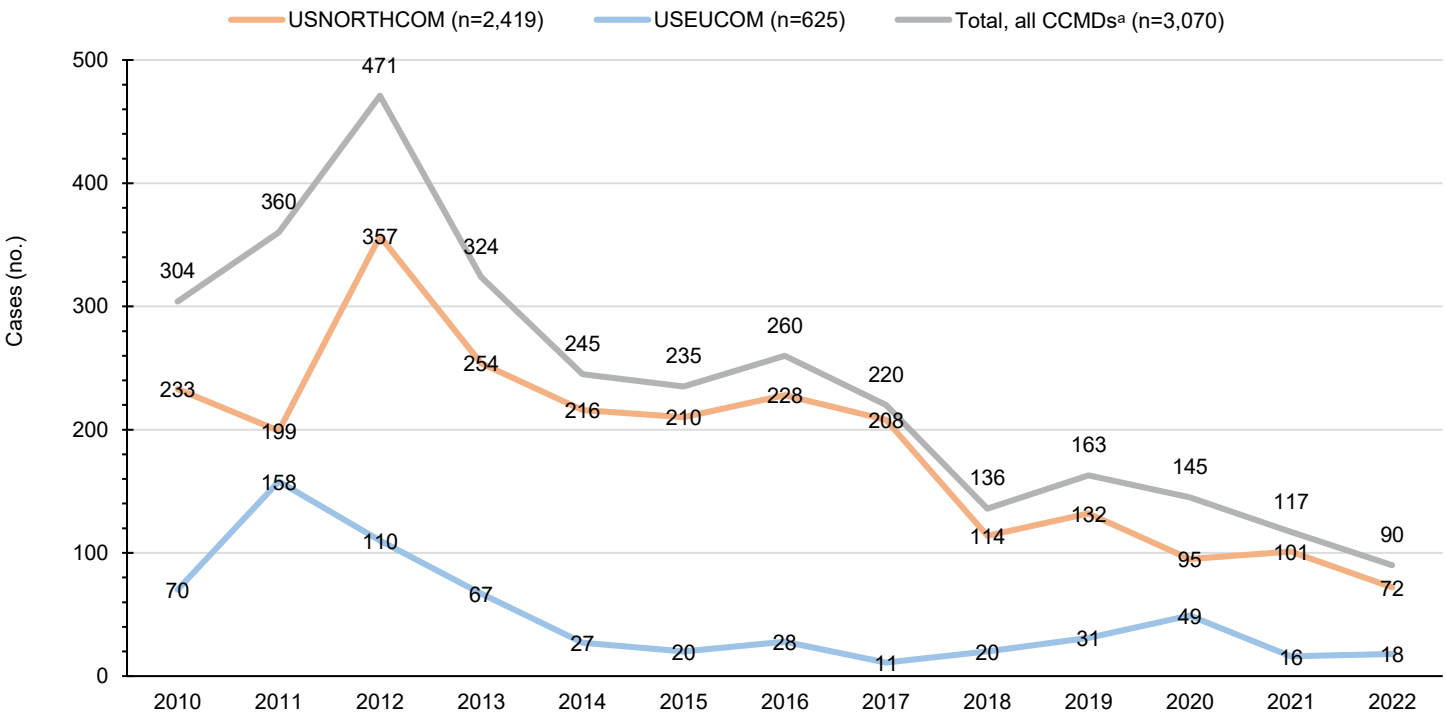
Lyme disease cases constituted the largest proportion of overall RMEs in this report, with highest numbers occurring in 2012. A substantial proportion of Lyme disease cases were reported from locations in the northeastern U.S., where Lyme disease is known to be endemic: 43% of service members and non-service beneficiaries

TABLE. Four Most Frequently Reported Vector-borne Disease Cases[a] by U.S. Combatant Command Region and Case Classification, MHS Service and Non-Service Member Beneficiaries, 2010–2022

Disease and Case Classification	USNORTHCOM	USAFRICOM	USCENTCOM	USEUCOM	USINDOPACOM	USSOUTHCOM	Total
	No.	No.	No.	No.	No.	No.	No.
Lyme Disease	2,721	0	4	648	26	1	3,400
Confirmed	2,132	0	4	576	18	1	2,731
Probable	287	0	0	49	3	0	339
Suspect	302	0	0	23	5	0	330
Malaria	457	16	92	69	45	0	679
Confirmed	436	14	88	65	43	0	646
Probable	6	0	0	1	0	0	7
Suspect	15	2	4	3	2	0	26
Rocky Mountain Spotted Fever	885	0	0	3	5	0	893
Confirmed	279	0	0	1	2	0	282
Probable	454	0	0	0	1	0	455
Suspect	152	0	0	2	2	0	156
Dengue Fever	165	16	1	6	24	15	227
Confirmed	134	10	1	5	19	15	184
Probable	20	4	0	1	1	0	26
Suspect	11	2	0	0	4	0	17

Abbreviations: MHS, Military Health System; USNORTHCOM, U.S. Northern Command; USAFRICOM, U.S. Africa Command; USCENTCOM, U.S. Central Command; USEUCOM, U.S. European Command; USINDOPACOM, U.S. Indo-Pacific Command; USSOUTHCOM, U.S. Southern Command.
[a]Four most-frequently reported vector-borne disease cases among Lyme disease, malaria, Rocky Mountain Spotted Fever, Dengue fever, Zika virus infection, Chikungunya, arboviral diseases, ehrlichiosis/anaplasmosis, leishmaniasis, trypanosomiasis, tularemia, relapsing fever, typhus, Rift Valley fever, babesiosis, hemorrhagic fevers, other mosquito-borne viral fever, bartonellosis, filariasis, plague, yellow fever, Japanese encephalitis, and sandfly fever.

FIGURE. Confirmed and Probable Lyme Disease Cases by Selected U.S. Combatant Commands for MHS Service and Non-Service Member Beneficiaries, 2010–2022



Abbreviations: MHS, Military Health System; USNORTHCOM, U.S. Northern Command; USEUCOM, U.S. European Command; CCMD, Combatant Command.
[a]Includes all confirmed and probable cases of Lyme disease in all CCMDs.

were diagnosed at NORTHCOM Groton (New London Submarine Base, CT) and NORTHCOM New England. The New London Submarine Base is close to Lyme, Connecticut, where an epidemiological evaluation of a cluster of children with arthritis resulted in the first complete description of the infection in 1976, giving the disease its name.[6] Connecticut still ranks in the top 10 states for reported Lyme disease cases.[7] No Lyme disease cases were reported in AFRICOM during the surveillance period, because the vectors (*Ixodes pacificus* and *Ixodes scapularis*) are not present in the region.

In 2017, the Armed Forces expanded its RME guidelines to include all spotted fever rickettsioses (SFR), to better align with CDC case definitions.[2] Diagnoses and reports of rickettsial diseases at military hospitals and clinics in NORTHCOM (where RMSF is endemic) significantly increased after the surveillance requirement expansion from only RMSF to the broader SFR group. In this review, all SFR cases were RMSF diagnoses (n=893).

Approximately 68% of RMSF cases reported during the surveillance period could not be confirmed. All laboratory tests performed at military health facilities for RMSF were Indirect Fluorescent Antibody (IFA) assay and other antibody tests, and no records of testing with PCR of blood or eschar specimens were found. Definite identification of *Rickettsiae* is not feasible solely by IFA due to considerable serologic cross-reactivity, particularly when high-endpoint titers are seen for more than 1 rickettsial antigen.[8] Increased use of molecular assays (i.e., real-time PCR) can both confirm and offer species-specific diagnosis in a single sample, facilitating identification and management of rickettsial diseases in both service members and non-service beneficiaries.

The observed decline in the incidence of mosquito-borne cases, such as malaria and dengue, among deployed service members over the last decade is likely due to reduced deployments to endemic regions, with the exception of EUCOM.[4] Although dengue fever is not represented significantly in EUCOM in this study, there is a rising risk of dengue and other VBDs due to environmental changes and expanding global travel and trade.[9,10,11]

VBDs often manifest with non-specific symptoms, and when unconfirmed could constitute a number of other infections or health conditions. Lyme disease is frequently misdiagnosed as chronic fatigue syndrome, fibromyalgia, or multiple sclerosis. This non-specificity of symptoms and related issues such as diagnostic availability and cross-reactivity in diagnosis confirmation can pose challenges for accurate case identification and classification, resulting in the major limitations to this study's findings.

This report summarizes data from electronic reports of RMEs and examines the incidence and geographic distribution of the top 4 vector-borne infectious diseases among service members and non-service MHS beneficiaries in the CCMDs during a recent 13-year period. Awareness of the risk of these VBDs will help senior leaders develop and employ strategies to decrease avertable medical problems in MHS beneficiaries, maximizing the productivity and readiness of the medical force.

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A Content Review of Articles Published in the Medical Surveillance Monthly Report, 2019–2023

Kristen R. Rossi, MPH; Robert N. Pursley, MA

In continuous publication since 1995, the *Medical Surveillance Monthly Report (MSMR)* serves as the official peer-reviewed journal of the Armed Forces Health Surveillance Division (AFHSD) and the Defense Health Agency (DHA) Public Health Directorate. This monthly publication provides evidence-based estimates of the incidence, distribution, impact, and trends of illness and injury among U.S. military service members and associated populations. *MSMR* reports present data, public health information, and original research with direct relevance to the operational fitness of military members or Military Health System (MHS) beneficiaries' health, safety, and well-being.

This editorial provides a bibliometric summary and thematic analysis for articles published in *MSMR* over a 5-year period, from January 2019 through December 2023. The bibliometric summary provides annual metadata on most-read articles and journal impact, while the thematic content analysis reviews published article data to quantify the populations of focus and primary study outcomes or topics of interest, which are further grouped into major thematic categories, corresponding to the International Classification of Diseases (ICD) chapter subjects. For analytic summaries described in full and brief reports as well as Surveillance Snapshots, the data sources utilized to study the main outcome were also reviewed.

Summary Data

From January 2019 through December 2023, *MSMR* published a total of 248 articles. Full reports (n=166), Surveillance Snapshots (n=33), and brief reports (n=17) were the predominant content types, followed by a range of other articles including editorials (n=10), outbreak reports (n=7), case reports (n=6), and historical perspectives (n=5). Less-employed article types included letters to the editor (n=2), notice to readers (n=1), and Images in Health Surveillance (n=1).

The annual number of published articles declined over the past 5 years, from 58 articles in 2019 to 44 articles in 2023 **(Figure)**. Notably, a summary of Reportable Medical Events (RMEs) for Department of Defense (DOD) service members and other MHS beneficiaries returned to *MSMR* in 2023; however, the 8 summary reports published in 2023 were not included for this content review. Sentinel RME summaries were regular features of *MSMR* until 2010.[1]

The population of interest in the majority of articles (n=206; 83.1%) focused on service members (active component, reserve component, or former service members), while 9.6% (n=24) of articles centered on both service members and non-service member beneficiaries, and 5.6% (n=14) were limited to non-service member beneficiaries; 4 articles did not include a particular population of interest (e.g., environmental sampling data).

Content Themes

The content themes for each *MSMR* article published over the 5-year period were reviewed and then grouped into major thematic categories corresponding to ICD chapter subjects. Content themes not aligned to a chapter subject group were classified into separate categories, described in **Table 1**. Among the 248 total articles published in *MSMR* from 2019 to 2023, 42 (16.9%) articles provided a summary of total health care burden and provision, rather than 1 specific thematic topic. Each year, the *MSMR* publishes an annual compendium of burden of disease reports that groups diagnoses to inform readership of the major drivers of health care provision within the MHS.[2]

While injuries, musculoskeletal diseases, and mental health disorders are the categories of medical conditions associated with most medical encounters and greatest numbers of hospital bed days reported among active component service members in 2022,[2] infectious and parasitic diseases (n=73, 29.4%) represented a substantial majority of publication topics identified in the 5-year content theme review, described in **Table 1**. Additionally, maternal conditions contributed to approximately 13% of all hospital bed days for active component female service members in 2022,[2] but no articles were published for service women on the topics of pregnancy, childbirth, and the puerperium, or for certain conditions originating in the perinatal period.

Publication themes discussing contact with health services or procedures ('Z-codes') represented 24 (9.7%) of all articles; the majority of these were related to immunization (n=14, 5.6%) **(Table 1)**. Other topics associated with health service contacts or procedures (n=10, 4.0%) included women's health issues related to contraception use, infertility, menstrual suppression, or cervical cancer screening (n=5) as well as men's health issues related to vasectomy or testosterone replacement therapy (n=2) **(data not shown)**.

Data Sources

The methods of each article were manually reviewed to classify the data source of the major outcome of interest that was described in full and brief reports as well as Surveillance Snapshots (n=216). Six data source categories were assessed for each article, including: 1) administrative inpatient and ambulatory records, 2) laboratory results, 3) pharmacy prescriptions,

TABLE 1. MSMR Article Content Themes by ICD Chapter Topic, 2019–2023

Topic	No.	%
ICD chapter topic		
Certain infectious and parasitic diseases	73	29.4
Injury, poisoning, and certain other consequences of external causes	19	7.7
Mental, behavioral, and neurodevelopmental disorders	18	7.3
Diseases of the musculoskeletal system and connective tissue	14	5.6
Diseases of the eye and adnexa	10	4.0
Endocrine, nutritional, and metabolic diseases	8	3.2
Diseases of the respiratory system	5	2.0
Diseases of the digestive system	5	2.0
Diseases of the skin and subcutaneous tissue	5	2.0
Symptoms, signs, and abnormal clinical and laboratory findings, not elsewhere classified	5	2.0
Neoplasms	3	1.2
Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	2	0.8
Diseases of the nervous system	2	0.8
Diseases of the circulatory system	1	0.4
Diseases of the genitourinary system	1	0.4
Diseases of the ear and mastoid process	0	0.0
Pregnancy, childbirth, and the puerperium	0	0.0
Certain conditions originating in the perinatal period	0	0.0
Congenital malformations, deformations, and chromosomal abnormalities	0	0.0
Contact with health services or procedures (Z-codes)		
Immunization	14	5.6
Other Z-codes	10	4.0
Topics not aligned with ICD chapters		
Overall health care burden or utilization	42	16.9
Public health surveillance methods	6	2.4
Other	5	2.0
Total	248	100.0

Abbreviation: ICD, International Classification of Diseases.

4) RME records, 5) survey data, and 6) all other data. Many articles included more than 1 data source for the major outcome of interest, and each of those data sources were classified independently. Since immunization records may be stored in a range of service-specific data systems, or as administrative records, those data were included in the 'other data' source category. Data outside of the main outcome of interest that were related to covariate or dependent variable analyses were not assessed.

Almost 30% (n=61) of full and brief reports and Surveillance Snapshots combined more than 1 data source for analysis of an outcome of interest. Administrative data for clinical conditions from inpatient and ambulatory records, based on ICD diagnoses, contributed to a substantive majority of articles (n=150, 69.4%), followed by laboratory data (n=44, 20.4%), RME records (n=42, 19.4%), then other data sources (n=45, 20.8%). Survey data (n=14, 6.5%) and pharmacy records (n=9, 4.2%) contributed to a smaller proportion of analyses. The largest proportion of other sources from articles with 'other data' source classifications included immunization records (n=12), chart reviews (n=8), and medical evacuation records (n=7) **(data not shown)**.

Bibliometric Summary

The articles published to the *MSMR* website hosted by health.mil garnered a total of 274,518 unique page views from 2019 to 2023, with a median of 296 unique page views per article. Four articles received over 10,000 web page views, with "Testosterone Replacement Therapy Use Among Active Component Service Men" exceeding all other articles during the 5-year period for maximum unique views (n=41,167) **(Table 2)**. The publication date of that article, March 1, 2019, corresponds with a 2018 report from the U.S. Department of Veterans Affairs Office of the Inspector General that documented health care providers' poor adherence to guideline recommendations for the diagnosis and treatment of men with hypogonadism.[3]

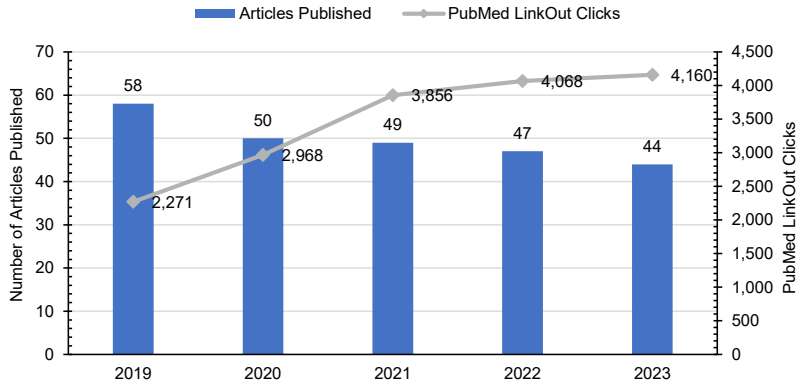
The National Center for Biotechnology Information LinkOut service routinely tracks the number of clicks from the *MSMR* publisher icon in PubMed's abstract listing to the journal's open access, full text articles on health.mil.[4] The LinkOut clicks from *MSMR* abstracts on PubMed in 2023 remained relatively stable compared to 2022 **(Figure)**, but over the 5-year publication period *MSMR*'s LinkOut clicks almost doubled, from 2,271 to 4,160. The far greater number of total page views of articles hosted on the *MSMR* health.mil website compared to LinkOut clicks from PubMed indicates a significant readership originating from the AFHSD journal home page.

MSMR also tracks CiteScore metrics from Scopus, which are based on the number of citations to articles published by a journal over 4 years, divided by the number of the same document types indexed in Scopus and published during those respective 4 years.[5] The *MSMR* CiteScore has continually increased over the past 3 years, from 0.7 in 2020 to 1.9 in 2022.

Future Direction

While *MSMR* will continue to maintain full text, open access to articles through publication on the journal website in 2024, the full text access from the PubMed abstract display will begin linkage to PubMed Central. This full text archival process will

FIGURE. Annual Bibliometric Summary Data, 2019–2023[a]



[a]PubMed LinkOut Hits represent the annual number of LinkOut 'hits' (clicks) on the publisher's icons in PubMed's abstract display and clicks on the publisher's links in the LinkOut list of resources.

potentially expand readership to a larger academic community, while standardizing and improving historic archival links to PubMed. The journal will also continue to track CiteScore metrics from Scopus. The improvement of the CiteScore metric in recent years corresponds with the increasing number of PubMed LinkOut clicks over the same period, which may be further bolstered by full text archival processes to PubMed Central during 2024.

Biosurveillance remains a high-priority mission for the DOD, with DHA Public Health prioritizing capabilities to support a better biodefense posture in 2023 and beyond.[6,7] *MSMR* welcomes new submissions accordant with the 2023 DOD Biodefense Posture Review, which outlines significant reforms for a resilient force to deter use of bioweapons, rapidly respond to natural outbreaks, and minimize global risk of laboratory accidents.[8]

Just one-fifth of the analytic reports (i.e., full reports, brief reports, Surveillance Snapshots) published in *MSMR* from 2019 to 2023 were supported by laboratory capabilities. Critical topics such as antimicrobial resistance, wastewater surveillance, and other environmental threats were presented but are likely under-represented, as sustaining and strengthening U.S. deterrence of the biothreat environment, including naturally occurring, accidental, and deliberate biological threats, is a recently heightened priority.[7]

A substantial number of articles published from 2019 to 2023 employed dual or multi-sourced data approaches, typically combining laboratory, RME, or administrative records; pharmacy records, however, contributed to relatively few full and brief reports and Surveillance Snapshots. Pharmacosurveillance offers a different and useful perspective for public health capabilities, supporting surveillance for empirical treatment in the absence of laboratory confirmation often corresponding with lags in illness reporting. While laboratory records available within the MHS are usually limited to results generated from military hospitals and clinics, the Pharmacy Data Transaction Service (PDTS) offers a comprehensive data source for DOD beneficiaries with prescription orders originating from military hospitals and clinics, mail order, and retail-dispensed facilities.[9]

The low number of outbreak reports and case reports published over the last 5 years also indicates an unrealized opportunity to broaden content from clinicians in addition

TABLE 2. Ten Most-Read Articles on the MSMR Website, 2019–2023[a]

MSMR Volume, Issue, and Publishing Date	Article Title	Unique Page Views
MSMR Vol. 26 No. 3 (Posted Mar. 1, 2019)	Testosterone Replacement Therapy Use Among Active Component Service Men, 2017	41,167
MSMR Vol. 28 No. 1 (Posted Jan. 1, 2021)	The Prevalence of Attention-Deficit/Hyperactivity Disorder (ADHD) and ADHD Medication Treatment in Active Component Service Members, U.S. Armed Forces, 2014–2018	28,313
MSMR Vol. 26 No. 3 (Posted Mar. 1, 2019)	Sexually Transmitted Infections, Active Component, U.S. Armed Forces, 2010–2018	13,084
MSMR Vol. 26 No. 8 (Posted Aug. 1, 2019)	Update: Routine Screening for Antibodies to Human Immunodeficiency Virus, Civilian Applicants for U.S. Military Service and U.S. Armed Forces, Active and Reserve Components, January 2014–June 2019	12,022
MSMR Vol. 26 No. 3 (Posted Mar. 1, 2019)	Vasectomy and Vasectomy Reversals, Active Component, U.S. Armed Forces, 2000–2017	8,078
MSMR Vol. 26 No. 3 (Posted Mar. 1, 2019)	Brief Report: Male Infertility, Active Component, U.S. Armed Forces, 2013–2017	6,058
MSMR Vol. 26 No. 7 (Posted Jul. 1, 2019)	Infectious Mononucleosis, Active Component, U.S. Armed Forces, 2002–2018	5,583
MSMR Vol. 26 No. 4 (Posted Apr. 1, 2019)	Update: Heat Illness, Active Component, U.S. Armed Forces, 2018	5,558
MSMR Vol. 27 No. 2 (Posted Feb. 1, 2020)	Images in Health Surveillance: Skin Rashes in Children Due to Infectious Causes	5,541
MSMR Vol. 26 No. 12 (Posted Dec. 1, 2019)	Prevalence of Glucose-6-Phosphate Dehydrogenase Deficiency, U.S. Armed Forces, May 2004–September 2018	5,172

[a]Webpage views represent cumulative, unique views of articles published to the *MSMR* web site, summarized as of Dec. 13, 2023; thus, the number of page views is expected to rise over time.

to each of the Public Health Defense Centers engaged in local force health protection. Additionally, increased publication of editorials, letters to the editor, and notices to readers may offer another venue for publishing efforts by the Army, Navy, and Air Force to enable a healthy, ready Force.

As we usher in a new year that will see the start of *MSMR*'s 30th year of production, our editorial staff continues to welcome new submissions, especially those aligned with DHA Public Health's strategic position for meeting the needs of the MHS, the military services, and the Combatant Commands, for the support of our nation's security. Detailed instructions for prospective authors are available on the *MSMR* website.

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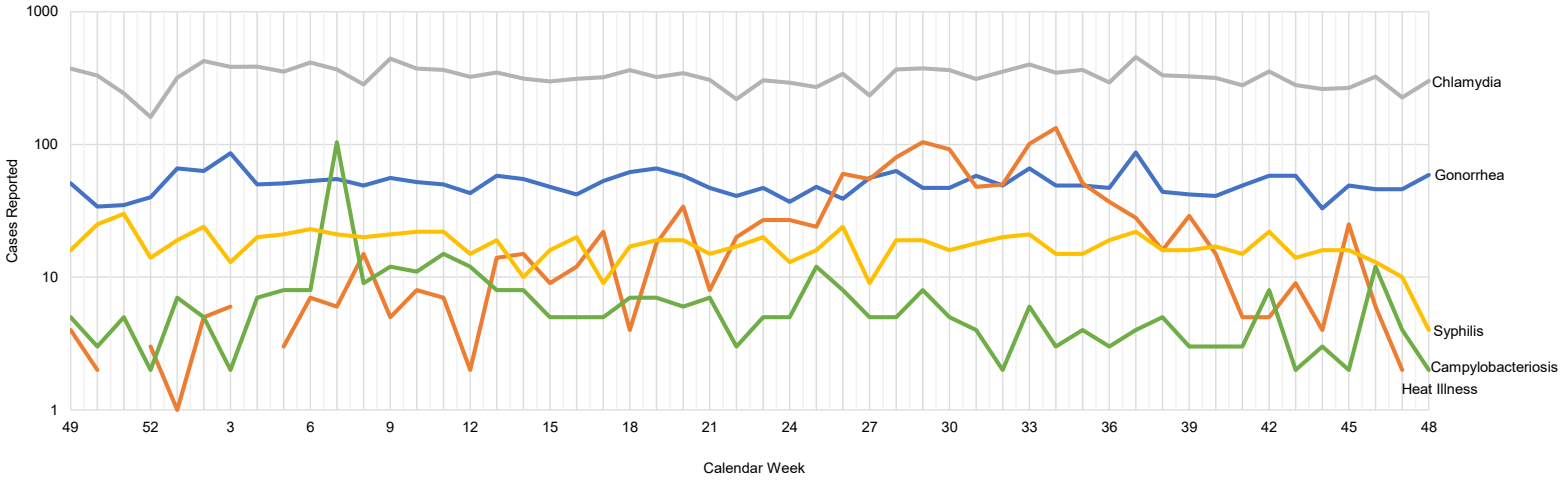
Reportable Medical Events at Military Health System Facilities Through Week 48, Ending November 30, 2023

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

TOP 5 REPORTABLE MEDICAL EVENTS BY CALENDAR WEEK, ACTIVE COMPONENT (DECEMBER 4, 2022 - NOVEMBER 30, 2023)



Note: There were 0 heat illness cases in week 51 of 2022 and weeks 4 and 48 of 2023.
Abbreviation: No., number.
[a]Cases are shown on a logarithmic scale.

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) for monitoring, controlling, and preventing 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 top 5 RMEs, and is presented with the current month's (October 2023) top 5 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 48, Ending November 30, 2023[a]

Reportable Medical Event[b]	Active Component[c]					MHS Beneficiaries[d]
	October	November	YTD 2023	YTD 2022	Total, 2022	November
	no.	no.	no.	no.	no.	no.
Amebiasis	-	1	13	9	13	1
Arboviral diseases, neuroinvasive and non-neuroinvasive	-	-	2	1	1	1
Brucellosis	-	-	-	2	2	-
COVID-19-associated hospitalization and death[e]	9	5	100	7	7	59
Campylobacteriosis	14	16	252	215	230	11
Chikungunya virus disease	-	-	2	1	1	-
Chlamydia trachomatis	1,336	1,209	15,862	18,168	19,432	180
Cholera	-	-	4	2	2	-
Coccidioidomycosis	1	3	24	14	15	-
Cold weather injury[f]	9	12	124	131	151	-
Cryptosporidiosis	1	1	61	45	46	-
Cyclosporiasis	-	-	15	10	10	-
Dengue virus infection	1	-	7	1	1	-
E. coli, Shiga toxin-producing	2	3	65	66	67	4
Ehrlichiosis/anaplasmosis	-	-	29	3	3	-
Giardiasis	6	4	71	67	71	1
Gonorrhea	216	208	2,503	3,116	3,305	40
Haemophilus influenzae, invasive	-	-	1	1	1	1
Hantavirus disease	-	-	1	1	1	-
Heat illness[f]	36	35	1,254	1,205	1,214	-
Hepatitis A	-	-	7	13	16	1
Hepatitis B	7	9	135	114	119	8
Hepatitis C	2	4	47	54	57	6
Influenza-associated hospitalization[g]	9	3	19	141	148	10
Lead poisoning, pediatric[h]	-	-	-	-	-	3
Legionellosis	1	1	5	3	4	2
Leishmaniasis	-	-	1	1	1	-
Leprosy	-	-	2	1	1	-
Leptospirosis	1	-	4	1	1	-
Lyme disease	6	2	66	61	65	8
Malaria	2	4	25	26	26	1
Meningococcal disease	-	-	2	2	2	-
Mpox	2	1	3	93	93	-
Norovirus	17	22	387	202	222	29
Pertussis	5	3	13	9	10	8
Post-exposure prophylaxis against Rabies	41	36	534	487	514	26
Q fever	-	-	2	3	3	-
Rubella	-	-	2	3	3	-
Salmonellosis	26	5	114	118	122	14
Schistosomiasis	-	-	-	1	1	-
Severe Acute Respiratory Syndrome (SARS)	-	-	-	1	1	-
Shigellosis	-	1	57	29	33	2
Spotted Fever Rickettsiosis	-	1	31	69	70	-
Syphilis (all)	76	50	826	956	1,049	15
Toxic Shock Syndrome	-	-	1	-	-	-
Trypanosomiasis	-	-	1	1	1	-
Tuberculosis	2	-	11	11	11	1
Tularemia	-	-	1	-	-	-
Typhoid fever	-	-	2	-	-	-
Typhus fever	-	-	2	1	1	-
Varicella	-	2	11	14	16	2
Total case counts	1,828	1,641	22,701	25,480	27,163	434

Abbreviations: MHS, Military Health System; YTD, year-to-date; no., number; RME, reportable medical event; DRSi, Disease Reporting System internet; ACSM, active component service member; FMP, Family Military Prefix.

[a] RMEs reported through the DRSi as of November 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 October 1, 2023–October 31, 2023 and November 1, 2023–November 30, 2023. YTD comparison is displayed for the period of January 1, 2023–November 30, 2023 for MHS facilities. Previous year counts are provided as the following: previous year YTD—January 1, 2022–November 30, 2022; total 2022—January 1, 2022–December 31, 2022.

[b] RME categories with 0 reported cases among ACSMs 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, 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. Does not include cases of hospitalization or death reported under the previous COVID-19 case definition.

[f] Only reportable for ACSMs.

[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.

From the Editor's Desk

Robert Johnson, MD, MPH, MBA, FACPM, FASMA

With humility and pride, this month I begin my tenure as the new Editor-in-Chief of the *Medical Surveillance Monthly Report (MSMR)*. Since the launch of the *MSMR* in 1995, there have been 3 prior editors-in-chief. For the past 5 months, *MSMR* has continued to thrive with an outstanding interim leader, Dr. Angelia Eick-Cost, who stepped up to take the lead editor role during the search for a permanent editor-in-chief. Dr. Cost has my sincere appreciation for her superb work in maintaining the high professional standards of *MSMR*. I know that I share the sentiments of the *MSMR* staff and co-workers when I share our heartfelt thanks to Dr. Cost.

In the most recent Armed Forces Health Surveillance Division (AFHSD) Annual Report, *MSMR* is referred to as the "premiere medical peer-reviewed journal published by the AFHSD and Defense Health Agency (DHA)," which provides "evidence-based estimates of the incidence, distribution, impact and trends of illness and injury among U.S. military service members and associated populations." *MSMR* has a distinguished legacy of excellence and professional rigor. I am honored to pick up and carry that standard further.

I come to this position after a 30-year military career followed by academic, research, and executive roles at the University of Texas Medical Branch School of Medicine, the Civil Aerospace Medical Institute (a FAA Federal Laboratory), and as a physician executive with a national managed care support contractor administering the TRICARE East Region for the DHA. My military experience spans operational medical support in 5 continents, operational epidemiology, longitudinal research that included the role of principal investigator for 2 long-term military cohort studies, directing the U.S. Air Force Preventive Medicine Residency Program, and numerous teaching and leadership positions. My medical specialty training and certifications include Preventive Medicine and Aerospace Medicine along with academic training in epidemiology. I am excited to bring together my training and experience in the operational medicine, research, and leadership domains in the role of *MSMR* editor-in-chief.

Military Public Health continues its steadfast contribution to the health and readiness of the Force. Public Health develops policies and practices to maintain our national defense, informed by timely, operationally relevant, and practical health and safety information that supports leading Armed Forces health professionals and individual service members.

MSMR focuses on data-driven, health-related information and analysis, embedded in the Epidemiology and Analysis Branch of AFHSD. We are well-positioned within the health and medical surveillance infrastructure of DHA to engage these significant resources and function as its medical journal publishing arm.

As we build on the well-earned accolades of the legacy of *MSMR*, we continue the excellence and operational relevance of the published product. I look forward to maintaining the excellent relationships with the leaders and staff of AFHSD and the Public Health Directorate of DHA. We will focus on expanding the involvement of our editorial advisory board partners and actively engage with them to draw upon their expertise and recommendations. We plan to continue to expand our academic affiliations and professional outreach to DOD clinical and operational leaders within the public health domain to assure we address their identified health challenges where we can.

The role of the *MSMR*, within and supporting the overall mission of AFHSD, the Public Health Directorate, and DHA, remains vital. The application of appropriate database utilization, information review, and methodologically-valid analysis remains the "gold standard" of epidemiologic surveillance and medical knowledge development. At *MSMR*, we continue to strive for timeliness with careful deliberation, relevance with objectivity, and scientific validity focused on readiness and force health protection.

Very Respectfully,
Robert Johnson
MD, MPH, MBA, FACPM, FASMA
Col (ret) USAF, MC, CFS
Editor-in-Chief
Medical Surveillance Monthly Report

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