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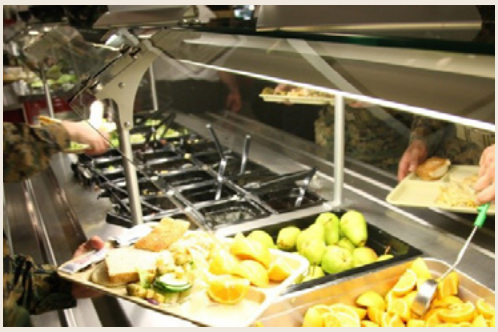

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Incidence and Management of Chronic Insomnia, Active Component, U.S. Armed Forces, 2012 to 2021

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The Department of Veterans Affairs and Department of Defense Clinical Practice Guideline (VA/DOD CPG) provides evidence-based management pathways to mitigate the negative consequences of common sleep disorders among service members (SMs). This retrospective cohort study estimated the incidence of chronic insomnia in active component military members from 2012 through 2021 and the percentage of SMs receiving VA/DOD CPG-recommended insomnia treatments. During this period, 148,441 incident cases of chronic insomnia occurred, with an overall rate of 116.1 per 10,000 person-years (p-yrs). A sub-analysis of SMs with chronic insomnia diagnosed during 2019-2020 found that 53.9% received behavioral therapy and 72.7% received pharmacotherapy. As case ages increased, the proportion who received therapy decreased. Co-existing mental health conditions increased the likelihood of receiving therapy for insomnia cases. Clinician education about the VA/DOD CPG may improve utilization of these evidence-based management pathways for SMs with chronic insomnia.

What are the new findings?

From 2012 through 2021, the crude incidence rate of chronic insomnia among active component service members was 116.1 cases per 10,000 person-years, and the annual rate remained stable throughout the 10-year period. Among those diagnosed, 53.7% received behavioral therapy, the first line recommended insomnia treatment, and 72.7% received pharmacotherapy.

What is the impact on readiness and force health protection?

Insufficient sleep from chronic insomnia poses a direct threat to operational readiness due to impaired cognitive performance and increased musculoskeletal injury. The evidence-based management pathways outlined in the Department of Veterans Affairs and Department of Defense Clinical Practice Guideline should be promoted to mitigate the negative consequences of chronic insomnia.

Insomnia is characterized by a subjective perception of difficulty initiating or maintaining sleep, dissatisfaction with sleep quantity or quality despite adequate opportunity, and subsequent daytime impairment. Chronic insomnia is defined as insomnia symptoms for at least 3 months duration and occurring at least 3 days per week, by the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5),*[1] and the *International Classification of Sleep Disorders, Third Edition*.[1,2]

Insomnia is the most common sleep disorder in the U.S., with 20% to 30% of adults reporting at least 1 symptom of insomnia and an estimated 6% to 10% meeting diagnostic criteria for chronic insomnia.[3,4] In a RAND report on sleep in the military, 48.6% of military personnel surveyed had poor sleep quality, and recent studies have reported the prevalence of insomnia as ranging from 4.5% to 22.8% among military personnel.[5-9] In addition, studies suggest insomnia is a growing health threat to SMs. Department of Defense (DOD) medical surveillance data for the period 2000 through 2009 document a 19-fold increase in insomnia diagnoses over the 9-year period (crude incidence rate of insomnia increased from 7.2 to 135.8 cases per 10,000 person years [p-yrs]).[10] Additionally, during Operation Iraqi Freedom (OIF), Operation Enduring Freedom (OEF), and Operation New Dawn (OND), diagnosis rates of insomnia increased dramatically in all branches of service.[11,12]

Sleep is vital to systemic physiology including metabolism, appetite regulation, immune and hormone function, as well as cardiovascular systems; it is critical to neurobehavior, cognitive performance, memory consolidation, and mood regulation.[13] Not surprisingly, insomnia has been associated with higher rates of numerous physical and mental health conditions, as well as poor job performance and increased work-related injuries and accidents. Within the military, daytime fatigue due to poor sleep poses a direct threat to military operational readiness, as it is associated with negative health impacts such as impaired decision making and reaction time, decreased cognitive function, increased musculoskeletal injury, and decreased anaerobic and endurance performance.[14-17] The impacts of insomnia can be severe, as evidenced by 2 separate fatal collisions of U.S. Navy ships in 2017 in which fatigue was cited as a contributing factor.[18,19]

The effects of poor sleep are well known to the DOD, and in 2019 a joint VA/DOD CPG was published to provide clinicians a framework by which to evaluate, treat, and manage the needs of patients with sleep disorders and promote greater sleep health among SMs.[20] This study provides

an update on the incidence of chronic insomnia among active component SMs between 2012 and 2021 and examines the implementation of the VA/DOD CPG recommendations among the active duty population diagnosed with chronic insomnia in the Military Health System (MHS) between 2019 and 2021.

Methods

All data for this study were obtained from the Defense Medical Surveillance System (DMSS). The DMSS contains comprehensive longitudinal data and links demographic information to direct and purchased health care encounters for active component SMs of the U.S. Armed Forces. Records of prescribed and dispensed sleep aid medications from the Pharmacy Data Transaction Service (PDTS) are also contained within DMSS. Data were also compiled from records of annual Periodic Health Assessments (PHAs), which include self-reports of a SM's average sleep duration that capture the number of hours of sleep attained on most days during the 2 weeks prior to the PHA.

The overarching goals of this study were: 1) to determine the incidence of chronic insomnia among active component SMs by demographic and military characteristics; 2) to determine the proportion of incident chronic insomnia cases that received behavioral therapy (BT) or pharmacotherapy (PT) for treatment of chronic insomnia within 365 days after diagnosis; and 3) to determine the proportion of incident chronic insomnia cases that reported adequate sleep (7 or more hours/night) on a PHA administered before and after their chronic insomnia diagnoses. The surveillance period was 1 January 2012 through 31 December 2021. The surveillance population included all individuals who served at any time in the active component of the Army, Navy, Air Force, or Marine Corps.

An incident case of insomnia was defined by records of at least 2 medical encounters (inpatient or outpatient) annotated with an International Classification of Diseases, 9th/10th revision (ICD-9 or ICD-10) diagnostic code for insomnia in any diagnostic position. Encounters had to be at least 90, but no more than 390, days apart (similar to the approach used by Bramoweth and colleagues to account for variability in annual appointment scheduling), and the incident date was defined as the first of the 2 qualifying encounters.[21] The ICD-9 and ICD-10 codes used to define a case of insomnia are listed in **Table 1**. Incidence rates were calculated as incident cases of chronic insomnia per 10,000 p-yrs of active component SMs. Individuals with a chronic insomnia diagnosis prior to 1 January 2012 were excluded and person-time was censored after the incident date of each incident case.

To assess the second objective, individuals with incident cases of chronic insomnia diagnosed during 2019 and 2020 were included in a subpopulation to determine the proportions that received BT or PT for treatment within 365 days after diagnosis. Individuals who did not have at least 1 year of follow-up time after their incident diagnosis were excluded. Baseline demographic, military, and clinical characteristics of cases were analyzed. Clinical characteristics included care type (direct care in military hospitals or clinics or outsourced to private sector care) and co-occurring ICD-10 diagnoses within the past year of traumatic brain injury (TBI) or a mental health condition commonly associated with insomnia symptoms, including anxiety, depression, substance use disorder, bipolar disorder, adjustment disorder, or post-traumatic stress disorder (PTSD).[22-26] The Current Procedural Terminology (CPT) codes used to define behavioral therapy medical encounters for insomnia are listed in **Table 2**. Brief Behavioral Therapy for Insomnia (BBT-I) was defined as 1-4 sessions of BT, and Cognitive Behavioral Therapy for Insomnia (CBT-I) was defined as 5 or more sessions of BT. An outpatient medical encounter with an ICD-9 or ICD-10 code for insomnia in any diagnostic position in combination with 1 of the CPT codes listed in **Table 2** was considered BT for insomnia. A PDTS record for a dispensed sleep aid medication listed in **Table 3** was considered PT for chronic insomnia. Both generic and brand

TABLE 1. ICD-9/ICD-10 diagnostic codes for insomnia

ICD-9	
307.42	Persistent disorder of initiating or maintaining sleep
307.41	Transient disorder of initiating or maintaining sleep
327.02	Insomnia due to mental disorder
780.52	Insomnia, unspecified
327.00	Organic insomnia, unspecified
327.01	Insomnia due to medical condition classified elsewhere
327.09	Other organic insomnias
ICD-10	
F51.0	Insomnia not due to a substance or known physiological condition
F51.01	Primary insomnia
F51.02	Adjustment insomnia
F51.03	Paradoxical insomnia
F51.04	Psychophysiological insomnia
F51.05	Insomnia due to other mental disorder
F51.09	Other insomnia not due to a substance or known physiological condition
G47.0	Insomnia
G47.00	Insomnia, unspecified
G47.01	Insomnia due to a medical condition
G47.09	Other insomnia

Abbreviations: ICD-9, International Classification of Diseases, 9th revision; ICD-10, International Classification of Diseases, 10th revision.

names for each medication were searched in the PDTS record. All sleep aid medications included in the analysis, with the exception of the orexin receptor antagonist lemborexant (Dayvigo), were medications cited as reviewed PT interventions in the VA/DOD CPG methodology. Lemborexant was included in the analysis because it has the same mechanism of action as suvorexant (Belsomra), which was reviewed in the VA/DOD CPG methodology, but the Food and Drug Administration approval for use of lemborexant as a pharmacotherapy for insomnia was granted after the publication of the VA/DOD CPG.

For the third objective, PHA results were assessed from surveys administered before and after chronic insomnia diagnoses to determine the proportion of incident chronic insomnia cases self-reporting adequate sleep (7 or more hours/night). During the self-reported survey portion of the PHA, SMs are asked, "During the last 2 weeks, how many hours of sleep did you get on most days?" Available responses include "Less than 5 hours," "5 to less than 7 hours," "7 to 9 hours," and "More than 9 hours." In this analysis, responses were quantified as a dichotomous variable, with "Less than 5 hours" and "5 to less than 7 hours" considered inadequate sleep (less than 7 hours of sleep per night) and "7 to 9 hours" and "More than 9 hours" considered adequate sleep (7 or more hours of sleep per night). Individuals without a PHA record between 9 and 15 months after the chronic insomnia incident date were excluded. The percentage of those who reported adequate sleep was analyzed according to what type of treatment was received (BT, PT, or none).

Results

During the 10 years from 2012 through 2021, there were 148,441 incident diagnoses of chronic insomnia among active component SMs, with an overall crude incidence rate of 116.1 cases per 10,000 p-yrs (**Table 4**). The rates of incident diagnoses of insomnia remained relatively stable throughout the surveillance period (**Figure 1**); the highest annual rate was in 2016 at 134.0 cases per 10,000 p-yrs, and the lowest annual rate

TABLE 2. CPT codes associated with behavioral therapy medical encounters for insomnia

CPT Code	Description
Psychiatric diagnostic procedure codes	
90791	Psychiatric diagnostic evaluation
90792	Psychiatric diagnostic evaluation with medical services
Psychotherapy codes	
90832	Psychotherapy, 30 minutes with patient
90833	Psychotherapy, 30 minutes with patient when performed with an evaluation and management service
90834	Psychotherapy, 45 minutes with patient
90836	Psychotherapy, 45 minutes with patient when performed with an evaluation and management service
90837	Psychotherapy, 60 minutes with patient
90838	Psychotherapy, 60 minutes with patient when performed with an evaluation and management service
Health and behavior assessment/intervention codes	
96150	Health and behavior assessment (e.g., health-focused clinical interview, behavioral observations, psychophysiological monitoring, health-oriented questionnaires), each 15 minutes face-to-face with the patient; initial assessment
96151	Health and behavior assessment (e.g., health-focused clinical interview, behavioral observations, psychophysiological monitoring, health-oriented questionnaires), each 15 minutes face-to-face with the patient; reassessment
96152	Health and behavior intervention, each 15 minutes, face-to-face; individual
96153	Health and behavior intervention, each 15 minutes, face-to-face; group (2 or more patients)
96154	Health and behavior intervention, each 15 minutes, face-to-face; family (with the patient present)

Abbreviation: CPT, Current Procedural Terminology.

TABLE 3. Generic drug and brand names for analysis of pharmacotherapy for insomnia, by VA/DOD CPG recommendations

Drug (Generic) Name	Brand Name(s)
VA/DOD CPG–recommended for short-term course pharmacotherapy for chronic insomnia	
Doxepin	Silenor
Eszopiclone	Lunesta
Zaleplon	Sonata
Zolpidem	Ambien
Zolpidem, extended release	Ambien CR
Zolpidem sublingual	Intermezzo, Edluar
Zolpidem tartrate	Zolpimist
VA/DOD CPG–Insufficient evidence to recommend for or against use	
Ramelteon	Rozerem
Suvorexant	Belsomra
VA/DOD CPG–Not recommended for use against chronic insomnia	
Trazodone	Desyrel
Trazodone, extended release	Oleptro
Quetiapine	Seroquel
Temazepam	Restoril
Triazolam	Halcion
Estazolam	ProSom
Quazepam	Doral
Flurazepam	Dalmane
Oxazepam	Serax
Diphenhydramine	Benadryl, Nytol, Simply Sleep
Melatonin	
Not listed in VA/DOD CPG	
Lemborexant	Dayvigo

Abbreviation: VA/DOD CPG; Veterans Affairs/Department of Defense Clinical Practice Guidelines.

TABLE 4. Numbers and incidence rates of chronic insomnia,[a] active component service members, 2012 to 2021

	No.	Rate per 10,000 p-yrs
Total	148,441	116.0
Service		
Army	92,759	200.0
Navy	18,756	59.0
Air Force	23,858	77.0
Marine Corps	13,068	71.0
Sex		
Male	115,953	107.5
Female	32,488	162.4
Age group, y		
<20	4,032	43.8
20-24	34,356	82.8
25-29	32,431	106.7
30-34	24,260	119.7
35-39	25,496	179.1
40+	27,866	227.3
Racial/ethnic group		
Non-Hispanic White	75,195	101.9
Non-Hispanic Black	37,690	186.4
Hispanic	21,224	110.1
Other/Unknown	14,332	98.6
Rank		
Junior enlisted (E1-E4)	54,370	96.4
Senior enlisted (E5-E9)	74,921	153.1
Junior officer (O1-O3)	7,552	59.3
Senior officer (O4-O10)	8,116	101.1
Warrant officer (W1-W5)	3,482	199.2
Education level		
High school or less	89,944	108.5
Some college	26,567	174.9
Bachelor's or advanced degree	29,866	110.7
Other/unknown	2,064	73.7
Marital status		
Single	42,347	77.2
Married	93,041	138.1
Other/unknown	13,053	231.8
Military occupation		
Combat-related[b]	23,565	130.1
Motor transport	5,564	149.4
Pilot/air crew	1,669	34.5
Repair/engineering	35,392	93.3
Communications/intelligence	39,483	144.1
Health care	18,536	169.8
Other/unknown	24,232	97.3
Prior USCENTCOM deployment		
Yes	81,279	173.0
No	67,162	83.1
Geographic region		
Northeast	4,578	129.3
Midwest	8,787	110.9
South	84,058	152.0
West	33,170	107.4
Overseas	13,520	75.7
Unknown/missing	4,328	35.1

[a]One case per individual in surveillance period.
[b]Infantry/artillery/combat engineering.
Abbreviations: P-yrs, person-years; No., number; USCENTCOM, U.S. Central Command

was in 2020 at 99.8 cases per 10,000 p-yrs. The Army's rates of chronic insomnia were consistently the highest among the services (**Table 4**), with an incidence rate more than twice the rate of any other service each year, peaking at 242.8 cases per 10,000 p-yrs in 2016 (**data not shown**).

Incidence increased linearly with age, with rates lowest among the youngest (<20 years) and highest among the oldest (>40 years) SMs. Incidence of chronic insomnia differed by sex as well as racial/ethnic group. Throughout the period, the incidence rate was 51% higher among females than males, and 69% to 89% higher for Non-Hispanic Black SMs compared to those of Non-Hispanic White, Hispanic, or Other/unknown race/ethnicity. Service members with a history of prior USCENTCOM deployment had an incidence rate 108% higher than those without prior USCENTCOM deployment **(Table 4)**. The rate differences by age, sex, race and ethnicity, and prior USCENTCOM deployment persisted throughout the entire surveillance period **(data not shown)**.

Treatment for chronic insomnia

There were 20,034 individuals with incident chronic insomnia diagnoses between 1 January 2019 and 31 December 2020. Of this subpopulation, 53.9% received BT and 72.7% received PT (**Table 5**). Some demographic and clinical subgroups were more likely to receive BT or PT for management of chronic insomnia. Across the services, the percentage of SMs receiving PT was similar; however, BT for insomnia was most common among Army SMs (**Figure 2**). The percentages of SMs who received therapy (BT or PT) decreased linearly with increasing age (**Figure 3**). A higher percentage of individuals with co-occurring mental health conditions received BT and PT compared to the overall population (**Table 5**). For example, 90.5% of individuals with co-occurring bipolar disorder received PT and 68.3% received BT, compared to 72.7% and 53.9% overall. A higher percentage of women (77.1%) received PT for insomnia management than men (71.3%); however, the percentages of those who received BT were similar for women and men.

No large differences (>5%) were seen in the percentage of SMs who received BT or

PT by race/ethnicity or by history of prior USCENTCOM deployment. In addition, there was little difference by military occupation in percentages who received BT or PT, except for pilots/air crew, of whom only 39.2% received BT and 53.9% received PT.

Of the individuals who received BT, 64.2% received BBT-I and 35.8% received CBT-I. Nearly all BT for insomnia management (97.2%) was provided in the direct care system (military hospitals or clinics). **Figure 4** charts all dispensed PT based on the VA/DOD CPG recommendations.

Self-reported sleep duration before and after chronic insomnia diagnosis

The study cohort for this sub-analysis included 7,240 SMs; 12,794 individuals were excluded because they did not have a PHA record 9-15 months after their chronic insomnia incident date. On the PHA prior to diagnosis of chronic insomnia (baseline PHA), 961 SMs (13.3%) reported adequate (at least 7 hours) sleep on most days during the last 2 weeks, 5,785 SMs (79.9%) reported inadequate sleep (less than 7 hours per night), and 494 SMs (6.8%) did not have a baseline PHA **(data not shown)**.

During a subsequent PHA performed 9-15 months after chronic insomnia diagnosis, 11.0% of the total 7,240 cases reported adequate sleep in the last 2 weeks. However, of the 79.9% who reported inadequate sleep on the baseline PHA, only 8.1% reported adequate sleep duration on the subsequent PHA. There was no difference in adequate sleep between SMs who received BT (10.4%) and PT (10.2%).

Editorial Comment

This study examined the incidence of chronic insomnia in the last 10 years among active component military members along with the implementation of the 2019 VA/DOD CPG for the management of chronic insomnia in the MHS. The incidence rate of chronic insomnia remained relatively stable over the 10-year period. Consistent with prior studies, this analysis shows that certain demographic and clinical characteristics, including age, sex, and racial/ethnic group were associated with higher incidence rates of chronic insomnia.[27-29] Among the services, the Army consistently had the highest rates of chronic insomnia (a finding consistent with prior reports).[30] Additionally, the Army had higher rates of BT for treatment of chronic insomnia than all the other services. While the entire DOD has begun to prioritize optimal sleep as a means of enhancing SM safety and productivity, the Army has been at the forefront of service-wide educational programming on military-appropriate sleep practices. Additionally, the Army recently updated its Holistic Health and Fitness Manual to expand upon the importance of sleep and methods to improve sleep hygiene. These initiatives may help explain the higher incidence rates detected in the Army as well as the higher percentages of SMs who received BT for management.[31]

The incidence rate of chronic insomnia peaked in 2016, and there has been a continued downward trend in chronic insomnia diagnoses since 2016, which may reflect the lower operational tempo with the conclusions of OIF, OEF, and OND. The lowest incidence rate was in 2020; however, the incidence rate increased in 2021, which aligns with the higher prevalence of anxiety, depression, and insomnia during the early phases of the COVID-19 pandemic.[32] COVID-19 led to unprecedented changes in how individuals live and work, and increased psychological stress due to health concerns, social isolation, financial hardship, disruption of education, and uncertainty about the future has had major impacts on mental health and sleep behavior globally.[32] Further analysis of the incidence rate of chronic insomnia over time is warranted to better understand the impact of the COVID-19 pandemic on sleep.

A sub-analysis of those with insomnia diagnosed in 2019 and 2020 shows, with increasing age, an inverse relationship between increasing incidence of chronic insomnia and decreasing percentages of individuals receiving therapeutics (BT or PT). This inverse relationship could be due to the fact this analysis did not evaluate a wide range of potential co-occurring health conditions that may contribute to insomnia symptoms, particularly among older individuals, such as chronic pain, tinnitus, cancer, diabetes, heart disease, and gastroesophageal reflux disease (GERD). No differentiation was made between idiopathic insomnia and insomnia due to a comorbid condition with a direct link to some external factor such as medical illness, mental disorders, or other disruptive sleep disorder that prevents proper rest. The VA/DOD CPG-recommended treatments evaluated in this study specify management of idiopathic insomnia and these treatments may differ from the medical management needed to treat the underlying causes of

FIGURE 1. Crude annual incidence rate of chronic insomnia, active component service members, 2012 to 2021

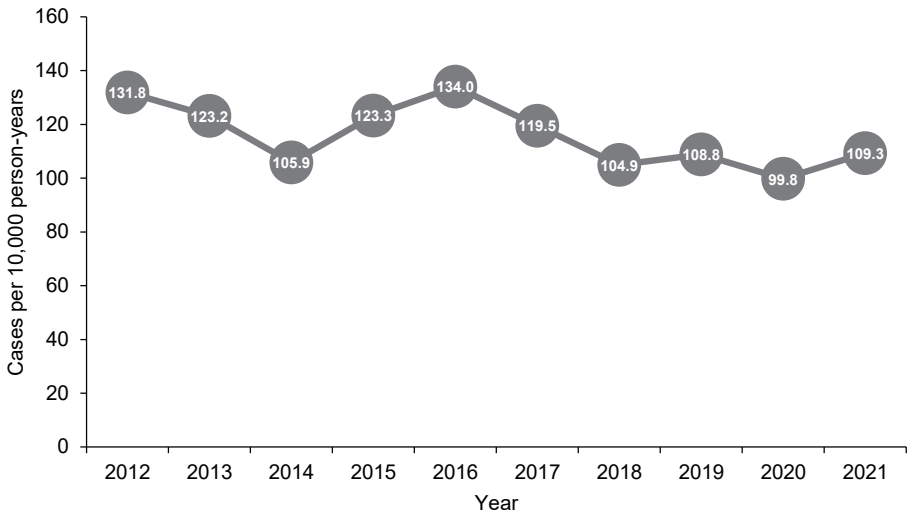


TABLE 5. Percent of incident chronic insomnia cases diagnosed during 2019-2020 who received behavioral therapy or pharmacotherapy for insomnia,[a] by demographics, active component service members

	Chronic Insomnia Cases	With Any BT Encounter		With Any PT	
	No.	No.	%	No.	%
Total	20,034	10,792	53.9	14,573	72.7
Year of incident chronic insomnia diagnosis					
2019	10,296	6,028	58.5	7,431	72.2
2020	9,738	4,764	48.9	7,142	73.3
Service					
Army	11,823	7,678	64.9	8,863	75.0
Navy	3,351	1,295	38.6	2,392	71.4
Air Force	3,226	1,102	34.2	2,125	65.9
Marine Corps	1,634	717	43.9	1,193	73.0
Sex					
Male	14,950	7,941	53.1	10,652	71.3
Female	5,084	2,851	56.1	3,921	77.1
Age group, y					
<20	653	412	63.1	529	81.0
20-24	4,460	2,746	61.6	3,415	76.6
25-29	4,059	2,261	55.7	3,061	75.4
30-34	3,143	1,590	50.6	2,267	72.1
35-39	4,018	2,002	49.8	2,795	69.6
40+	3,701	1,781	48.1	2,506	67.7
Racial/ethnic group					
Non-Hispanic White	9,300	4,903	52.7	6,665	71.7
Non-Hispanic Black	5,304	3,023	57.0	3,994	75.3
Hispanic	3,295	1,799	54.6	2,407	73.1
Other/unknown	2,135	1,067	50.0	1,507	70.6
Rank					
Junior enlisted (E1-E4)	6,651	4,088	61.5	5,155	77.5
Senior enlisted (E5-E9)	10,257	5,254	51.2	7,319	71.4
Junior officer (O1-O3)	1,224	568	46.4	870	71.1
Senior officer (O4-O10)	1,348	556	41.2	839	62.2
Warrant officer (W1-W5)	554	326	58.8	390	70.4
Education level					
High school or less	11,051	6,297	57.0	8,312	75.2
Some college	3,712	1,977	53.3	2,632	70.9
Bachelor's or advanced degree	5,035	2,412	47.9	3,458	68.7
Other/unknown	236	106	44.9	171	72.5
Marital status					
Single	6,017	3,462	57.5	4,502	74.8
Married	12,213	6,372	52.2	8,714	71.4
Other/unknown	1,804	958	53.1	1,357	75.2
Military occupation					
Combat-related[b]	2,544	1,501	59.0	1,836	72.2
Motor transport	729	433	59.4	537	73.7
Pilot/air crew	204	80	39.2	110	53.9
Repair/engineering	4,807	2,467	51.3	3,468	72.1
Communications/intelligence	5,638	3,040	53.9	4,123	73.1
Health care	2,715	1,441	53.1	2,036	75.0
Other/unknown	3,397	1,830	53.9	2,463	72.5
USCENTCOM deployment prior to incident insomnia diagnosis					
Yes	9,207	4,856	52.7	6,484	70.4
No	10,827	5,936	54.8	8,089	74.7
Geographic region					
Northeast	575	281	48.9	406	70.6
Midwest	1,211	634	52.4	881	72.7
South	11,713	6,278	53.6	8,549	73.0
West	4,054	2,156	53.2	2,910	71.8
Overseas	2,112	1,252	59.3	1,571	74.4
Unknown/missing	369	191	51.8	256	69.4
Co-occurring diagnoses within +/-365 days of incident chronic insomnia					
Alcohol or substance use disorder	2,480	1,700	68.5	2,108	85.0
Anxiety disorder	8,924	5,492	61.5	7,193	80.6
Depressive disorder	7,554	4,930	65.3	6,244	82.7
Adjustment disorder	11,080	7,113	64.2	8,839	79.8
PTSD	4,762	3,098	65.1	4,010	84.2
Bipolar disorder	369	252	68.3	334	90.5
TBI	2,475	1,435	58.0	1,874	75.7

[a]Demographics measured at the time of the incident case diagnosis and BT/PT treatment provided within 1 year of the incident case.
[b]Infantry/artillery/combat engineering.
Abbreviations: No., number; BT, behavioral therapy; PT, pharmacotherapy; PTSD, post-traumatic stress disorder; TBI, traumatic brain injury; USCENTCOM, U.S. Central Command.

health conditions associated with insomnia due to a comorbid condition. Therefore, this analysis may underestimate the percentage of older individuals receiving treatment for chronic insomnia because management for various comorbid conditions was not evaluated.

The findings of this study highlight a gap between the VA/DOD CPG recommendations for management of chronic insomnia and current MHS clinical practice. There was a nearly 20% difference in the percentage of SMs who received BT compared to PT, despite the guideline's recommendation of CBT-I as the first line treatment instead of PT. In a previous multiyear study of sedative hypnotic medications dispensed within the MHS, active duty SMs consistently demonstrated a higher prevalence of sedative hypnotic prescriptions than non-active duty SMs.[33] Although the percentage of BT receipt increased for individuals with co-occurring mental health conditions, the percentage of PT receipt was also about 20% higher in these individuals. This is of concern because several VA/DOD CPGs published for management of mental health conditions recommend BT as either sole first line treatment or in conjunction with PT. The VA/DOD CPG acknowledges the potential for limited access to CBT-I, especially in rural or remote locations. The burden of frequent visits and potential perceived stigma also may affect SM willingness for BT participation.

Evaluating the effectiveness of BBT-I, provider-directed telehealth CBT-I, and self-directed internet-based programs in comparison to conventional CBT-I could potentially expand treatment capabilities and engender greater patient involvement in their own treatment. When considering PT for management of chronic insomnia, only 18% of SMs with incident cases of chronic insomnia in this study received sleep aid medications indicated for short-term pharmacotherapy as recommended in the VA/DOD CPG. The majority of medications dispensed for chronic insomnia were recommended against guideline use, suggesting that MHS clinical practice may need updating to align with the recommended management of chronic insomnia.

FIGURE 2. Percentage of incident chronic insomnia cases diagnosed during 2019 and 2020 receiving insomnia therapy, by service

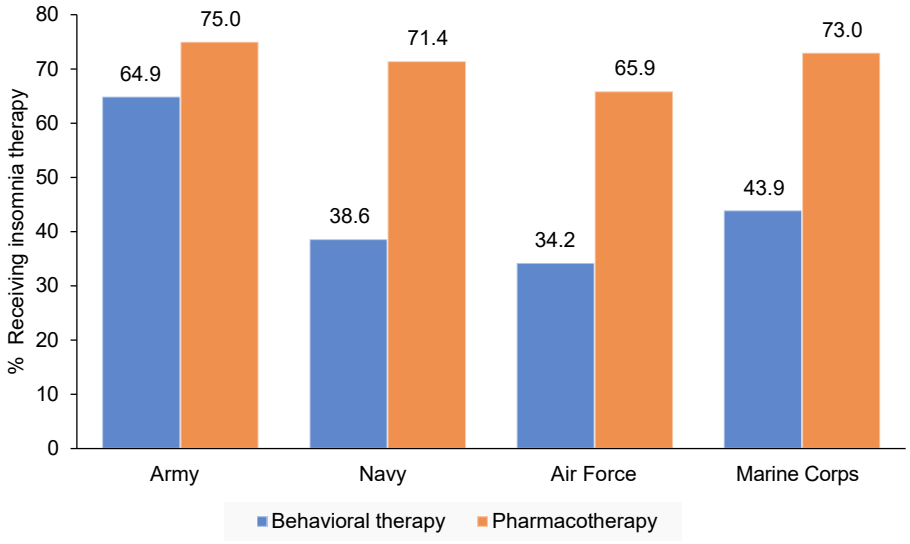
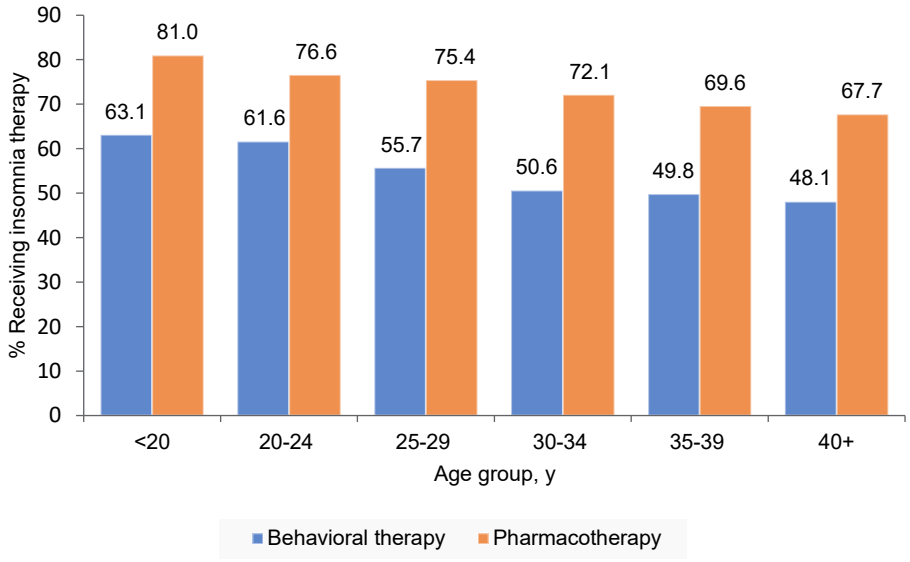


FIGURE 3. Percentage of incident chronic insomnia cases diagnosed during 2019 and 2020 receiving insomnia therapy, by age group



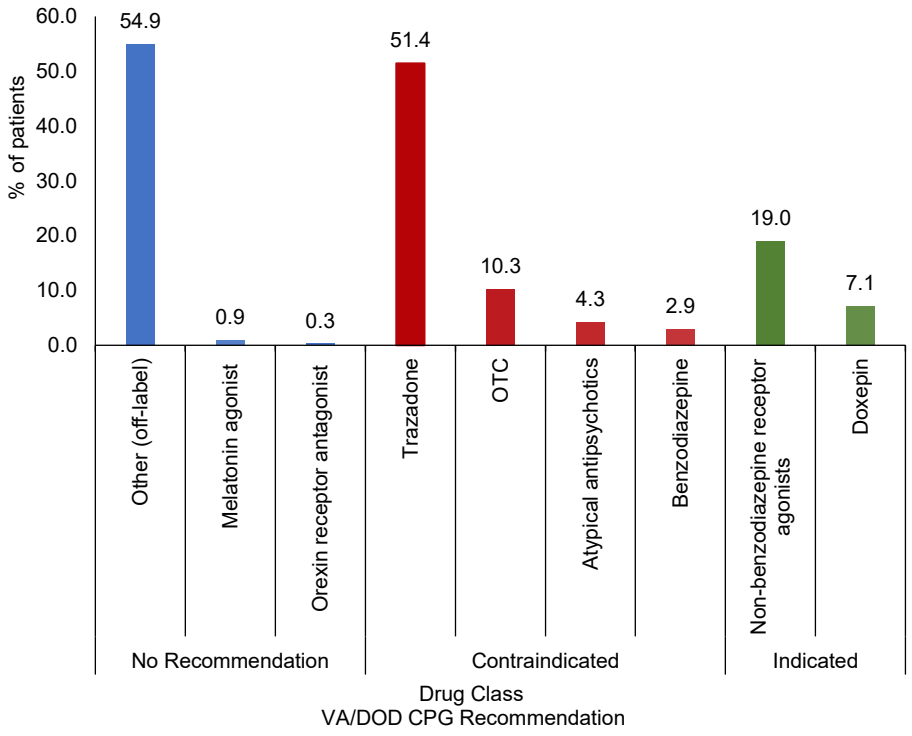
There are several limitations that should be considered when interpreting the results of this study. First, chronic insomnia could have been misclassified, since it is captured by ICD-9 and ICD-10 diagnostic codes, which are susceptible to provider coding errors. As there is no ICD code specific to chronic insomnia, the diagnosis of chronic insomnia was inferred by documentation of multiple encounters for 1 individual associated with insomnia diagnosis during a 90 to 390-day period. This may have captured recurrent or episodic cases not fully meeting the chronic insomnia criteria. The decreased incidence rate of chronic insomnia in 2020 may be a function of the reduced medical service access and use during the early phase of the COVID-19 pandemic, as opposed to an actual decrease in incident chronic insomnia. In addition, the incident cases of chronic insomnia in 2021 may be under-captured because encounter data were not available throughout the entire 390-day period, as outlined in the case definition.

Second, BT used to treat potential co-occurring health conditions such as anxiety disorder, chronic pain, or tinnitus may have been misclassified as BT for insomnia treatment because the CPT codes do not differentiate between BT for insomnia or other conditions. Although the case definition required a diagnosis of insomnia in the encounter to count as BT for insomnia, in cases of multiple diagnoses, no distinction could be made. Additionally, access to BT may have been limited in 2020 due to COVID-19 pandemic mitigation measures. Third, medications available over the counter were likely under-captured in PDTS. Melatonin, diphenhydramine, and valerian are not recommended for management of chronic insomnia but can be purchased without a prescription.

Fourth, assessing outcome measures for the treatment of chronic insomnia with administrative data is challenging, as there is no ability to capture sleep quality or quantity with the existing diagnostic codes. While PHA data offer a glimpse of recent self-assessed sleep adequacy, the PHA does not contain validated sleep screening questions; therefore, it is not an adequate measure of sleep self-assessment and cannot assess treatment effect on overall sleep improvement. Nevertheless, the strength of the study is its large population-based cohort that comprehensively captured a wide range of longitudinal data and linked demographic information to both direct and purchased care medical encounters as well as pharmacy services, demonstrating the management of chronic insomnia within the MHS.

Poor sleep affects the health and performance of individual SMs and poses a threat to military operational readiness. The evidence-based management pathways established in the VA/DOD CPG for chronic insomnia aim to mitigate the negative consequences of this common sleep disorder. Clinician education is necessary to promote the implementation of the VA/DOD CPG management pathways for SMs with chronic insomnia. A prospective assessment of both the implementation of these recommendations and the sleep outcomes from recommended treatment is needed to better measure improved sleep duration and quality and more clearly assess the effectiveness of chronic insomnia management among military SMs.

FIGURE 4. Percentage of patients dispensed medication, by name and drug class, among those dispensed any pharmacotherapy (n=14,573)



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Increased Prevalance of Overweight and Obesity and Incidence of Prediabetes and Type 2 Diabetes During the COVID-19 Pandemic, Active Component Service Members, U.S. Armed Forces, 2018 to 2021

Regan A. Stiegmann, DO, MPH; Chelsea B. Payne, MD, MPH (Lt Col, USAF); Mary Anne Kiel, MD (Col, USAF); Shauna L. Stahlman, PhD, MPH

This study evaluated trends in the prevalence of overweight, obesity, and diabetes among active component service members between 2018 and 2021, before and after the start of the COVID-19 pandemic. This study also investigated the incidence of prediabetes and type 2 diabetes mellitus (T2DM) diagnoses during the same period. Between 2018 and 2021, the prevalence of obesity among active component service members who completed a Periodic Health Assessment (PHA) increased from 16.1% to 18.8%. The incidence of prediabetes increased from 588.2 to 763.8 cases per 100,000 person-years (p-yrs), and the incidence of T2DM increased from 55.5 to 69.6 per 100,000 p-yrs. The largest relative increases in obesity prevalence were in the youngest (<30 years) age categories. Navy members and Hispanic service members experienced the largest absolute and relative increases in rates of new diabetes diagnoses. These findings indicate that during the COVID-19 pandemic active component service members experienced increased prevalence of obesity, prediabetes, and diabetes. Evaluation of lifestyle factors associated with these chronic diseases among service members may be useful to enhance deployment readiness and operational effectiveness.

What are the new findings?

Between 2018 and 2021, the prevalence of obesity, prediabetes, and diabetes increased among active component service members. The largest relative increases in obesity prevalence were in the youngest (<30 years) age categories. Navy members and Hispanic service members experienced the largest absolute and relative increases in rates of new diabetes diagnoses.

What is the impact on readiness and force health protection?

The COVID-19 pandemic was accompanied by increasing obesity and overweight prevalence and increasing incidence of diabetes and prediabetes among active component service members. These largely preventable health conditions can adversely affect military recruitment, retention, and readiness. The military services need to increase their emphasis on lifestyle modification to enhance health maintenance, wellness, and general readiness optimization among service members.

The COVID-19 pandemic has resulted in over 1,077,300 deaths in the U.S., from the start of the pandemic in 2020 through November 2022.[1] COVID-19 was the third leading cause of death in the U.S., after heart disease and cancer, from 2020 to 2021.[2] The pandemic profoundly disrupted everyday life for many people, altering their nutrition, sleep, physical activity, stress management, and social networks. The U.S. Centers for Disease Control and Prevention (CDC) found that elevated body mass index (BMI) and a history of diabetes were associated with an increased risk for severe COVID-19 illness and death.[3] Additionally, obesity is associated with an increased risk of chronic disease, including diabetes and all-cause mortality.[4]

Prior to the COVID-19 pandemic in the U.S., prevalence rates of overweight and obesity diagnoses were already rapidly trending in an upward direction. In 2008, 33.7% of adults in the U.S. were obese, and by 2018 that proportion had increased to 42.4%.[5] Furthermore, the rising number of adults in the U.S. who were severely obese (BMI≥40) represented 5.7% of the American population in 2008 and had climbed to 9.2% by 2018.[5] In the 2 years since the start of the pandemic, several studies have indicated continued increases in overweight and obesity diagnoses, particularly in children and adolescents.[6-8] These trends are concerning, as overweight and obesity are established risk factors for several chronic diseases including prediabetes, type 2 diabetes, hypertension, heart disease, stroke, sleep apnea, metabolic syndrome, fatty liver diseases, osteoarthritis, kidney disease, gallbladder disease, and multiple types of cancer.[9]

Currently, more than 37 million Americans are estimated to have diabetes, the vast majority (90-95%) type 2 diabetes mellitus (T2DM).[10] Although the incidence of new diabetes diagnoses decreased among U.S. adults from 2008 to 2019, rates of newly diagnosed T2DM increased in children and adolescents between 2002 and 2015[11]; 1 study

in Alabama found significant increases in monthly new-onset pediatric T2DM during the pandemic.[12] Of further concern, an estimated 96 million U.S. adults (38% of the U.S. population) were diagnosed with prediabetes or elevated fasting blood glucose in 2019.[13]

The U.S. military recruits new service members from young, healthy members of the U.S. population. An estimated 25% of young people aged 17 to 24, however, have elevated BMIs that disqualify them from the U.S. military.[14] Preexisting chronic medical conditions including diabetes also affect the services' ability to recruit and retain able-bodied forces.[14] One study found that active duty soldiers with elevated BMIs were 47% more likely to experience a musculoskeletal injury and utilized health care at a 49% higher rate.[15] Chronic injuries can not only affect service members' capacities for continued qualification for deployment, but can also pose greater health risks and threaten the mission during service member deployment. A qualitative systematic review of militaries over 2 decades found strong scientific evidence for obesity as a modifiable risk factor for musculoskeletal injury.[15]

The COVID-19 pandemic began in January 2020 and rapidly began to affect almost all aspects of daily life. Pandemic effects included closures of workplaces and community infrastructures such as schools, daycare facilities, gyms, churches, restaurants, and other public spaces. New laws and cultural norms dictated that individuals were to avoid direct contact and remain distanced from other people who were potentially infected, and to wear masks in most social settings. Service members were likewise affected but also carried additional burdens of prolonged quarantine periods and frequent testing, as commanders were pressed to meet overseas mission requirements in a degraded operational environment.

The objective of this study was to evaluate the prevalence of overweight and obesity among active component service members between 2018 and 2021, before and after the start of the COVID-19 pandemic. This study also investigated the incidence of prediabetes and T2DM diagnoses during the same period.

Methods

The study population included all active component U.S. military service members in the Army, Navy, Air Force, and Marine Corps. Periodic Health Assessment (PHA), medical encounter, and demographic data were obtained from the Defense Medical Surveillance System (DMSS), the central repository of medical surveillance data for the U.S. Armed Forces. Service members are required to complete PHAs on an annual basis. Diagnoses of diabetes mellitus and elevated blood glucose levels were ascertained from the DMSS, which includes records of inpatient and outpatient encounters at clinics and hospitals within the Military Health System (MHS), as well as civilian sources of health care reimbursed by TRICARE, the uniformed services health care program. To calculate BMI, records of height and weight were obtained from electronic PHA documentation.

Service members were included in the overweight and obesity analysis if they completed an electronic PHA between 1 January 2018 and 31 December 2021. Women with a pregnancy or birth-related diagnosis (International Classification of Diseases, 10th Revision [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. One weight measurement was included for each service member per year; if multiple weight measurement records were available from the same year, the last recorded weight measurement of the year was used. Height (recorded in inches) and weight (recorded in pounds) were used to calculate BMI using the formula: weight (lbs.) x 703 / [height (in.)^2].[17] A service member with a BMI≥30 was classified as obese, and a service member with BMI≥25 was classified as overweight. Records of weight less than 40 lbs. or greater than 370 lbs., height less than 30 in. or greater than 100 in., or BMI less than 12 or greater than 45 were excluded, as these measurements were assumed to be data entry errors.

Cases of elevated blood glucose ("prediabetes") were defined by an outpatient medical encounter with an elevated blood glucose diagnosis in any diagnostic position (ICD-9: 790.2*, ICD-10: R73*). An individual was considered an incident case only once per lifetime, and the incident date was established by the earliest qualifying medical encounter. Prevalent cases (i.e., cases occurring before the start of the surveillance period) were excluded, and active component person-time was censored at the time of the incident case diagnosis. Incidence rates for elevated blood glucose were calculated per 100,000 person-years (p-yrs) of active component service.

A case of T2DM was defined by a record of 2 or more inpatient or outpatient medical encounters occurring within 90 days of each other, with a diagnosis of T2DM in the first (primary) diagnostic position (ICD-9: beginning with '250' and the 5th digit is '0' or '2'; ICD-10: E11*). If an inpatient or outpatient encounter with a diagnosis for type 1 diabetes (ICD-9: beginning with '250' and the 5th digit is '1' or '3'; ICD-10: E10*) was listed in the primary diagnostic position between the first 2 case-defining encounters, then that case was excluded, as the type could not be determined. Inpatient medical encounters for women with a diabetes mellitus diagnosis were excluded if there was a diagnosis for labor and delivery (ICD-9: 650–669, V27; ICD-10: beginning with 'O' or Z37) in any diagnostic position within 6 months following the diabetes mellitus encounter, as these were presumed to be cases of gestational diabetes. Encounters with co-occurring diagnoses for gestational diabetes (ICD-9: 648.0; ICD-10: O24.4, O24.91, O24.92, O24.93) were excluded for the same purpose. The incidence date for diabetes mellitus was defined as the date of the first inpatient or outpatient encounter with a diagnosis of T2DM in the primary diagnostic position. A service member was considered an incident case only once per lifetime. As in the prediabetes analysis, prevalent cases were excluded, and active component person-time was censored at the time of the incident case diagnosis. Incidence rates for T2DM were calculated per 100,000 p-yrs of active component service.

Results

Overweight and Obesity

The prevalence of obesity among active component service members who completed a PHA increased from 16.1% in 2018 to 18.8% in 2021 **(Table 1, Figure 1)**. This was a relative increase of 13.3% from 2020, when the obesity prevalence was 16.6% **(Figure 1)**. When both obesity and overweight were considered, the prevalence increased from 65.5% in 2018 to 67.3% in 2021 **(Figure 1)**. The absolute and relative percent increases from 2018 to 2021 were higher in females than males **(Table 1)**. Although the largest relative increases in obesity prevalence were in the youngest (<30 years) age groups, the largest absolute percent increase was in the oldest (50+ years) age category **(Table 1)**. Among military occupations, the largest absolute and relative percent increases in obesity occurred among health care workers. Those in repair and engineering occupations had the highest prevalences of obesity, however, in the calendar years 2018 through 2021 **(data not shown)**. Absolute percent increases were similar by racial/ethnic group and service branch. The Marine Corps demonstrated the largest relative increase, from 6.6% to 8.9%; however, Marines maintained the lowest obesity prevalence compared to the other service branches. The Air Force demonstrated the largest absolute increase, from 15.1% to 18.7%. Non-Hispanic Blacks, Navy service members, males **(data not shown)**, and those aged 40 to 44 years had the highest prevalence of obesity compared to their respective counterparts during each calendar year between 2018 and 2021 **(Figure 2)**.

Prediabetes

The annual incidence per 100,000 p-yrs of elevated blood glucose rose from 588.2 in 2018 to 763.8 in 2021 **(Table 2, Figure 3)**. The absolute increase in rate of elevated blood glucose from 2018 to 2021 was higher for females than males, but the relative increase was similar for males and females **(Table 2)**. The largest increase in incidence of prediabetes occurred in individuals over

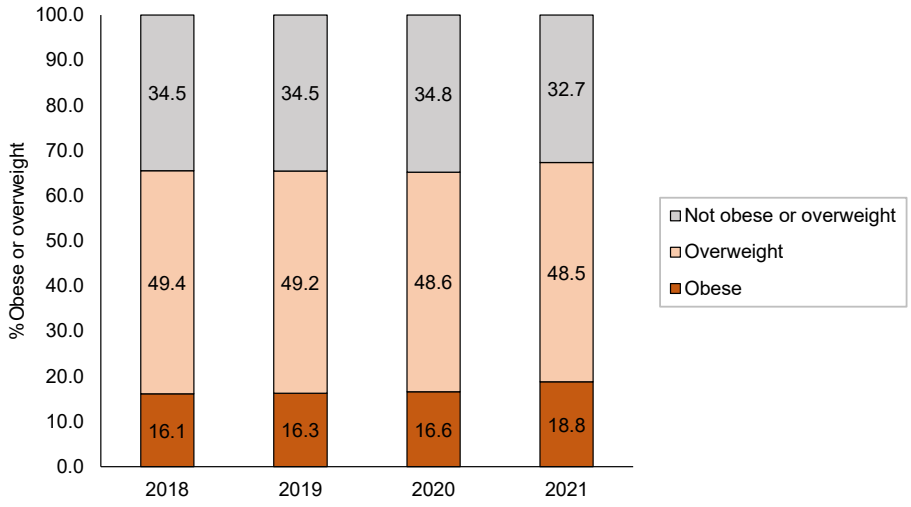
TABLE 1. Annual percentage of obesity (BMI≥30) among active component service members with at least 1 PHA weight measurement, 2018 and 2021

	2018 (n=671,253)[a]		2021 (n=544,824)[a]		Absolute Difference, 2018 to 2021	Relative Difference, 2018 to 2021
	No. obese	%	No. obese	%		
Total	108,337	16.1	102,455	18.8	2.7	16.5
Sex						
Male	96,571	17.0	89,265	19.6	2.6	15.3
Female	11,766	11.3	13,190	14.6	3.3	29.2
Age group, y						
<20	1,288	3.1	1,257	4.3	1.1	36.3
20-24	19,781	9.8	20,937	12.1	2.2	22.7
25-29	24,835	15.6	24,732	18.7	3.2	20.3
30-34	23,166	20.3	20,843	23.6	3.3	16.1
35-39	21,547	25.1	19,061	28.1	3.0	12.0
40-44	11,306	26.3	10,110	29.7	3.4	12.9
45-49	4,841	24.9	3,889	28.9	4.0	16.2
50+	1,573	21.2	1,626	25.5	4.3	20.2
Service						
Army	42,648	16.2	45,947	18.3	2.1	12.8
Navy	26,127	23.9	27,189	27.1	3.2	13.4
Air Force	35,321	15.1	23,081	18.7	3.6	24.1
Marine Corps	4,241	6.6	6,238	8.9	2.3	35.6
Racial/ethnic group						
Non-Hispanic White	54,094	14.0	49,530	16.5	2.4	17.4
Non-Hispanic Black	23,900	22.3	22,508	24.7	2.5	11.1
Hispanic	18,440	17.8	19,330	20.5	2.7	15.2
Other/unknown	11,903	16.0	11,087	18.8	2.9	18.1
Rank						
Junior enlisted (E1-E4)	27,740	10.4	29,632	13.2	2.8	26.7
Senior enlisted (E5-E9)	63,458	23.2	58,494	26.4	3.3	14.1
Warrant officer (W0)	2,067	21.0	1,996	21.3	0.3	1.3
Junior officer (O1-O3)	7,278	9.8	6,302	10.9	1.1	11.0
Senior officer (O4-O10)	7,794	16.3	6,031	18.6	2.3	13.9
Marital status						
Single, never married	27,149	10.1	29,552	12.6	2.5	24.8
Married	74,138	20.2	66,180	23.5	3.3	16.3
Other/unknown	7,050	20.0	6,723	23.5	3.5	17.8
Education level						
High school or less	59,388	15.0	60,398	17.9	2.8	18.9
Some college	22,407	22.5	18,231	26.0	3.6	15.8
Bachelor's or advanced degree	25,126	15.2	22,434	17.5	2.3	15.0
Other/unknown	1,416	11.6	1,392	14.9	3.3	28.2
Military occupation						
Combat-specific[b]	11,674	14.1	13,962	15.0	0.8	6.0
Motor transport	2,657	16.3	3,000	19.0	2.7	16.7
Pilot/air crew	3,503	12.5	3,085	13.6	1.2	9.2
Repair/engineering	35,689	18.6	32,816	21.8	3.2	17.2
Communications/ intelligence	25,054	17.1	23,061	19.8	2.6	15.4
Health care	10,785	15.7	10,584	19.8	4.1	26.3
Other/unknown	18,975	13.8	15,947	17.3	3.4	24.8
Geographic region						
Northeast	4,071	19.0	4,110	19.1	0.1	0.5
Midwest	7,707	16.4	6,799	20.1	3.7	22.4
South	51,850	16.3	52,240	19.2	3.0	18.3
West	28,250	15.7	25,216	17.6	2.0	12.6
Overseas	13,854	15.5	11,689	18.2	2.7	17.7
Other (includes missing/ unknown)	2,605	18.5	2,401	22.5	4.0	21.4

[a]Number of active component service members with at least 1 weight measurement from the PHA.
[b]Infantry/artillery/combat engineering.
Abbreviations: No., number; PHA, Periodic Health Assessment.

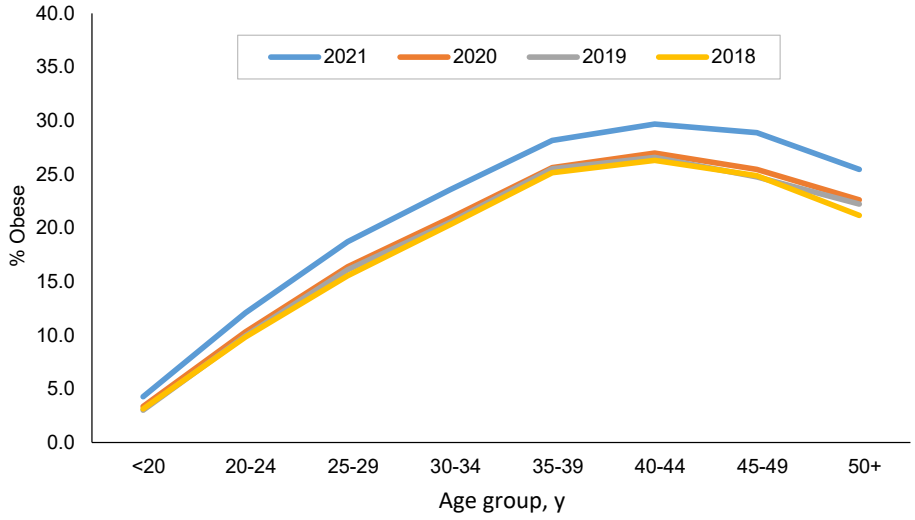
the age of 50. Absolute and relative percent increases were highest for Air Force members, from 542.9 per 100,000 p-yrs in 2018 to 806.6 per 100,000 p-yrs in 2021. Individuals of non-Hispanic Black race/ethnicity had the largest absolute rate increase, from 1,026.4 to 1,355.1 per 100,000 p-yrs, although the absolute increase was highest among those with other or unknown race/ethnicity. The occupation of military health care worker demonstrated the highest absolute percent increase of elevated blood glucose, although pilots had the largest relative percent increase. Females, non-Hispanic Blacks, health care workers, and those aged 50 years or older each had the highest prevalence of prediabetes compared to their respective counterparts during each calendar year between 2018 and 2021 **(data not shown)**. Navy members had the highest rates between 2019 and 2021, although Army members had the highest rates in 2018 **(data not shown)**.

FIGURE 1. Annual percentage of obesity (BMI≥30) and overweight (BMI≥25) among active component service members with at least 1 PHA weight measurement, 2018 to 2021



Abbreviation: PHA, Periodic Health Assessment

FIGURE 2. Annual percentage of obesity (BMI≥30) by age group, active component service members with at least 1 PHA weight measurement, 2018 to 2021



Abbreviation: PHA, Periodic Health Assessment

Type 2 Diabetes Mellitus

The annual incidence of T2DM among active component service members increased from 55.5 per 100,000 p-yrs in 2018 to 69.6 per 100,000 p-yrs in 2021 **(Table 3, Figure 3)**. The absolute increase in T2DM incidence was higher for males than females, but the relative increase was highest for females **(Table 3)**. Navy members and Hispanics experienced the largest absolute and relative increases in rates between 2018 and 2021. Males, non-Hispanic Blacks, Navy members, those working in health care or communications/intelligence, and those aged 45 years and older had the highest T2DM rates compared to their respective counterparts during each calendar year between 2018 and 2021 **(data not shown)**.

Editorial Comment

The increase in BMI noted in this study is not a new trend for the Department of Defense (DOD), as combined overweight and obesity rates increased from 50.6% in 1995 to 60.8% in 2008.[18] Furthermore, data from *DOD Health of the Force* reports demonstrate that, from 2015 to 2019, the overall prevalence of obesity diagnoses within the active component increased from 16% to 18%, and by 2020 the prevalence of obesity reached 19%.[19,20] Results from this study demonstrate an escalation of the prevalence of obesity described in the *DOD Health of the Force* reports. During the years preceding the pandemic, obesity prevalence remained steady around 16%, with smaller relative percent changes occurring between years; for example, the relative percent change in obesity prevalence between 2019 and 2020 was 1.8%. However, after the start of the pandemic, specifically between 2020 and 2021, the relative percent change of obesity prevalence substantially increased, by 13.3%. This coincides with a period when COVID-19 restrictions affected daily activities and lifestyle habits of service

members, along with other populations around the globe.

While U.S. states and local authorities implemented CDC COVID-19 guidelines to varying degrees, the DOD's force health protection guidance, travel restrictions, and health protection conditions drove standardization and compliance across the joint services.[21] For deployment readiness, the military services were required to provide "clean," COVID-19-free forces, and at times this resulted in prolonged restriction of movement and repeated COVID-19 testing prior to mobilization. Increased telework and decreased access to wellness facilities, group physical training, and dining options in the active duty population, along with other COVID-19-related policies, may have also contributed to the sharp 2.2% rise in obesity prevalence captured during the first year of the pandemic (2020-2021).

In this study it is also important to note the relatively higher absolute incidence of prediabetes and T2DM in women, non-Hispanic Blacks, Hispanics, and those aged 45 years and older, which reflect known risk factors also present in the general U.S. population. Lifestyle factors were likely a significant contributor to the high prevalence of obesity and increases in elevated blood glucose and T2DM rates in health care workers compared to other occupations. Service-specific requirements and regulations may also affect rates of elevated BMI and diabetes. For example, the Navy experienced the largest increase in incidence of T2DM; sailors underway on ships and submarines face highly restricted environments with limited food choices, as well as restricted time and space to perform physical training. The services also have different physical fitness standards and methods of measuring fitness at accession and throughout the spectrum of service.

There are some limitations present in this study that should be acknowledged while interpreting the results. Many PHAs are conducted over the phone and are accomplished primarily by record review. Additionally, during in-person PHAs, objective data are frequently recorded based on patient self-reporting, including metrics such as height and weight (the latter of which is frequently underestimated),

TABLE 2. Annual incidence (per 100,000 person-years) of elevated blood glucose levels, active component service members, 2018 and 2021

	2018		2021		Absolute Difference, 2018 to 2021	Relative Difference, 2018 to 2021
	No.	Rate	No.	Rate		
Total	7,448	588.2	9,913	763.8	175.7	29.9
Sex						
Male	5,760	543.7	7,563	703.5	159.8	29.4
Female	1,688	816.3	2,350	1,055.2	238.8	29.3
Age group, y						
<20	130	127.9	117	125.3	-2.5	-2.0
20-24	874	210.8	1,037	242.6	31.8	15.1
25-29	926	313.7	1,463	477.4	163.7	52.2
30-34	1,161	579.6	1,521	736.5	156.9	27.1
35-39	1,560	1,091.6	2,111	1,396.1	304.6	27.9
40-44	1,468	2,102.0	1,994	2,720.2	618.1	29.4
45-49	924	3,016.9	1,019	3,694.9	677.9	22.5
50+	405	3,664.7	651	5,490.9	1,826.2	49.8
Service						
Army	3,185	697.5	3,925	838.5	141.0	20.2
Navy	2,044	652.5	2,813	851.0	198.5	30.4
Air Force	1,699	542.9	2,587	806.6	263.6	48.6
Marine Corps	520	283.4	588	329.6	46.1	16.3
Racial/ethnic group						
Non-Hispanic White	3,212	447.5	3,905	546.3	98.9	22.1
Non-Hispanic Black	2,064	1,026.4	2,791	1,355.1	328.7	32.0
Hispanic	1,124	555.1	1,687	735.6	180.5	32.5
Other/unknown	1,048	723.5	1,530	1,035.9	312.4	43.2
Rank						
Junior enlisted (E1-E4)	1,348	241.6	1,837	323.5	81.9	33.9
Senior enlisted (E5-E9)	4,303	883.4	5,843	1,157.6	274.3	31.0
Warrant officer (W0)	205	1,179.8	293	1,658.6	478.8	40.6
Junior officer (O1-O3)	481	377.3	595	459.8	82.6	21.9
Senior officer (O4-O10)	1,111	1,454.8	1,345	1,722.3	267.6	18.4
Marital status						
Single, never married	1,277	230.4	1,893	317.9	87.4	38.0
Married	5,571	856.2	7,163	1,121.8	265.6	31.0
Other/unknown	600	976.9	857	1,344.4	367.5	37.6
Education level						
High school or less	3,203	395.5	4,179	501.3	105.9	26.8
Some college	1,558	985.7	1,963	1,305.2	319.5	32.4
Bachelor's or advanced degree	2,537	931.4	3,435	1,190.8	259.4	27.8
Other/unknown	150	578.0	336	1,324.9	746.9	129.2
Military occupation						
Combat-specific[a]	767	441.0	815	447.7	6.7	1.5
Motor transport	239	640.4	292	731.3	90.9	14.2
Pilot/air crew	170	374.4	250	544.2	169.8	45.3
Repair/engineering	1,986	527.8	2,686	696.0	168.2	31.9
Communications/ intelligence	1,952	723.7	2,599	942.0	218.3	30.2
Health care	949	866.6	1,224	1,145.4	278.8	32.2
Other/unknown	1,385	545.1	2,047	783.8	238.7	43.8
Geographic region						
Northeast	352	951.0	522	1,417.4	466.5	49.1
Midwest	652	795.4	645	773.2	-22.2	-2.8
South	4,239	731.3	5,720	961.0	229.7	31.4
West	1,575	485.7	1,612	475.4	-10.3	-2.1
Overseas	479	337.5	991	689.0	351.5	104.2
Other (includes missing/ unknown)	151	149.0	423	425.7	276.7	185.8

[a]Infantry/artillery/combat engineering.
Abbreviation: No., number; PHA, Periodic Health Assessment

as opposed to clinical staff obtaining actual measurements. Due to the COVID-19 pandemic, more PHAs were conducted through telehealth than normally completed in person, including PHAs for aviators and individuals in other high performance career fields, which likely contributed to an underestimation of the diagnoses assessed in this study.

Opportunities exist within the current PHA, physical fitness testing, and body composition programs to obtain in-person vital signs, including BMI calculations and laboratory screening for diabetes and other metabolic diseases. Current screening practices across the joint services do not adequately identify individuals with prediabetes. The percentage of active duty service members meeting prediabetes screening criteria between 2014 and 2018 ranged from 47.3% to 56%, yet only 4.8% to 6.7% of those meeting the criteria during that timeframe were actually screened.[22] Strategies that identify upstream determinants of health and incorporate effective and sustainable interventions into the MHS care delivery model are needed to address those factors predisposing service members to poor health.

Certain lifestyle factors amplified by the COVID-19 pandemic increased the prevalence of elevated BMI and incidence of both prediabetes and diabetes in service members from 2018 to 2021. These factors can affect national security because of their effects on recruitment and retention. In a recent study of military-aged U.S. populations, only 34.3% of participants met both BMI standards and engaged in adequate physical activity.[23] Service members with elevated BMI and poorly controlled diabetes may be required to undergo a medical board and potentially not meet requirements for theater deployment.[24]

The U.S. Preventive Service Task Force and the CDC recognize that lifestyle change programs, including intensive therapeutic interventions, are evidence-based and critical for preventing and reversing chronic disease.[25, 26] CDC-approved programs typically require a lifestyle coach specifically trained to lead the program, assist participants in meeting goals, and stay motivated.[26] In recent years the Defense Health Agency (DHA) and USAF both started Lifestyle

TABLE 3. Annual incidence (per 100,000 person-years) of type 2 diabetes, active component service members, 2018 and 2021

	2018		2021		Absolute Difference, 2018 to 2021	Relative Difference, 2018 to 2021
	No.	Rate	No.	Rate		
Total	718	55.5	927	69.6	14.1	25.4
Sex						
Male	633	58.6	810	73.6	15.0	25.6
Female	85	40.0	117	50.7	10.7	26.9
Age group, y						
<20	6	5.9	3	3.2	-2.7	-45.6
20-24	34	8.2	60	14.0	5.8	71.2
25-29	45	15.1	95	30.6	15.5	102.9
30-34	77	37.6	105	49.5	11.9	31.7
35-39	193	129.1	228	142.8	13.8	10.7
40-44	179	237.7	227	281.7	44.1	18.5
45-49	134	388.9	125	391.8	2.8	0.7
50+	50	380.3	84	566.5	186.2	49.0
Service						
Army	304	65.2	348	72.5	7.3	11.1
Navy	223	69.0	332	97.0	27.9	40.4
Air Force	167	52.2	221	67.1	14.9	28.5
Marine Corps	24	13.0	26	14.4	1.4	11.1
Racial/ethnic group						
Non-Hispanic White	214	29.3	279	38.2	8.9	30.5
Non-Hispanic Black	267	128.8	321	149.8	21.0	16.3
Hispanic	106	51.3	178	75.8	24.5	47.7
Other/unknown	131	87.9	149	97.4	9.5	10.8
Rank						
Junior enlisted (E1-E4)	70	12.5	129	22.6	10.1	80.9
Senior enlisted (E5-E9)	509	101.0	646	122.7	21.7	21.5
Warrant officer (W0)	23	126.5	23	122.8	-3.7	-2.9
Junior officer (O1-O3)	28	21.7	31	23.6	1.9	8.9
Senior officer (O4-O10)	88	107.7	98	115.9	8.2	7.7
Marital status						
Single, never married	98	17.6	156	26.0	8.4	47.9
Married	553	82.3	675	101.5	19.2	23.4
Other/unknown	67	105.3	96	143.9	38.6	36.7
Education level						
High school or less	294	35.9	403	47.6	11.8	32.9
Some college	183	111.6	193	122.6	11.0	9.8
Bachelor's or advanced degree	232	81.9	285	94.2	12.3	15.0
Other/unknown	9	33.9	46	176.3	142.4	419.8
Military occupation						
Combat-specific[a]	64	36.4	63	34.1	-2.2	-6.2
Motor transport	20	52.7	28	68.6	15.9	30.2
Pilot/air crew	10	21.6	13	27.7	6.0	28.0
Repair/engineering	218	56.8	295	74.6	17.9	31.4
Communications/ intelligence	208	75.1	246	86.3	11.3	15.0
Health care	74	65.1	100	89.4	24.3	37.3
Other/unknown	124	47.9	182	68.0	20.1	42.0
Geographic region						
Northeast	32	84.3	40	105.0	20.7	24.5
Midwest	51	61.0	61	71.3	10.4	17.0
South	404	68.1	484	79.0	10.9	16.0
West	149	45.1	189	54.6	9.5	21.0
Overseas	59	40.7	91	61.6	20.9	51.3
Other (includes missing/ unknown)	23	22.2	62	61.0	38.7	174.2

[a]Infantry/artillery/combat engineering.
Abbreviation: No., number; PHA, Periodic Health Assessment

and Performance Medicine working groups that focus on integrating the pillars of lifestyle medicine across the MHS. They seek to offer service members healthier choices at military installations in support of disease prevention and human performance optimization. Numerous studies, including the Blue Zones Project, which investigated the world's longest living populations, have demonstrated that lifestyle characteristics have significant effects on longevity. Findings from these studies support prioritization of whole food plant-based nutrition, natural movement, committed social networks, adequate rest, stress management, and healthy choices including avoidance of risky substances.[27]

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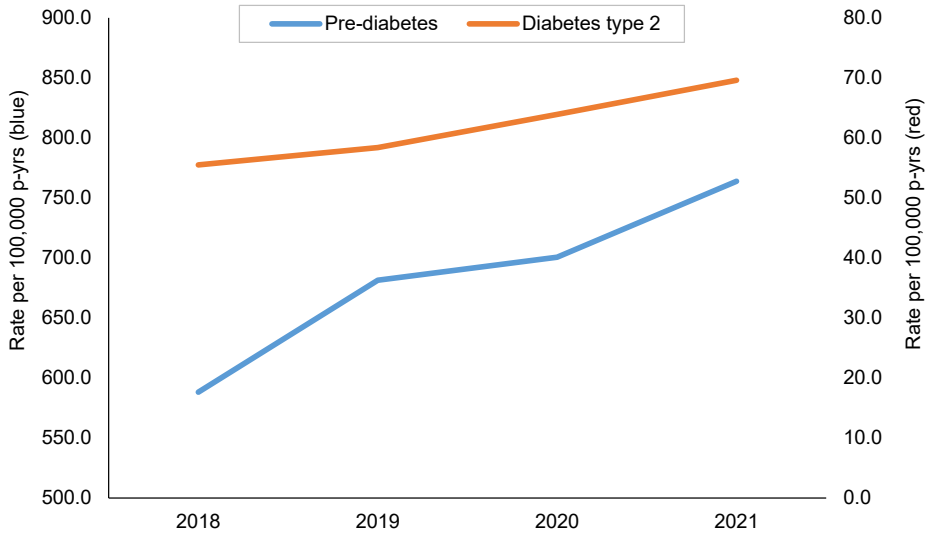
FIGURE 3. Annual incidence (per 100,000 person-years) of pre-diabetes and type 2 diabetes, active component service members, 2018 to 2021



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Trends in the Incidence of Eating Disorders Among Active Component Service Members, 2017 to 2021

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From 2017 through 2021, a total of 2,454 active component U.S. military service members received incident diagnoses for 1 of the following eating disorders: anorexia nervosa (AN), bulimia nervosa (BN), binge eating disorder (BED), or "other/unspecified eating disorder" (OUED). The incidence rate of any eating disorder was 3.6 cases per 10,000 person-years (p-yrs). The case-defining diagnoses OUED, BN, and BED accounted for nearly 89% of total incident cases. The incidence rate of any eating disorder among women was more than 8 times the rate among men. Overall rates were highest among service members under 30 years of age. Crude annual incidence rates of total eating disorders increased in 2021, following the COVID-19 pandemic. Increased prevalence of major life stressors and mental health conditions were reported on Periodic Health Assessment (PHA) forms completed in the 1-year period after an eating disorder diagnosis. These data suggest the need for increased attention to eating disorder prevention. Additionally, treatment programs could be warranted as continued effects of the COVID-19 pandemic are elucidated within the military population.

What are the new findings?

During this study's 5-year surveillance period, from 2017 through 2021, annual incidence rates of eating disorders increased from 2.8 cases per 10,000 person-years (p-yrs) to 5.0 cases per 10,000 p-yrs. Periodic Health Assessment (PHA) forms completed in the 1-year period before and 1-year period after eating disorder diagnosis indicated increased prevalence of major life stressors, depression, and post-traumatic stress disorder (PTSD) following diagnosis.

What is the impact on readiness and force health protection?

Increased incidence of eating disorders suggests need for promoting prevention and treatment among service members to improve medical readiness. PHA forms may provide greater insight into service members' physical and mental well-being before and after eating disorder diagnoses.

Eating disorders are characterized by a persistent disturbance of eating behaviors resulting in significant physiological impairment.[1] Dysfunctional eating attitudes, thoughts, and emotions are crucial to the origin and continuance of these disorders.[2,3] Although eating disorders affect individuals regardless of age, gender, race, and weight, they are viewed as female-oriented and are particularly gendered in symptom presentation, treatment-seeking behavior, and social perception, and these factors affect incidence measurement among men.[4,5,6] Historical and clinical focus on concerns of weight loss among women have likely contributed to inattention to men with eating disorders, as male body image concerns often center on muscularity.[4,5,7] In a large-scale systematic literature review, the weighted means (ranges) of lifetime prevalence of all evaluated eating disorders (AN, BN, BED, or OUED) were higher among women than men.[8] Variation in prevalence estimates can be attributed to eating disorder classification, study design, and population.[8]

Estimates derived from clinical interview studies demonstrate that U.S. military women have a higher prevalence of eating disorders than civilian women, while military men demonstrate comparable prevalence to civilian men. Among military populations, approximately 5%-8% of women and 0.1% of men are diagnosed with an eating disorder. [9,10,11] Comparatively, lifetime prevalence of individual eating disorders among civilians range from 0.9% to 4.9% for women and 0.3% to 4.0% for men.[12] A prior *MSMR* report further describes annual incidence rates of AN, BN, and OUED by sex among active component service members from 2013 through 2017; that report demonstrated an incidence rate of any eating disorder was 2.7 cases per 10,000 p-yrs, with women's incidence rate more than 11 times that of men.[13]

Service members are not actively screened for eating disorders after accession into the military. Annual health screenings including Periodic Health Assessment (PHA) forms and bi-annual weigh-ins assess military members' universal medical readiness.[14] While there are no specific questions pertaining to eating disorders on the PHA, questions within the behavioral health assessment may alert behavioral health specialists to an eating disorder, triggering individual follow-up.[14] Additionally, physical symptoms including low body mass index (BMI) may indicate an eating disorder.[14] Although PHA forms are a useful tool for insight into service

member physical and mental well-being, no studies, to our knowledge, have used these questionnaires to examine the relationship between eating disorders and service member health.

The current study aims to update annual incidence rates and demographic trends of eating disorders among military service members between 2017 and 2021, while expanding on prior work. In previous *MSMR* analyses, BED was grouped with OUED, since the International Classification of Diseases, 9th Revision (ICD-9) diagnostic codes did not allow discrete BED assessment. The International Classification of Diseases, 10th Revision (ICD-10) diagnostic codes now differentiate BED from other eating disorders, as BED represents the most prevalent eating disorder worldwide; thus, in this study BED is assessed independently from OUED.[15] Additionally, Coast Guard service members are included for improved understanding of the overall health of the force. Finally, this study assesses the trends in service members' PHA mental health assessments and BMI in the 1 year prior to and following an eating disorder diagnosis.

Methods

This study includes active component service members from all military services from 1 January 2017 through 31 December 2021. Data were obtained from the Defense Medical Surveillance System (DMSS). Demographic information including age, racial/ethnic group, military service, rank, and occupation at time of eating disorder diagnosis were included. Hospitalization and ambulatory records in direct and purchased care were used to determine specific incident eating disorder diagnoses. An incident case for an eating disorder (AN, BN, BED, or OUED) was defined either by 1 qualifying ICD-10 code in the first or second diagnostic position of a hospitalization record or first diagnostic position in an ambulatory medical encounter record.[16] The incidence date was the date of first hospitalization or outpatient medical encounter. Case-defining diagnoses for AN, BN, BED, and OUED are detailed in **Table 1**.[1,16] Service members were only counted once during the surveillance period. The first recorded diagnosis of either AN or BN was prioritized over BED and OUED, while cases of BED were prioritized over OUED. The ICD-10 code in the primary diagnostic position was used to determine a case of AN or BN if a service member was diagnosed with both disorders during the incident encounter. Service members with a hospitalization or ambulatory encounter for an eating disorder diagnosis **(Table 1)** prior to the surveillance period were excluded. Incidence rates were calculated as incident eating disorder diagnoses per 10,000 p-yrs.

Responses to Mental Health Assessment (MHA) questions from the most recent PHA completed by a service member in the 1 year preceding and 1 year following an eating disorder diagnosis were analyzed. Provider responses of "yes" to questions about service member "major life stressors" (*MHA1.a.*), "history of mental health care" (*MHA2*), "PTSD screening" (*MHA6.a. through MHA6.e.*), and "depression screening" (*MHA7.a. or MHA7.b.*) were included in the analysis. The most recent height and weight recorded in the 1 year preceding and 1 year following an eating disorder diagnosis were obtained from the PHA or from Military Entrance Processing Station (MEPS) data, to determine changes in physical health. Height and weight were used to calculate BMI with the formula: weight (lb) x 703 / [height (in)^2].[17] Prevalence of PHA

TABLE 1. Summary of diagnostic criteria for anorexia nervosa, bulimia nervosa, binge eating disorder, and other or unspecified eating disorders[a,b]

Eating disorder	ICD-9 code	ICD-10 code[c,d,e]
Anorexia nervosa (AN)	307.1	F50.0*
Refusal to maintain normal body weight, fear of gaining weight or becoming fat, and a disturbed perception of one's body weight		
Bulimia nervosa (BN)	307.51	F50.2
Recurrent episodes of binge eating, inappropriate compensatory behavior to prevent weight gain such as self-induced vomiting, laxative and diuretic use, fasting and excessive exercise		
Binge eating disorder (BED)	-	F50.81
Recurrent episodes of eating large quantities of food, often to the point of discomfort, and associated with feelings loss of control, distress and guilt		
Other/unspecified eating disorder (OUED)	307.50, 307.59	F50.8, F50.82, F50.89, F50.9

These conditions are exclusive of anorexia nervosa, bulimia nervosa, and binge eating disorder. *Other eating disorders* include avoidant/restrictive food intake disorder.[c] *Other specified eating disorder* includes pica in adults and psychogenic loss of appetite. *Unspecified eating disorder* applies to presentations in which symptoms characteristic of a feeding and eating disorder that cause clinically significant distress or impairment in social, occupational, or other important areas of functioning predominates, but do not meet the full criteria for any of the disorders in the feeding and eating disorder diagnostic class. Includes atypical anorexia nervosa and atypical bulimia nervosa.

Abbreviation: ICD-9/ICD-10, International Classification of Diseases (9th/10th revision)
[a] American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5-TR)*. Arlington, VA: American Psychiatric Assocation; 2022.[1]
[b] Armed Forces Health Surveillance Division. Surveillance Case Definition. Eating Disorders. May 2018.[16]
[c] F50.81 (binge eating disorders) and F50.89 (other specified eating disorder) were added to the ICD-10 coding system on October 1, 2016.
[d] ICD-10 code F50.8 (other eating disorders) was added to the ICD-10 coding system on October 1, 2015 and was changed to a parent code on October 1, 2016.
[e] ICD-10 code F50.82 (avoidant/restrictive food intake disorder) was added to the ICD-10 coding system on October 1, 2017.

responses and BMI during the 1 year before and 1 year after an eating disorder diagnosis were calculated among those who completed a PHA form.

Results

During the 5-year surveillance period, a total of 2,454 active component service members received an incident eating disorder diagnosis **(Table 2)**. The distributions of incident eating disorder diagnoses by demographic characteristics are presented in **Table 2**. For both sexes, service members in the younger age groups (29 years or younger) had the highest incidence rates, which generally declined with age. Among female service members, incidence rates for any eating disorder were highest in non-Hispanic White service members (17.1 cases per 10,000 p-yrs), Marines (21.7 cases per 10,000 p-yrs), junior enlisted (17.8 cases per 10,000 p-yrs), and those in combat-specific occupations (17.0 cases per 10,000 p-yrs) **(Table 2)**. Of note, the incidence rate of eating disorders among female Marines was more than twice that of their counterparts in the Navy and Coast Guard. Among male service members, Army soldiers (2.1 per 10,000 p-yrs), junior enlisted (2.0 per 10,000 p-yrs), and those in a health care occupation (3.3 per 10,000 p-yrs) had the highest incidence rates of an eating disorder diagnosis **(Table 2)**.

The incidence rate of all eating disorders was 3.6 cases per 10,000 p-yrs, with OUED representing the highest rate by eating disorder type (1.4 per 10,000 p-yrs), followed by BN (1.1 per 10,000), BED (0.7 per 10,000), and AN (0.4 per 10,000) **(Table 3)**. Females comprised the majority (63.4%) of total incident cases, with an incidence rate more than 8 times than that of males (13.8 and 1.6 cases per 10,000 p-yrs, respectively) **(Table 3)**.

The annual incidence rates of all eating disorders among active component service members increased from 2017 through 2019 (2.8 and 3.8 cases per 10,000 p-yrs, respectively), decreased in 2020 (3.6 cases per 10,000 p-yrs), and increased in 2021 (5.0 cases per 10,000 p-yrs) **(data not shown)**. This overall upward trend was observed in both males and females during the study period **(Figures 1, 2)**. From the first year of the surveillance period to its last, annual incidence rates of all eating disorders doubled for men **(Figure 1)**, with incidence rates of BED and OUED tripling and doubling, respectively. Female service members' incident case diagnoses of BED more than doubled from the first year of surveillance to the last **(Figure 2)**, with incidence rates of OUED increasing notably from 2020 (4.9 cases per 10,000 p-yrs) to 2021 (7.9 cases per 10,000 p-yrs). Female service members' rates of BN fluctuated during the surveillance period, from 3.8 to 5.7 cases per 10,000 p-yrs **(Figure 2)**, while annual incidence rates of AN were relatively stable, with rates increasing in 2021 to 2.0 cases per 10,000 p-yrs **(Figure 2)**.

TABLE 2. Incidence of all eating disorders among active component U.S. Armed Forces, by demographic characteristics, 2017 to 2021

	Male		Female		Female/ Male
	No.	Rate[a]	No.	Rate[a]	RR
Total	898	1.6	1,556	13.8	8.6
Age group, y					
<20	56	1.4	134	14.2	10.1
20-24	337	1.9	695	18.7	9.8
25-29	231	1.8	407	14.7	8.2
30-34	120	1.3	147	8.4	6.5
35-39	80	1.2	108	8.9	7.4
40+	74	1.3	65	7.3	5.6
Racial/ethnic group					
Non-Hispanic White	527	1.6	826	17.1	10.7
Non-Hispanic Black	91	1.1	273	10.0	9.1
Hispanic	174	1.9	277	13.0	6.8
Other	106	1.7	180	11.4	6.7
Service					
Army	426	2.1	558	15.6	7.4
Navy	141	1.1	347	10.4	9.5
Marine Corps	124	1.5	174	21.7	14.5
Air Force	186	1.4	454	13.8	9.9
Coast Guard	21	1.2	23	7.6	6.3
Rank					
Junior enlisted (E1-E4)	489	2.0	902	17.8	8.9
Senior enlisted (E5-E9)	291	1.3	435	10.8	8.3
Officer (O1-O3 [W1-W3])	84	1.4	170	11.4	8.1
Officer (O4-O10 [W4-W5])	34	0.9	49	6.9	7.7
Occupation					
Combat-specific[b]	129	1.5	51	17.0	11.3
Motor transport	33	1.8	50	13.7	7.6
Pilot/air crew	11	0.5	7	4.2	8.4
Repair/engineering	226	1.3	299	13.4	10.3
Communications/intelligence	211	2.0	490	13.8	6.9
Heath care	121	3.3	325	15.8	4.8
Other/unknown	167	1.5	334	12.8	8.5

Abbreviations: No, number; RR, rate ratio
[a]Rate per 10,000 person-years.
[b]Infantry/artillery/combat engineering/armor.

Similar proportions of PHA forms were completed in the 1-year periods preceding and following eating disorder diagnoses among males and females **(Table 4)**. Among those who responded to PHA mental health questions, female service members demonstrated higher prevalence of reported major life stressors, PTSD, and depression in both periods compared to male service members **(Table 4)**. Among both male and female service members, higher prevalence of major life stressors (prevalence difference [PD]=10.2% and 7.1%, respectively), PTSD (PD=4.2% and 8.2%, respectively), and depression (PD=4.3% and 3.0%, respectively) were reported in the 1-year period following an eating disorder diagnosis. Additionally, higher prevalence of BMIs categorized as obese was reported in the year following eating disorder diagnosis for both male (PD=0.4%) and female (PD=3.9%) service members. Prevalence of mental health care within the prior year increased 1 year after an eating disorder diagnosis (PD=29.0% for men and 29.3% for women), but data acquired for this study do not indicate the reasons attributed.

Editorial Comment

In this study, annual incidence rates of total eating disorders increased by approximately 79% between 2017 and 2021, with OUED accounting for the highest rates in military personnel when analyzed by type of eating disorder. Rates of BN and BED also notably increased throughout the surveillance period. Although rates of AN remained relatively stable in this study, it increased in 2021 among female service members.

OUED constitutes a broad category of eating disorders not meeting the diagnostic criteria of established disorders,[18] and clinical case heterogeneity, along with diagnostic ambiguity, may explain why these atypical presentations are rising. Expectations of military physical readiness and body composition standards among service members may offer additional explanation of higher OUED incidence, as well as BN and BED. In this study, OUED and BED were examined separately, in contrast to the previous *MSMR* report, which classified OUED and BED together.[13] When assessed separately, BED expressed annual incidence rates much lower than OUED overall, indicating that the upward trajectory of OUED may not be influenced by BED.

Individuals with OUED, BN, and BED can have BMIs ranging from normal to obese.[12] Significantly low BMI, a diagnostic criterion of AN,[1] negatively affects physical performance[19,20] and cannot be concealed during biannual weigh-ins. Although compensatory behaviors can hinder physical performance,[19] patients with BN and BED generally demonstrate adequate physical fitness.[20] In this study, the majority of male service members with incident case diagnoses had overweight or obese BMIs **(Table 4)**, while among females normal to overweight

FIGURE 1. Annual incidence rates of eating disorders among active component male service members, by type, U.S. Armed Forces, 2017 to 2021

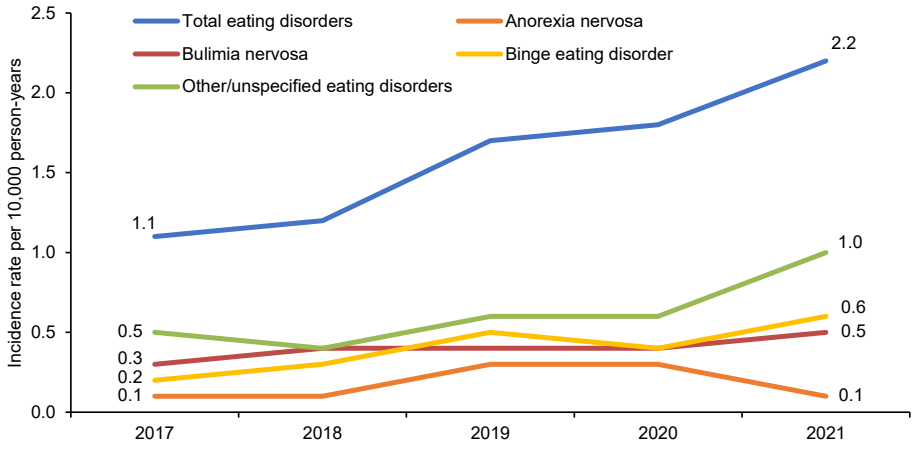

TABLE 3. Incidence of eating disorders among active component U.S. Armed Forces, by type, 2017 to 2021

	All Eating Disorders, Total		Anorexia		Bulimia		Binge Eating		Other Eating Disorder	
	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]
Total	2,454	3.6	271	0.4	746	1.1	467	0.7	970	1.4
Male	898	1.6	110	0.2	210	0.4	226	0.4	352	0.6
Female	1,556	13.8	161	1.4	536	4.8	241	2.1	618	5.5
Female:Male RR	8.6		7.0		2.6		5.3		9.2	
Female % (all cases)	63.4%		59.4%		71.8%		51.6%		63.7%	

Abbreviations: No., number; RR, rate ratio
[a]Rate per 10,000 person-years.

BMIs were more common. Given the growing population of obese service members[21] and the comorbid nature of obesity and eating disorders,[22] further increases of OUED, BN, and BED may be expected.

The surveillance period includes the COVID-19 pandemic, during which this study documented a temporal increase of eating disorder diagnoses among military personnel. While incidence rates of eating disorders were rising from 2017 to 2019, a marked shift in rates occurred from 2020 to 2021. These results are similar to findings among civilian populations demonstrating increased incidence of eating disorders during the COVID-19 pandemic, as aspects of pandemic life exacerbated eating disorder behaviors, due to multiple factors.[23-25] Diversion of resources to COVID-19 remediation reduced health care access and use,[26,27] potentially causing the decline of observed eating disorder incidence in 2020. Meanwhile, disrupted daily routines, economic impacts, and social isolation all heightened stress and worsened mental health during the pandemic,[23,28] likely contributing to the excessive eating disorder burden observed in 2021.

Stay-at-home recommendations not only altered social and physical environments, but physical activity and eating patterns: Physical activity decreased during COVID-19 home confinement while eating habits were adversely affected.[29] In

FIGURE 2. Annual incidence rates of eating disorders among active component female service members, by type, U.S. Armed Forces, 2017 to 2021

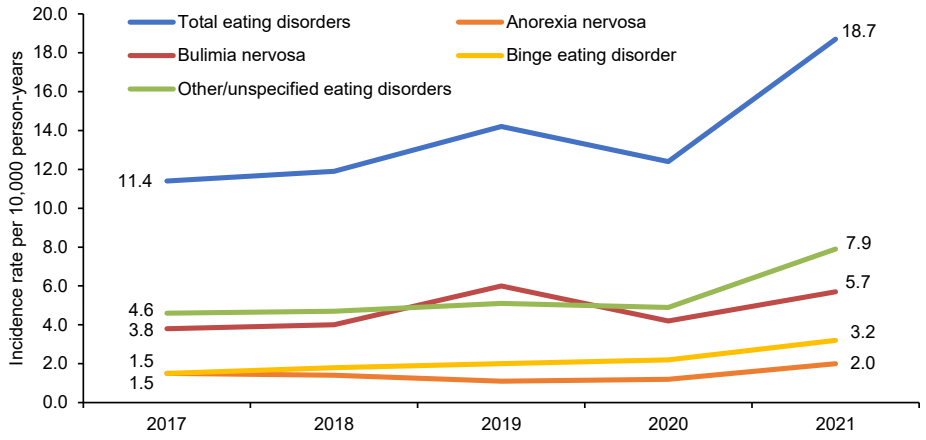

TABLE 4. Prevalence of PHA mental health assessment responses 1 year before and after an incident case eating disorder diagnosis from 2017 to 2021, active component U.S. Armed Forces

	Male (n=898)[a]					Female (n=1,556)[a]				
	Pre-PHA[b]		Post-PHA[c]		PD	Pre-PHA[b]		Post-PHA[c]		PD
PHA completion[d]	No.	%	No.	%	%	No.	%	No.	%	%
Total	484	53.9	469	52.2	-1.7	837	53.8	865	55.6	1.8
Selected PHA questions for mental and physical health[e]										
Major life stressor reported	118	24.4	162	34.5	10.2	250	29.9	320	37.0	7.1
Referral indicated for major life stressor[f]	10	2.1	8	1.7	-0.4	30	3.6	5	0.6	-3.0
History of mental health care received (past year)	161	33.3	292	62.3	29.0	370	44.2	636	73.5	29.3
Referral indicated for mental health care[f]	45	9.3	63	13.4	4.1	122	14.6	110	12.7	-1.9
PTSD reported	82	16.9	99	21.1	4.2	209	25.0	287	33.2	8.2
Referral indicated for PTSD	0	0.0	0	0.0	0.0	0	0.0	0	0.0	0.0
Depression reported	68	14.1	86	18.3	4.3	142	17.0	173	20.0	3.0
Referral indicated for depression[f]	9	1.9	4	0.9	-1.0	22	2.6	3	0.4	-2.3
BMI										
Underweight (<18.5)	4	0.8	5	1.1	0.2	23	2.8	22	2.5	-0.2
Normal (18.5-24.9)	95	19.6	73	15.6	-4.1	287	34.3	278	32.1	-2.2
Overweight (25-29.9)	159	32.9	131	27.9	-4.9	283	33.8	261	30.2	-3.6
Obese (30+)	179	37.0	208	44.4	7.4	182	21.7	222	25.7	3.9
Unknown	47	9.7	52	11.1	1.4	62	7.4	82	9.5	2.1

Abbreviations: No., number; PD, prevalence difference; PHA, Periodic Health Assessment; BMI, body mass index; PTSD, Post-traumatic stress disorder (PTSD)
[a] Service members with an incident case diagnosis of eating disorder during the surveillance period (denominator for PHA completion).
[b] Most recent PHA form completed in the 1 year period before incident case eating disorder diagnosis.
[c] Most recent PHA form completed in the 1 year period after incident case eating disorder diagnosis.
[d] Percentage calculated from total service members with an incident case diagnosis of eating disorder during surveillance period.
[e] Percentage calculated from total service members who completed a PHA form.
[f] Referral may not be indicated if service member is already seeking treatment for concern.

addition, real and perceived food insecurity, another aspect of pandemic life, could be responsible for trends observed in BED and BN, and possibly OUED. Media coverage of empty shelves led panicked shoppers to stockpile food,[30] potentially contributing to the cyclical pattern of food restriction, food hoarding, and overeating observed with food insecurity behaviors.[31] The relationship between food insecurity and disordered eating has been associated with binge eating, BED, and BN[31,32]; obesity, common in BED,[15] is also linked with food insecurity.[33]

Military experiences may create susceptibility among some service members to the "feast-or-famine" cycle. A qualitative study of service members found behavioral responses (e.g., overeating or food hoarding) to experiences of food unavailability and strict mealtime regimens while in service.[34] In a surveyed population of active duty Army households, marginal (e.g., low or very low) food insecurity increased over 1.5-fold with the onset of the pandemic.[35]

PTSD and depression are frequently comorbid among military and veterans with eating disorders[36] and in those with combat exposure.[37] As noted in this study **(Table 2)**, female service members with combat-specific occupations had highest occupational incidences of eating disorders, while incidence rates of combat-specific occupations among male service members were lower than among other occupations. Associations between prior combat exposure and eating disorder development were explored in this study, but meaningful results could not be concluded due to insufficient data **(data not shown)**. Previous studies found PTSD more common in female service members than in males[38,39]; specifically, female Marines and Sailors were found to have over 12 times the odds of comorbid PTSD and eating disorders.[37] This study further supports the assertion that women with PTSD may be more vulnerable to eating disorder development. Female service members with an incident case of an eating disorder reported higher PTSD prevalence than male service members; female Marines had an overall incidence rate more than 14 times that of men.

Although women in military service are more likely to be diagnosed with an eating disorder, the rise in eating disorders attributable to OUED and BED among men in this study is noteworthy. Increased incidence of male eating disorders was most prominent in 2021. Higher prevalence increases of reported major life stressors (PD: 2.6%), PTSD (PD: 2.0%), and depression (PD: 1.1%) occurred in men diagnosed with an eating disorder in 2021 compared to those diagnosed in 2020 **(data not shown)**; it should be noted that the highest prevalence increases of major life stressors, PTSD, and depression for men occurred among those diagnosed in 2019, meaning some of these service members completed their post-diagnosis PHA forms in 2020. Due to worsening mental health during the pandemic and post-pandemic periods, male service members may have volunteered or been referred for mental health care, resulting in higher 2021 incidence. Additionally, several factors including a diagnostic framework focused on weight loss,[4] muscular-oriented disordered eating,[4] and unhealthy "making weight" behaviors to adhere to military weight standards[36,40-41] may explain why a higher number of male service members are diagnosed with OUED and BED than AN and BN.

While the impact of COVID-19 on eating disorders should not be downplayed, it is more likely that psychosocial stressors of a pandemic, including social isolation, disruption of daily routines, and food insecurity, compounded by military life, resulted in increased eating disorder burdens. Stress and preexisting psychopathologies are precursors to eating disorder development,[42] although service members in this study were more likely to report stress and mental health concerns after an eating disorder diagnosis. Excessive prevalence of major life stressors, depression, and PTSD among male and female service members after eating disorder diagnoses are particularly concerning, as 1 study of active component military found that service members with mental health conditions are more at risk of attrition compared to those treated for non-mental health-related conditions.[43] Attrition reduction has the potential to save the Department of Defense (DOD) millions of dollars in training and recruitment costs.[43,44]

Several limitations to this study should be noted. Due to the secretive nature of eating disorders and fear of military reprimand, incidence of eating disorders is likely underreported within this population. Additionally, differing presentations of eating disorders in men and women may result in underestimation of incidence in male service members, as male presentations may not adhere to a largely female-oriented diagnostic framework.[4] Secondly, PHA forms were not completed for all service members with an incident case diagnosis of eating disorder, and service members may not respond accurately on PHA forms, to avoid stigma. Finally, the COVID-19 pandemic was associated with widespread, extended disruption to daily life. The impact of the pandemic on eating disorder incidence in the military population was not fully explored in this study and should be explored further. Relationships between major life stressors, depression, PTSD, and eating disorders in military populations should be further evaluated to mitigate risk of eating disorder development.

Within the U.S. military, eating disorders are growing at a substantial rate. The COVID-19 pandemic amplified eating disorder vulnerability among the military population, which the interruption to health care in 2020 compounded, demonstrated by the stark increases of eating disorder diagnoses in 2021. While eating disorders are considerably more common in female service members, eating disorders increased 2-fold among male service members during this 5-year surveillance period. As more service members are affected by such disorders, greater adverse outcomes to mental health, physical fitness, and military performance may be expected. These findings reveal the need for prevention and treatment of eating disorders to reduce their unique burden among military members.

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The views expressed in this article are those of the authors and do not necessarily reflect the official policy of the Department of Defense or the U.S. Government.

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