MAY 2020

Volume 27
Number 05

MSMR

MEDICAL SURVEILLANCE MONTHLY REPORT

Annual Summary Issue

Special Reports

Absolute and Relative Morbidity Burdens Attributable to Various Illnesses and Injuries, Active Component, U.S. Armed Forces, 2019

Perceptions of the relative importance of various health conditions in military populations often determine the natures, extents, and priorities for resources applied to primary, secondary, and tertiary prevention activities. However, these perceptions are inherently subjective and may not reflect objective measures of the relationship between the conditions and their impact on health, fitness, military operational effectiveness, healthcare costs, and so on.

Several classification systems and morbidity measures have been developed to quantify the "public health burdens" that are attributable to various illnesses and injuries in defined populations and settings.[1] Not surprisingly, different classification systems and morbidity measures lead to different rankings of illness- and injury-specific public health burdens.[2]

For example, in a given population and setting, the illnesses and injuries that account for the most hospitalizations are likely different from those that account for the most outpatient medical encounters. The illnesses and injuries that account for the most medical encounters overall may differ from those that affect the most individuals, have the most debilitating or long-lasting effects, and so on.[2] Thus, in a given population and setting, the classification system or measure used to quantify condition-specific morbidity burdens shapes to a large extent the conclusions that may be drawn regarding the relative importance of various conditions and, in turn, the resources that may be indicated to prevent or minimize their impacts.

This annual summary uses a standard disease classification system (modified for use among U.S. military members) and several healthcare burden measures to quantify the impacts of various illnesses and injuries among members of the active component of the U.S. Armed Forces in 2019.

METHODS

The surveillance period was 1 January through 31 December 2019. The surveillance population included all individuals who served in the active component of the U.S. Army, Navy, Air Force, or Marine Corps at any time during the surveillance period. All data used in this analysis were derived from records routinely maintained in the Defense Medical Surveillance System (DMSS). These records document both ambulatory encounters and hospitalizations of active component members of the U.S. Armed Forces in fixed military and civilian (if reimbursed through the Military Health System [MHS]) treatment facilities worldwide.

For this analysis, DMSS data for all inpatient and outpatient medical encounters of all active component members during 2019 were summarized according to the primary (first-listed) diagnosis (if reported with an International Classification of Diseases, 10th Revision [ICD-10] code between A00 and T88, an ICD-10 code beginning with Z37, or Department of Defense unique personal history codes (DOD0101–DOD0105). For summary purposes, all illness- and injury-specific diagnoses (as defined by the ICD-10) were grouped into 151 burden of disease-related "conditions" and 25 "categories" based on a modified version of the classification system developed for the Global Burden of Disease (GBD) Study.[1] Prior *MSMR* analyses grouped illness- and injury-specific diagnoses into 142 conditions. Review of preliminary results of the 2019 burden analysis revealed that within 8 of the 22 "all other" conditions, large numbers of medical encounters were attributable to 9 diagnosis codes or groups of codes (cervicalgia, chronic pain, vaginitis and vulvitis, urinary tract infection and cystitis, deviated nasal septum, tinea skin infections, constipation, testicular hypofunction, and gout). Based on this finding, these diagnosis codes or groups of codes were broken out and treated as separate burden of disease-related conditions in the current analysis.

In general, the GBD system groups diagnoses with common pathophysiologic or etiologic bases and/or significant international health policymaking importance. In this analysis, some diagnoses that are grouped into single categories in the GBD system (e.g., mental health disorders) were disaggregated to increase the military relevance of the results. Also, injuries were classified by affected anatomic site rather than by cause because external causes of injuries are incompletely reported in military outpatient records.

The "morbidity burdens" attributable to various "conditions" were estimated based on the total number of medical encounters attributable to each condition

WHAT ARE THE NEW FINDINGS?

In 2019, as in previous years, the medical conditions associated with the most medical encounters, the largest numbers of affected service members, and the greatest numbers of hospital days were in the major categories of injuries, musculoskeletal disorders, and mental health disorders.

WHAT IS THE IMPACT ON READINESS AND FORCE HEALTH PROTECTION?

The aforementioned categories of illness and injury disproportionately reduce the readiness and fitness of service members and detract from their ability to execute the missions of the Armed Forces. Such disorders remain high-priority targets for preventive action and research to lessen their impact on the ready force.

(i.e., total hospitalizations and ambulatory visits for the condition with a limit of 1 encounter per individual per condition per day), numbers of service members affected by each condition (i.e., individuals with at least 1 medical encounter for the condition during the year), and total bed days during hospitalizations for each condition.

The new electronic health record for the MHS, MHS GENESIS, was implemented at 4 military treatment facilities in the state of Washington in 2017 (Naval Hospital Oak Harbor, Naval Hospital Bremerton, Air Force Medical Services Fairchild, and Madigan Army Medical Center). Implementation of the second wave of MHS GENESIS sites began in 2019 and included 3 facilities in California (Travis Air Force Base [AFB], the Presidio of Monterey, and Naval Air Station Lemoore) and 1 in Idaho (Mountain Home AFB). Medical data from facilities using MHS GENESIS are not available in the DMSS. Therefore, medical encounter data for individuals seeking care at any of these facilities after their conversion to MHS GENESIS were not included in the current analysis.

RESULTS

Morbidity burden, by category

In 2019, more active component service members (n=542,914) received medical care for injury/poisoning than any other morbidity-related category **(Figures 1a, 1b)**. In addition, injury/poisoning accounted for more medical encounters (n=2,933,393) than any other morbidity category and one-quarter (25.4%) of all medical encounters overall.

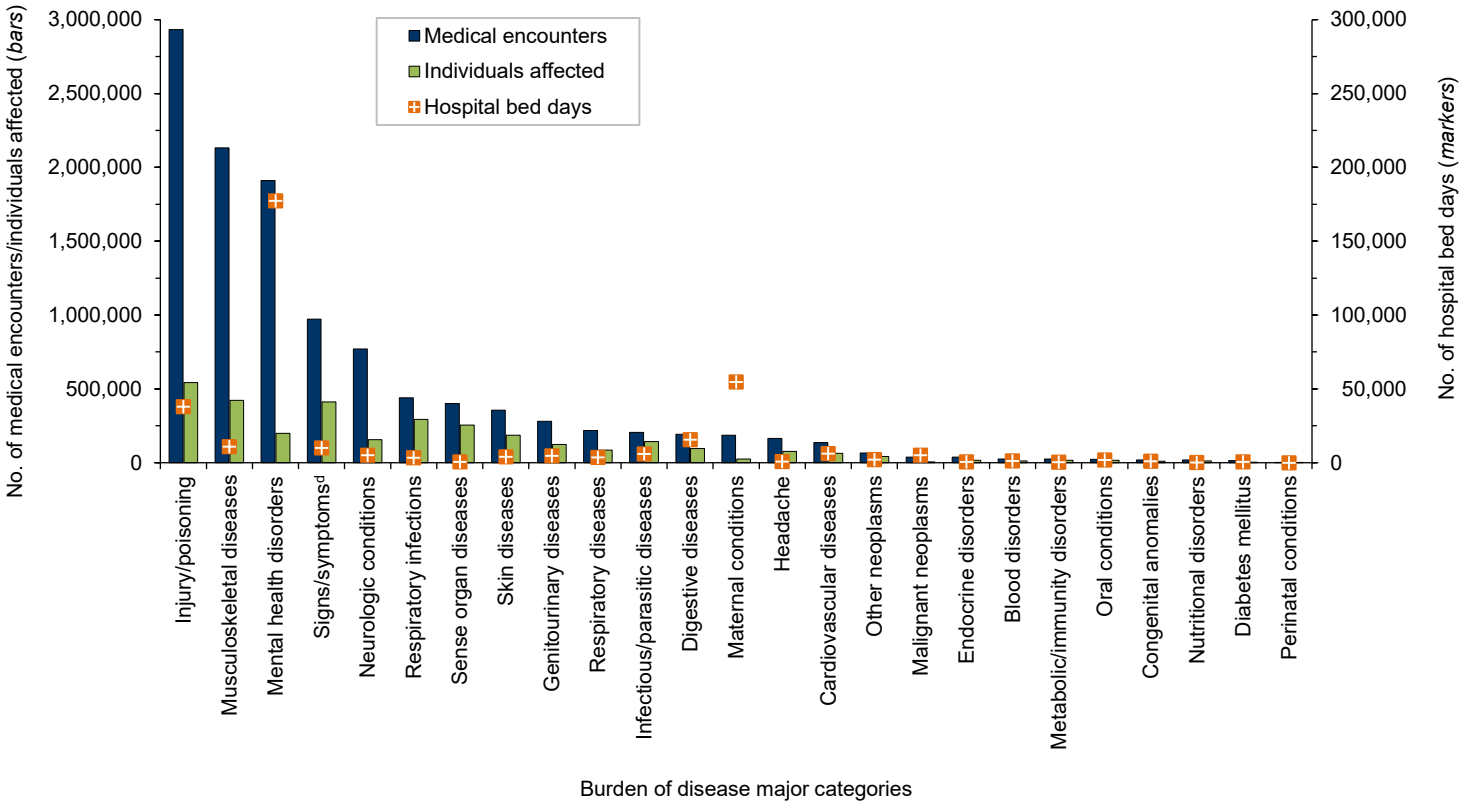
Mental health disorders accounted for more hospital bed days (n=177,298) than any other morbidity category and half (50.2%) of all hospital bed days overall **(Figures 1a, 1b)**. Together, injury/poisoning and mental health disorders accounted for about three-fifths (60.9%) of all hospital bed days and more than two-fifths (41.9%) of all medical encounters.

Of note, maternal conditions (including pregnancy complications and delivery) accounted for a relatively large proportion of all hospital bed days (n=54,598; 15.5%) but a much smaller proportion of medical encounters overall (n=186,936; 1.6%) **(Figures 1a, 1b)**. Routine prenatal visits are not included in this summary.

Medical encounters, by condition

In 2019, the 3 burden of disease-related conditions that accounted for the most medical encounters (i.e., other back problems, knee injuries, and arm/shoulder injuries) accounted for almost one-quarter

FIGURE 1a. Numbers of medical encounters,[a] individuals affected,[b] and hospital bed days, by burden of disease major category,[c] active component, U.S. Armed Forces, 2019



[a]Medical encounters include total hospitalizations and ambulatory visits for the condition (with no more than 1 encounter per individual per day per condition).

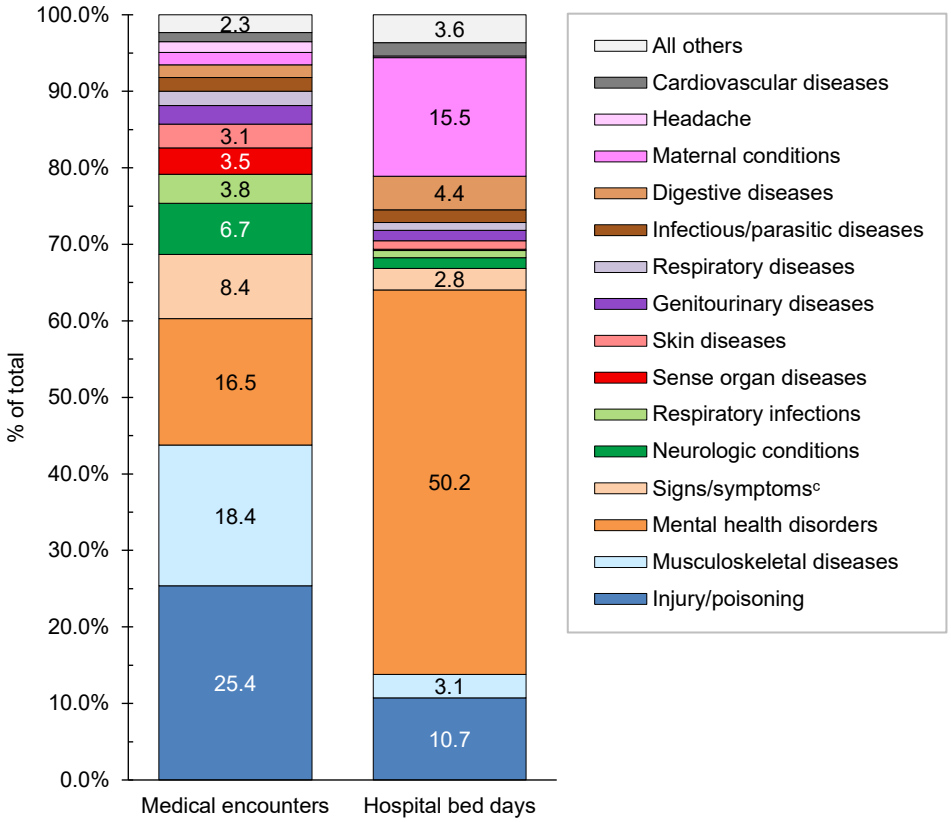
[b]Individuals with at least 1 hospitalization or ambulatory visit for the condition.

[c]Burden of disease major categories based on a modified version of those defined in the Global Burden of Disease Study.[1]

[d]Includes ill-defined conditions.

No., number.

FIGURE 1b. Percentage of medical encounters[a] and hospital bed days, attributable to burden of disease major categories,[b] active component, U.S. Armed Forces, 2019



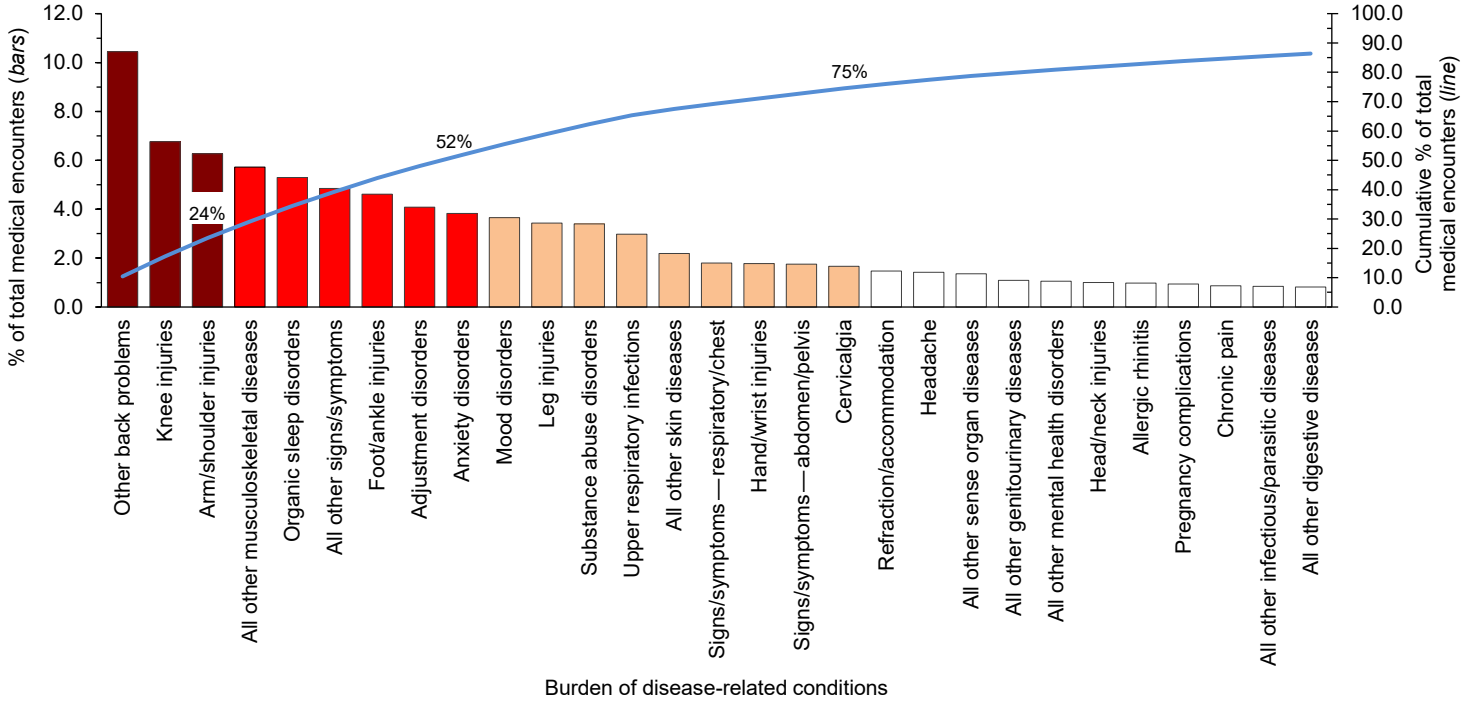
[a]Medical encounters include total hospitalizations and ambulatory visits for the condition (with no more than 1 encounter per individual per day per condition).
[b]Burden of disease major categories based on a modified version of those defined in the Global Burden of Disease Study.[1]
[c]Includes ill-defined conditions.

(23.5%) of all illness- and injury-related medical encounters overall **(Figure 2)**. Moreover, the 9 conditions that accounted for the most medical encounters accounted for more than half (51.9%) of all illness- and injury-related medical encounters overall. In general, the conditions that accounted for the most medical encounters among active component service members in 2019 were predominantly musculoskeletal diseases (e.g., back problems), injuries (e.g., knee, arm/shoulder, foot/ankle, or leg), and mental health disorders (e.g., adjustment disorders, anxiety disorders, mood disorders, or substance abuse disorders) **(Table, Figure 2)**.

Individuals affected, by condition

In 2019, more active component service members received medical care for all other signs and symptoms than for any other specific condition **(Table)**. Of the 10 conditions that affected the most service members, 3 were injuries (knee, arm/shoulder, foot/ankle), 2 were musculoskeletal diseases (other back problems and all other musculoskeletal diseases), 2 were signs and symptoms (all other signs and symptoms and respiratory and chest), 1

FIGURE 2. Percentage and cumulative percentage distribution, burden of disease-related conditions[a] that accounted for the most medical encounters, active component, U.S. Armed Forces, 2019



[a]Burden of disease-related conditions based on a modified version of those defined in the Global Burden of Disease Study.[1]

TABLE. Health care burdens attributable to various diseases and injuries, U.S. Armed Forces, 2019

Major category condition[a]	Medical encounters[b]		Individuals affected[c]		Bed days	
	No.	Rank[d]	No.	Rank[d]	No.	Rank[d]
Injury and poisoning						
Knee injuries	782,191	(2)	159,130	(5)	1,307	(35)
Arm and shoulder injuries	725,204	(3)	138,219	(9)	2,527	(26)
Foot and ankle injuries	533,879	(7)	149,395	(6)	2,077	(28)
Leg injuries	397,173	(11)	101,369	(13)	6,369	(11)
Hand and wrist injuries	205,577	(16)	77,250	(16)	1,261	(36)
Head and neck injuries	116,003	(24)	53,918	(21)	8,424	(7)
Back and abdomen injuries	51,527	(34)	31,515	(33)	4,270	(18)
Other complications NOS	32,392	(45)	18,201	(47)	6,632	(10)
Other injury from external causes	32,195	(46)	15,530	(51)	442	(61)
Environmental	25,249	(50)	19,240	(43)	750	(44)
Unspecified injury	17,319	(60)	12,413	(57)	638	(51)
Poisoning, nondrug	5,468	(102)	3,811	(85)	419	(63)
Poisoning, drugs	3,481	(107)	1,922	(100)	2,494	(27)
All other injury	3,391	(108)	2,938	(93)	70	(101)
Other burns	1,479	(118)	661	(113)	169	(79)
Other superficial injury	850	(126)	629	(114)	0	(147)
Underdosing	15	(151)	15	(150)	0	(147)
Musculoskeletal diseases						
Other back problems	1,208,044	(1)	240,533	(3)	4,911	(14)
All other musculoskeletal diseases	662,136	(4)	224,844	(4)	4,397	(17)
Cervicalgia	192,698	(18)	53,376	(22)	114	(91)
Osteoarthritis	39,811	(40)	18,592	(46)	986	(41)
Other knee disorders	13,789	(66)	5,718	(73)	334	(67)
Other shoulder disorders	11,226	(77)	4,603	(79)	87	(96)
Rheumatoid arthritis	3,127	(109)	1,033	(107)	67	(102)
Mental health disorders						
Adjustment disorders	472,436	(8)	91,571	(15)	36,299	(3)
Anxiety disorders	442,752	(9)	66,082	(19)	19,417	(5)
Mood disorders	422,891	(10)	49,830	(24)	59,101	(1)
Substance abuse disorders	393,276	(12)	29,828	(35)	49,849	(2)
All other mental disorders	122,099	(23)	43,626	(26)	3,581	(21)
Personality disorders	19,267	(57)	3,216	(90)	2,853	(24)
Psychotic disorders	18,220	(58)	2,059	(99)	5,581	(13)
Somatoform disorders	10,939	(78)	2,616	(97)	601	(54)
Tobacco dependence	7,713	(85)	5,139	(74)	16	(124)
Signs/symptoms						
All other signs and symptoms	560,975	(6)	261,473	(1)	8,034	(8)
Respiratory and chest	208,136	(15)	127,607	(10)	878	(42)
Abdomen and pelvis	202,797	(17)	127,425	(11)	1,045	(39)
Neurologic conditions						
Organic sleep disorders	612,803	(5)	121,567	(12)	319	(69)
Chronic pain	100,538	(27)	33,755	(31)	193	(77)
All other neurologic conditions	36,002	(43)	12,704	(56)	3,541	(22)
Other mononeuritis—upper and lower limbs	13,518	(68)	7,072	(68)	61	(106)
Epilepsy	5,361	(103)	1,612	(105)	714	(46)
Multiple sclerosis	2,803	(112)	499	(118)	133	(90)
Parkinson disease	275	(138)	62	(138)	57	(107)
Respiratory infections						
Upper respiratory infections	344,561	(13)	252,545	(2)	703	(48)
Lower respiratory infections	67,286	(31)	43,862	(25)	2,597	(25)
Otitis media	27,536	(49)	21,851	(40)	45	(112)
Sense organ diseases						
Refraction/accommodation	170,271	(19)	141,377	(7)	3	(140)
All other sense organ diseases	157,277	(21)	98,416	(14)	490	(58)
Hearing disorders	59,967	(33)	37,398	(28)	13	(129)
Glaucoma	11,702	(71)	7,361	(67)	28	(120)
Cataracts	1,282	(121)	699	(111)	1	(145)
Skin diseases						
All other skin diseases	253,292	(14)	140,716	(8)	3,860	(19)
Sebaceous gland diseases	60,445	(32)	33,645	(32)	15	(125)
Contact dermatitis	42,386	(39)	30,865	(34)	50	(109)

TABLE. (cont.) Health care burdens attributable to various diseases and injuries, U.S. Armed Forces, 2019

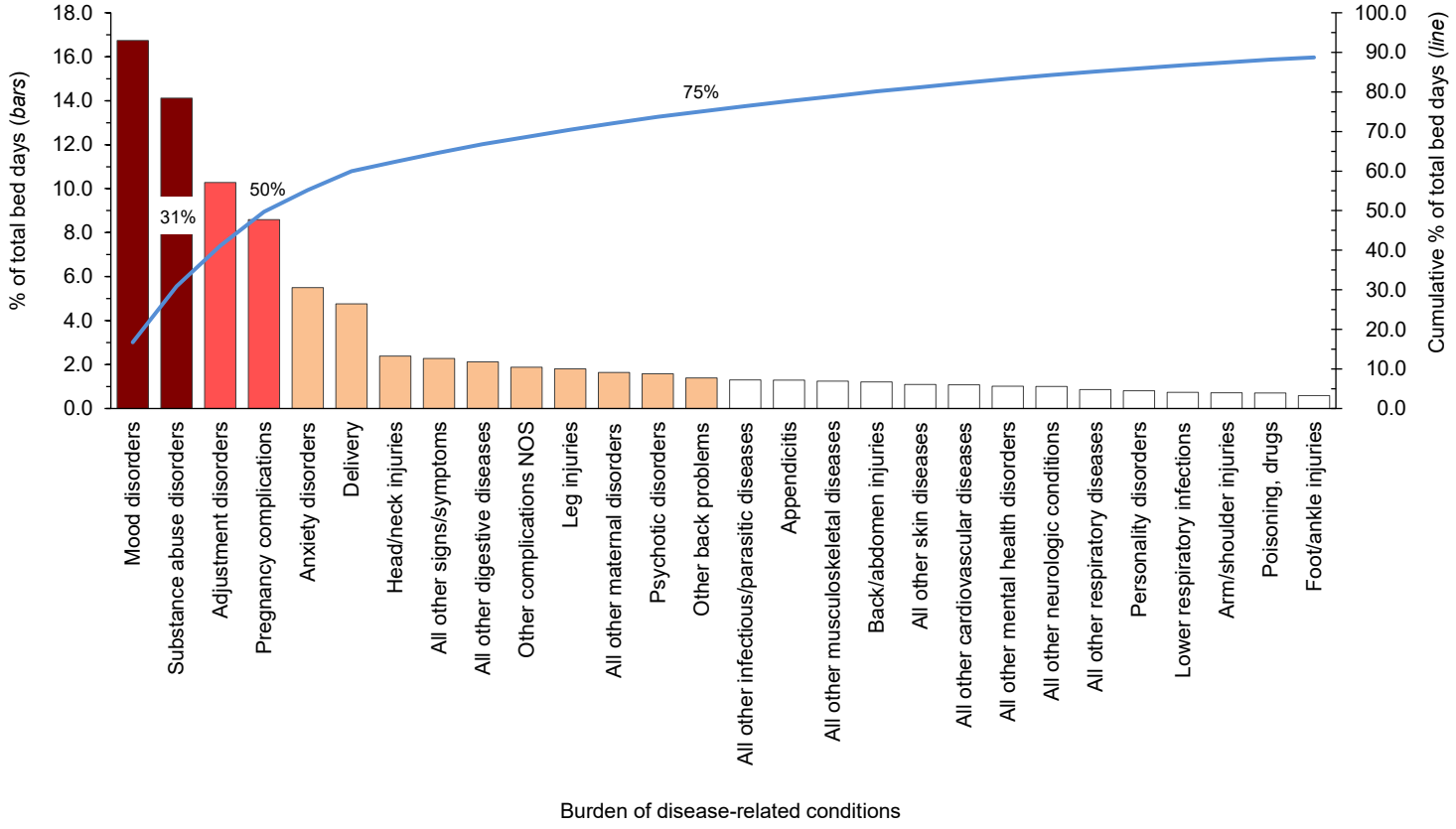
Major category condition[a]	Medical encounters[b]		Individuals affected[c]		Bed days	
	No.	Rank[d]	No.	Rank[d]	No.	Rank[d]
Genitourinary diseases						
All other genitourinary diseases	126,174	(22)	66,878	(18)	1,753	(31)
Female genital pain	38,095	(42)	17,251	(48)	85	(98)
Menstrual disorders	24,828	(51)	16,067	(49)	473	(60)
UTI and cystitis	24,539	(52)	18,730	(45)	165	(80)
Other breast disorders	19,738	(56)	10,968	(59)	336	(66)
Vaginitis and vulvitis	18,092	(59)	13,391	(54)	3	(140)
Kidney stones	14,872	(65)	6,385	(71)	513	(56)
Nephritis and nephrosis	11,389	(75)	4,228	(82)	1,378	(34)
Benign prostatic hypertrophy	2,908	(110)	1,910	(101)	33	(114)
Respiratory disease						
Allergic rhinitis	113,215	(25)	42,270	(27)	5	(138)
All other respiratory diseases	43,227	(36)	24,399	(38)	3,040	(23)
Asthma	30,816	(47)	12,874	(55)	293	(72)
Chronic sinusitis	12,807	(69)	7,041	(69)	64	(104)
Deviated nasal septum	12,208	(70)	6,858	(70)	161	(82)
Chronic obstructive pulmonary disease	5,625	(100)	4,813	(77)	106	(92)
Infectious and parasitic diseases						
All other infectious and parasitic diseases	97,790	(28)	65,469	(20)	4,592	(15)
Diarrheal diseases	42,601	(38)	36,387	(29)	721	(45)
Tinea skin infections	23,590	(53)	19,408	(42)	4	(139)
Unspecified viral infection	16,475	(61)	15,282	(52)	137	(89)
STDs (excluding chlamydia)	11,605	(72)	8,317	(65)	94	(95)
Chlamydia	10,180	(81)	8,885	(64)	9	(133)
Tuberculosis	1,202	(122)	439	(121)	158	(83)
Hepatitis B and C	1,055	(124)	538	(117)	9	(133)
Intestinal nematode infection	274	(139)	225	(132)	0	(147)
Malaria	144	(144)	53	(142)	67	(102)
Bacterial meningitis	133	(147)	39	(145)	99	(94)
Tropical cluster	103	(148)	44	(143)	14	(127)
Digestive diseases						
All other digestive diseases	94,723	(29)	52,963	(23)	7,494	(9)
Esophagus disease	33,581	(44)	20,542	(41)	627	(52)
Other gastroenteritis and colitis	30,730	(48)	18,949	(44)	2,034	(29)
Constipation	15,811	(63)	11,788	(58)	143	(88)
Inguinal hernia	10,853	(79)	4,568	(80)	284	(74)
Appendicitis	6,461	(90)	3,070	(91)	4,559	(16)
Peptic ulcer disease	1,202	(122)	814	(110)	286	(73)
Cirrhosis of the liver	251	(140)	73	(136)	84	(99)
Maternal conditions						
Pregnancy complications	108,882	(26)	22,257	(39)	30,333	(4)
All other maternal disorders	43,001	(37)	10,095	(61)	5,789	(12)
Delivery	20,231	(55)	10,869	(60)	16,809	(6)
Ectopic pregnancy/miscarriage/abortion	8,442	(83)	3,771	(86)	423	(62)
Puerperium complications	6,380	(91)	3,492	(87)	1,244	(37)
Headache						
Headache	164,312	(20)	76,663	(17)	834	(43)
Cardiovascular diseases						
All other cardiovascular diseases	68,245	(30)	33,901	(30)	3,809	(20)
Essential hypertension	51,140	(35)	27,625	(36)	163	(81)
Cerebrovascular disease	7,486	(86)	1,705	(104)	1,159	(38)
Ischemic heart disease	6,380	(91)	2,524	(98)	710	(47)
Inflammatory	2,651	(114)	1,317	(106)	323	(68)
Rheumatic heart disease	476	(133)	386	(125)	29	(119)
Other neoplasms						
All other neoplasms	38,458	(41)	25,562	(37)	1,421	(33)
Benign skin neoplasm	16,235	(62)	13,412	(53)	8	(136)
Lipoma	8,084	(84)	5,112	(75)	41	(113)
Uterine leiomyoma	3,856	(105)	1,904	(102)	659	(49)

TABLE. (cont.) Health care burdens attributable to various diseases and injuries, U.S. Armed Forces, 2019

Major category condition[a]	Medical encounters[b]		Individuals affected[c]		Bed days	
	No.	Rank[d]	No.	Rank[d]	No.	Rank[d]
Malignant neoplasms						
Lymphoma and multiple myeloma	5,881	(94)	603	(115)	652	(50)
All other malignant neoplasms	5,846	(95)	922	(109)	1,038	(40)
Leukemia	5,741	(97)	275	(129)	1,525	(32)
Breast cancer	4,136	(104)	406	(122)	157	(84)
Melanoma and other skin cancers	3,656	(106)	1,838	(103)	32	(115)
Testicular cancer	2,844	(111)	548	(116)	247	(75)
Colon and rectum cancers	2,676	(113)	229	(131)	482	(59)
Brain	2,148	(117)	192	(133)	387	(65)
Thyroid	1,409	(119)	391	(124)	156	(85)
Mouth and oropharynx cancers	797	(127)	123	(135)	64	(104)
Cervix uteri cancer	726	(128)	367	(126)	17	(123)
Prostate cancer	715	(129)	161	(134)	50	(109)
Stomach cancer	499	(132)	33	(146)	146	(87)
Trachea, bronchus, and lung cancers	405	(135)	66	(137)	52	(108)
Pancreas cancer	288	(137)	26	(147)	49	(111)
Bladder cancer	195	(141)	58	(139)	3	(140)
Esophagus cancer	163	(142)	14	(151)	84	(99)
Ovary cancer	157	(143)	54	(140)	13	(129)
Liver cancer	144	(144)	25	(148)	30	(117)
Corpus uteri cancer	90	(150)	21	(149)	2	(144)
Endocrine disorders						
Testicular hypofunction	11,525	(74)	4,363	(81)	0	(147)
Hypothyroidism	10,223	(80)	5,775	(72)	14	(127)
Other thyroid disorders	9,175	(82)	3,923	(84)	298	(71)
All other endocrine disorders	7,440	(88)	3,995	(83)	177	(78)
Blood disorders						
All other blood disorders	7,466	(87)	3,491	(88)	581	(55)
Iron-deficiency anemia	6,280	(93)	2,857	(96)	106	(92)
Other non-deficiency anemias	5,732	(98)	2,890	(95)	391	(64)
Hereditary anemias	5,603	(101)	4,633	(78)	30	(117)
Other deficiency anemias	596	(130)	326	(127)	9	(133)
Metabolic and immunity disorders						
Lipoid metabolism disorders	11,593	(73)	9,348	(62)	10	(132)
Gout	5,811	(96)	3,049	(92)	27	(121)
All other metabolic disorders	5,651	(99)	2,924	(94)	307	(70)
Immunity disorders	2,338	(116)	686	(112)	87	(96)
Oral conditions						
All other oral conditions	21,570	(54)	15,778	(50)	1,868	(30)
Dental caries	583	(131)	494	(119)	3	(140)
Periodontal disease	436	(134)	404	(123)	7	(137)
Congenital disorders						
All other congenital anomalies	15,554	(64)	9,168	(63)	623	(53)
Congenital heart disease	2,384	(115)	949	(108)	236	(76)
Other circulatory anomalies	1,353	(120)	458	(120)	147	(86)
Nutritional disorders						
Overweight, obesity	11,254	(76)	8,279	(66)	31	(116)
All other nutritional disorders	6,527	(89)	5,050	(76)	15	(125)
Protein-energy malnutrition	138	(146)	43	(144)	12	(131)
Diabetes mellitus						
Diabetes mellitus	13,525	(67)	3,290	(89)	492	(57)
Conditions arising during the perinatal period[e]						
Low birth weight	987	(125)	295	(128)	1	(145)
All other perinatal anomalies	351	(136)	246	(130)	19	(122)
Birth asphyxia and birth trauma	97	(149)	54	(140)	0	(147)

[a]Burden of disease major categories and burden of disease-related conditions based on a modified version of those defined in the Global Burden of Disease Study.[1]
[b]Medical encounters include total hospitalizations and ambulatory visits for the condition (with no more than 1 encounter per individual per day per condition).
[c]Individuals with at least 1 hospitalization or ambulatory visit for the condition.
[d]Rank based on number of encounters, individuals affected, or bed days within 151 burden-related disease conditions; for medical encounters, 3 pairs of tied values were given the same ranking, which resulted in a highest rank of 151; for individuals affected, 1 pair of tied values were given the same ranking, which resulted in a highest rank of 151; for hospital bed days, 14 sets of tied values were given the same ranking, which resulted in a highest rank of 147.
[e]Conditions affecting newborns erroneously coded on service member medical records.
No., number; NOS, not otherwise specified; UTI, urinary tract infection; STDs, sexually transmitted diseases.

FIGURE 3. Percentage and cumulative percentage distribution, burden of disease-related conditions[a] that accounted for the most hospital bed days, active component, U.S. Armed Forces, 2019



[a]Burden of disease-related conditions based on a modified version of those defined in the Global Burden of Disease Study.[1]
NOS, not otherwise specified.

was respiratory infections (upper respiratory infections), 1 was a sense organ disease (refraction/accommodation), and 1 was skin diseases (all other skin diseases).

Hospital bed days, by condition

In 2019, mood and substance abuse disorders accounted for more than one-quarter (30.9%) of all hospital bed days. Together, 4 mental health disorders (mood, substance abuse, adjustment, and anxiety) and 2 maternal conditions (pregnancy complications and delivery) accounted for three-fifths (60.0%) of all hospital bed days **(Table, Figure 3)**. Slightly more than 10 percent (10.7%) of all hospital bed days were attributable to injuries and poisonings; head/neck injuries, other complications not otherwise specified, leg injuries, and back/abdomen injuries accounted for 7.3% of the injury- and poisoning-related hospital bed days.

Relationships between healthcare burden indicators

There was a strong positive correlation between the number of medical encounters attributable to various conditions and the number of individuals affected by the conditions (r=0.86) **(data not shown)**. For example, the 3 leading causes of medical encounters were among the 9 conditions that affected the most individuals **(Table)**. In contrast, there were weak to moderate positive relationships between the hospital bed days attributable to conditions and either the numbers of individuals affected by (r=0.18) or medical encounters attributable to (r=0.37) the same conditions. For example, labor and delivery and substance abuse disorders were among the top-ranking conditions in terms of proportion of total hospital bed days; however, these conditions affected relatively few active component service members.

EDITORIAL COMMENT

This report reiterates the major findings of prior annual reports on morbidity and healthcare burdens among U.S. military members. In 2019, as in prior years, the burden of disease categories of musculoskeletal disorders, injuries, mental health disorders, and pregnancy- and delivery-related conditions accounted for relatively large proportions of the morbidity and healthcare burdens that affected active component service members. Of the 151 burden of disease-related conditions, just 9 (6.0%) accounted for slightly more than half of all illness- and injury-related medical encounters of active component members. These conditions included 3 anatomic site-defined injuries (knee, arm/shoulder, and foot/ankle), 2 musculoskeletal conditions (other back problems and all other musculoskeletal diseases), organic sleep disorders,

all other signs and symptoms, and 2 mental health disorders (adjustment and anxiety disorders). It is important to note that this pattern of illness and injury among U.S. active component members is distinctive from that of other population groups that are different in terms of demographic distribution and occupational hazards. Examples of such different populations include not only the general U.S. population but also other MHS beneficiaries such as family members and retirees. The differing burdens of disease and injury for the other MHS beneficiaries are described in another article in this issue of the *MSMR*.[3]

Mental health disorders (including substance abuse disorders), injuries, and musculoskeletal disorders of the back have been leading causes of morbidity and disability among service members throughout military history.[4–9] It is well recognized that the prevention, treatment, and rehabilitation of back problems and joint injuries, and the detection, characterization, and management of mental health disorders—including substance abuse and deployment stress-related disorders (e.g., post-traumatic stress disorder)—should be the highest priorities for military medical research, public health, and force health protection programs.

In summary, this analysis, like those of prior years, documents that relatively few illnesses and injuries account for most of the morbidity and healthcare burdens that affect U.S. military members. Illnesses and injuries that disproportionately contribute to morbidity and healthcare burdens should be high-priority targets for preventive action, research, and resources.

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Hospitalizations, Active Component, U.S. Armed Forces, 2019

This report documents the frequencies, rates, trends, and distributions of hospitalizations of active component members of the U.S. Army, Navy, Air Force, and Marine Corps during calendar year 2019. Summaries are based on standardized records of hospitalizations at U.S. military and non-military (reimbursed care) medical facilities worldwide. For this report, primary (first-listed) discharge diagnoses are considered indicative of the primary reasons for hospitalizations; summaries are based on the first 3 digits of the International Classification of Diseases, 10th Revision (ICD-10) codes used to report primary discharge diagnoses. Hospitalizations not routinely documented with standardized, automated records (e.g., during field training exercises or while shipboard) are not centrally available for health surveillance purposes and thus are not included in this report.

Frequencies, rates, and trends

In 2019, there were 66,989 records of hospitalizations of active component members of the U.S. Army, Navy, Air Force, and Marine Corps **(Table 1)**; 33.0% of the hospitalizations were in non-military facilities **(data not shown)**. The annual hospitalization rate (all causes) for 2019 was 50.9 per 1,000 service member person-years (p-yrs). This rate was unchanged from the rate for 2018 (50.9 per 1,000 p-yrs). The rates for 2018 and 2019 were the lowest rates reported during 2010–2019, the years covered in this report **(Figure 1)**.

Hospitalizations, by illness and injury categories

As in prior years, in 2019, 3 diagnostic categories accounted for three-fifths (60.0%) of all hospitalizations of active component members: mental health disorders (28.1%),

WHAT ARE THE NEW FINDINGS?

The annual hospitalization rate for any cause in 2019 was unchanged from the rate in 2018 at 50.9 per 1,000 service member person-years. The rates for 2018 and 2019 were the lowest rates in the past 10 years. Rates of hospitalization in most of the ICD-10 major diagnostic categories have declined in recent years, but numbers and rates of hospitalizations for mental health disorders have increased.

WHAT IS THE IMPACT ON READINESS AND FORCE HEALTH PROTECTION?

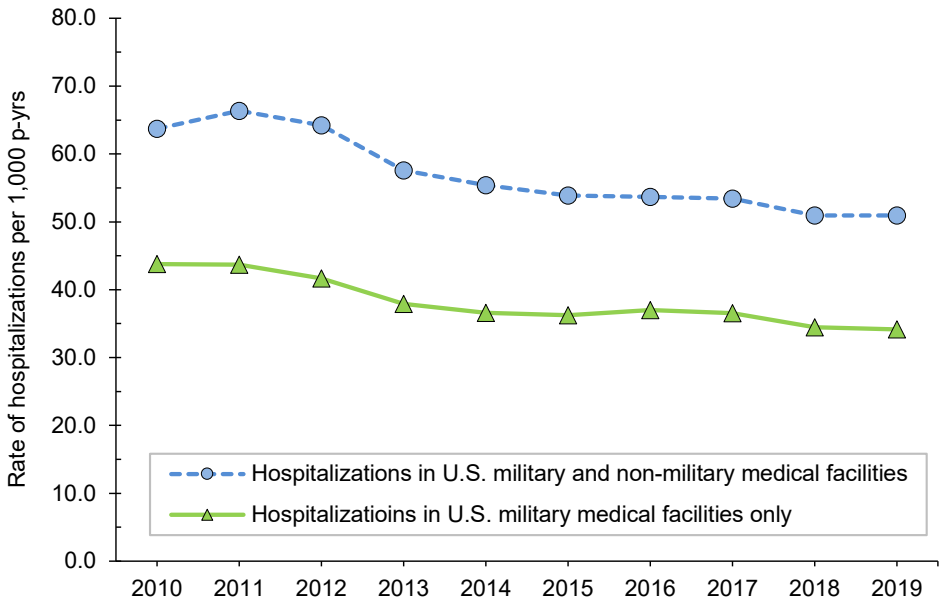
Declining rates of hospitalization for most categories of illness and injury may reflect the relatively recent decrease in numbers of active duty military personnel involved in peacekeeping and combat operations. The reasons for the increase in mental health disorder-related hospitalizations are not known, but this trend warrants continued research and emphasis on preventive measures for this relatively common category associated with lengthy hospitalizations.

TABLE 1. Numbers, rates,[a] and ranks[b] of hospitalizations, by ICD-9/ICD-10 major diagnostic category, active component, U.S. Armed Forces, 2015, 2017, and 2019

	2015[c]			2017			2019		
Major diagnostic category (ICD-9 codes; ICD-10 codes)	No.	Rate[a]	Rank[b]	No.	Rate[a]	Rank[b]	No.	Rate[a]	Rank[b]
Mental health disorders (290–319; F01–F99)	15,570	12.0	(1)	18,176	14.2	(1)	18,819	14.3	(1)
Pregnancy and delivery (630–679, relevant V-codes; O00–O99, relevant Z codes)[d]	15,379	76.8	(2)	15,362	74.2	(2)	15,093	68.2	(2)
Injury and poisoning (800–999; S00–T98, DOD0101–DOD0105)	7,034	5.4	(3)	6,632	5.2	(3)	6,278	4.8	(3)
Digestive system (520–579; K00–K95)	6,326	4.9	(5)	5,462	4.3	(4)	5,322	4.0	(4)
Musculoskeletal system and connective tissue (710–739; M00–M99)	6,378	4.9	(4)	5,312	4.1	(5)	4,701	3.6	(5)
Signs, symptoms, and ill-defined conditions (780–799; R00–R99)	3,013	2.3	(7)	3,224	2.5	(6)	2,939	2.2	(6)
Other (V01–V99, except pregnancy-related; Z00–Z99, except pregnancy-related)[e]	3,226	2.5	(6)	2,006	1.6	(8)	2,163	1.6	(7)
Respiratory system (460–519; J00–J99)	1,906	1.5	(10)	1,876	1.5	(9)	2,041	1.6	(8)
Genitourinary system (580–629; N00–N99)	2,170	1.7	(8)	2,037	1.6	(7)	1,887	1.4	(9)
Circulatory system (390–459; I00–I99)	2,043	1.6	(9)	1,836	1.4	(10)	1,687	1.3	(10)
Nervous system and sense organs (320–389; G00–G99, H00–H95)	1,549	1.2	(12)	1,705	1.3	(11)	1,493	1.1	(11)
Neoplasms (140–239; C00–D49)	1,653	1.3	(11)	1,568	1.2	(12)	1,354	1.0	(12)
Infectious and parasitic diseases (001–139; A00–B99)	1,200	0.9	(14)	1,103	0.9	(14)	1,091	0.8	(13)
Skin and subcutaneous tissue (680–709; L00–L99)	1,379	1.1	(13)	1,165	0.9	(13)	1,069	0.8	(14)
Endocrine, nutrition, immunity (240–278; E00–E89)	645	0.5	(15)	556	0.4	(15)	520	0.4	(15)
Hematologic and immune disorders (279–289; D50–D89)	287	0.2	(17)	285	0.2	(16)	280	0.2	(16)
Congenital anomalies (740–759; Q00–Q99)	366	0.3	(16)	245	0.2	(17)	252	0.2	(17)
Total	70,124	53.9		68,550	53.4		66,989	50.9	

[a]Rate per 1,000 person-years.
[b]Rank of major diagnostic category based on number of hospitalizations.
[c]2015 hospitalization data included ICD-9 diagnostic codes.
[d]Rate of pregnancy and delivery-related hospitalizations among females only.
[e]Other factors influencing health status and contact with health services (excluding pregnancy-related).
ICD, International Classification of Diseases; No., number.

FIGURE 1. Rates of hospitalization, by year, active component, U.S. Armed Forces, 2010–2019



P-yrs, person-years.

pregnancy- and delivery-related conditions (22.5%), and injury/poisoning (9.4%) **(Table 1)**. Similar to 2015 and 2017, in 2019 there were more hospitalizations for mental health disorders than for any other major diagnostic category (per ICD-10); 2008 was the last year in which the number of hospitalizations for pregnancy- and delivery-related conditions exceeded the number for mental health disorders **(data not shown)**.

Comparing 2019 to 2015, numbers of hospitalizations decreased in all major categories of illnesses and injuries except for mental health disorders and respiratory system disorders, which increased 20.9% and 7.1%, respectively **(Table 1)**. The largest drop in the number of hospitalizations during 2015–2019 was seen in the category of "other factors influencing health status and contact with health services" (excluding pregnancy-related) (hospitalization difference, 2015–2019: -1,063; 33.0% decrease).

Hospitalizations, by sex

In 2019, the hospitalization rate (all causes) among females was more than 3 times that of males (120.2 per 1,000 p-yrs vs. 36.9 per 1,000 p-yrs, respectively). Excluding pregnancy and delivery, the rate of hospitalizations among females (52.0 per 1,000 p-yrs) was 40.9% higher than among males **(data not shown)**.

Overall hospitalization rates were higher (i.e., the rate difference [RD] was greater than 1.0 per 1,000 p-yrs) among females than males for mental health disorders (female:male, RD: 7.7 per 1,000 p-yrs); genitourinary disorders (RD: 3.6 per 1,000 p-yrs); and neoplasms (RD: 1.6 per 1,000 p-yrs) **(data not shown)**. With the exception of pregnancy- and delivery-related conditions, hospitalization rates were relatively similar among males and females for the remaining 13 major disease-specific categories **(data not shown)**.

Relationships between age and hospitalization rates varied considerably across illness- and injury-specific categories. For example, among both males and females, hospitalization rates generally increased with age for musculoskeletal system/connective tissue disorders, neoplasms, and circulatory, genitourinary, digestive, nervous, and endocrine/nutrition/immunity disorders **(Figure 2)**. Among service members aged 30 years or older, there was a pronounced difference by sex in the slopes of the rates of neoplasms, with the rates among females notably higher than among males in the same age groups. Rates decreased with age for mental health disorders but were relatively stable across age groups for injury/poisoning, signs/symptoms/ill-defined conditions, and infectious/parasitic diseases.

Most frequent diagnoses

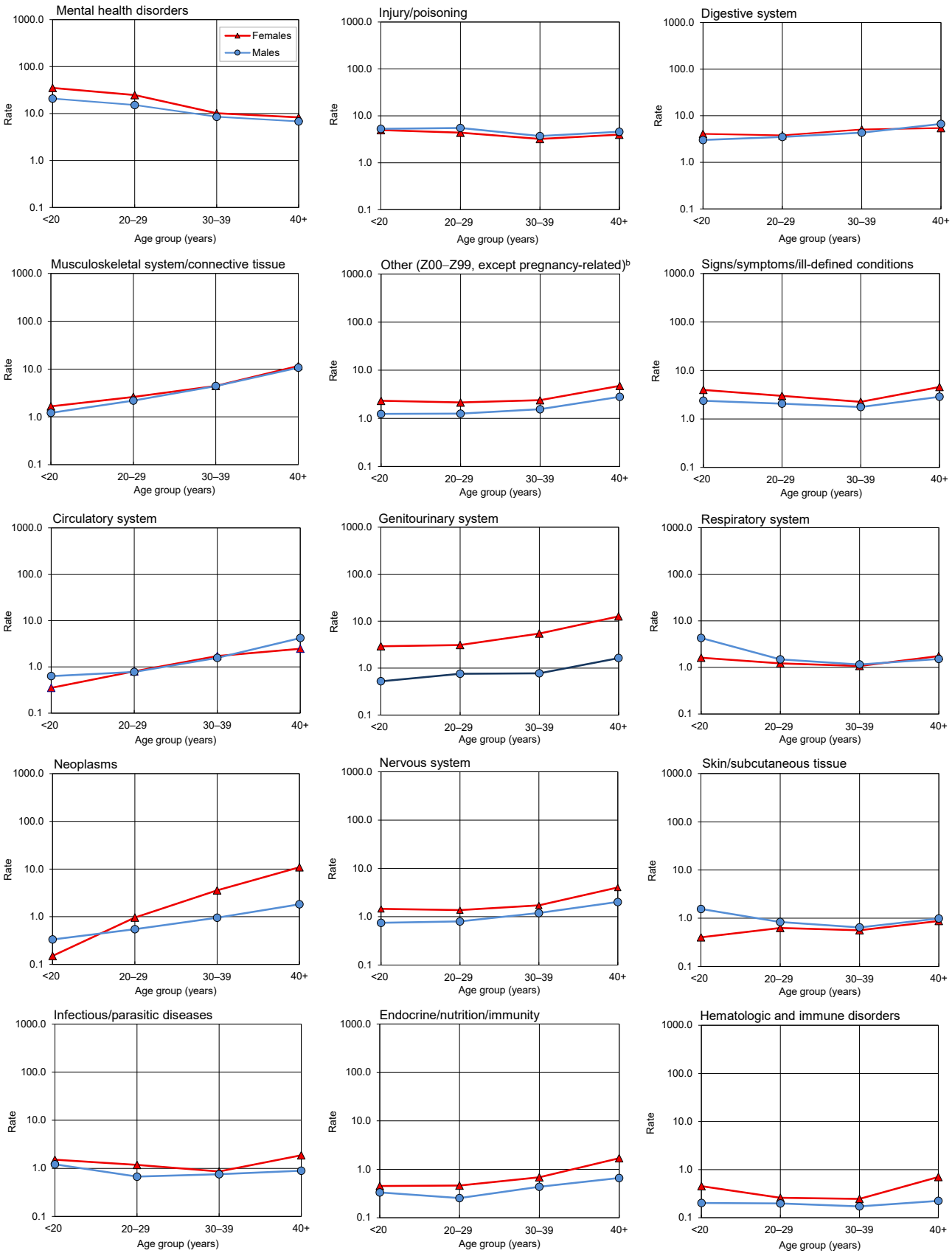
In 2019, adjustment disorder was the most frequent discharge diagnosis among males (n=4,473) **(Table 2)**. Alcohol dependence (n=2,207), major depressive disorder [single episode, unspecified] (n=1,255), acute appendicitis (n=1,196), major depressive disorder [recurrent, severe without psychotic features] (n=1,123), other symptoms and signs involving emotional state (n=605), and post-traumatic stress disorder (PTSD) (n=581) were the next 6 most frequent diagnoses in males **(Table 2)**.

In 2019, pregnancy- and delivery-related conditions represented 4 of the top 5 leading causes of hospitalizations among females, and this category alone accounted for 56.9% of all hospitalizations of females **(Table 3)**. The top 5 discharge diagnoses in this condition category included post-term (late) pregnancy (n=1,183), abnormality in fetal heart rate and rhythm (n=1,013), premature rupture of membranes [onset of labor within 24 hours of rupture] (n=936), maternal care due to uterine scar from previous surgery (n=840), and second degree laceration during delivery (n=759). Other than pregnancy- and delivery-related diagnoses, leading causes of hospitalizations among females were adjustment disorder (n=1,305), recurrent major depressive disorder without psychotic features (n=532), major depressive disorder [single episode, unspecified] (n=436), PTSD (n=421), and alcohol dependence (n=267). Combined, mental health disorder diagnoses accounted for one-sixth (17.3%) of all hospitalizations of females.

Injury/poisoning

As in the past, in 2019, injury/poisoning was the third leading cause of hospitalizations of U.S. military members **(Table 1)**. Of all injury/poisoning-related hospitalizations in U.S. military medical facilities (n=3,798), more than half (58.6%) had a missing or invalid NATO Standardization Agreement (STANAG) code **(Table 4)**. Nearly one-third (31.9%) of all "unintentional" injury/poisoning-related hospitalizations in U.S. military facilities (n=1,425) were considered caused by falls and miscellaneous (n=455), while land transport (n=320) accounted for 22.5% of "unintentional" injury/poisoning-related hospitalizations **(Table 4)**.

FIGURE 2. Rates[a] of hospitalization, by ICD-10 major diagnostic category, age group, and sex, active component, U.S. Armed Forces, 2019



[a]Rate per 1,000 person-years; rates are shown on semi-log plots.
[b]Other factors influencing health status and contact with health services (excluding pregnancy-related).
ICD, International Classification of Diseases.

TABLE 2. Numbers and percentages of the most frequent diagnoses during hospitalization, by ICD-10 major diagnostic category, males, active component, U.S. Armed Forces, 2019

Diagnostic category (ICD-10 codes) ♂	No.	%[a]
Mental health disorders (F01–F99)	**14,231**	
Adjustment disorders	4,473	31.4
Alcohol dependence	2,207	15.5
Major depressive disorder, single episode, unspecified	1,255	8.8
Major depressive disorder, recurrent severe without psychotic features	1,123	7.9
Post-traumatic stress disorder (PTSD)	581	4.1
Injury and poisoning (S00–T98, DOD0101–DOD0105)	**5,368**	
Infection following a procedure	243	4.5
Concussion	172	3.2
Fracture of shaft of tibia	143	2.7
Fracture of mandible	141	2.6
Other fractures of lower leg	133	2.5
Digestive system (K00–K95)	**4,375**	
Other and unspecified acute appendicitis	1,196	27.3
Acute appendicitis with localized peritonitis	317	7.2
Acute pancreatitis, unspecified	143	3.3
Noninfective gastroenteritis and colitis, unspecified	137	3.1
Other and unspecified intestinal obstruction	104	2.4
Musculoskeletal system (M00–M99)	**3,886**	
Other specified disorders of muscle	502	12.9
Thoracic, thoracolumbar, and lumbosacral intervertebral disc disorders with radiculopathy	354	9.1
Major anomalies of jaw size	240	6.2
Spinal stenosis	205	5.3
Other spondylosis with radiculopathy	181	4.7
Other (Z00–Z99, except pregnancy-related)[b]	**1,627**	
Encounter for examination and observation for unspecified reason	344	21.1
Encounter for antineoplastic chemotherapy and immunotherapy	242	14.9
Encounter for other specified postprocedural aftercare	231	14.2
Encounter for other orthopedic aftercare	205	12.6
Encounter for other administrative examinations	97	6.0
Signs, symptoms, and ill-defined conditions (R00–R99)	**2,273**	
Other symptoms and signs involving emotional state	605	26.6
Syncope and collapse	235	10.3
Other chest pain	189	8.3
Chest pain, unspecified	125	5.5
Unspecified convulsions	97	4.3
Circulatory system (I00–I99)	**1,439**	
Pulmonary embolism without acute cor pulmonale	167	11.6
Non-ST elevation (NSTEMI) myocardial infarction	70	4.9
Unspecified atrial fibrillation and atrial flutter	70	4.9
Paroxysmal atrial fibrillation	67	4.7
Cerebral infarction, unspecified	50	3.5
Genitourinary system (N00–N99)	**908**	
Acute kidney failure, unspecified	214	23.6
Hydronephrosis with renal and ureteral calculous obstruction	70	7.7
Calculus of kidney	58	6.4
Hypertrophy of breast	47	5.2
Calculus of ureter	39	4.3

Diagnostic category (ICD-10 codes) ♂	No.	%[a]
Respiratory system (J00–J99)	**1,762**	
Pneumonia, unspecified organism	311	17.7
Peritonsillar abscess	149	8.5
Lobar pneumonia, unspecified organism	125	7.1
Other pneumothorax and air leak	78	4.4
Deviated nasal septum	75	4.3
Neoplasms (C00–D49)	**840**	
Acute lymphoblastic leukemia (ALL)	49	5.8
Acute myeloblastic leukemia	36	4.3
Malignant neoplasm of thyroid gland	35	4.2
Malignant neoplasm of testis, unspecified whether descended or undescended	29	3.5
Benign neoplasm of pituitary gland	27	3.2
Nervous system and sense organs (G00–G99, H00–H95)	**1,122**	
Sleep apnea	97	8.6
Epilepsy, unspecified	58	5.2
Acute pain, NEC	57	5.1
Brachial plexus disorders	42	3.7
Migraine, unspecified	32	2.9
Skin and subcutaneous tissue (L00–L99)	**934**	
Cellulitis and acute lymphangitis of other parts of limb	393	42.1
Pilonidal cyst and sinus with abscess	57	6.1
Cutaneous abscess, furuncle and carbuncle of limb	55	5.9
Pilonidal cyst and sinus without abscess	50	5.4
Cellulitis and acute lymphangitis of face and neck	38	4.1
Infectious and parasitic diseases (A00–B99)	**830**	
Sepsis, unspecified organism	266	32.0
Viral intestinal infection, unspecified	45	5.4
Infectious gastroenteritis and colitis, unspecified	45	5.4
Viral infection, unspecified	43	5.2
Enterocolitis due to *Clostridium difficile*	29	3.5
Endocrine, nutrition, and immunity disorders (E00–E89)	**384**	
Dehydration	48	12.5
Type 1 diabetes mellitus with ketoacidosis	42	10.9
Type 2 diabetes mellitus with ketoacidosis	36	9.4
Type 2 diabetes mellitus with other specified complications	30	7.8
Thyrotoxicosis with diffuse goiter	27	7.0
Congenital anomalies (Q00–Q99)	**188**	
Atrial septal defect	21	11.2
Other congenital deformities of hip	21	11.2
Congenital insufficiency of aortic valve	16	8.5
Pectus excavatum	13	6.9
Malformation of coronary vessels	12	6.4
Hematologic and immune disorders (D50–D89)	**212**	
Neutropenia, unspecified	33	15.6
Immune thrombocytopenic purpura	21	9.9
Other specified aplastic anemias and other bone marrow failure syndromes	17	8.0
Acute posthemorrhagic anemia	10	4.7
Agranulocytosis secondary to cancer chemotherapy	10	4.7

[a]Percentage of the total number of hospitalizations within the diagnostic category.
[b]Other factors influencing health status and contact with health services (excluding pregnancy-related).
ICD, International Classification of Diseases; No., number; NSTEMI, non-ST segment elevation myocardial infarction; NEC, not elsewhere classified.

TABLE 3. Numbers and percentages of most frequent diagnoses during hospitalization, by ICD-10 major diagnostic category, females, active component, U.S. Armed Forces, 2019

Diagnostic category (ICD-10 codes) ♀	No.	%[a]
Mental health disorders (F01–F99)	**4,588**	
Adjustment disorders	1,305	28.4
Major depressive disorder, recurrent severe without psychotic features	532	11.6
Major depressive disorder, single episode, unspecified	436	9.5
Post-traumatic stress disorder (PTSD)	421	9.2
Alcohol dependence	267	5.8
Pregnancy and delivery (O00–O99, relevant Z codes)	**15,093**	
Post-term pregnancy	1,183	7.8
Abnormality in fetal heart rate and rhythm complicating labor and delivery	1,013	6.7
Premature rupture of membranes, onset of labor within 24 hours of rupture	936	6.2
Maternal care due to uterine scar from previous surgery	840	5.6
Second degree perineal laceration during delivery	759	5.0
Injury and poisoning (S00–T98, DOD0101–DOD0105)	**910**	
Poisoning by, adverse effect of and underdosing of other and unspecified antidepressants	57	6.3
Infection following a procedure	54	5.9
Poisoning by, adverse effect of and underdosing of 4-aminophenol derivatives	37	4.1
Other fractures of lower leg	31	3.4
Concussion	24	2.6
Digestive system (K00–K95)	**947**	
Other and unspecified acute appendicitis	242	25.6
Acute cholecystitis	49	5.2
Noninfective gastroenteritis and colitis, unspecified	43	4.5
Calculus of gallbladder with acute cholecystitis	41	4.3
Acute appendicitis with localized peritonitis	34	3.6
Musculoskeletal system (M00–M99)	**815**	
Major anomalies of jaw size	84	10.3
Other specified disorders of muscle	72	8.8
Spinal stenosis	42	5.2
Thoracic, thoracolumbar, and lumbosacral intervertebral disc disorders with radiculopathy	42	5.2
Anomalies of dental arch relationship	40	4.9
Other (Z00–Z99, except pregnancy-related)[b]	**536**	
Encounter for examination and observation for unspecified reason	155	28.9
Encounter for other specified postprocedural aftercare	79	14.7
Encounter for other administrative examinations	64	11.9
Encounter for other orthopedic aftercare	44	8.2
Encounter for antineoplastic chemotherapy and immunotherapy	25	4.7
Signs, symptoms, and ill-defined conditions (R00–R99)	**666**	
Other symptoms and signs involving emotional state	172	25.8
Syncope and collapse	68	10.2
Unspecified abdominal pain	47	7.1
Pain localized to other parts of lower abdomen	39	5.9
Unspecified convulsions	33	5.0
Circulatory system (I00–I99)	**248**	
Pulmonary embolism without acute cor pulmonale	51	20.6
Supraventricular tachycardia	11	4.4
Non-ST elevation (NSTEMI) myocardial infarction	10	4.0
Cerebral aneurysm, nonruptured	10	4.0
Acute embolism and thrombosis of deep veins of lower extremity	8	3.2

Diagnostic category (ICD-10 codes) ♀	No.	%[a]
Genitourinary system (N00–N99)	**979**	
Abnormal uterine and vaginal bleeding, unspecified	133	13.6
Other and unspecified ovarian cysts	77	7.9
Hypertrophy of breast	65	6.6
Acute tubulo-interstitial nephritis	58	5.9
Excessive and frequent menstruation with regular cycle	53	5.4
Respiratory system (J00–J99)	**279**	
Peritonsillar abscess	27	9.7
Pneumonia, unspecified organism	25	9.0
Chronic tonsillitis and adenoiditis	20	7.2
Acute tonsillitis, unspecified	18	6.5
Other intraoperative and postprocedural complications and disorders of respiratory system, NEC	17	6.1
Neoplasms (C00–D49)	**514**	
Leiomyoma of uterus, unspecified	153	29.8
Intramural leiomyoma of uterus	58	11.3
Subserosal leiomyoma of uterus	43	8.4
Malignant neoplasm of thyroid gland	23	4.5
Malignant neoplasm of breast of unspecified site	21	4.1
Nervous system and sense organs (G00–G99, H00–H95)	**371**	
Migraine, unspecified	23	6.2
Acute pain, NEC	22	5.9
Other epilepsy and recurrent seizures	20	5.4
Epilepsy, unspecified	15	4.0
Brachial plexus disorders	15	4.0
Skin and subcutaneous tissue (L00–L99)	**135**	
Cellulitis and acute lymphangitis of other parts of limb	30	22.2
Cellulitis and acute lymphangitis of face and neck	14	10.4
Postprocedural hematoma and seroma of skin and subcutaneous tissue following a procedure	12	8.9
Pilonidal cyst and sinus with abscess	7	5.2
Excessive and redundant skin and subcutaneous tissue	7	5.2
Infectious and parasitic diseases (A00–B99)	**261**	
Sepsis, unspecified organism	84	32.2
Sepsis due to other Gram-negative organisms	21	8.0
Infectious gastroenteritis and colitis, unspecified	18	6.9
Other specified sepsis	14	5.4
Herpesviral meningitis	10	3.8
Endocrine, nutrition, and immunity disorders (E00–E89)	**136**	
Thyrotoxicosis with diffuse goiter	21	15.4
Nontoxic single thyroid nodule	11	8.1
Hypokalemia	11	8.1
Nontoxic multinodular goiter	9	6.6
Type 1 diabetes mellitus with ketoacidosis	6	4.4
Hematologic and immune disorders (D50–D89)	**68**	
Iron deficiency anemia, unspecified	15	22.1
Acute posthemorrhagic anemia	6	8.8
Neutropenia, unspecified	6	8.8
Iron deficiency anemia secondary to blood loss (chronic)	5	7.4
Anemia, unspecified	5	7.4

[a]Percentage of the total number of hospitalizations within the diagnostic category.
[b]Other factors influencing health status and contact with health services (excluding pregnancy-related).
ICD, International Classification of Diseases; No., number; NSTEMI, non-ST segment elevation myocardial infarction; NEC, not elsewhere classified.

TABLE 4. Numbers and percentages of injury-related hospitalizations,[a] by causal agent,[b] active component, U.S. Armed Forces, 2019

Cause	No.	% total
Unintentional	1,425	37.5
Fall and miscellaneous	455	12.0
Land transport	320	8.4
Athletics	133	3.5
Poisons and fire	121	3.2
Complications of medical/surgical	111	2.9
Machinery, tools	97	2.6
Environmental	74	1.9
Air transport	54	1.4
Guns, explosives (includes accidents during war)	52	1.4
Water transport	8	0.2
Intentional	148	3.9
Self-inflicted	98	2.6
Battle casualty	27	0.7
Non-battle, inflicted by other (e.g., assault)	23	0.6
Missing/invalid code	2,225	58.6
Total	3,798	100.0

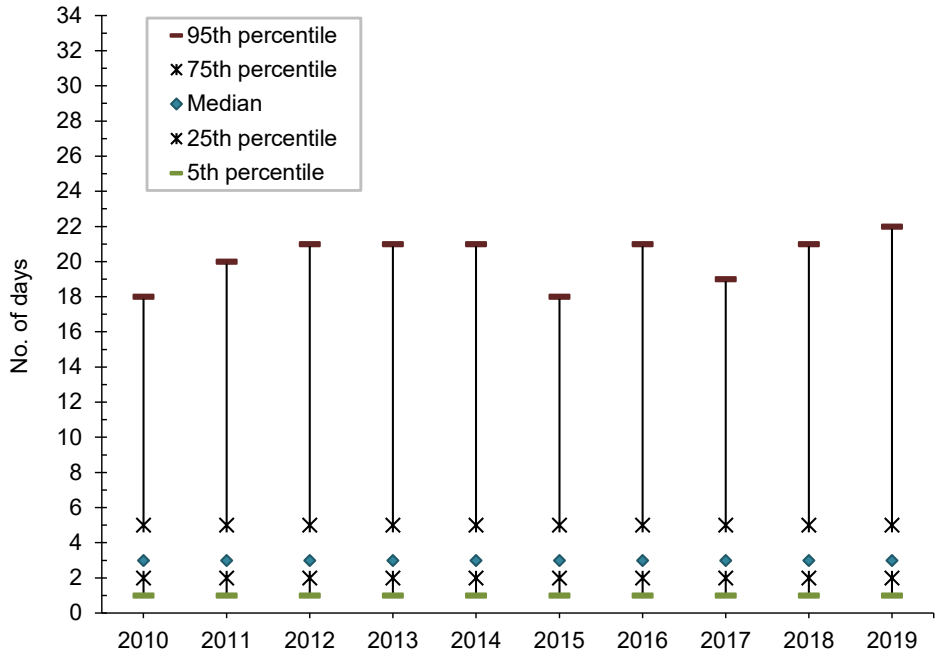
[a]Hospitalizations in U.S. military medical facilities only.
[b]Causal agents were determined by codes per NATO Standardization Agreement (STANAG) 2050.
No., number.

Among males, injury/poisoning-related hospitalizations were most often related to infection following a procedure, concussion, fracture of the tibial shaft, or fracture of the mandible **(Table 2)**. Among females, injury/poisoning-related hospitalizations were most often related to poisoning by/adverse effect of/underdosing of other and unspecified antidepressants, infection following a procedure, poisoning by/adverse effect of acetaminophen derivatives, or other fractures of the lower leg **(Table 3)**.

Durations of hospitalizations

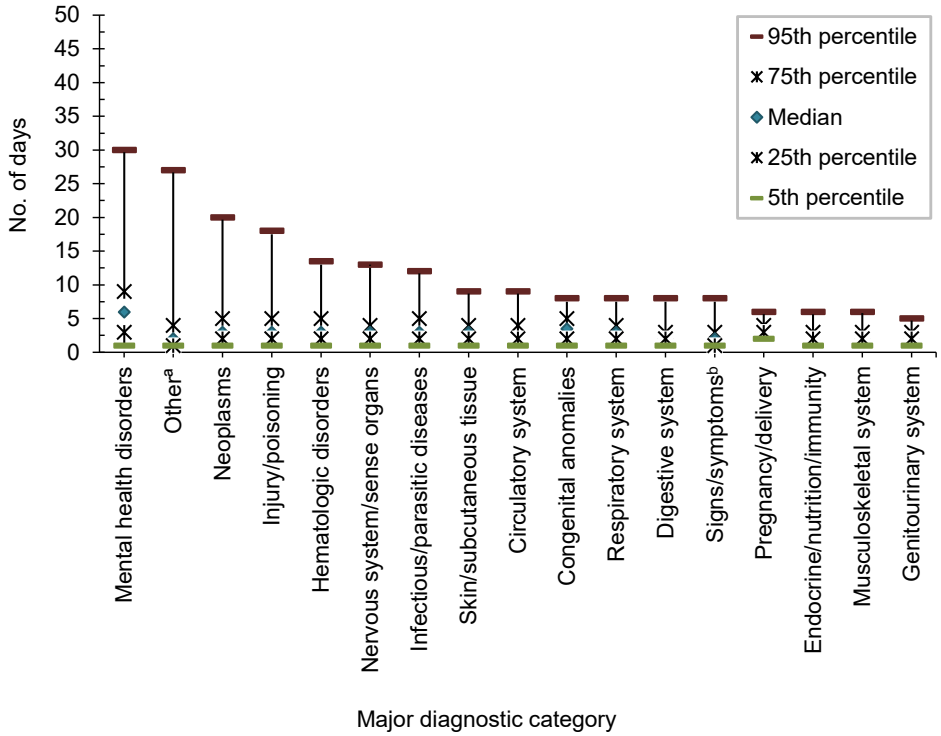
During 2010–2019, the median duration of hospital stays (all causes) remained stable at 3 days **(Figure 3)**. As in previous years, medians and ranges of durations of

FIGURE 3. Length of hospital stay, active component, U.S. Armed Forces, 2010–2019



No., number.

FIGURE 4. Length of hospital stay, by ICD-10 major diagnostic category, active component, U.S. Armed Forces, 2010–2019



[a]Other factors influencing health status and contact with health services (excluding pregnancy-related).
[b]Includes ill-defined conditions.
ICD, International Classification of Diseases; No., number.

TABLE 5. Numbers and rates of hospitalizations, by service and ICD-10 major diagnostic category, active component, U.S. Armed Forces, 2019

	Army		Navy		Air Force		Marine Corps	
Major diagnostic category (ICD-10 codes)	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]
Mental health disorders (F01–F99)	7,813	16.6	4,282	12.9	4,165	12.8	2,559	13.8
Pregnancy and delivery (O00–O99, relevant Z codes)[b]	5,062	70.7	4,388	66.5	4,396	65.2	1,247	75.6
Injury and poisoning (S00–T98, DOD0101–DOD0105)	3,115	6.6	1,108	3.3	974	3.0	1,081	5.8
Digestive system (K00–K95)	2,240	4.7	1,244	3.8	1,134	3.5	704	3.8
Musculoskeletal system and connective tissue (M00–M99)	2,108	4.5	911	2.8	1,107	3.4	575	3.1
Signs, symptoms, and ill-defined conditions (R00–R99)	1,764	3.7	454	1.4	516	1.6	205	1.1
Respiratory system (J00–J99)	913	1.9	333	1.0	359	1.1	436	2.3
Other (Z00–Z99, except pregnancy-related)[c]	846	1.8	389	1.2	600	1.8	328	1.8
Genitourinary system (N00–N99)	843	1.8	410	1.2	432	1.3	202	1.1
Circulatory system (I00–I99)	710	1.5	436	1.3	373	1.1	168	0.9
Nervous system and sense organs (G00–G99, H00–H95)	653	1.4	307	0.9	377	1.2	156	0.8
Neoplasms (C00–D49)	498	1.1	334	1.0	363	1.1	159	0.9
Skin and subcutaneous tissue (L00–L99)	465	1.0	195	0.6	180	0.6	229	1.2
Infectious and parasitic diseases (A00–B99)	441	0.9	224	0.7	253	0.8	173	0.9
Endocrine, nutrition, immunity (E00–E89)	211	0.4	127	0.4	119	0.4	63	0.3
Hematologic and immune disorders (D50–D89)	102	0.2	71	0.2	56	0.2	51	0.3
Congenital anomalies (Q00–Q99)	94	0.2	46	0.1	64	0.2	48	0.3
Total	27,878	59.1	15,259	46.1	15,468	46.8	8,384	45.1

[a]Rate per 1,000 person-years.
[b]Rates for pregnancy and delivery-related hospitalizations among females only.
[c]Other factors influencing health status and contact with health services (excluding pregnancy-related).
ICD, International Classification of Diseases; No., number.

hospitalizations varied considerably across major diagnostic categories. For example, median lengths of hospitalizations varied from 2 days (e.g., musculoskeletal system disorders; genitourinary system disorders; signs, symptoms, and ill-defined conditions) to 6 days (mental health disorders). For most diagnostic categories, less than 5% of hospitalizations exceeded 12 days, but for 6 categories, 5% of hospitalizations had longer durations: nervous system/sense organ disorders (13 days), hematologic disorders (13.5 days), injury/poisoning (18 days), neoplasms (20 days), other nonpregnancy-related factors influencing health status and contact with health services (primarily orthopedic aftercare and rehabilitation following a previous illness or injury) (27 days), and mental health disorders (30 days) **(Figure 4)**.

Hospitalizations, by service

Among active component members of the Navy and Air Force, pregnancy- and delivery-related conditions accounted for more hospitalizations than any other category of illnesses or injuries; however, among active component members of the Army and Marine Corps, mental health disorders were the leading cause of hospitalizations **(Table 5)**. The crude hospitalization rate for mental health disorders among active component Army members (16.6 per 1,000 p-yrs) was higher than among members of all other services.

Injury/poisoning was the third leading cause of hospitalizations in the Army and the Marine Corps, fourth in the Navy, and fifth in the Air Force **(Table 5)**. The hospitalization rate for injury/poisoning was highest among Army (6.6 per 1,000 p-yrs) and Marines Corps members (5.8 per 1,000 p-yrs) and lowest among Air Force members (3.0 per 1,000 p-yrs).

EDITORIAL COMMENT

The hospitalization rates for all causes among active component members in 2018 and 2019 were the lowest rates seen in the past 10 years. As in past years, in 2019, mental health disorders, pregnancy- and delivery-related conditions, and injury/poisoning accounted for more than half of all hospitalizations of active component members. Adjustment and mood disorders were among the leading causes of hospitalizations among both male and female service members. In recent years, attention at the highest levels of the U.S. military and significant resources have focused on detecting, diagnosing, and treating mental health disorders—especially those related to long and repeated deployments and combat stress. Annual numbers and crude rates of hospitalizations for mental health disorders increased between 2015 and 2017 and remained relatively stable between 2017 and 2019; the number of mental health disorder-related hospitalizations in 2019 was more than 3,000 greater than in 2015 and the crude rate was 19.6% higher.

The reasons for the recent downturn in the trends for annual numbers of hospitalizations overall and for the slight increase in mental health disorder-related hospitalizations in particular are not clear. It is conceivable that there has been a decline in the impact of combat and peacekeeping operations on overall morbidity among service members since the withdrawal of U.S.

forces from Iraq and the official end to combat operations in Afghanistan. Continued monitoring of hospitalizations and all other healthcare encounters over time may permit elucidation of the possible reasons for the recent trends in hospitalization.

This summary has certain limitations that should be considered when interpreting the results. For example, the scope of this report is limited to members of the active components of the U.S. Armed Forces. Many reserve component members were hospitalized for illnesses and injuries while serving on active duty in 2019; however, these hospitalizations are not accounted for in this report. In addition, many injury/poisoning-related hospitalizations occur in non-military hospitals. If there are significant differences between the causes of injuries and poisonings that resulted in hospitalizations in U.S. military and non-military hospitals, the summary of external causes of injuries requiring hospital treatment reported here **(Table 4)** could be misleading. Also, this summary is based on primary (first-listed) discharge diagnoses only; however, in many hospitalized cases, there are multiple underlying conditions. For example, military members who are wounded in combat or injured in motor vehicle accidents may have multiple injuries and complex medical and psychological complications. In such cases, only the first-listed discharge diagnosis would be accounted for in this report. Finally, the new electronic health record for the Military Health System, MHS GENESIS, was implemented at 4 military treatment facilities in the state of Washington in 2017 (Naval Hospital Oak Harbor, Naval Hospital Bremerton, Air Force Medical Services Fairchild, and Madigan Army Medical Center). Implementation of the second wave of MHS GENESIS sites began in 2019 and included 3 facilities in California (Travis Air Force Base [AFB], the Presidio of Monterey, and Naval Air Station Lemoore) and 1 in Idaho (Mountain Home AFB). Medical data from facilities using MHS GENESIS are not available in the Defense Medical Surveillance System. Therefore, medical encounter data for individuals seeking care at any of these facilities after their conversion to MHS GENESIS were not included in the current analysis. Even with these limitations, this report provides useful and informative insights regarding the natures, rates, and distributions of the most serious illnesses and injuries that affect active component military members.

Ambulatory Visits, Active Component, U.S. Armed Forces, 2019

This report documents the frequencies, rates, trends, and characteristics of ambulatory healthcare visits of active component members of the U.S. Army, Navy, Air Force, and Marine Corps during 2019. Ambulatory visits of U.S. service members in fixed military and nonmilitary (reimbursed through the Military Health System [MHS]) medical treatment facilities are documented with standardized, automated records. These records are routinely archived for health surveillance purposes in the Defense Medical Surveillance System (DMSS), which is the source of data for this report. Ambulatory visits that are not routinely and completely documented with standardized electronic records (e.g., during deployments, field training exercises, or at sea) are not included in this analysis. As in previous *MSMR* reports, all records of ambulatory visits of active component service members were categorized according to the first 4 characters of the International Classification of Diseases, 10th Revision (ICD-10) codes entered in the primary (first-listed) diagnostic position of the visit records.[1] The analysis depicts the distribution of diagnoses according to the 17 traditional categories of the ICD system.

Frequencies, rates, and trends

During 2019, there were 17,431,300 reported ambulatory visits of active component service members. The crude annual rate (all causes) was 13,255.3 visits per 1,000 person-years (p-yrs) or 13.3 visits per p-yr; thus, on average, each service member had approximately 13 ambulatory encounters during the year **(Table 1)**. The rate of documented ambulatory visits in 2019 was 4.7% higher than the rate in 2018 (12,661.4 visits

WHAT ARE THE NEW FINDINGS?

In 2019, the average active component service member had about 13 ambulatory encounters. About 74% of illness- and injury-related encounters were for musculoskeletal system/connective tissue disorders, mental health disorders, nervous system/sense organ disorders, and signs/symptoms/ill-defined conditions. Rates for most illnesses and injuries tended to be higher among females than males.

WHAT IS THE IMPACT ON READINESS AND FORCE HEALTH PROTECTION?

Conditions affecting the musculoskeletal system (including injuries) and mental health disorders are common causes of ambulatory encounters among active component service members. These encounters themselves limit affected members' availability for duty. These conditions that affect readiness continue to warrant research and preventive measures to reduce their impact on the force.

TABLE 1. Numbers, rates,[a] and ranks[b] of ambulatory visits, by ICD-9/ICD-10 major diagnostic category, active component, U.S. Armed Forces, 2015, 2017, and 2019

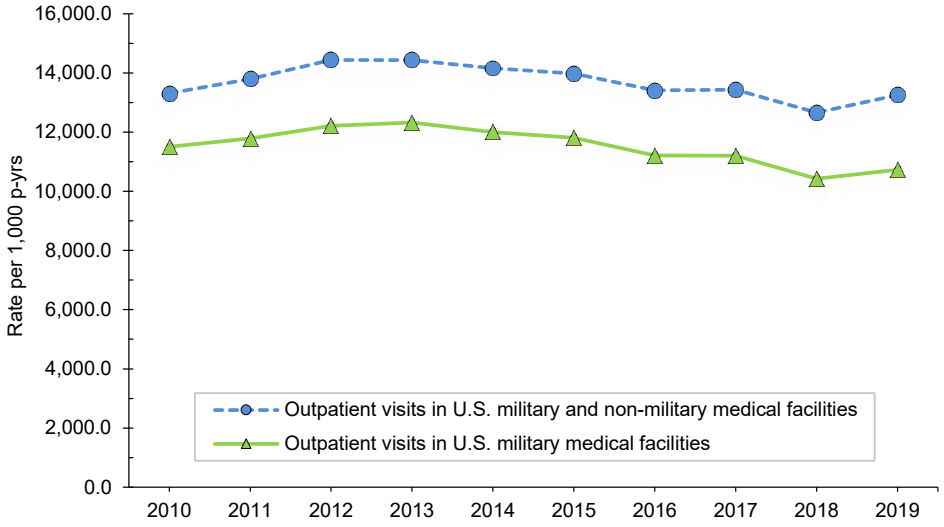
	2015[c]			2017			2019		
Major diagnostic category (ICD-9; ICD-10)	No.	Rate[a]	Rank[b]	No.	Rate[a]	Rank[b]	No.	Rate[a]	Rank[b]
Other (V01–V99, except pregnancy-related; Z00–Z99, except pregnancy-related)[d]	7,820,537	6,008.1	(1)	5,508,935	4,291.5	(1)	5,383,259	4,093.6	(1)
Musculoskeletal system and connective tissue (710–739; M00–M99)	3,214,906	2,469.8	(2)	4,274,696	3,330.0	(2)	4,419,217	3,360.5	(2)
Mental health disorders (290–319; F01–F99)	1,890,660	1,452.5	(3)	1,968,954	1,533.8	(3)	1,946,006	1,479.8	(3)
Nervous system and sense organs (320–389; G00–G99, H00–H95)	1,057,885	812.7	(4)	1,301,600	1,014.0	(4)	1,362,767	1,036.3	(4)
Signs, symptoms, and ill-defined conditions (780–799; R00–R99)	1,008,378	774.7	(5)	1,048,810	817.0	(5)	1,156,704	879.6	(5)
Injury and poisoning (800–999; S00–T98, DOD0101–DOD0105)	802,571	616.6	(6)	791,615	616.7	(6)	763,522	580.6	(6)
Respiratory system (460–519; J00–J99)	568,841	437.0	(7)	608,753	474.2	(7)	641,919	488.1	(7)
Skin and subcutaneous tissue (680–709; L00–L99)	364,544	280.1	(8)	374,235	291.5	(8)	373,583	284.1	(8)
Pregnancy and delivery (630–679, relevant V-codes; O00–O99, relevant Z codes)[e]	331,421	1,655.9	(9)	318,498	1,538.0	(9)	339,471	1,533.4	(9)
Genitourinary system (580–629; N00–N99)	257,248	197.6	(10)	243,548	189.7	(10)	255,059	194.0	(10)
Digestive system (520–579; K00–K95)	239,492	184.0	(11)	222,399	173.3	(11)	224,697	170.9	(11)
Infectious and parasitic diseases (001–139; A00–B99)	212,415	163.2	(12)	203,552	158.6	(12)	192,283	146.2	(12)
Circulatory system (390–459; I00–I99)	142,752	109.7	(13)	117,712	91.7	(13)	121,912	92.7	(13)
Neoplasms (140–239; C00–D49)	118,934	91.4	(14)	112,035	87.3	(14)	109,520	83.3	(14)
Endocrine, nutrition, immunity (240–278; E00–E89)	116,374	89.4	(15)	100,210	78.1	(15)	93,206	70.9	(15)
Hematologic and immune disorders (279–289; D50–D89)	23,124	17.8	(17)	24,410	19.0	(16)	28,719	21.8	(16)
Congenital anomalies (740–759; Q00–Q99)	25,267	19.4	(16)	19,456	15.2	(17)	19,456	14.8	(17)
Total	18,195,349	13,978.5		17,239,418	13,429.7		17,431,300	13,255.3	

[a]Rates are based on 1,000 person-years.
[b]Rank of major diagnostic category based on number of hospitalizations.
[c]2015 ambulatory visit data included ICD-9 diagnostic codes.
[d]Other factors influencing health status and contact with health services (excluding pregnancy-related).
[e]Rate of pregnancy and delivery-related hospitalizations among females only.
ICD, International Classification of Diseases; No., number.

per 1,000 p-yrs) but 8.2% lower than the peak in 2012 (14,438.8 visits per 1,000 p-yrs) **(Figure 1)**. In 2019, 30.9% of ambulatory visits were classified into the "other" category (i.e., other factors influencing health status and contact with health services, excluding pregnancy-related), which includes health care not related to a current illness or injury **(Table 1)**. Such care includes routine and special medical examinations (e.g., periodic, occupational, or retirement), therapeutic and rehabilitative treatments for previously diagnosed illnesses or injuries (e.g., physical therapy), immunizations, counseling, deployment-related health assessments, and screening.

In 2019, there were 12,048,041 documented ambulatory visits for illnesses and injuries (ICD-10: A00–T88, including relevant pregnancy Z-codes), not including diagnoses classified as "other," for a crude annual rate of illness- and injury-related visits of approximately 9.2 visits per p-yr **(Table 1)**. The rate of ambulatory visits for illnesses and injuries in 2019 was similar to the rate in 2017 (9.1 visits per p-yr) but slightly higher than the rate in 2015 (8.0 visits per p-yr).

FIGURE 1. Rates of ambulatory visits by year, active component, U.S. Armed Forces, 2010–2019



P-yrs, person-years.

Ambulatory visits, by diagnostic categories

In 2019, 4 major diagnostic categories accounted for almost three-quarters (73.7%) of all illness- and injury-related ambulatory visits among active component service members: musculoskeletal system/connective tissue disorders (36.7%); mental health disorders (16.2%); disorders of the nervous system and sense organs (11.3%); and signs, symptoms, and ill-defined conditions (9.6%) **(Table 1)**.

Between 2015 and 2019, there were increases in the numbers of visits in 8 major diagnostic categories of illness and injury and decreases in 8 categories **(Table 1)**. In terms of both the numbers of ambulatory visits and the percentage change in the numbers of visits for illnesses and injuries, the largest increases during 2015–2019 were for musculoskeletal system/connective tissue disorders (change: +1,204,311 visits; +37.5%) and disorders of the nervous system and sense organs (change: +304,882; +28.8%). The largest decrease in numbers of visits between 2015 and 2019 was for injury and poisoning (change: -39,049; -4.9%) **(Table 1)**. The largest percentage decreases in ambulatory visits during 2015–2019 were for congenital anomalies (change: -5,811; -23.0%); endocrine, nutrition, and immunity disorders (change: 23,168; -19.9%); disorders of the circulatory system (change: -20,840; -14.6%); and infectious and parasitic diseases (change: -20,132; -9.5%); moreover, the rates of ambulatory visits for illnesses and injuries in 3 of these categories (congenital anomalies; endocrine, nutrition, and immunity disorders; and infectious and parasitic diseases) showed consistent decreases during the 5-year period (2015–2017 and 2017–2019).

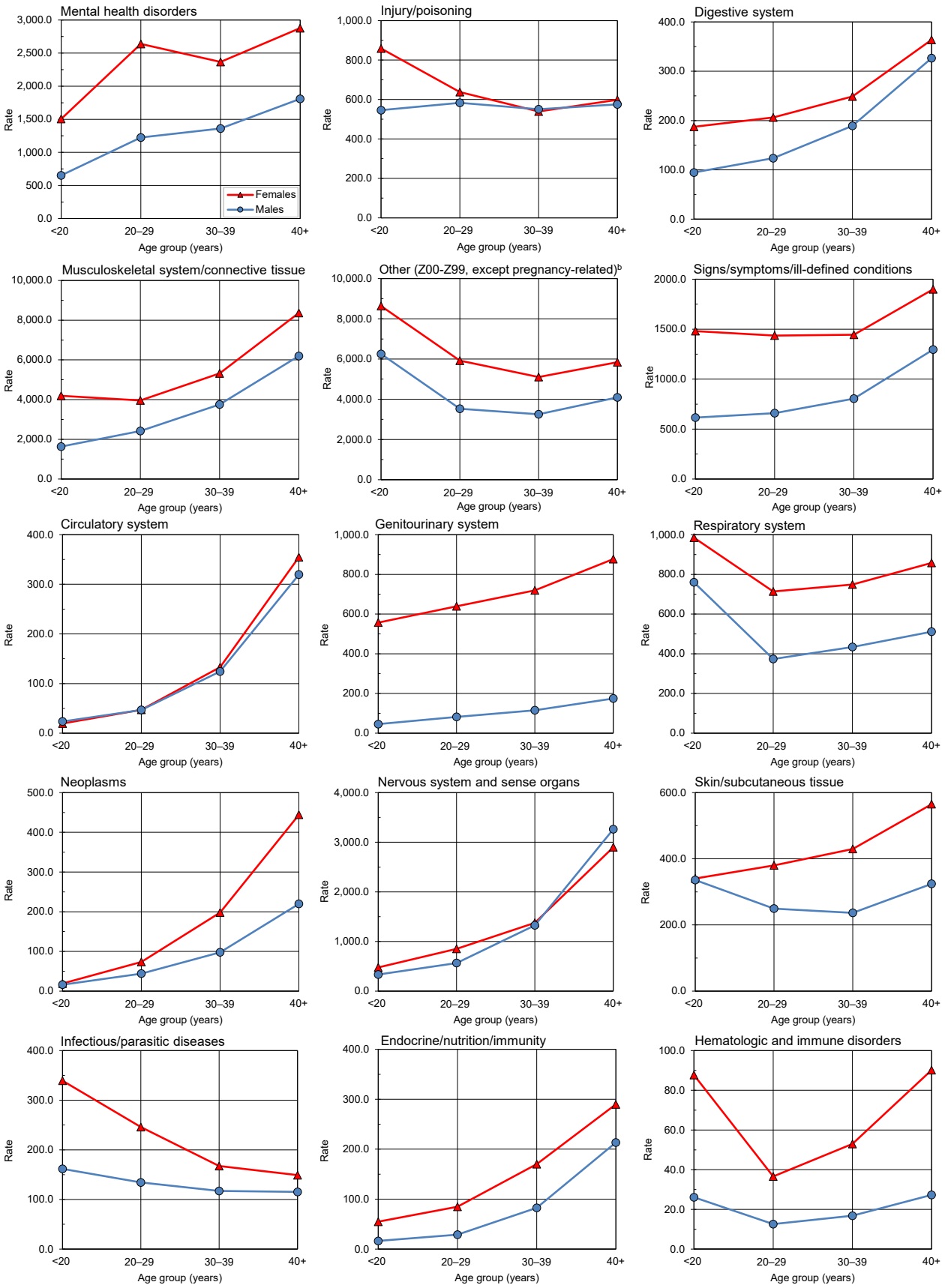
In general, the relative distributions of ambulatory visits by ICD-10 diagnostic categories remained stable over the surveillance period **(Table 1)**. In a comparison of the numbers and rates of visits attributable to each of the 17 major diagnostic categories in the years 2015 and 2019, the rank orders of 1 pair of categories were exchanged: hematologic and immune system disorders (17th to 16th) and congenital anomalies (16th to 17th). The rank orders of the 17 major diagnostic categories were the same in 2017 and 2019.

Ambulatory visits, by sex

In 2019, males accounted for nearly three-fourths (73.2%) of all illness- and injury-related visits; however, the annual crude rate among females (14.6 visits per p-yr) was 81.2% higher than that among males (8.1 visits per p-yr) **(data not shown)**. Excluding pregnancy- and delivery-related visits (which accounted for 10.5% of all non-Z-coded ambulatory visits among females), the illness and injury ambulatory visit rate among females was 13.1 visits per p-yr. As in the past, rates for illness- and injury-related categories were generally higher among females than males **(Figure 2)**.

Among all illness- and injury-specific diagnoses, 3 of the 5 diagnoses with the largest numbers of ambulatory visits were the same for males and females. However, the crude rate (per 1,000 p-yrs) was at least 41% higher among females than males for these 3 common diagnoses: pain in joint (female: 1,853.0; male: 1,254.3; female:male rate ratio [RR]: 1.48); low back pain (female: 791.9; male: 560.9; RR: 1.41); and adjustment disorders (female: 620.0; male: 266.3; RR: 2.33) **(data not shown)**. Five other diagnoses were among the 10 most common diagnoses for both males and females: pain in limb, hand, foot, fingers, and toes; post-traumatic stress disorder (PTSD); sleep apnea; alcohol dependence; and cervicalgia. Of note, sleep apnea was the 3rd most frequent illness- or injury-specific primary diagnosis during ambulatory visits of males, but it ranked as the 9th most common diagnosis among females. Among females, the 7th most common diagnosis was anxiety disorder, unspecified, which was the 11th most common diagnosis among males **(Tables 2, 3)**.

FIGURE 2. Rates[a] of ambulatory visits, by ICD-10 major diagnostic category, age group, and sex, active component, U.S. Armed Forces, 2019



[a]Rate per 1,000 person-years.
[b]Other factors influencing health status and contact with health services (excluding pregnancy-related).
ICD, International Classification of Diseases.

TABLE 2. Numbers and percentages of the most frequent diagnoses during ambulatory visits, by ICD-10 major diagnostic category, males, active component, U.S. Armed Forces, 2019

Diagnostic category (ICD-10 codes) ♂	No.	%[a]
Infectious and parasitic diseases (A00–B99)	**142,089**	
Viral intestinal infection, unspecified	17,232	12.1
Viral infection, unspecified	12,019	8.5
Infectious gastroenteritis and colitis, unspecified	9,369	6.6
Plantar wart	7,686	5.4
Other viral warts	7,151	5.0
Neoplasms (C00–D49)	**80,893**	
Neoplasm of uncertain behavior of skin	12,118	15.0
Melanocytic nevi of trunk	3,354	4.1
Other benign neoplasm of skin, unspecified	2,678	3.3
Benign lipomatous neoplasm of skin and subcutaneous tissue of trunk	2,608	3.2
Neoplasm of unspecified behavior of bone, soft tissue, and skin	2,532	3.1
Endocrine, nutrition, immunity (E00–E89)	**66,655**	
Testicular hypofunction	11,515	17.3
Hyperlipidemia, unspecified	6,567	9.9
Type 2 diabetes mellitus without complications	4,568	6.9
Hypothyroidism, unspecified	4,161	6.2
Dehydration	3,489	5.2
Hematologic and immune disorders (D50–D89)	**17,746**	
Anemia, unspecified	2,177	12.3
Sickle-cell trait	1,944	11.0
Anemia due to glucose-6-phosphate dehydrogenase [G6PD] deficiency	1,664	9.4
Other specified disorders of white blood cells	1,576	8.9
Iron deficiency anemia, unspecified	1,342	7.6
Mental health disorders (F01–F99)	**13,957,51**	
Adjustment disorders	291,247	20.9
Alcohol dependence	241,863	17.3
Post-traumatic stress disorder (PTSD)	167,001	12.0
Anxiety disorder, unspecified	74,193	5.3
Alcohol abuse	63,953	4.6
Nervous system and sense organs (G00–G99, H00–H95)	**11,166,48**	
Sleep apnea	474,915	42.5
Myopia	80,580	7.2
Chronic pain, not elsewhere classified	59,908	5.4
Insomnia	42,309	3.8
Astigmatism	21,169	1.9
Circulatory system (I00–I99)	**101,900**	
Essential (primary) hypertension	44,615	43.8
Scrotal varices	4,707	4.6
Atherosclerotic heart disease of native coronary artery	2,455	2.4
Varicose veins of lower extremities with other complications	2,373	2.3
Paroxysmal atrial fibrillation	2,189	2.1
Respiratory system (J00–J99)	**474,046**	
Acute upper respiratory infection, unspecified	96,248	20.3
Acute nasopharyngitis [common cold]	55,512	11.7
Acute pharyngitis, unspecified	48,646	10.3
Allergic rhinitis due to pollen	35,642	7.5
Other allergic rhinitis	21,779	4.6
Digestive system (K00–K95)	**174,297**	
Gastro-esophageal reflux disease without esophagitis	16,675	9.6
Noninfective gastroenteritis and colitis, unspecified	12,397	7.1
Unilateral inguinal hernia, without obstruction or gangrene	8,492	4.9
Constipation	8,097	4.6
Hemorrhage of anus and rectum	7,693	4.4
Genitourinary system (N00–N99)	**106,533**	
Other specified disorders of male genital organs	23,114	21.7
Calculus of kidney	7,034	6.6
Hypertrophy of breast	5,791	5.4
Male erectile dysfunction, unspecified	4,420	4.1
Epididymitis	4,256	4.0
Skin and subcutaneous tissue (L00–L99)	**284,257**	
Pseudofolliculitis barbae	42,225	14.9
Acne vulgaris	17,156	6.0
Ingrowing nail	16,257	5.7
Cellulitis and acute lymphangitis of other parts of limb	13,940	4.9
Dermatitis, unspecified	11,268	4.0
Musculoskeletal system and connective tissue (M00–M99)	**3,385,558**	
Pain in joint	1,371,763	40.5
Low back pain	613,442	18.1
Pain in limb, hand, foot, fingers, and toes	252,651	7.5
Cervicalgia	138,273	4.1
Radiculopathy	60,353	1.8
Congenital anomalies (Q00–Q99)	**14,339**	
Congenital pes planus	2,418	16.9
Congenital pes cavus	1,113	7.8
Other congenital deformities of feet	819	5.7
Atrial septal defect	712	5.0
Congenital insufficiency of aortic valve	604	4.2
Signs, symptoms, and ill-defined conditions (R00–R99)	**829,514**	
Headache	50,548	6.1
Other symptoms and signs involving emotional state	46,677	5.6
Chest pain, unspecified	41,774	5.0
Cough	31,293	3.8
Nausea with vomiting, unspecified	30,352	3.7
Injury/poisoning (S00–T98, DOD0101–DOD0105)	**624,155**	
Sprain of ankle	41,409	6.6
Sprain of shoulder joint	25,245	4.0
Sprain of cruciate ligament of knee	23,926	3.8
Tear of meniscus, current injury	15,616	2.5
Fracture of other and unspecified metacarpal bone	15,229	2.4
Other (Z00–Z99, except pregnancy-related)[b]	**40,657,11**	
Encounter for immunization	724,635	17.8
Encounter for other administrative examinations	604,949	14.9
Encounter for examination of ears and hearing	363,533	8.9
Other specified counseling	192,623	4.7
Encounter for other orthopedic aftercare	148,681	3.7

[a]Percentage of the total number of hospitalizations within the diagnostic category.
[b]Other factors influencing health status and contact with health services (excluding pregnancy-related).
ICD, International Classification of Diseases; No., number.

TABLE 3. Numbers and percentages of the most frequent diagnoses during ambulatory visits, by ICD-10 major diagnostic category, females, active component, U.S. Armed Forces, 2019

Diagnostic category (ICD-10 codes) ♀	No.	%[a]
Infectious and parasitic diseases (A00–B99)	**50,194**	
Viral intestinal infection, unspecified	6,102	12.2
Candidiasis of vulva and vagina	6,069	12.1
Viral infection, unspecified	4,419	8.8
Infectious gastroenteritis and colitis, unspecified	3,553	7.1
Chlamydial infection of genitourinary tract, unspecified	2,054	4.1
Neoplasms (C00–D49)	**28,627**	
Neoplasm of uncertain behavior of skin	3,088	10.8
Leiomyoma of uterus, unspecified	2,858	10.0
Malignant neoplasm of breast of unspecified site	2,140	7.5
Melanocytic nevi of trunk	980	3.4
Malignant neoplasm of upper-outer quadrant of breast	880	3.1
Endocrine, nutrition, immunity (E00–E89)	**26,551**	
Hypothyroidism, unspecified	3,497	13.2
Polycystic ovarian syndrome	2,205	8.3
Obesity, unspecified	1,921	7.2
Vitamin D deficiency, unspecified	1,673	6.3
Overweight	1,407	5.3
Hematologic and immune disorders (D50–D89)	**10,973**	
Iron deficiency anemia, unspecified	3,362	30.6
Anemia, unspecified	1,989	18.1
Sickle-cell trait	906	8.3
Iron deficiency anemia secondary to blood loss (chronic)	780	7.1
Other specified disorders of white blood cells	533	4.9
Mental health disorders (F01–F99)	**550,255**	
Adjustment disorders	137,266	24.9
Post-traumatic stress disorder (PTSD)	75,540	13.7
Anxiety disorder, unspecified	36,404	6.6
Alcohol dependence	34,109	6.2
Major depressive disorder, recurrent, moderate	27,407	5.0
Nervous system and sense organs (G00–G99, H00–H95)	**246,119**	
Sleep apnea	34,548	14.0
Myopia	27,190	11.0
Chronic pain, not elsewhere classified	22,752	9.2
Insomnia	12,209	5.0
Migraine without aura	9,101	3.7
Circulatory system (I00–I99)	**20,012**	
Essential (primary) hypertension	6,263	31.3
Varicose veins of lower extremities with other complications	1,169	5.8
Venous insufficiency (chronic) (peripheral)	759	3.8
Pulmonary embolism without acute cor pulmonale	642	3.2
Acute embolism and thrombosis of deep veins of lower extremity	606	3.0
Respiratory system (J00–J99)	**167,873**	
Acute upper respiratory infection, unspecified	33,498	20.0
Acute nasopharyngitis [common cold]	22,198	13.2
Acute pharyngitis, unspecified	20,413	12.2
Allergic rhinitis due to pollen	12,874	7.7
Other allergic rhinitis	8,697	5.2

Diagnostic category (ICD-10 codes) ♀	No.	%[a]
Digestive system (K00–K95)	**50,400**	
Constipation	7,875	15.6
Noninfective gastroenteritis and colitis, unspecified	4,461	8.9
Gastro-esophageal reflux disease without esophagitis	4,125	8.2
Hemorrhage of anus and rectum	1,752	3.5
Other hemorrhoids	1,270	2.5
Genitourinary system (N00–N99)	**148,526**	
Acute vaginitis	16,090	10.8
Urinary tract infection, site not specified	13,209	8.9
Other specified noninflammatory disorders of vagina	7,407	5.0
Abnormal uterine and vaginal bleeding, unspecified	7,270	4.9
Acute cystitis	6,629	4.5
Pregnancy and delivery (O00–O99, relevant Z codes)	**339,471**	
Encounter for supervision of normal first pregnancy	35,113	10.3
Encounter for care and examination of lactating mother	33,533	9.9
Encounter for supervision of other normal pregnancy	27,073	8.0
Encounter for routine postpartum follow-up	18,013	5.3
Other specified diseases and conditions complicating pregnancy, childbirth and the puerperium	14,952	4.4
Skin and subcutaneous tissue (L00–L99)	**89,326**	
Acne vulgaris	13,500	15.1
Dermatitis, unspecified	4,606	5.2
Acne, unspecified	3,440	3.9
Ingrowing nail	2,800	3.1
Cellulitis and acute lymphangitis of other parts of limb	2,406	2.7
Musculoskeletal system and connective tissue (M00–M99)	**1,033,659**	
Pain in joint	410,223	39.7
Low back pain	175,325	17.0
Pain in limb, hand, foot, fingers, and toes	78,656	7.6
Cervicalgia	54,422	5.3
Stress fracture	24,278	2.3
Signs, symptoms, and ill-defined conditions (R00–R99)	**327,190**	
Headache	24,395	7.5
Pelvic and perineal pain	24,252	7.4
Unspecified abdominal pain	17,569	5.4
Other symptoms and signs involving emotional state	15,624	4.8
Nausea with vomiting, unspecified	14,863	4.5
Injury/poisoning (DOD0101–DOD0105)	**139,367**	
Sprain of ankle	11,674	8.4
Sprain of cruciate ligament of knee	4,971	3.6
Concussion	3,732	2.7
Injury of muscle, fascia and tendon of abdomen, lower back, and pelvis	3,049	2.2
Sprain of hip	3,008	2.2
Other (Z00–Z99, except pregnancy-related)[b]	**1,317,548**	
Encounter for other administrative examinations	166,278	12.6
Encounter for immunization	161,266	12.2
Other specified counseling	85,684	6.5
Encounter for examination of ears and hearing	60,907	4.6
Encounter for other specified special examinations	44,836	3.4

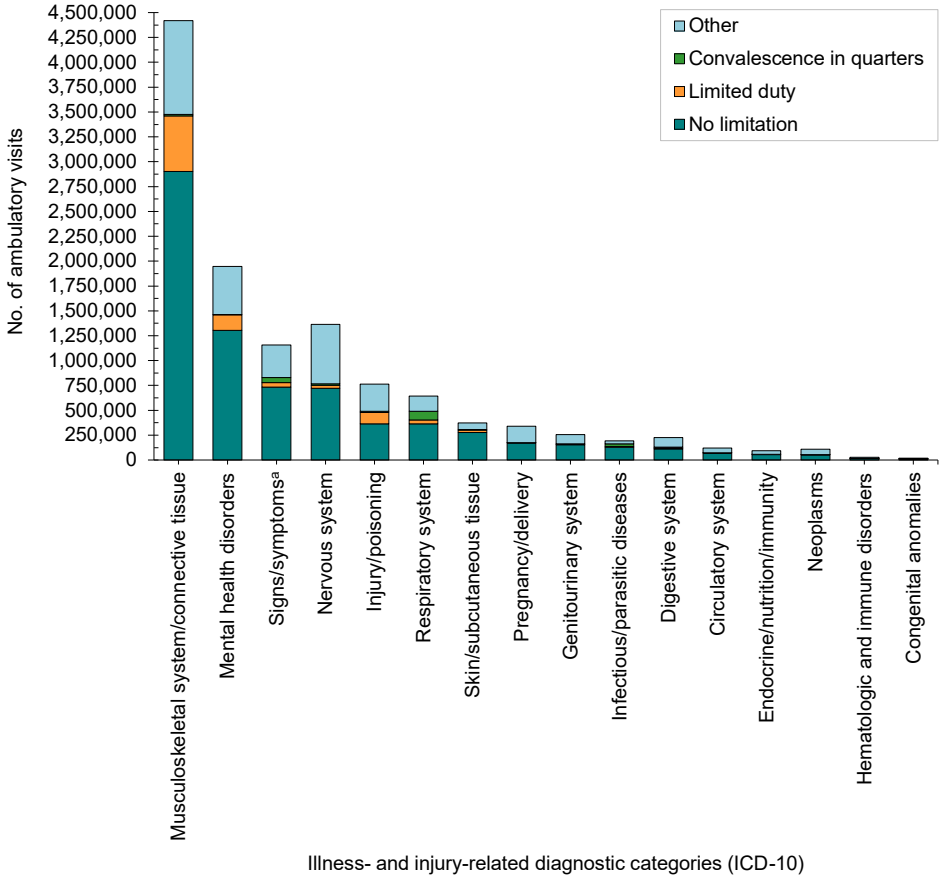
[a]Percentage of the total number of hospitalizations within the diagnostic category.
[b]Other factors influencing health status and contact with health services (excluding pregnancy-related).
ICD, International Classification of Diseases; No., number.

Across diagnostic categories, relationships between age group and ambulatory visit rates were broadly similar among males and females **(Figure 2)**. For example, among both males and females, ambulatory visit rates for neoplasms and circulatory disorders among those aged 40 years or older were 15 or more times the rates among those younger than 20 years old; in contrast, clinic visit rates for infectious and parasitic diseases were lower among the oldest compared to the youngest service members. As in the past, ambulatory visit rates for disorders of the nervous system; digestive system; endocrine system, nutrition, and immunity; and musculoskeletal system/connective tissue rose more steeply with advancing age than most other categories of illness or injury (for which rates were relatively stable or only modestly increased) **(Figure 2)**.

Dispositions after ambulatory visits

Because disposition codes are assigned to ambulatory medical encounters that occur only at military treatment facilities (MTFs), the following metrics do not include outsourced care. Approximately 61.7% of all illness- and injury-related visits resulted in "no limitation" (i.e., duty without limitations) dispositions **(data not shown)**. Approximately 1 in 52 (1.9%) illness- and injury-related visits resulted in "convalescence in quarters" dispositions **(data not shown)**. The illness- and injury-related diagnostic categories with the highest proportions of "limited duty" dispositions were injuries and poisonings (14.9%) and musculoskeletal system/connective tissue disorders (12.6%) **(Figure 3)**. The illness- and injury-related diagnostic categories with the highest proportions of "convalescence in quarters" were infectious and parasitic diseases (14.4%) and diseases of the respiratory system (13.6%). Musculoskeletal system/connective tissue disorders (55.4%) accounted for more than one-half of all "limited duty" dispositions, and mental health disorders (15.4%) and injury/poisoning (11.3%) together accounted for more than one-quarter (26.8%) **(Figure 4)**. Diseases of the respiratory system accounted for about three-eighths (37.8%) of all "convalescence in quarters" dispositions—more than twice as many (n=87,207) as any other disease category, except signs and symptoms (21.9%).

FIGURE 3. Ambulatory visits in relation to reported dispositions, by illness- and injury-related diagnostic category, active component, U.S. Armed Forces, 2019



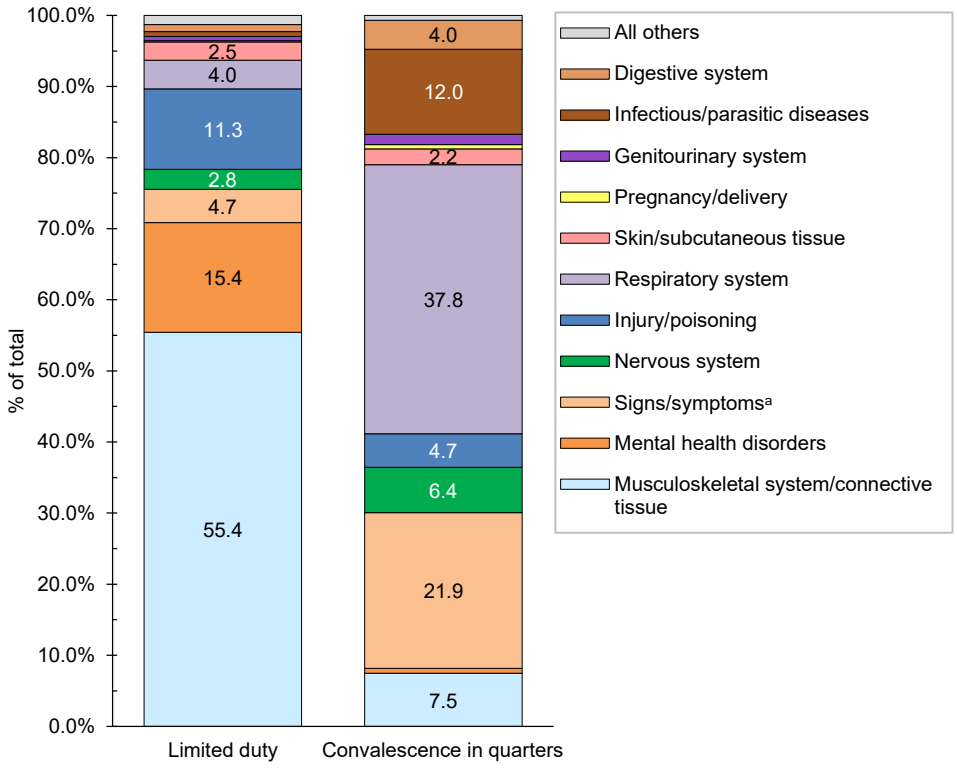
[a]Includes ill-defined conditions.
No., number; ICD, International Classification of Diseases.

EDITORIAL COMMENT

During the 5-year period, the distribution of illness- and injury-related ambulatory visits in relation to their reported primary causes has remained fairly stable. In 2019, musculoskeletal system/connective tissue and mental health disorders accounted for more than one-half (52.9%) of all illness- and injury-related diagnoses documented on standardized records of ambulatory encounters. Over the course of the surveillance period (2015–2017 and 2017–2019), 5 major illness- and injury-related categories (musculoskeletal system/connective tissue disorders; disorders of the nervous system and sense organs; hematologic and immune disorders; signs/symptoms and ill-defined conditions; and disorders of the respiratory system) showed consistent increases in numbers of ambulatory visits and rates and 3 major illness- and injury-related categories (endocrine, nutrition, and immunity disorders; infectious and parasitic diseases; and neoplasms) showed consistent decreases. The former upward trend is likely due, at least in part, to an increase in active duty military strength. At the end of September 2019, there were approximately 25,000 more military personnel on active duty than at the same time in 2015.[2]

During 2015–2019, the relative ranking of injuries and poisonings (rank: 6) as a primary cause of ambulatory visits remained stable. However, the numbers and rates of visits declined by 3.5% and 5.8%, respectively, since 2017. Nevertheless, the potential military operational impacts of various conditions cannot be assessed by numbers of attributable ambulatory visits alone. For example, in 2019, injuries and poisonings accounted for approximately 1 of every 23 ambulatory visits overall;

FIGURE 4. Percentages of ambulatory visit-related limited duty and convalescence in quarters dispositions, attributable to illness- and injury-related diagnostic categories, active component, U.S. Armed Forces, 2019



[a]Includes ill-defined conditions.

however, of ambulatory visits occurring at MTFs, 16.4% (slightly less than 1 in 6) had limited duty or "convalescence in quarters" dispositions. Of particular note, in relation to injuries and musculoskeletal conditions, in 2019, as in the past, joint and back injuries and other disorders accounted for large numbers of ambulatory visits; resources should continue to be focused on preventing, treating, and rehabilitating back pain and injuries among active component members.

It should be noted that the summary data using the major diagnostic categories of the ICD-10 system presented here deserve as detailed an examination as presented in **Tables 2 and 3**. For example, the general category identified as "nervous system" encompasses diseases of the nervous system and the sense organs (eyes and ears). Results presented in **Tables 2 and 3** indicate that the more common diagnoses in this category refer to sleep disorders, disorders of refraction and accommodation, and pain disorders. Closer scrutiny reveals that the overall increase (n=304,882) in annual visits for this category from 2015 to 2019 (described earlier) can be attributed mostly to a rise in diagnoses of organic sleep disorders from 365,822 in 2015 to 563,981 in 2019.[3]

Several limitations should be considered when interpreting the findings of this report. For example, ambulatory care that is delivered by unit medics and at deployed medical treatment facilities (such as in Afghanistan or Iraq or at sea) may not be documented on standardized, automated records and thus not archived in the DMSS. In turn, this summary does not reflect the experience of active component military members overall to the extent that the natures and rates of illnesses and injuries may vary between those who are deployed and those who are not deployed.

In addition, this summary is based on primary (first-listed) diagnosis codes reported on ambulatory visit records. As a result, the current summary discounts morbidity related to comorbid and complicating conditions that may have been documented in secondary diagnostic positions of the healthcare records. Furthermore, the accuracy of reported diagnoses likely varies across conditions, care providers, treatment facilities, and clinical settings. Although some specific diagnoses made during individual encounters may not be definitive, final, or even correct, summaries of the frequencies, natures, and trends of ambulatory encounters among active component members are informative and potentially useful. For example, the relatively large numbers of ambulatory visits for mental health disorders in general and the large numbers of visits for organic sleep disorders among males reflect patterns of responses by the MHS to the effects of combat- and deployment-related stresses on active component service members.

Also, this report documents all ambulatory healthcare visits but does not provide estimates of the incidence rates of the diagnoses described. In contrast to common, self-limited, and minor illnesses and injuries that require very little, if any, follow-up or continuing care, illnesses and injuries that necessitate multiple ambulatory visits for evaluation, treatment, and rehabilitation are overrepresented in this summary of the ambulatory burden of health care. Finally, the new electronic health record for the MHS, MHS GENESIS, was implemented at 4 military treatment facilities in the state of Washington in 2017 (Naval Hospital Oak Harbor, Naval Hospital Bremerton, Air Force Medical Services Fairchild, and Madigan Army Medical Center). Implementation of the second wave of MHS GENESIS sites began in 2019 and included 3 facilities in California (Travis Air Force Base [AFB], the Presidio of Monterey, and Naval Air Station Lemoore) and 1 in Idaho (Mountain Home AFB). Medical data from facilities using MHS GENESIS are not available in the DMSS. Therefore, medical encounter data for individuals seeking care at any of these facilities after their conversion to MHS GENESIS were not included in the current analysis.

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Surveillance Snapshot: Illness and Injury Burdens, Reserve Component, U.S. Armed Forces, 2019

FIGURE 1. Numbers of medical encounters,[a] individuals affected,[b] and hospital bed days, by burden of disease major category,[c] reserve component,[d] U.S. Armed Forces, 2019

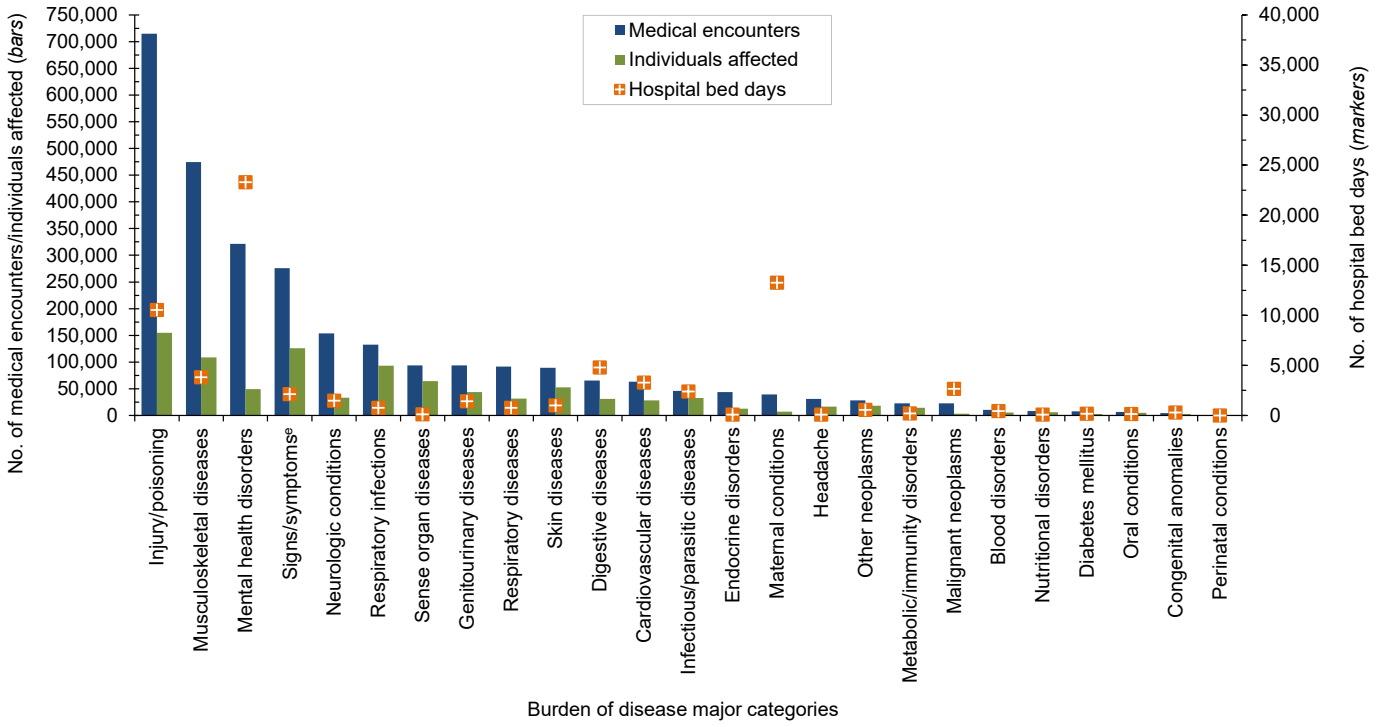
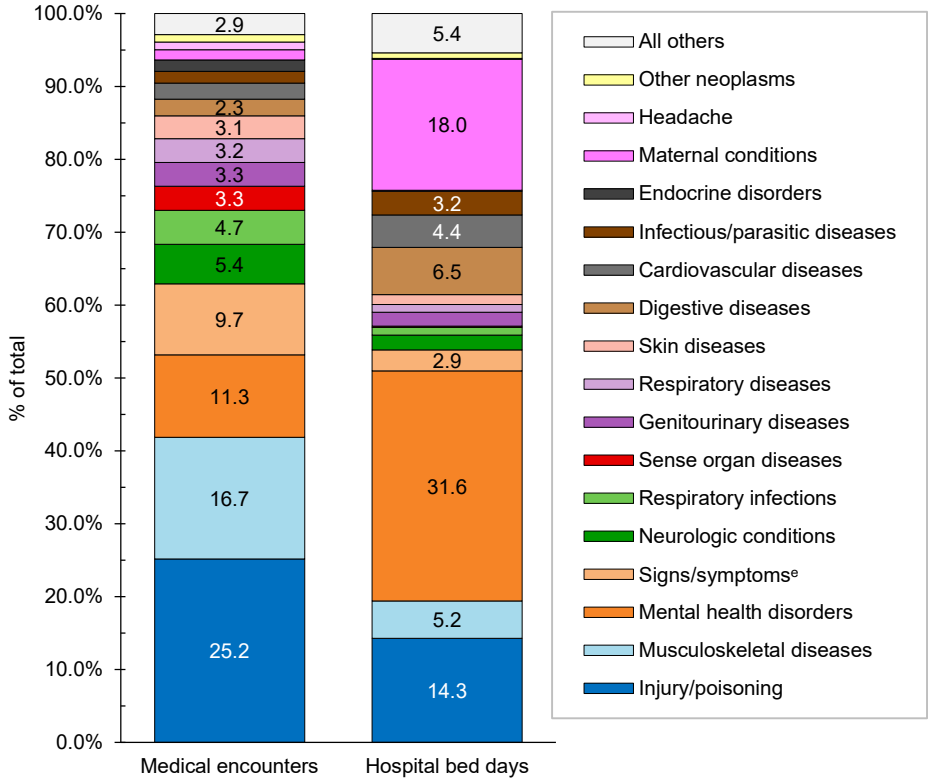


FIGURE 2. Percentages of medical encounters[a] and hospital bed days, by burden of disease category,[c] reserve component,[d] U.S. Armed Forces, 2019



[a]Medical encounters include total hospitalizations and ambulatory visits for the condition (with no more than 1 encounter per individual per day per condition).

[b]Individuals with at least 1 hospitalization or ambulatory visit for the condition.

[c]Burden of disease categories are the same as those used for analyses of morbidity burdens in the active component overall (see pp. 2–9).

[d]The reserve component is made up of Reserve and Guard members of each service.

[e]Includes ill-defined conditions.

No., number.

Surveillance Snapshot: Illness and Injury Burdens, Recruit Trainees, Active Component, U.S. Armed Forces, 2019

FIGURE 1. Numbers of medical encounters,[a] individuals affected,[b] and hospital bed days, by burden of disease major category,[c] recruit trainees,[d] active component, U.S. Armed Forces, 2019

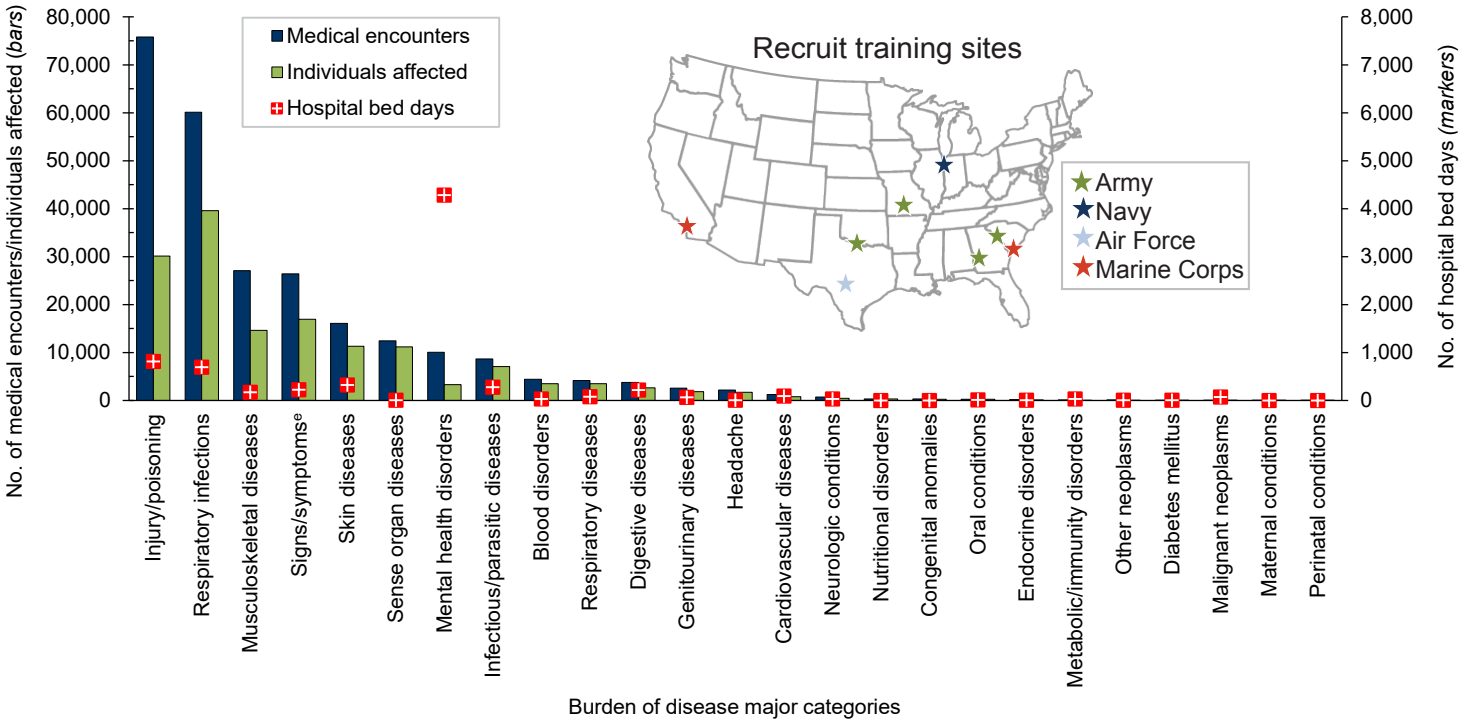
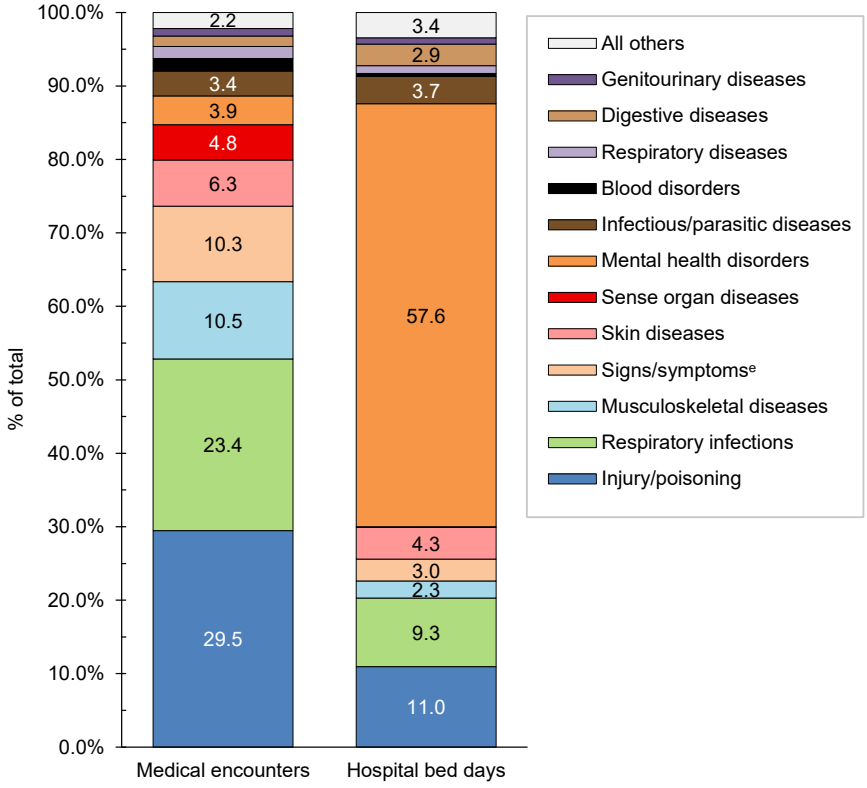


FIGURE 2. Percentages of medical encounters[a] and hospital bed days, by burden of disease major category,[c] recruit trainees,[d] active component, U.S. Armed Forces, 2019



[a]Medical encounters include total hospitalizations and ambulatory visits for the condition (with no more than 1 encounter per individual per day per condition).

[b]Individuals with at least 1 hospitalization or ambulatory visit for the condition.

[c]Burden of disease categories are the same as those used for analyses of mobidity burdens in the active component overall (see pp. 2–9).

[d]Recruit trainees are defined as active component members of the Army, Navy, Air Force, or Marine Corps with a rank of E1–E4 who served at 1 of the 8 basic training locations **(Figure 1, map inset)** during a service-specific training period following a first-ever personnel record. The data shown here are a subset of the active component data found on pp. 2–9.

[e]Includes ill-defined conditions.

No., number.

Medical Evacuations out of the U.S. Central Command, Active and Reserve Components, U.S. Armed Forces, 2019

In 2019, there were 1,142 medical evacuations of service members from the U.S. Central Command area of responsibility that were followed by at least 1 medical encounter in a fixed medical facility outside the operational theater. There were more medical evacuations for mental health disorders than for any other single category of illnesses or injuries. The number of medical evacuations attributable to battle injuries increased steadily from 2015 through 2017 then decreased in 2018 and remained relatively stable through 2019, for an overall increase of 65.7%. The number of medical evacuations attributable to non-battle injuries and illnesses remained relatively stable through 2017, rose slightly in 2018, and decreased in 2019. Compared to their respective counterparts, non-Hispanic white service members, those aged 20–24 years, Army members, junior and senior enlisted personnel, and those in repair/engineering occupations accounted for the largest proportions of medical evacuations. Most service members who were evacuated were returned to normal duty status following their post-evacuation hospitalizations or outpatient encounters.

WHAT ARE THE NEW FINDINGS?

The numbers of medical evacuations of service members in 2019 were roughly similar to the numbers for the previous 4 years. The proportions of evacuations that were due to battle injuries (5%) and to disease/non-battle injuries (95%) remained steady during this period. Evacuations for mental health disorders were the most common among the ICD-10 major diagnostic categories. Most service members who were evacuated were soon returned to duty.

WHAT IS THE IMPACT ON READINESS AND FORCE HEALTH PROTECTION?

Only 1,142 service members were evacuated during 2019, but the process of medical evacuation of service members to Europe and CONUS is logistically demanding. The effort expended to evacuate service members to sources of definitive, modern health care is a reassuring investment in the health, welfare, and importance of the men and women serving overseas.

Although there have been substantial reductions in combat operations taking place in the U.S. Central Command (CENTCOM) area of responsibility (AOR) in Southwest Asia,[1] the number of service members deployed to the CENTCOM AOR is still significant. Recent reports and budget documents indicate that there may be as many as 15,000 service members in Afghanistan for Operation Freedom's Sentinel and another 7,200 in Iraq and Syria for Operation Inherent Resolve.[2–5] In theaters of operations such as Afghanistan, most medical care is provided by deployed military medical personnel; however, some injuries and illnesses require medical management outside the operational theater. In these cases, the affected individuals are usually transported by air to a fixed military medical facility in Europe or the U.S. where the service members receive the specialized, technically advanced, and/or prolonged diagnostic, therapeutic, and rehabilitative care required.

Medical air transports, or medical evacuations, are costly and generally indicative of serious medical conditions. Some serious conditions are directly related to participation in or support of combat operations (e.g., battle wounds); however, many others are unrelated to combat and may be preventable. This report summarizes the natures, numbers, and trends of conditions for which male and female military members were medically evacuated from CENTCOM AOR operations during 2019 and compares them to the previous 4 years.

METHODS

The surveillance period was 1 January 2015 through 31 December 2019. The surveillance population included all members of the active and reserve components of the U.S. Army, Navy, Air Force, and Marine Corps who were deployed to the CENTCOM AOR during the period. The outcome of interest in this analysis was medical evacuations during the surveillance period from the CENTCOM AOR (e.g., Afghanistan or Iraq) to a medical treatment facility outside the CENTCOM AOR. Records of all medical evacuations conducted by the U.S. Transportation Command (TRANSCOM) maintained in the TRANSCOM Regulating and Command & Control Evacuation System (TRAC2ES) were utilized. Evacuations were included in the analyses if the affected service member had at least 1 inpatient or outpatient medical encounter in a permanent military medical facility in the U.S. or Europe during a time interval extending from 5 days before to 10 days after the reported evacuation date.

Medical evacuations included in the analyses were classified by the causes and natures of the precipitating medical conditions (based on information reported in relevant evacuation and medical encounter records). First, all medical conditions that resulted in evacuations were classified as either "battle injuries" or "non-battle injuries and illnesses" (based on entries in an indicator field of the TRAC2ES

evacuation record). Evacuations due to non-battle injuries and illnesses were subclassified into 17 illness/injury categories based on International Classification of Diseases, 9th and 10th Revisions (ICD-9 and ICD-10, respectively) diagnostic codes reported on the records of medical encounters after evacuation. For the purposes of this report, all records of hospitalizations and ambulatory visits from 5 days before to 10 days after the reported date of each medical evacuation were identified. In most cases, the primary (first-listed) diagnosis for either a hospitalization (if any occurred) or the earliest ambulatory visit after evacuation was considered indicative of the condition responsible for the evacuation. However, if the first-listed diagnostic code specified the external cause (rather than the nature) of an injury (ICD-9 E-code; ICD-10 V-, W-, X-, or Y-code) or an encounter for something other than a current illness or injury (e.g., observation, medical examination, or vaccination [ICD-9 V-codes; ICD-10 Z-codes, other than those related to pregnancy]), then secondary diagnoses that specified illnesses and injuries (ICD-9: 001–999; ICD-10: A00–T88) were considered the likely reasons for the subject evacuations. If there was no secondary diagnosis or if the secondary diagnosis also was an external cause code, the first-listed diagnostic code of a subsequent encounter was used.

The disposition after each medical evacuation was determined by using the disposition code associated with the medical encounter that was used for documenting the category of the medical evacuation. Inpatient disposition categories were returned to duty (code 01), transferred/discharged to other facility (codes 02–04, 09, 21–28, 43, or 61–66), died (codes 20, 30, 40–42, 50, or 51), separated from service (codes 10–15), and other/unknown. Outpatient disposition categories were released without limitation (code 1), released with work/duty limitation (code 2), immediate referral (code 4), sick at home/quarters (codes 3 or S), admitted/transferred to civilian hospital (codes 7, 9, A–D, or U), died (codes 8 or G), discharged home (code F), and other/unknown.

RESULTS

In 2019, a total of 1,142 medical evacuations of service members from the CENTCOM AOR were followed by at least 1 medical encounter in a fixed medical facility outside the operational theater **(Table 1)**. Overall, there were more medical evacuations for mental health disorders (n=309; 27.1%) than for any other single category of illnesses or injuries. In addition, the numbers of evacuations for non-battle injuries and poisonings (n=275; 24.1%); signs, symptoms, and ill-defined conditions (n=111; 9.7%); disorders of the digestive system (n=106; 9.3%); and musculoskeletal system/connective tissue disorders (n=89; 7.8%) were all higher than the number of evacuations for battle injuries (n=58; 5.1%). The

TABLE 1. Numbers and percentages of medical encounters following medical evacuation from theater, by ICD-10 major diagnostic category, U.S. Armed Forces, 2019

	Total		Males		Females	
Major diagnostic category (ICD-10 codes)	No.	%	No.	%	No.	%
Mental health disorders (F01–F99)	309	27.1	236	24.5	73	40.6
Non-battle injury and poisoning (S00–T88, DOD0101–DOD0105)	275	24.1	250	26.0	25	13.9
Signs, symptoms, and ill-defined conditions (R00–R99)	111	9.7	93	9.7	18	10.0
Digestive system (K00–K95)	106	9.3	92	9.6	14	7.8
Musculoskeletal system and connective tissue (M00–M99)	89	7.8	76	7.9	13	7.2
Battle injury (from TRAC2ES records)	58	5.1	57	5.9	1	0.6
Circulatory system (I00–I99)	38	3.3	35	3.6	3	1.7
Genitourinary system (N00–N99)	38	3.3	26	2.7	12	6.7
Nervous system and sense organs (G00–G99, H00–H95)	37	3.2	32	3.3	5	2.8
Other (Z00–Z99, except pregnancy related)	17	1.5	14	1.5	3	1.7
Respiratory system (J00–J99)	16	1.4	14	1.5	2	1.1
Neoplasms (C00–D49)	16	1.4	14	1.5	2	1.1
Skin and subcutaneous tissue (L00–L99)	14	1.2	11	1.1	3	1.7
Endocrine, nutrition, immunity (E00–E89)	10	0.9	7	0.7	3	1.7
Infectious and parasitic diseases (A00–B99)	4	0.4	3	0.3	1	0.6
Hematologic and immune disorders (D50–D89)	2	0.2	1	0.1	1	0.6
Pregnancy and delivery (O00–O99, relevant Z codes)	1	0.1	--	--	1	0.6
Congenital anomalies (Q00–Q99)	1	0.1	1	0.1	0	0.0
Total	1,142	100.0	962	100.0	180	100.0

ICD, International Classification of Diseases; No., number; TRAC2ES, U.S. Transportation Command (TRANSCOM) Regulating and Command & Control Evacuation System.

top 3 categories—mental health disorders (most frequently adjustment and depressive disorders); non-battle injuries (primarily fractures of extremities, strains, and sprains); and signs, symptoms, and ill-defined conditions (primarily pain and swelling)—accounted for more than half (60.9%) of all evacuations **(Table 1)**.

During 2015–2019, the annual number of medical evacuations attributable to battle injuries increased steadily from 2015 (n=35) through 2017 (n=71), decreased in 2018 (n=56), and remained relatively stable through 2019 (n=58) **(Figure)**. Over the 5-year period, the annual number of battle injury-related evacuations increased 65.7% from the nadir in 2015. The annual number of medical evacuations attributable to non-battle injuries and diseases remained relatively stable at low levels in 2015 (n=1,050), 2016 (n=1,010), and 2017 (n=1,024), increased in 2018 (n=1,209), and decreased in 2019 (n=1,084). In general, the annual numbers of medical evacuations over the course of the 5-year period varied in relation to the numbers of deployed service members, with the highest yearly counts of medical evacuations occurring in 2017 and 2018. The monthly numbers of medical evacuations decreased or remained stable in 2019 **(Figure)**.

Demographic and military characteristics

The number of medical evacuations in 2019 was higher among males (n=962) than females (n=180) **(Tables 1, 2)**. The most frequent causes of medical evacuations among male service members were non-battle injury and poisoning (n=250; 26.0%); mental health disorders (n=236; 24.5%); signs, symptoms, and ill-defined conditions (n=93; 9.7%); and digestive system disorders (n=92; 9.6%) **(Table 1)**. Among female service members, the most frequent causes of medical evacuations were mental health disorders (n=73; 40.6%); non-battle injury and poisoning (n=25; 13.9%); signs, symptoms, and ill-defined conditions (n=18; 10.0%); and digestive system disorders (n=14; 7.8%).

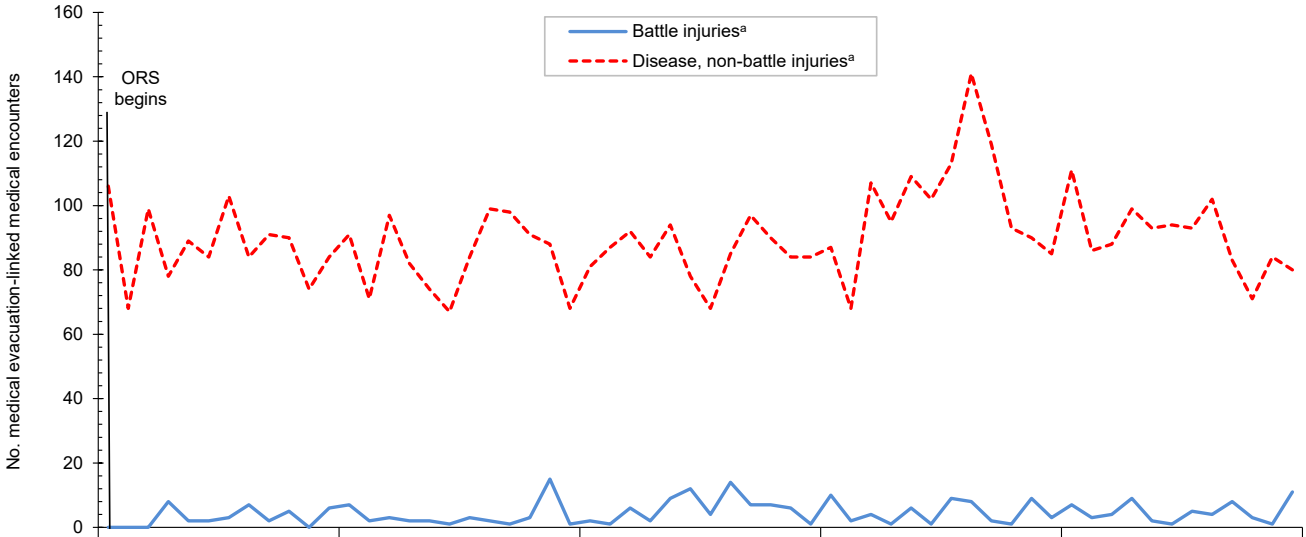
Compared to males, female service members had notably higher percentages of medical evacuations for mental health disorders and genitourinary system disorders **(Table 1)**. In contrast, male service members had higher percentages of evacuation for injuries (both battle and non-battle related). There was just 1 medical evacuation of a female service member during 2019 for a battle injury.

Within the various demographic and military characteristics of those service members who were evacuated, the largest numbers and proportions of evacuees were among non-Hispanic white service members, those aged 20–24 years, members of the Army, junior and senior enlisted personnel, and those in repair/engineering occupations **(Table 2)**. In 2019, most medical evacuations (85.2%) were characterized as having routine precedence. The remainder had priority (10.9%) or urgent (3.9%) precedence. All but 27 (2.4%) of the medical evacuations were accomplished through military transport **(Table 2)**.

Most frequent specific diagnoses

Among both males and females in 2019, a mental health disorder ("reaction to severe stress, and adjustment

FIGURE. Numbers of medical evacuations of U.S. service members for battle injuries and for disease and non-battle injuries, by month, 2015–2019



	2015	2016	2017	2018	2019
Battle injuries	35	42	71	56	58
Disease, non-battle injuries	1,050	1,010	1,024	1,209	1,084

[a]These classifications are based on the causal event of medical evacuation medical encounters.
No., number; ORS, Operation Resolute Support.

disorders") was the most frequent specific diagnosis (3-digit ICD-10 diagnosis code: F43) during initial medical encounters after evacuations **(Table 3)**. Of the remaining 5 most common 3-digit diagnoses associated with evacuations of males, 1 was related to digestive system diseases ("inguinal hernia"); 3 were injuries ("fracture at wrist and hand level," "intracranial injury," and "injury of muscle, fascia and tendon at shoulder and upper arm level"); and 1 was related to musculoskeletal disorders ("dorsalgia") **(Table 3)**.

Of the remaining top 5 diagnoses most frequently associated with evacuations of female service members, 1 was a condition that primarily affects women ("unspecified lump in breast"); 1 was an injury ("fracture of lower leg, including ankle"); 2 were mental health disorders ("other anxiety disorders" and "major depressive disorder, single episode"); and 1 was related to musculoskeletal disorders ("dorsalgia") **(Table 3)**.

Disposition

Of the 1,142 medical evacuations reported in 2019, a total of 486 (42.6%) resulted in inpatient encounters. About three-quarters (75.7%) of all service members who were hospitalized after medical evacuations were discharged back to duty. Slightly less than one-fifth (18.7%) of service members who were hospitalized after medical evacuations were transferred or discharged to other facilities **(Table 4)**.

Return to duty dispositions were much more likely after hospitalizations for non-battle injuries (72.3%) than for battle injuries (30.0%). The majority (70.0%) of battle injury-related hospitalizations and a little more than one-sixth (17.0%) of non-battle injury-related hospitalizations resulted in transfers/discharges to other facilities **(Table 4)**.

Nearly three-fifths (n=656; 57.4%) of all medical evacuations resulted in outpatient encounters only. Of the service members who were treated exclusively in outpatient settings after evacuations, the majority (80.9%) were discharged back to duty without work/duty limitations; 13.9% were released with work/duty limitations; and less than 1% each were admitted/transferred to a civilian hospital, immediately referred, or discharged to "home sick" for recuperation. Service members treated as outpatients after battle injury-related evacuations were more likely to be released without limitations (n=14; 77.8%) than medical evacuees treated as outpatients for non-battle injuries (n=125; 69.1%) **(Table 4)**.

EDITORIAL COMMENT

This report documented that only 5.1% of all medical evacuations during 2019 were associated with battle injuries. Counts of evacuations for battle injuries peaked in 2017, likely reflecting an increase in the number of service members deployed to the CENTCOM AOR. More evacuations in 2019 were attributed to mental health disorders than to any other category of illness or injury; the next most common categories, in descending order of frequency, were non-battle injuries and poisonings; signs, symptoms, and ill-defined conditions; digestive system disorders; and musculoskeletal disorders. Evacuations during the entire 5-year surveillance period followed a similar but slightly different pattern, with mental health disorders being the most frequent followed by non-battle injuries; musculoskeletal disorders; signs, symptoms and ill-defined conditions; and digestive system disorders. Of the major diagnostic categories for which there was more than 1 medical evacuation for both men and women, only percentages of evacuations for injuries (battle and non-battle) were noticeably higher among males compared to females. As in previous years, the majority of service members who were evacuated were returned to normal duty status following their post-evacuation hospitalizations or outpatient encounters. However, about one-half of those evacuated for battle injuries were returned to duty immediately after their initial healthcare encounters.

Overall, the changes in numbers of medical evacuations over the course of the surveillance period reflect the end of Operation Enduring Freedom in 2014,

TABLE 2. Demographic and military characteristics of service members medically evacuated from the U.S. Central Command area of responsibility, U.S. Armed Forces, 2019

	No.	% total
Total	1,142	100.0
Sex		
Male	962	84.2
Female	180	15.8
Race/ethnicity group		
Non-Hispanic white	692	60.6
Non-Hispanic black	198	17.3
Hispanic	149	13.0
Asian/Pacific Islander	48	4.2
Other/unknown	55	4.8
Age group (years)		
<20	29	2.5
20–24	378	33.1
25–29	276	24.2
30–34	159	13.9
35–39	131	11.5
40–44	75	6.6
45+	94	8.2
Service		
Army	740	64.8
Navy	126	11.0
Air Force	232	20.3
Marine Corps	44	3.9
Component		
Active	765	67.0
Reserve/Guard	377	33.0
Rank		
Junior enlisted (E1–E4)	503	44.0
Senior enlisted (E5–E9)	478	41.9
Junior officer (O1–O3; W1–W3)	97	8.5
Senior officer (O4–O10; W4–W5)	64	5.6
Occupation		
Combat-specific[a]	253	22.2
Motor transport	28	2.5
Repair/engineering	326	28.5
Communications/intelligence	266	23.3
Healthcare	75	6.6
Other/unknown	194	17.0
Marital status		
Married	614	53.8
Single, never married	449	39.3
Other/unknown	79	6.9
Education level		
High school or less	688	60.2
Some college	212	18.6
College	221	19.4
Other/unknown	21	1.8
Precedence[b]		
Routine	973	85.2
Priority	124	10.9
Urgent	45	3.9
Transport_mode_num[b]		
Military	1,115	97.6
Commercial	25	2.2
Other/unknown	2	0.2

[a]Infantry/artillery/combat engineering/armor.
[b]Data field within U.S. Transportation Command (TRANSCOM) Regulating and Command & Control Evacuation System (TRAC2ES).
No., number.

TABLE 3. Most frequent 3-digit ICD-10 diagnoses from medical evacuations, by sex, U.S. Armed Forces, 2019

Males			Females		
3-digit ICD-10	ICD-10 code description	No.	3-digit ICD-10	ICD-10 code description	No.
F43	Reaction to severe stress, and adjustment disorders	164	F43	Reaction to severe stress, and adjustment disorders	49
K40	Inguinal hernia	31	N63	Unspecified lump in breast	8
S62	Fracture at wrist and hand level	28	S82	Fracture of lower leg, including ankle	7
M54	Dorsalgia	22	F41	Other anxiety disorders	6
S06	Intracranial injury	22	M54	Dorsalgia	6
S46	Injury of muscle, fascia and tendon at shoulder and upper arm level	22	F32	Major depressive disorder, single episode	5

ICD, International Classification of Diseases; No., number.

the beginning of Operation Freedom's Sentinel, and the deployment of troops to Afghanistan, Iraq, and Syria.[5,6] The relatively low percentage of medical evacuations in 2019 suggests that most deployers were sufficiently healthy and ready for their deployments and received the medical care in theater necessary to complete their assignments without having to be evacuated. Moreover, the fact that very few medical evacuations were conducted for chronic conditions such as hematologic disorders and congenital anomalies supports the idea that most deployers were sufficiently healthy for deployment. However, it is not surprising that such conditions are occasionally diagnosed among deployed service members. For example, there was 1 medical evacuation for congenital anomalies in 2019 that was due to an instance of "other congenital malformations of nervous system" **(data not shown)**. Because congenital anomalies may not be identified and diagnosed until later in life,[7] the infrequent detection of such diagnoses during deployment is not unexpected.

TABLE 4. Dispositions after inpatient or outpatient encounters following medical evacuation, U.S. Armed Forces, 2019

Disposition	Total		Battle injury		Non-battle injury and poisoning	
	No.	%	No.	%	No.	%
Total	1,142	100.0	58	5.1	275	24.1
Inpatient	486	42.6	40		94	
Returned to duty	368	75.7	12	30.0	68	72.3
Transferred/discharged to other facility	91	18.7	28	70.0	16	17.0
Discharged home	1	0.2	0	0.0	1	1.1
Separated	0	0.0	0	0.0	0	0.0
Died	0	0.0	0	0.0	0	0.0
Other/unknown	26	5.3	0	0.0	9	9.6
Outpatient	656	57.4	18		181	
Released without limitation	531	80.9	14	77.8	125	69.1
Released with work/duty limitation	91	13.9	4	22.2	43	23.8
Sick at home/quarters	3	0.5	0	0.0	0	0.0
Immediate referral	3	0.5	0	0.0	0	0.0
Admitted/transferred to civilian hospital	3	0.5	0	0.0	1	0.6
Died	0	0.0	0	0.0	0	0.0
Discharged home	0	0.0	0	0.0	0	0.0
Other/unknown	25	3.8	0	0.0	12	6.6

No., number.

The proportion of medical evacuations attributed to mental health disorders (27.1%) was similar to the proportion reported in recent *MSMR* analyses of medical evacuations in 2018 (28.2%) but slightly higher than the proportion reported in 2017 (23.6%) and considerably higher than the proportion (11.6%) reported in an earlier *MSMR* report examining evacuations from Iraq during a 9-year period between 2003 and 2011.[1,8] However, that article also reported that during the last 4 years (2008–2011) of the surveillance period, as the proportion of evacuations for battle injuries fell sharply, the proportions of evacuations for mental disorders increased dramatically for both males (peak of 20.9% in 2010) and females (peak of 26.6% in 2010). Although some studies have indicated improved access to mental health care in deployed settings, the results from the current analysis indicate that mental health diagnoses still represent the single most common basis for medical evacuations out of the CENTCOM AOR.[9] This could be due, at least in part, to variations in the availability of mental health care in deployed settings. In these settings, the distribution of providers and clinics that deliver such services is uneven and varies according to factors such as the number of deployed personnel and the assessed needs of the particular unit.[9] In addition, although the number of mental healthcare providers in

Afghanistan increased from 2005 through 2010, this number decreased after 2013 as part of the overall drawdown of U.S. troops from the region.[9]

Several important limitations should be considered when interpreting the results of this analysis. Direct comparisons of numbers and percentages of medical evacuations by cause, as between males and females, can be misleading; for example, such comparisons do not account for differences between the groups in other characteristics (e.g., age, grade, military occupation, locations, and activities while deployed) that are significant determinants of medical evacuation risk. Also, for this report, most causes of medical evacuations were estimated from primary (first-listed) diagnoses that were recorded during hospitalizations or initial outpatient encounters after evacuation. In some cases, clinical evaluations in fixed medical treatment facilities after medical evacuations may have ruled out serious conditions that were clinically suspected in the theater. For this analysis, the causes of such evacuations reflect diagnoses that were determined after evaluations outside of the theater rather than diagnoses—perhaps of severe disease—that were clinically suspected in the theater. To the extent that this occurred, the causes of some medical evacuations may seem surprisingly minor.

Overall, the results highlight the continued need to tailor force health protection policies, training, supplies, equipment, and practices based on characteristics of the deployed force (e.g., combat vs. support; male vs. female) and the nature of the military operations (e.g., combat vs. humanitarian assistance).

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MSMR's Invitation to Readers

Medical Surveillance Monthly Report (MSMR) invites readers to submit topics for consideration as the basis for future *MSMR* reports. The *MSMR* editorial staff will review suggested topics for feasibility and compatibility with the journal's health surveillance goals. As is the case with most of the analyses and reports produced by Armed Forces Health Surveillance Branch staff, studies that would take advantage of the healthcare and personnel data contained in the Defense Medical Surveillance System (DMSS) would be the most plausible types. For each promising topic, Armed Forces Health Surveillance Branch staff members will design and carry out the data analysis, interpret the results, and write a manuscript to report on the study. This invitation represents a willingness to consider good ideas from anyone who shares the *MSMR*'s objective to publish evidence-based reports on subjects relevant to the health, safety, and well-being of military service members and other beneficiaries of the Military Health System (MHS).

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Morbidity Burdens Attributable to Various Illnesses and Injuries, Deployed Active and Reserve Component Service Members, U.S. Armed Forces, 2019

Every year, the *MSMR* estimates illness- and injury-related morbidity and healthcare burdens on the U.S. Armed Forces and the Military Health System (MHS) using electronic records of medical encounters from the Defense Medical Surveillance System (DMSS). These records document health care delivered in the fixed medical facilities of the MHS and in civilian medical facilities when care is paid for by the MHS. Healthcare encounters of deployed service members are documented in records that are maintained in the Theater Medical Data Store (TMDS), which is incorporated into the DMSS. This report updates previous analyses examining the distributions of illnesses and injuries that accounted for medical encounters ("morbidity burdens") of active component members in deployed settings in the U.S. Central Command (CENTCOM) and the U.S. Africa Command (AFRICOM) areas of operations during the 2019 calendar year.[1]

METHODS

The surveillance population included all individuals who served in the active or reserve components of the U.S. Army, Navy, Air Force, or Marine Corps and who had records of healthcare encounters captured in the TMDS during the surveillance period. The analysis was restricted to encounters where the theater of care specified was CENTCOM or AFRICOM or where the theater of operation was missing or null; by default, this excluded encounters in the U.S. Northern Command, U.S. European Command, U.S. Indo-Pacific Command, or U.S. Southern Command theater of operations. In addition, TMDS-recorded medical encounters where the data source was identified as Shipboard Automated Medical System (e.g., SAMS, SAMS8, SAMS9) or where the military treatment facility descriptor indicated care was provided aboard a ship (e.g., *USS George H.W. Bush* or *USS Dwight D. Eisenhower*) were excluded from this analysis. Encounters from aeromedical staging facilities outside of CENTCOM or AFRICOM (e.g., the 779th Medical Group Aeromedical Staging Facility or the 86th Contingency Aeromedical Staging Facility) were also excluded. Inpatient and outpatient medical encounters were summarized according to the primary (first-listed) diagnoses (if reported with an International Classification of Diseases, 9th Revision [ICD-9] code between 001 and 999 or beginning with V27 or with an International Classification of Diseases, 10th Revision [ICD-10] code between A00 and T88 or beginning with Z37). Primary diagnoses that did not correspond to an ICD-9 or ICD-10 code (e.g., 1XXXX, 4XXXX) were not reported in this burden analysis.

In tandem with the methodology described on page 2 of this issue of the *MSMR*, all illness- and injury-specific diagnoses were grouped into 151 burden of disease-related conditions and 25 major categories based on a modified version of the classification system developed for the Global Burden of Disease (GBD) Study.[2] The morbidity burdens attributable to various conditions were estimated on the basis of the total number of medical encounters attributable to each condition (i.e., total hospitalizations and ambulatory visits for the condition with a limit of 1 encounter per individual per condition per day) and the numbers of service members affected by the conditions. In general, the GBD system groups diagnoses with common pathophysiologic or etiologic bases and/or significant international health policy-making importance. For this analysis, some diagnoses that are grouped into single categories in the GBD system (e.g., mental health disorders) were disaggregated. Also, injuries were categorized by the affected anatomic sites rather than by causes because external causes of injuries are not completely reported in TMDS records. It is important to note that because the TMDS has not fully transitioned to ICD-10 codes, some ICD-9 codes appear in this analysis. In addition to the examination of the distribution of diagnoses by the 151 conditions and the 25 major categories of disease burden, a third analysis depicts the distribution of diagnoses according to the 17 traditional categories of the ICD system.

WHAT ARE THE NEW FINDINGS?

Three categories of morbidity burdens (injury/poisoning, musculoskeletal diseases, and signs/symptoms and ill-defined conditions) accounted for more than half of the total burden in theater. In 2019, the percentages of encounters due to mental health disorders decreased to levels much lower than during earlier periods of combat engagements. Compared to garrison disease burden, deployed service members had higher proportions of encounters for respiratory infections, skin diseases, and infectious and parasitic diseases.

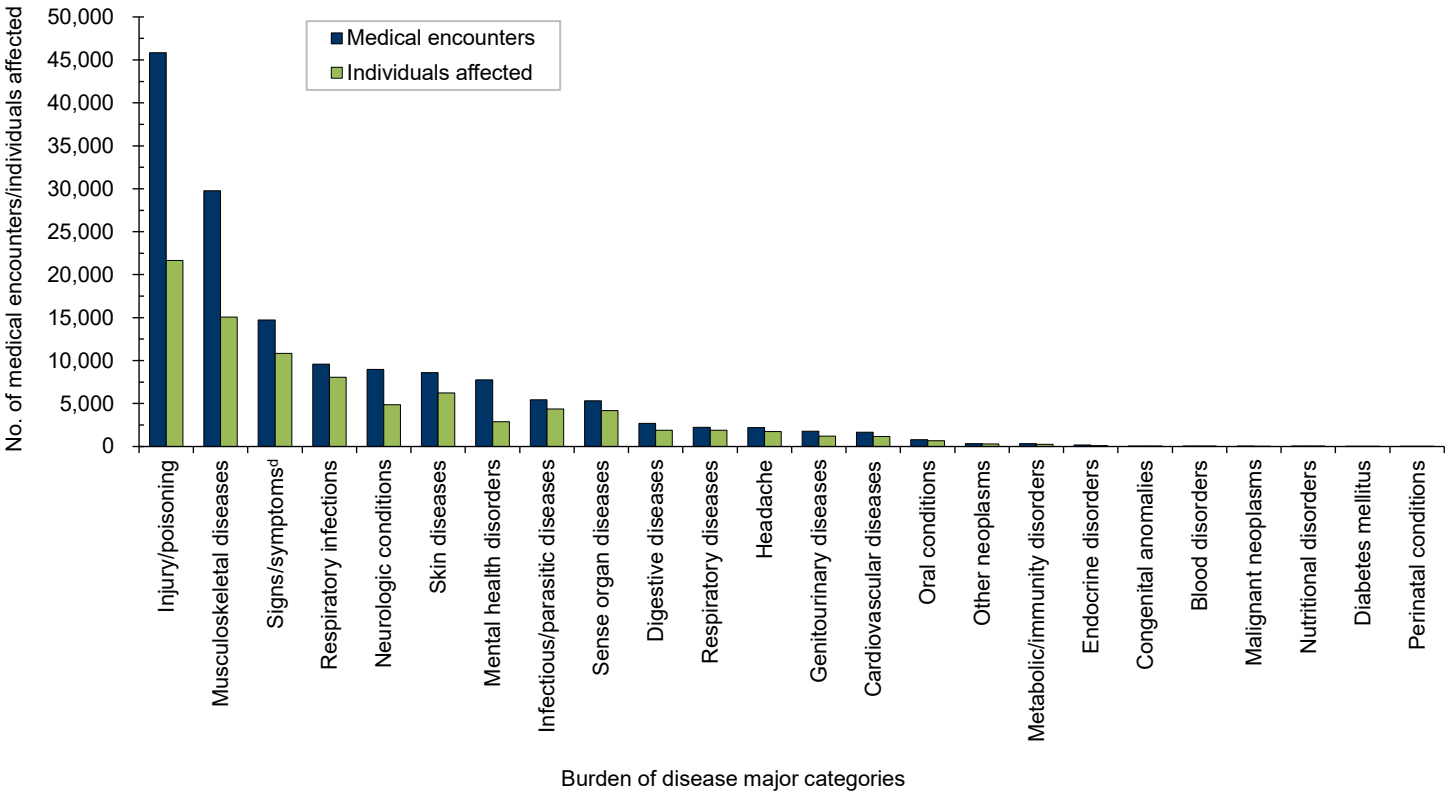
WHAT IS THE IMPACT ON READINESS AND FORCE HEALTH PROTECTION?

The similarities between the burden of disease and injury among deployed and non-deployed service members emphasize the continuing need for surveillance, research, and preventive measures for those ever-present health threats. The dissimilarities highlight those special health threats associated with the more austere environments of deployment areas and the needed area-specific preventive measures of importance.

RESULTS

In 2019, a total of 191,887 medical encounters occurred among 69,405 individuals while deployed to Southwest Asia/Middle East and Africa. A majority of the medical encounters (77.4%) and individuals affected (81.8%) occurred among males **(Figures 1a, 1b).**

FIGURE 1a. Medical encounters[a] and individuals affected,[b] by burden of disease major category,[c] deployed male service members, U.S. Armed Forces, 2019



[a]Medical encounters include total hospitalizations and ambulatory visits for the condition (with no more than 1 encounter per individual per day per condition).
[b]Individuals with at least 1 hospitalization or ambulatory visit for the condition.
[c]Burden of disease major categories based on a modified version of those defined in the Global Burden of Disease Study.[2]
[d]Includes ill-defined conditions.
No., number.

Medical encounters/individuals affected, by burden of disease categories

During 2019, the percentages of total medical encounters by burden of disease categories in both deployed men and women were generally similar; in both sexes, more encounters were attributable to injury/poisoning, musculoskeletal diseases, and signs/symptoms (including ill-defined conditions) than any other categories **(Figures 1a, 1b, 2a, 2b)**. Of note, females had a greater proportion of medical encounters for genitourinary diseases (5.6%) compared to males (1.2%). Females also had a higher proportion of medical encounters for mental health disorders (9.1%) compared to males (5.2%).

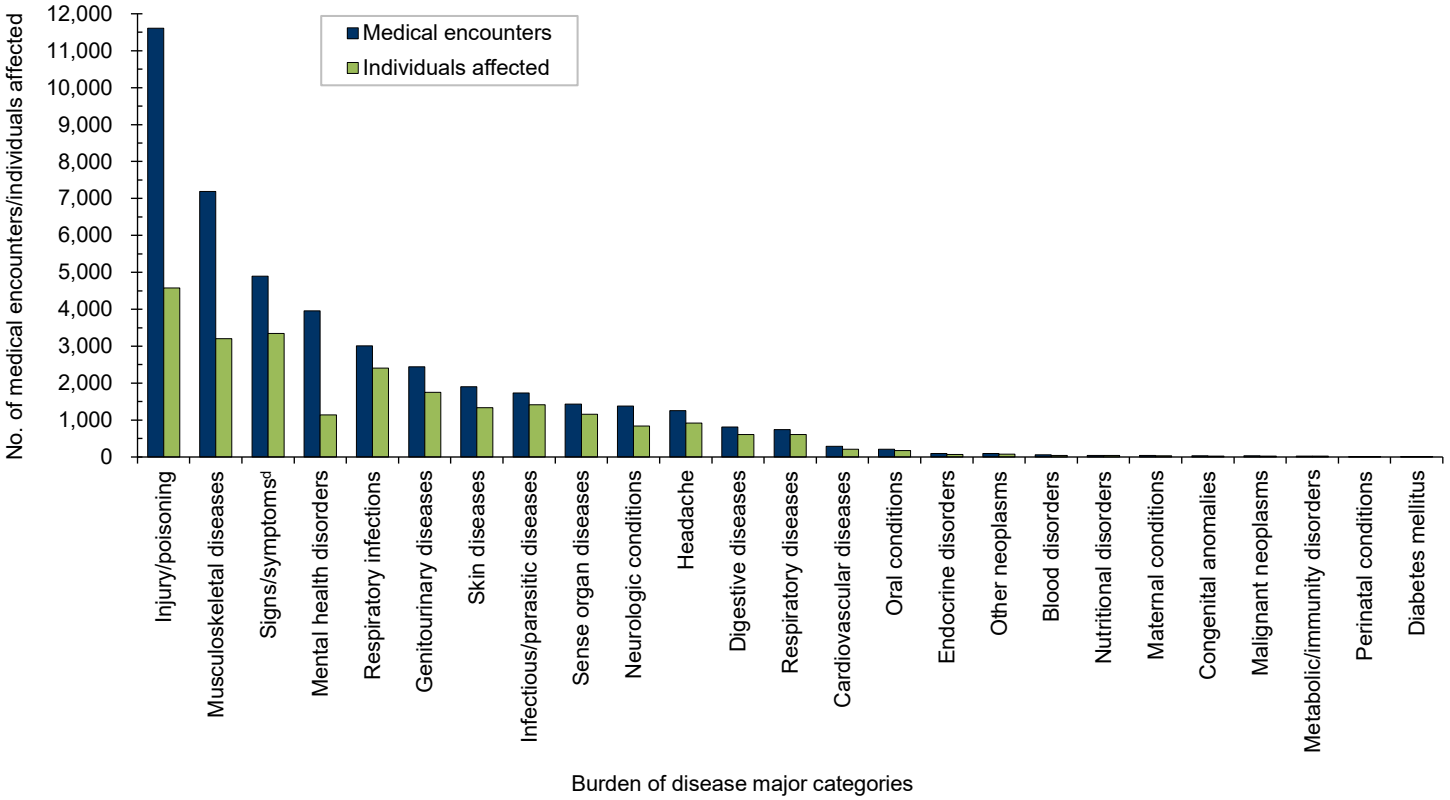
Among both males and females, 5 burden conditions (other back problems, arm and shoulder injuries, knee injuries, foot and ankle injuries, and upper respiratory infections) were among the top 6 burden conditions that accounted for the most medical encounters in 2019 **(Figures 3a, 3b)**. The remaining burden conditions among the top 6 were organic sleep disorders (specifically, circadian rhythm disorders) among males and all other signs and symptoms among females.

The 4-digit ICD-10 code with the most medical encounters in the other back problems category during 2019 was for lumbago/low back pain **(data not shown)**. For all other musculoskeletal diseases, the most common 4-digit ICD code for both males and females was for cervicalgia. The most common 4-digit ICD-10 code for arm and shoulder injuries among males and for knee injuries among males and females was for pain in the specified body part (e.g., pain in right or left shoulder or pain in right or left knee) **(data not shown)**.

Of note, among males, less than 0.3% of all medical encounters during deployment were associated with any of the following major morbidity categories: other neoplasms, metabolic/immunity disorders, endocrine disorders, congenital anomalies, blood disorders, malignant neoplasms, nutritional disorders, diabetes, and perinatal conditions **(Figure 1a)**. Among females, less than 0.3% of all medical encounters during deployment were associated with endocrine disorders, other neoplasms, blood disorders, nutritional disorders, maternal conditions, congenital anomalies, malignant neoplasms, metabolic/immunity disorders, perinatal conditions, and diabetes mellitus **(Figure 1b)**.

Among both sexes in 2019, injury/poisoning, musculoskeletal diseases, and signs/symptoms were the top 3 categories that affected the most individuals;

FIGURE 1b. Medical encounters[a] and individuals affected,[b] by burden of disease major category,[c] deployed female service members, U.S. Armed Forces, 2019



[a]Medical encounters include total hospitalizations and ambulatory visits for the condition (with no more than 1 encounter per individual per day per condition).
[b]Individuals with at least 1 hospitalization or ambulatory visit for the condition.
[c]Burden of disease major categories based on a modified version of those defined in the Global Burden of Disease Study.[2]
[d]Includes ill-defined conditions.
No., number.

musculoskeletal diseases ranked second among males and third among females **(Figures 1a, 1b)**.

Medical encounters, by major ICD-9/ICD-10 diagnostic category

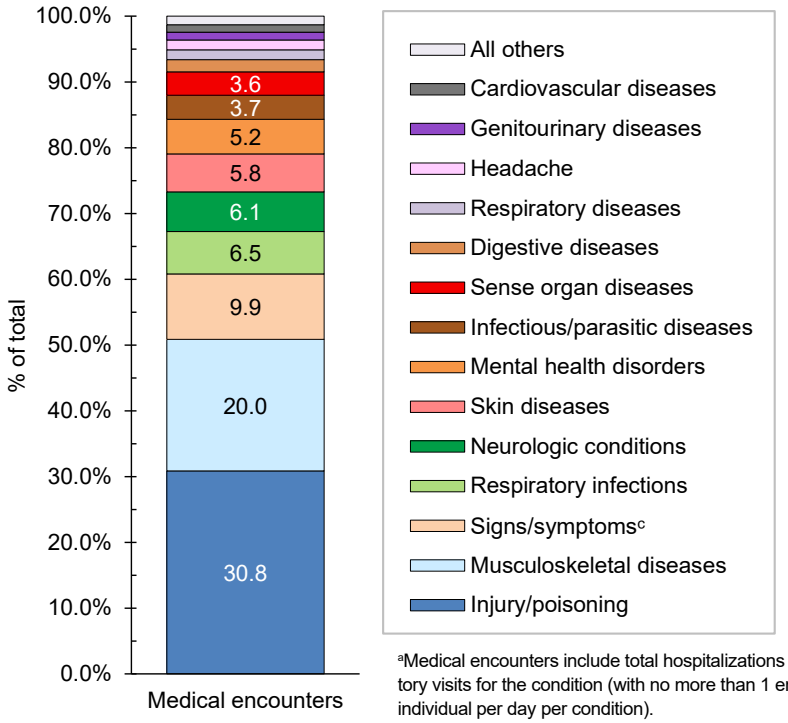
In 2019, among the 17 major ICD-9/ICD-10 diagnostic categories, the largest percentages of medical encounters were attributable to musculoskeletal system and "other" (includes factors influencing health status and contact with health services as well as external causes of morbidity) **(Figure 4)**. The percentage of medical encounters attributable to musculoskeletal system conditions increased from 2015 through 2019, and the percentage attributable to "other" decreased during the same period. Of note, the percentages of medical encounters attributable to mental health disorders decreased slightly from 6.4% in 2015 to 4.7% in 2019. However, the percentage of medical encounters attributable to disorders of the nervous system and sense organs more than doubled from 3.5% in 2015 to 7.8% in 2019. The percentages of medical encounters attributable to other major ICD-9/ICD-10 diagnostic categories were relatively similar during the years 2015, 2017, and 2019.

EDITORIAL COMMENT

This report documents the morbidity and healthcare burden among U.S. military members while deployed to Southwest Asia/Middle East and Africa during 2019. Similar to results from earlier surveillance periods,[1,3] 3 burden categories—injury/poisoning, musculoskeletal diseases, and signs/symptoms—together accounted for more than 50% of the total healthcare burden in theater among both male and female deployers. However, the 2019 percentages of encounters due to mental health disorders among males and females (5.2% and 9.1%, respectively) were much smaller than the corresponding percentages during 2008–2014 (13.1% and 13.8%, respectively).[3]

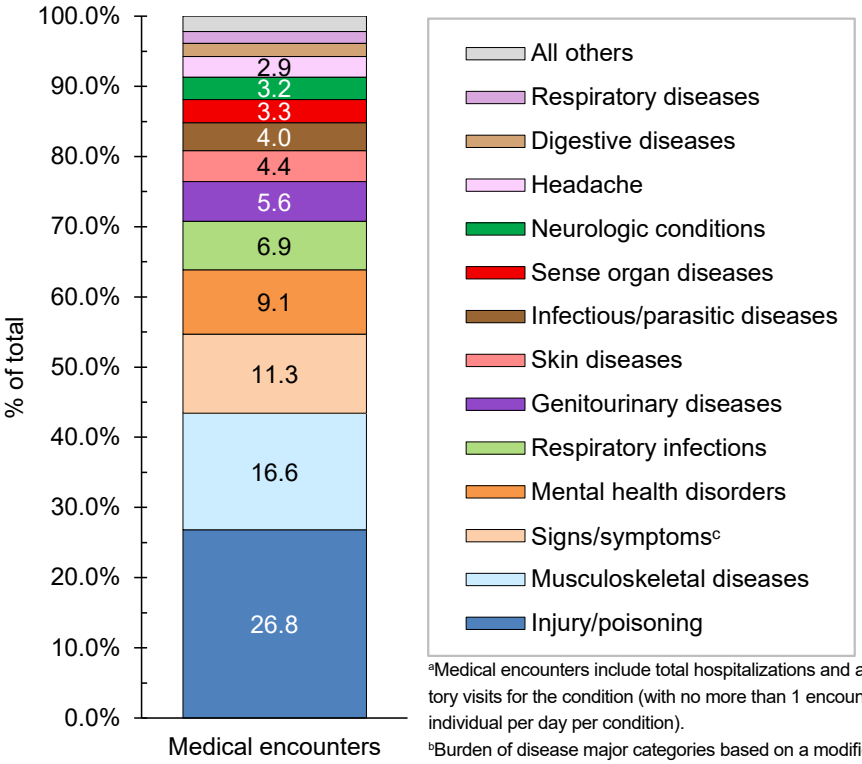
Compared to the distribution of major burden of disease categories documented in garrison, this report demonstrates relatively greater proportions of in-theater medical encounters due to respiratory infections, skin diseases, and infectious and parasitic diseases. The lack of certain amenities and greater exposure to austere environmental conditions may have compromised hygienic practices and contributed to this finding. In contrast, compared to the distribution of

FIGURE 2a. Percentage of medical encounters,[a] by burden of disease major category,[b] deployed male service members, U.S. Armed Forces, 2019



[a]Medical encounters include total hospitalizations and ambulatory visits for the condition (with no more than 1 encounter per individual per day per condition).
[b]Burden of disease major categories based on a modified version of those defined in the Global Burden of Disease Study.[2]
[c]Includes ill-defined conditions.

FIGURE 2b. Percentage of medical encounters,[a] by burden of disease major category,[b] deployed female service members, U.S. Armed Forces, 2019



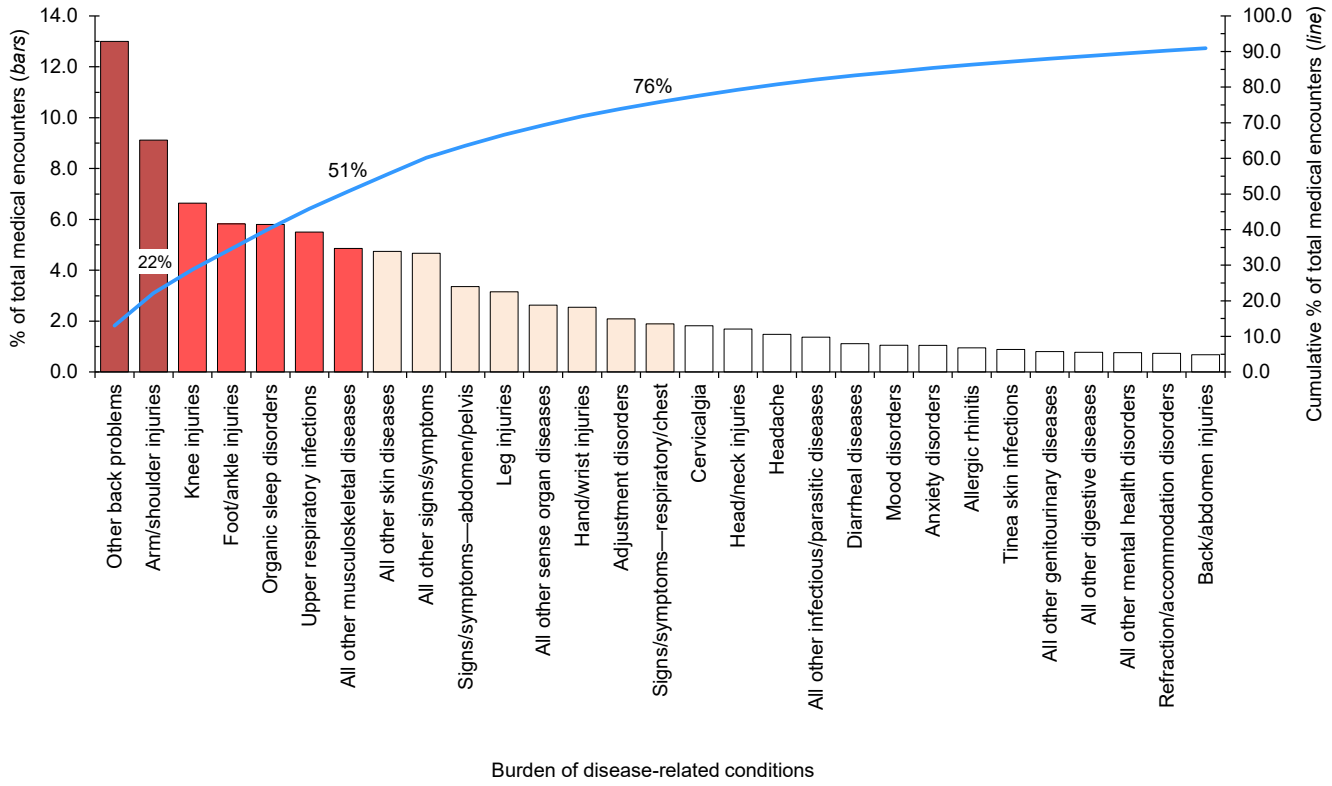
[a]Medical encounters include total hospitalizations and ambulatory visits for the condition (with no more than 1 encounter per individual per day per condition).
[b]Burden of disease major categories based on a modified version of those defined in the Global Burden of Disease Study.[2]
[c]Includes ill-defined conditions.

burden of disease in garrison, a relatively lower proportion of in-theater medical encounters due to mental health disorders was observed.[4] This finding may be due to a number of factors including reduced combat and operational stress in deployed settings and the continued emphasis on promoting psychological health and resilience in deployed service members.

However, 4 of the top 5 major burden of disease categories in-theater—injury/poisoning, musculoskeletal diseases, signs/symptoms, and mental health disorders—were the same as those reported in non-deployed settings.[4] Injury and musculoskeletal diseases ranked first and second in both settings. In garrison settings, mental health disorders, signs/symptoms, and neurologic conditions ranked third through fifth.[4] In contrast, sign/symptoms, respiratory infections, and mental health disorders ranked third through fifth in deployed settings. The similarity in these top conditions is likely attributable to the fact that both deployed and non-deployed populations generally comprise young and healthy individuals undergoing strenuous physical and mental tasks. Some of the similarity in the top conditions could also be attributed to service members receiving follow-up care once out of theater. For example, a service member medically evacuated out of theater for an injury could have encounters for injury recorded in both deployed and non-deployed (hospital or ambulatory care) settings.

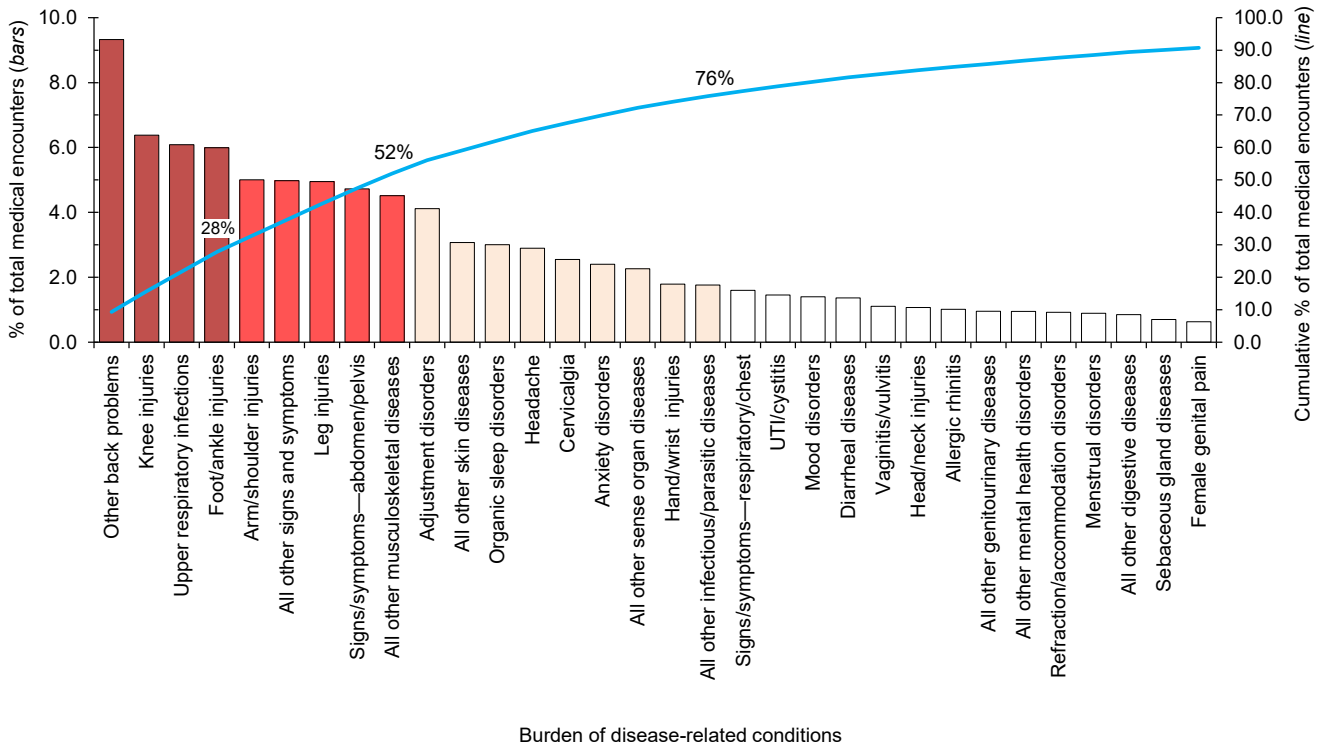
Encounters for certain conditions are not expected to occur often in deployment settings. For example, the presence of some conditions (e.g., diabetes, pregnancy, or congenital anomalies) makes the affected service members ineligible for deployment. As a result of this selection process, deployed service members are generally healthier than their non-deployed counterparts and, specifically, less likely to require medical care for conditions that preclude deployment. The overall result of such predeployment medical screening is diminished healthcare burdens (as documented in the TMDS) related to certain disease categories.

FIGURE 3a. Percentage and cumulative percentage distribution, burden of disease-related conditions[a] that accounted for the most medical encounters, deployed male service members, U.S. Armed Forces, 2019



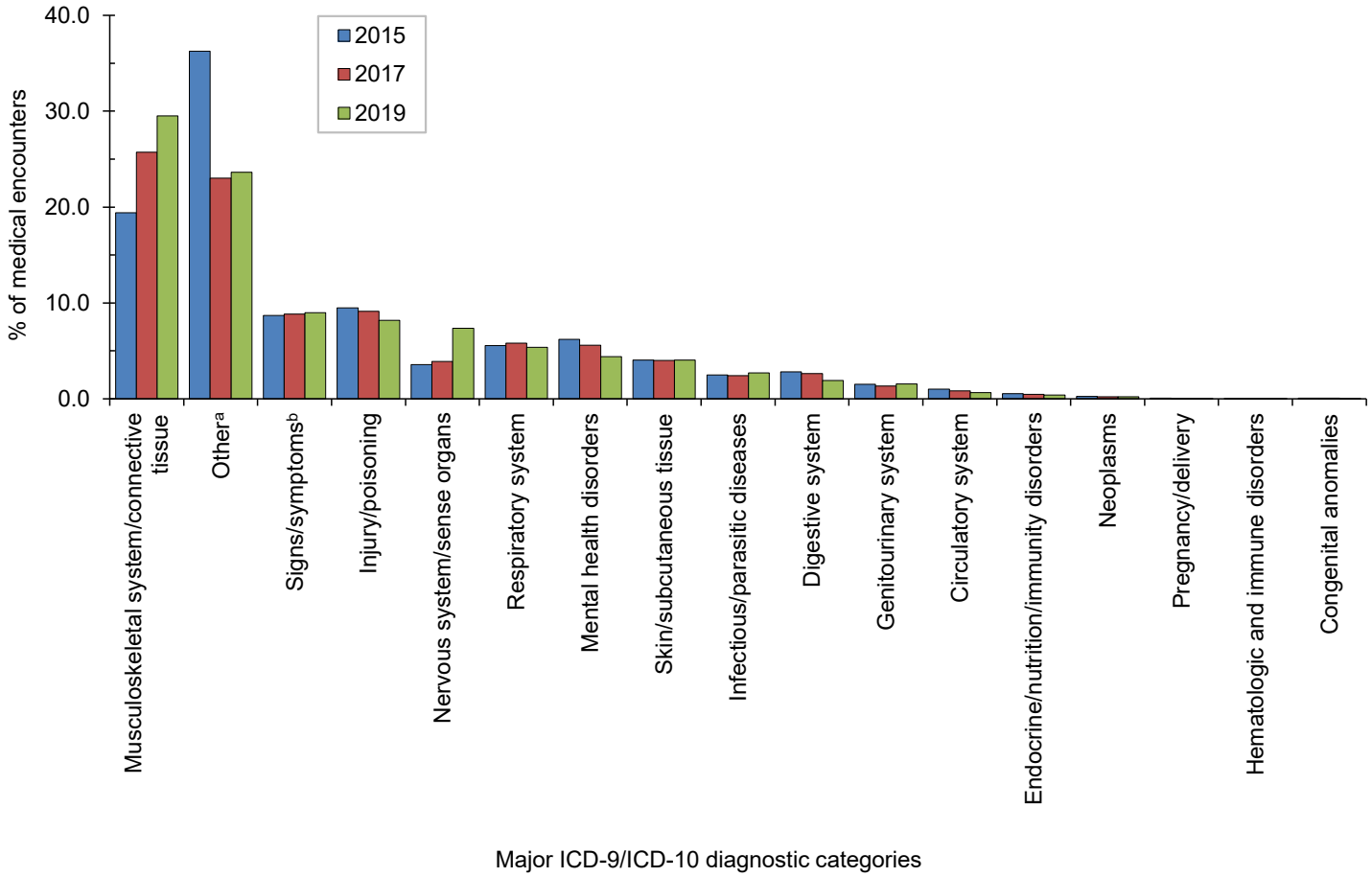
[a]Burden of disease major categories based on a modified version of those defined in the Global Burden of Disease Study.[2]

FIGURE 3b. Percentage and cumulative percentage distribution, burden of disease-related conditions[a] that accounted for the most medical encounters, deployed female service members, U.S. Armed Forces, 2019



[a]Burden of disease major categories based on a modified version of those defined in the Global Burden of Disease Study.[2]

FIGURE 4. Major ICD-9/ICD-10 diagnostic categories of in-theater medical encounters, active component, U.S. Armed Forces, 2015, 2017, and 2019



[a]Other factors influencing health status and contact with health services (excluding pregnancy-related).
[b]Includes ill-defined conditions.
ICD, International Classification of Diseases.

Interpretation of the data in this report should be done with consideration of some limitations. Not all medical encounters in theaters of operation are captured in the TMDS. Some care is rendered by medical personnel at small, remote, or austere forward locations where electronic documentation of diagnoses and treatment is not feasible. As a result, the data described in this report likely underestimate the total burden of health care actually provided in the areas of operation examined. In particular, some emergency medical care provided to stabilize combat-injured service members before evacuation may not be routinely captured in the TMDS. Another limitation derives from the potential for misclassification of diagnoses due to errors in the coding of diagnoses entered into the electronic health record. Although the aggregated distributions of illnesses and injuries found in this study are compatible with expectations derived from other examinations of morbidity in military populations (both deployed and non-deployed), instances of incorrect diagnostic codes (e.g., coding a spinal cord injury using a code that denotes the injury was suffered as a birth trauma rather than using a code indicating injury in an adult) warrant care in the interpretation of some findings. Although such coding errors are not common, their presence serves as a reminder of the extent to which this study depends on the capture of accurate information in the sometimes austere deployment environment in which healthcare encounters occur.

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Absolute and Relative Morbidity Burdens Attributable to Various Illnesses and Injuries, Non-service Member Beneficiaries of the Military Health System, 2019

Individuals who are eligible for care through the Military Health System (MHS) ("beneficiaries") include active component service members and their eligible family members, activated National Guard and Reserve service members and their eligible family members, and retirees and their eligible family members. In 2019, there were approximately 9.51 million beneficiaries eligible for health care in the MHS: 1.38 million active duty and activated reserve component service members, 1.68 million active duty family members, 190,000 Guard/Reserve members, 780,000 Guard/Reserve family members, and 5.49 million retirees and their family members.[1] Some beneficiaries of MHS care do not enroll in the healthcare plans provided by the MHS (e.g., they use insurance through their own employment), and some of those who are enrolled do not seek care through the MHS.

MHS beneficiaries may receive care from resources provided directly by the Uniformed Services (i.e., military medical treatment facilities [MTFs]) or from civilian healthcare resources (i.e., outsourced [purchased] care) that supplement direct military medical care.[1] In 2019, approximately 6.5 million non-service member beneficiaries utilized inpatient or outpatient services provided by the MHS (data source: the Defense Medical Surveillance System [DMSS]). In the population of non-service member MHS care recipients in 2019, there were more females (56.8%) than males (43.2%); more infants, children, and adolescents (those younger than 20 years old: n=1.67 million; 25.5%) and more seniors (those aged 65 years or older: n=2.10 million; 31.9%) than younger (aged 20–44 years: n=1.30 million; 19.7%) or older (aged 45–64 years: n=1.51 million; 22.9%) adults **(data not shown).**

Since 1998, the *MSMR* has published annual summaries of the numbers and rates of hospitalizations and outpatient medical encounters to assess the healthcare burdens of 16 categories of illnesses and injuries among active component military members. Beginning in 2001, the *MSMR* complemented those summaries with annual reports on the combined healthcare burden of both inpatient and outpatient care for 25 categories of health care. Since then, the *MSMR*'s annual burden issue has contained a report on hospital care, ambulatory care, and the overall burden of care each for active component service members. In 2014, for the first time and using similar methodology, the *MSMR* published a report that quantified the healthcare burden for illnesses and injuries among non-service members in calendar year 2013.[2] The current report represents an update and provides a summary of care provided to non-service members in the MHS

WHAT ARE THE NEW FINDINGS?

In 2019, as in previous years, findings emphasize the considerable differences in the types of diseases and injuries affecting non-service member beneficiaries compared to those affecting service members. Many of the differences can be attributed to differences in the age distributions of the 2 populations. The results of this analysis document that most healthcare services in the Military Health System are delivered to non-service member beneficiaries instead of service members.

WHAT IS THE IMPACT ON READINESS AND FORCE HEALTH PROTECTION?

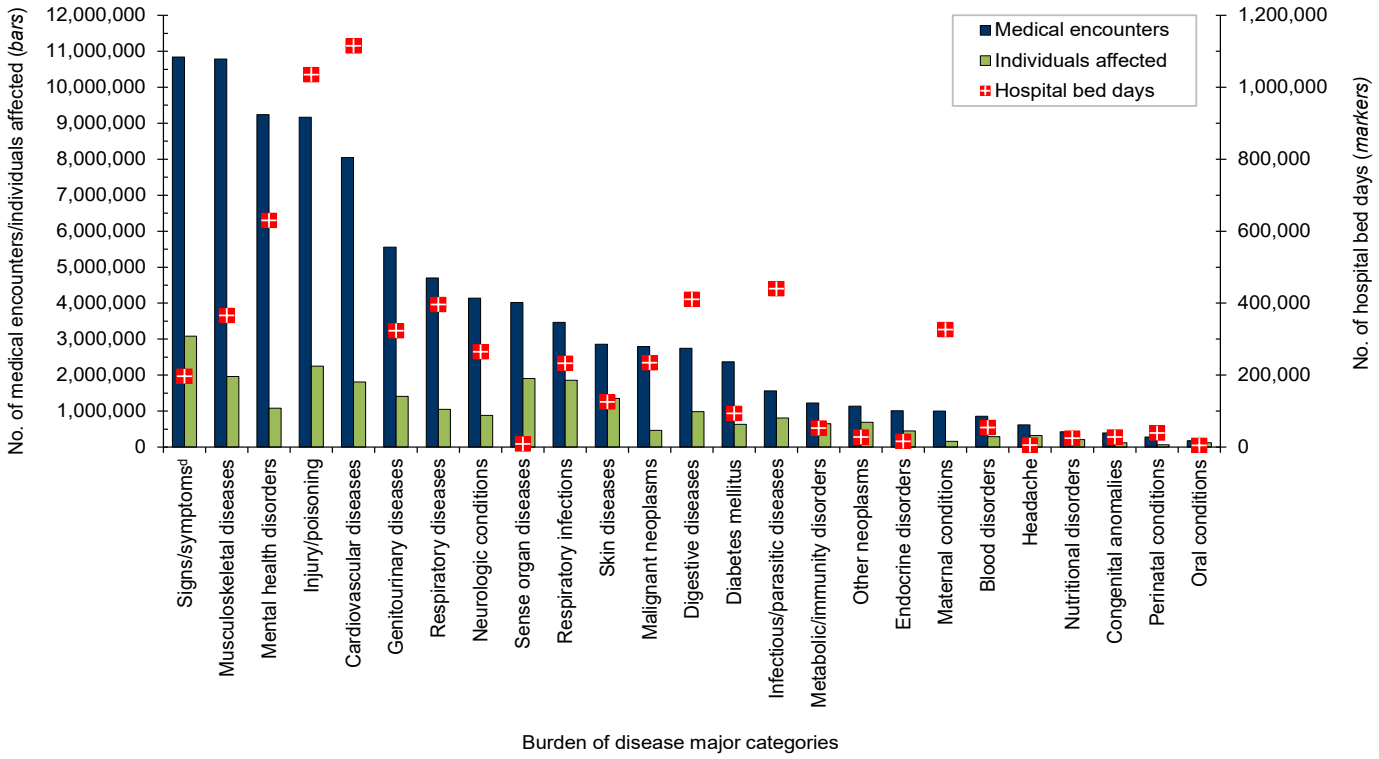
The care rendered to non-service member beneficiaries represents an important benefit to the families of service members and to retired service members. The provision of such care offers reassurance to service members that their families are receiving good health care, freeing them from worries about their families while engaged in national defense.

TABLE. Medical encounters,[a] individuals affected,[b] and hospital bed days, by source and age group, non-service member beneficiaries, 2019

	Medical encounters		Individuals affected		Hospital bed days		Medical encounters per individual affected
	No.	% total	No.	% total	No.	% total	
All non-service member beneficiaries	89,409,223	---	6,576,473	---	6,455,181	---	13.6
Source							
Direct care only	7,659,230	8.6	627,589	9.5	435,927	6.8	n/a
Outsourced care only	81,749,993	91.4	4,868,156	74.0	6,019,254	93.2	n/a
Direct and outsourced care	n/a	n/a	1,080,728	16.4	n/a	n/a	n/a
Age group[c]							
0–17 years	12,746,506	14.3	1,519,226	23.1	506,164	7.8	8.4
18–44 years	12,284,952	13.7	1,450,080	22.0	714,782	11.1	8.5
45–64 years	18,269,659	20.4	1,508,035	22.9	930,300	14.4	12.1
65 years or older	46,108,105	51.6	2,099,131	31.9	4,303,935	66.7	22.0

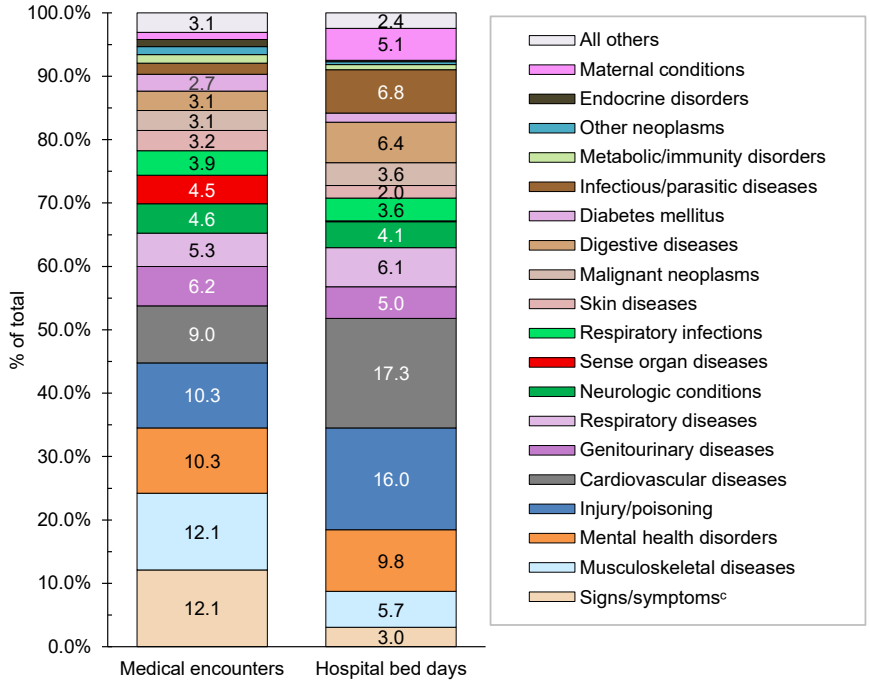
[a]Medical encounters include total hospitalizations and ambulatory visits for the condition (with no more than 1 encounter per individual per day per condition).
[b]Individuals with at least 1 hospitalization or ambulatory visit for the condition.
[c]Information on age was missing for 1 individual.

FIGURE 1a. Numbers of medical encounters,[a] individuals affected,[b] and hospital bed days, by burden of disease major category,[c] non-service member beneficiaries, 2019



[a]Medical encounters include total hospitalizations and ambulatory visits for the condition (with no more than 1 encounter per individual per day per condition).
[b]Individuals with at least 1 hospitalization or ambulatory visit for the condition.
[c]Burden of disease major categories based on a modified version of those defined in the Global Burden of Disease Study.[3]
[d]Includes ill-defined conditions.
No., number.

FIGURE 1b. Percentages of medical encounters[a] and hospital bed days, by burden of disease major category,[b] non-service member beneficiaries, 2019



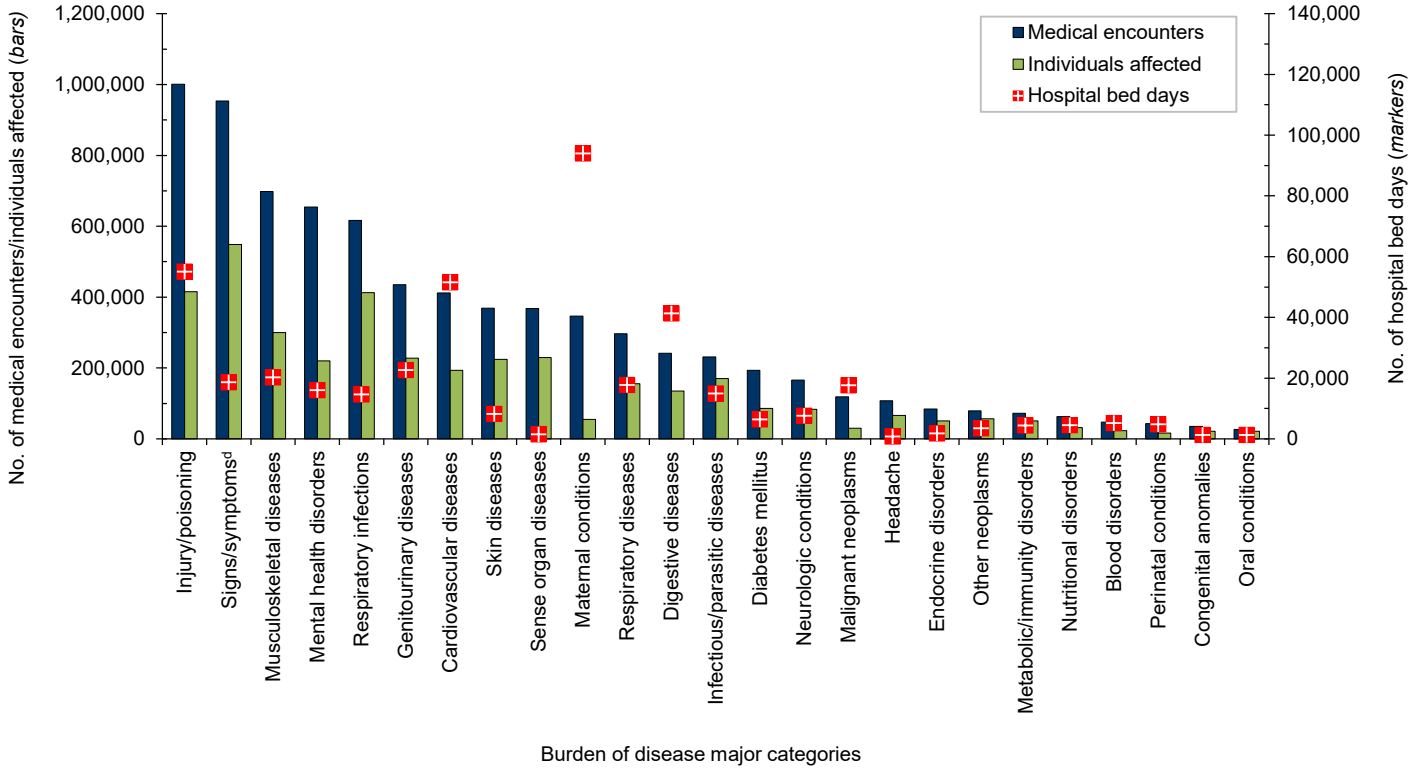
[a]Medical encounters include total hospitalizations and ambulatory visits for the condition (with no more than 1 encounter per individual per day per condition).
[b]Burden of disease major categories based on a modified version of those defined in the Global Burden of Disease Study.[3]
[c]Includes ill-defined conditions.

during calendar year 2019. Healthcare burden estimates are stratified by direct versus outsourced care and across 4 age groups of healthcare recipients.

METHODS

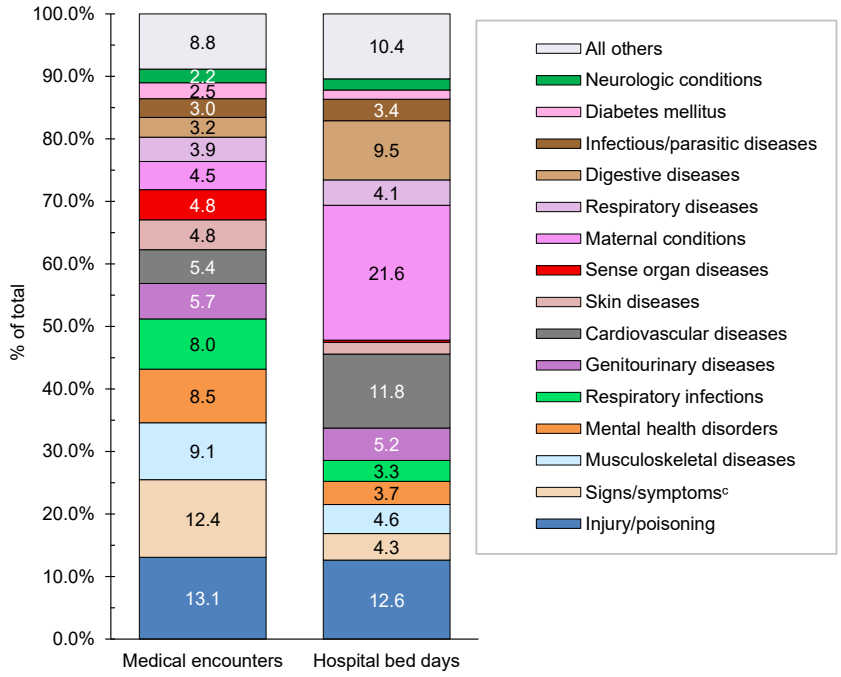
The surveillance period was 1 January through 31 December 2019. The surveillance population included all non-service member beneficiaries of the MHS who had at least 1 hospitalization or outpatient medical encounter during 2019 either through a military medical facility/provider or a civilian facility/provider (if paid for by the MHS). For this analysis, all inpatient and outpatient medical encounters were summarized according to the primary (first-listed) diagnoses documented on administrative records of the encounters if the diagnoses were reported with International Classification of Diseases, 10th Revision (ICD-10) codes that indicate the

FIGURE 2a. Numbers of medical encounters,[a] individuals affected,[b] and hospital bed days, by burden of disease major category,[c] non-service member beneficiaries, direct care only, 2019



[a]Medical encounters include total hospitalizations and ambulatory visits for the condition (with no more than 1 encounter per individual per day per condition).
[b]Individuals with at least 1 hospitalization or ambulatory visit for the condition.
[c]Burden of disease major categories based on a modified version of those defined in the Global Burden of Disease Study.[3]
[d]Includes ill-defined conditions.
No., number.

FIGURE 2b. Percentages of medical encounters[a] and hospital bed days, by burden of disease major category,[b] non-service member beneficiaries, direct care only, 2019



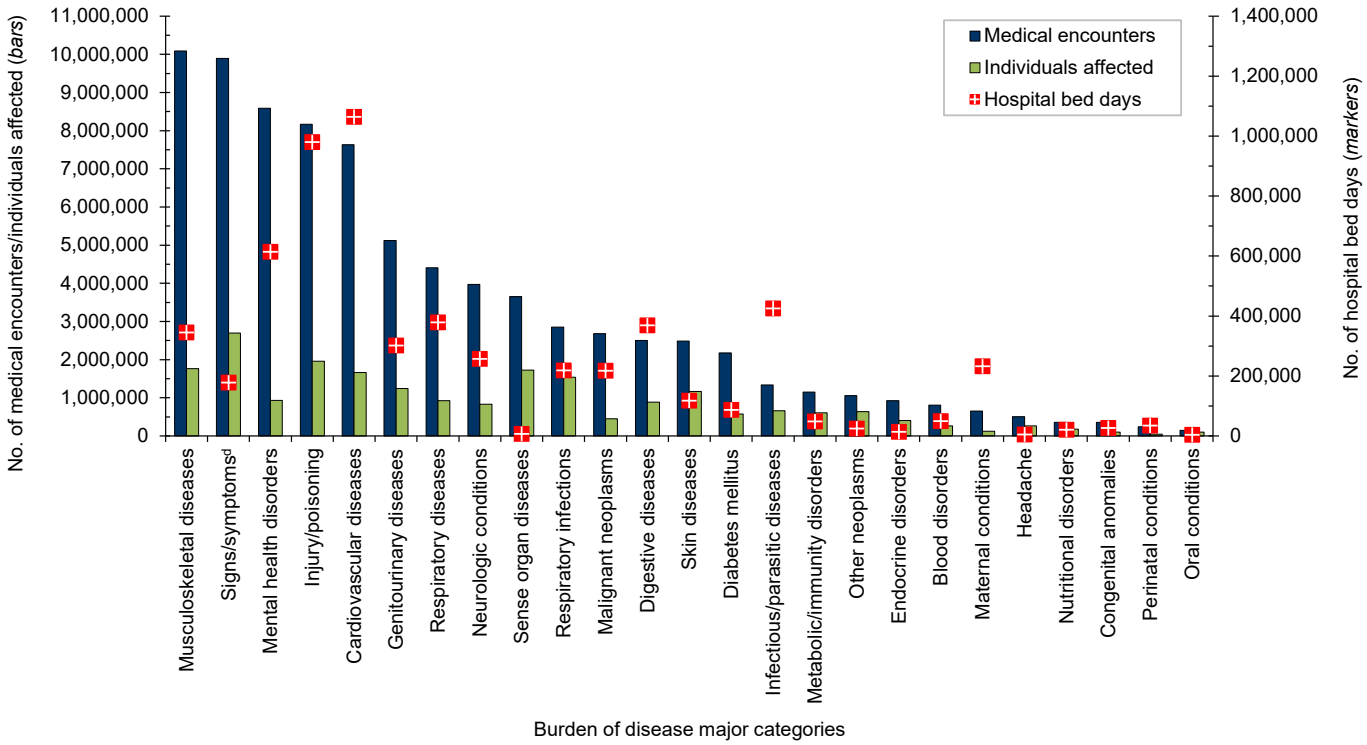
[a]Medical encounters include total hospitalizations and ambulatory visits for the condition (with no more than 1 encounter per individual per day per condition).
[b]Burden of disease major categories based on a modified version of those defined in the Global Burden of Disease Study.[3]
[c]Includes ill-defined conditions.

natures of illnesses or injuries (i.e., ICD-10 codes A00–T88). Nearly all records of encounters with first-listed diagnoses that were Z-codes (care other than for a current illness or injury—e.g., general medical examinations, after care, vaccinations) or V/W/X/Y-codes (indicators of the external causes but not the natures of injuries) were excluded from the analysis; however, encounters with primary diagnoses of Z37 ("outcome of delivery, single liveborn") were retained.

For summary purposes, all illness- and injury-specific diagnoses (as defined by the ICD-10) were grouped into 151 burden of disease-related conditions and 25 major categories based on a modified version of the classification system developed for the Global Burden of Disease Study.[3] The methodology for summarizing absolute and relative morbidity burdens is described on page 2 of this issue of the *MSMR*.

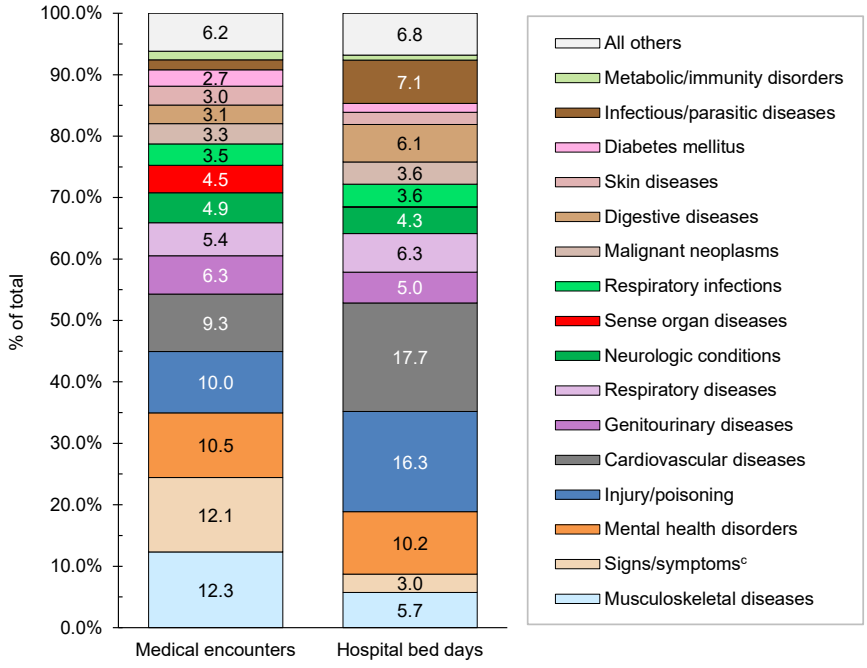
The new electronic health record for the MHS, MHS GENESIS, was implemented at 4 military treatment facilities

FIGURE 3a. Numbers of medical encounters,[a] individuals affected,[b] and hospital bed days, by burden of disease major category,[c] non-service member beneficiaries, outsourced care only, 2019



[a]Medical encounters include total hospitalizations and ambulatory visits for the condition (with no more than 1 encounter per individual per day per condition).
[b]Individuals with at least 1 hospitalization or ambulatory visit for the condition.
[c]Burden of disease major categories based on a modified version of those defined in the Global Burden of Disease Study.[3]
[d]Includes ill-defined conditions.
No., number.

FIGURE 3b. Percentages of medical encounters[a] and hospital bed days, by burden of disease major category,[b] non-service member beneficiaries, outsourced care only, 2019



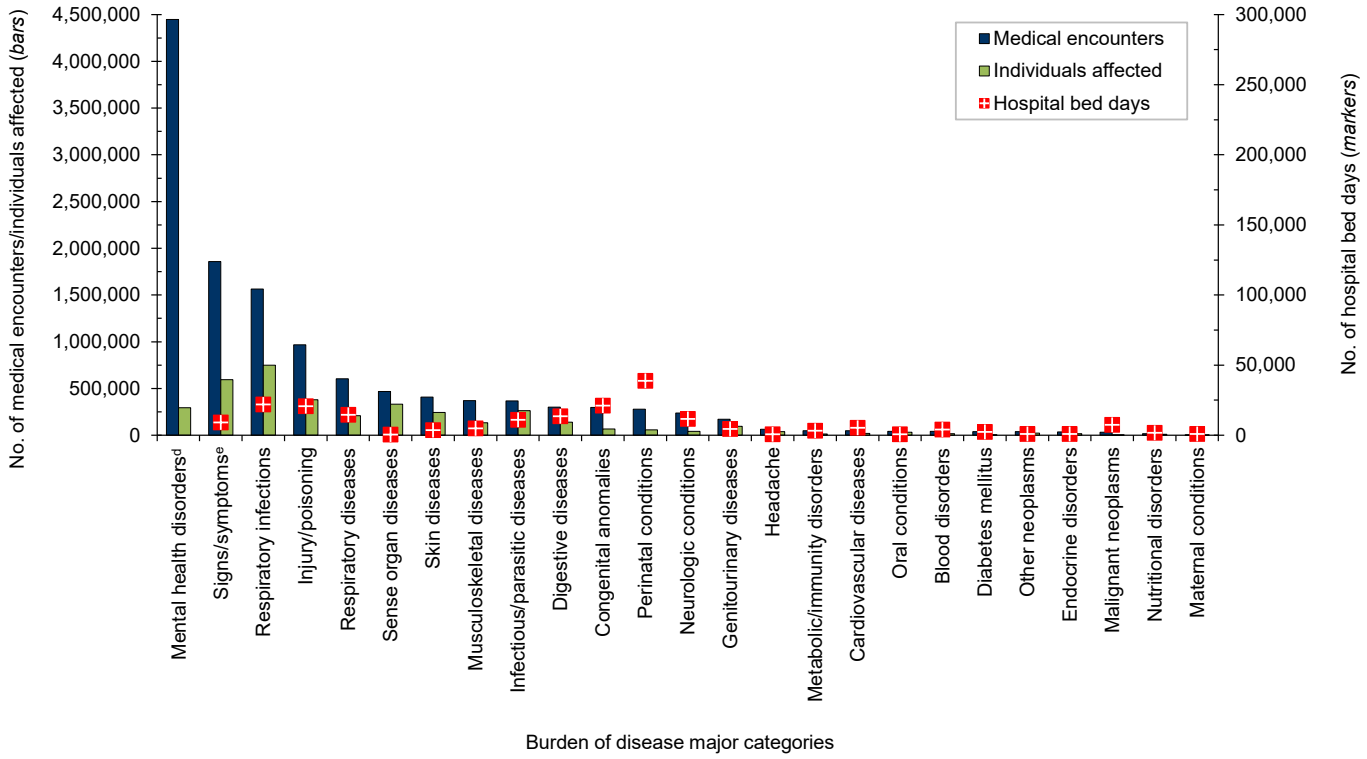
[a]Medical encounters include total hospitalizations and ambulatory visits for the condition (with no more than 1 encounter per individual per day per condition).
[b]Burden of disease major categories based on a modified version of those defined in the Global Burden of Disease Study.[3]
[c]Includes ill-defined conditions.

in the state of Washington in 2017 (Naval Hospital Oak Harbor, Naval Hospital Bremerton, Air Force Medical Services Fairchild, and Madigan Army Medical Center). Implementation of the second wave of MHS GENESIS sites began in 2019 and included 3 facilities in California (Travis Air Force Base [AFB], the Presidio of Monterey, and Naval Air Station Lemoore) and 1 in Idaho (Mountain Home AFB). Medical data from facilities using MHS GENESIS are not available in the DMSS. Therefore, medical encounter data for individuals seeking care at any of these facilities after their conversion to MHS GENESIS were not included in the current analysis.

RESULTS

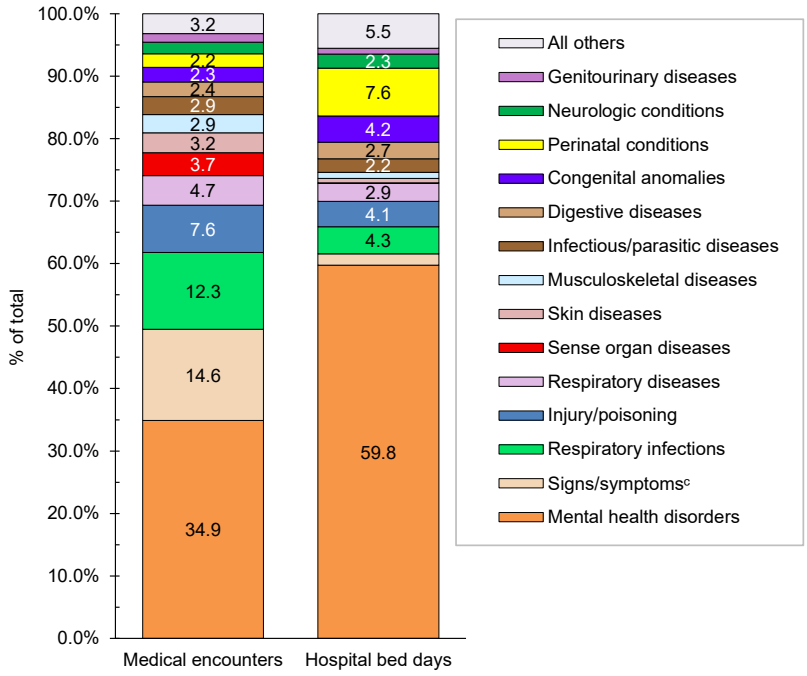
In 2019, a total of 6,576,473 non-service member beneficiaries of the MHS had 89,409,223 medical encounters **(Table)**. Thus, on average, each individual who accessed care from the MHS had 13.6

FIGURE 4a. Medical encounters,[a] individuals affected,[b] and hospital bed days, by burden of disease major category,[c] non-service member beneficiaries, pediatric non-service member beneficiaries, aged 0–17 years, 2019



[a]Medical encounters include total hospitalizations and ambulatory visits for the condition (with no more than 1 encounter per individual per day per condition).
[b]Individuals with at least 1 hospitalization or ambulatory visit for the condition.
[c]Burden of disease major categories based on a modified version of those defined in the Global Burden of Disease Study.[3]
[d]Mental health disorders accounted for 302,508 hospital bed days in 2019 (not shown in figure).
[e]Includes ill-defined conditions.
No., number.

FIGURE 4b. Percentages of medical encounters[a] and hospital bed days, by burden of disease category,[b] pediatric non-service member beneficiaries, aged 0–17 years, 2019



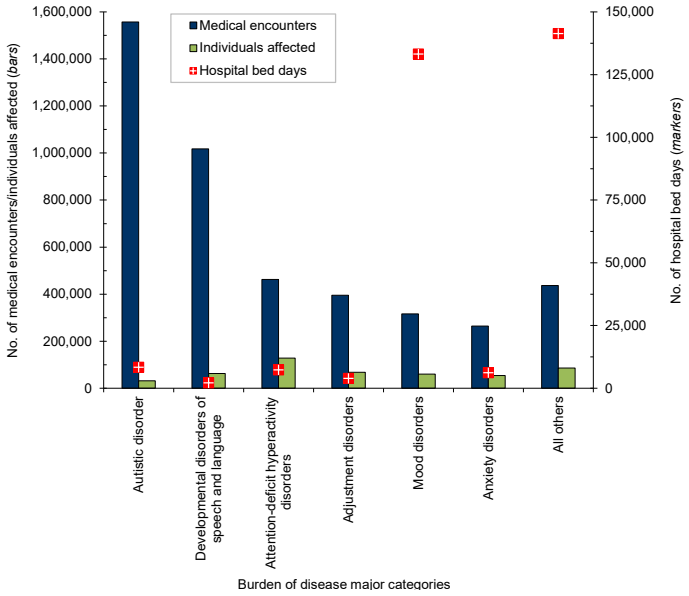
[a]Medical encounters include total hospitalizations and ambulatory visits for the condition (with no more than 1 encounter per individual per day per condition).
[b]Burden of disease major categories based on a modified version of those defined in the Global Burden of Disease Study.[3]
[c]Includes ill-defined conditions.

medical encounters over the course of the year. The top 3 morbidity-related categories, which accounted for slightly more than one-third (34.5%) of all medical encounters, were signs/symptoms and ill-defined conditions (12.1%), musculoskeletal diseases (12.1%), and mental health disorders (10.3%) **(Figures 1a, 1b)**. The illness/injury categories that affected the most beneficiaries who received any care were signs/symptoms and ill-defined conditions (46.8%), injury/poisoning (34.2%), and musculoskeletal diseases (29.8%).

Cardiovascular diseases accounted for more hospital bed days (n=1,115,429) than any other illness/injury category and 17.3% of all hospital bed days overall **(Figures 1a, 1b)**. An additional 39.0% of all bed days were attributable to injury/poisoning (16.0%), mental health disorders (9.8%), infectious/parasitic diseases (6.8%), and digestive diseases (6.4%).

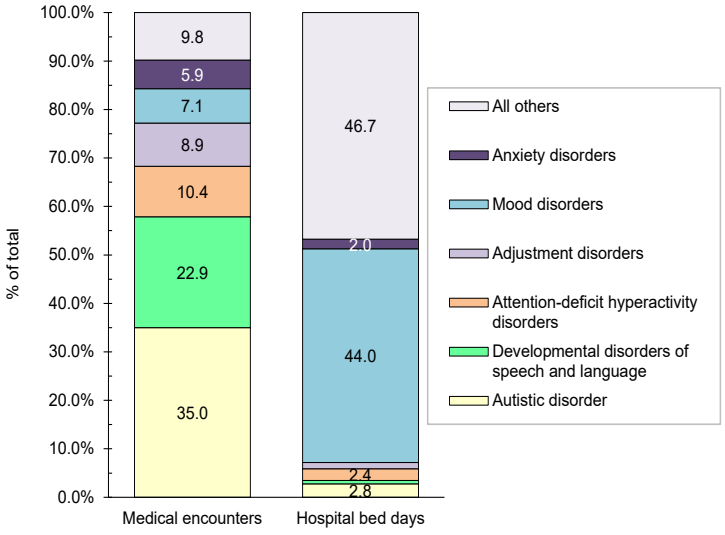
Of note, among all beneficiaries, maternal conditions (including pregnancy complications and delivery) accounted

FIGURE 4c. Medical encounters,[a] individuals affected,[b] and hospital bed days, by the mental health disorders accounting for the most morbidity burden, pediatric non-service member beneficiaries, aged 0–17 years, 2019



[a]Medical encounters include total hospitalizations and ambulatory visits for the condition (with no more than 1 encounter per individual per day per condition).
[b]Individuals with at least 1 hospitalization or ambulatory visit for the condition.
No., number.

FIGURE 4d. Percentages of medical encounters[a] and hospital bed days for mental health disorders by the conditions accounting for the most morbidity burden, pediatric non-service member beneficiaries, aged 0–17 years, 2019



[a]Medical encounters include total hospitalizations and ambulatory visits for the condition (with no more than 1 encounter per individual per day per condition).

for relatively more hospital bed days (n=326,306; 5.1%) than individuals affected (n=159,367; 2.4%) **(Figure 1a)**.

Direct care vs. outsourced care

In 2019, among non-service member beneficiaries, most medical encounters (91.4%) were in non-military medical facilities (outsourced care) **(Table)**. Of all beneficiaries with any illness or injury-related encounters during the year, many more received exclusively outsourced care (n=4,868,156; 74.0%) than either military medical (direct) care only (n=627,589; 9.5%) or both outsourced and direct care (n=1,080,728; 16.4%). By far, most inpatient care (93.2% of all bed days) was received in non-military facilities.

The proportions of medical encounters by morbidity-related categories were broadly similar for direct and outsourced care **(Figures 2a, 2b, 3a, 3b)**. However, encounters for injury/poisoning and respiratory infections were relatively more common in direct (13.1% and 8.0%, respectively) compared to outsourced (10.0% and 3.5%, respectively) care. Musculoskeletal diseases, cardiovascular diseases, neurologic conditions, and malignant neoplasms were relatively more common in outsourced (12.3%, 9.4%, 4.9%, and 3.3%, respectively) compared to direct (9.1%, 5.4%, 2.2%, and 1.5%, respectively) care.

Maternal conditions accounted for 21.6% of all direct care bed days but only 3.9% of all outsourced care bed days **(Figures 2a, 2b, 3a, 3b)**. However, cardiovascular diseases, mental health disorders, and musculoskeletal diseases accounted for relatively more of all outsourced than direct care bed days (% of outsourced vs. % of direct care bed days: cardiovascular, 17.7% vs. 11.8%; mental health, 10.2% vs. 3.7%; musculoskeletal, 5.7% vs. 4.6%).

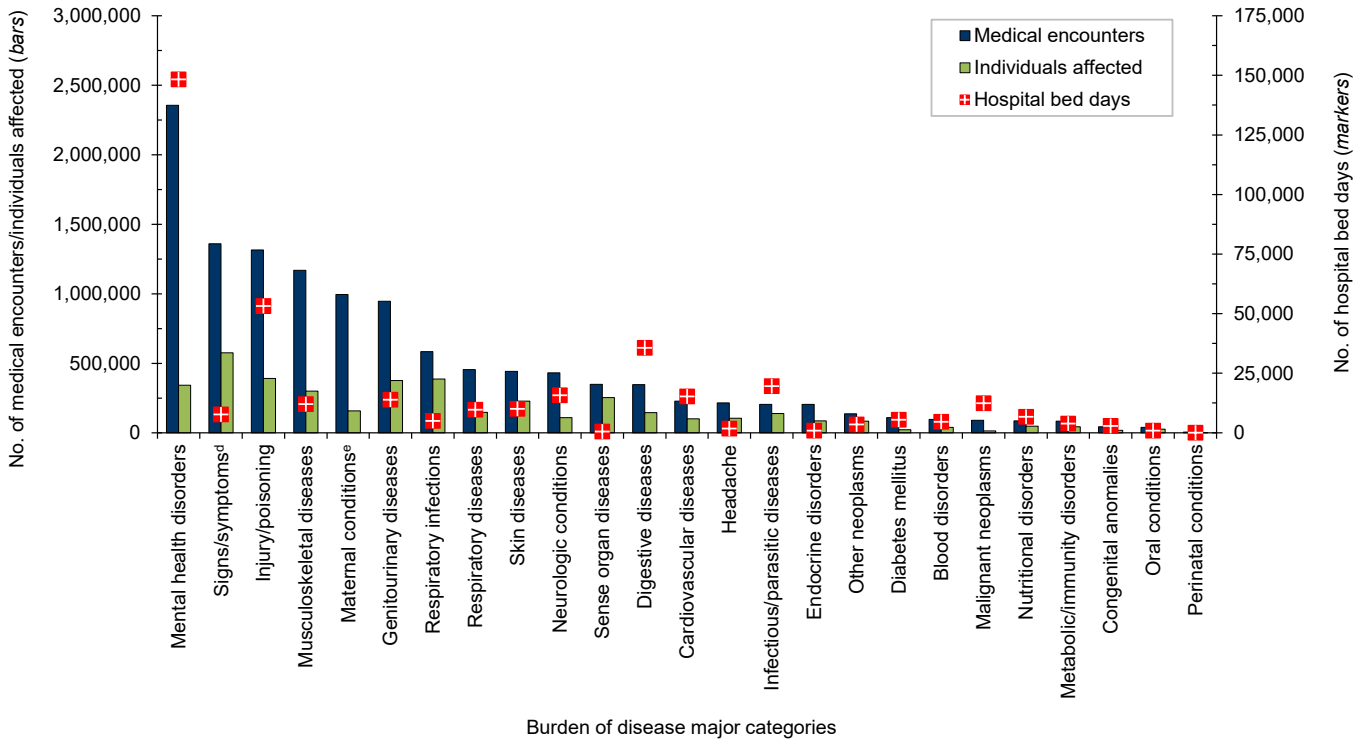
Pediatric beneficiaries (aged 0–17 years)

In 2019, pediatric beneficiaries accounted for 14.3% of all medical encounters, 23.1% of all individuals affected, and 7.8% of all hospital bed days **(Table)**. On average, each affected individual had 8.4 medical encounters during the year.

Mental health disorders accounted for slightly more than one-third (34.9%; n=4,449,523) of all medical encounters and 59.8% of all hospital bed days (n=302,508) among pediatric beneficiaries **(Figures 4a, 4b)**. On average, each pediatric beneficiary who was affected by a mental health disorder had 15.2 mental health disorder-related encounters during the year. More than two-thirds (68.3%) of all medical encounters for mental health disorders among pediatric beneficiaries were for autistic disorder (35.0%), developmental disorders of speech and language (22.9%), and attention deficit disorders (10.4%) **(Figures 4c, 4d)**. On average, there were 49.2 autism-related encounters per individual affected with autistic disorder and 16.3 encounters for developmental disorders of speech and language per individual affected with those specific disorders **(data not shown)**. Despite the high numbers of encounters associated with these 3 categories of mental health disorders, 44.0% of mental health disorder-related bed days were attributable to mood disorders and 42.1% of mood-related bed days were attributable to "major depressive disorder, recurrent severe without psychotic features" **(data not shown)**.

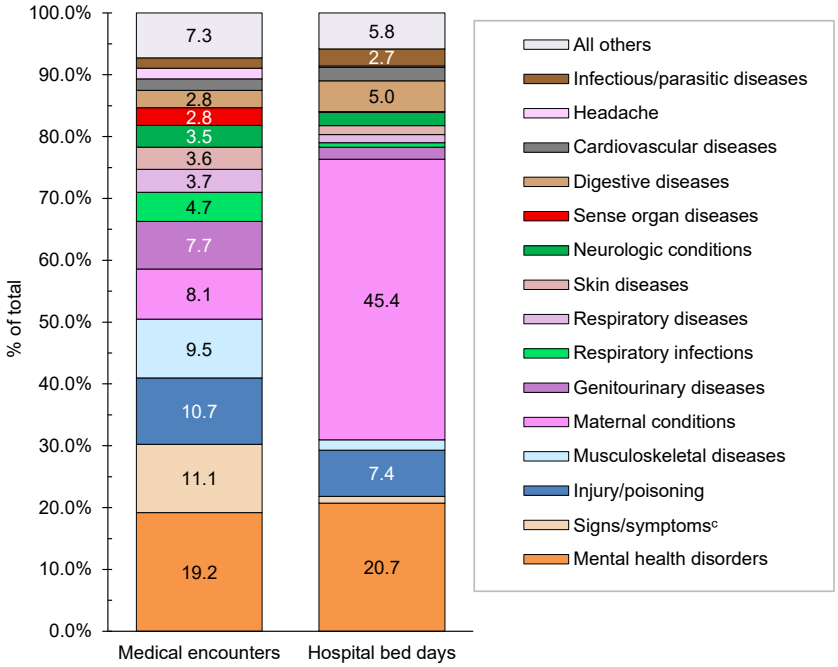
Among pediatric beneficiaries overall, "conditions arising during the perinatal period" (i.e., perinatal conditions) accounted for the second most hospital bed

FIGURE 5a. Medical encounters,[a] individuals affected,[b] and hospital bed days, by burden of disease major category,[c] non-service member beneficiaries, aged 18–44 years, 2019



[a]Medical encounters include total hospitalizations and ambulatory visits for the condition (with no more than 1 encounter per individual per day per condition).
[b]Individuals with at least 1 hospitalization or ambulatory visit for the condition.
[c]Burden of disease major categories based on a modified version of those defined in the Global Burden of Disease Study.[3]
[d]Includes ill-defined conditions.
[e]Maternal conditions accounted for 324,449 hospital bed days in 2019 (not shown in figure).
No., number.

FIGURE 5b. Percentages of medical encounters[a] and hospital bed days, by burden of disease major category,[b] non-service member beneficiaries, aged 18–44 years, 2019



[a]Medical encounters include total hospitalizations and ambulatory visits for the condition (with no more than 1 encounter per individual per day per condition).
[b]Burden of disease major categories based on a modified version of those defined in the Global Burden of Disease Study.[3]
[c]Includes ill-defined conditions.

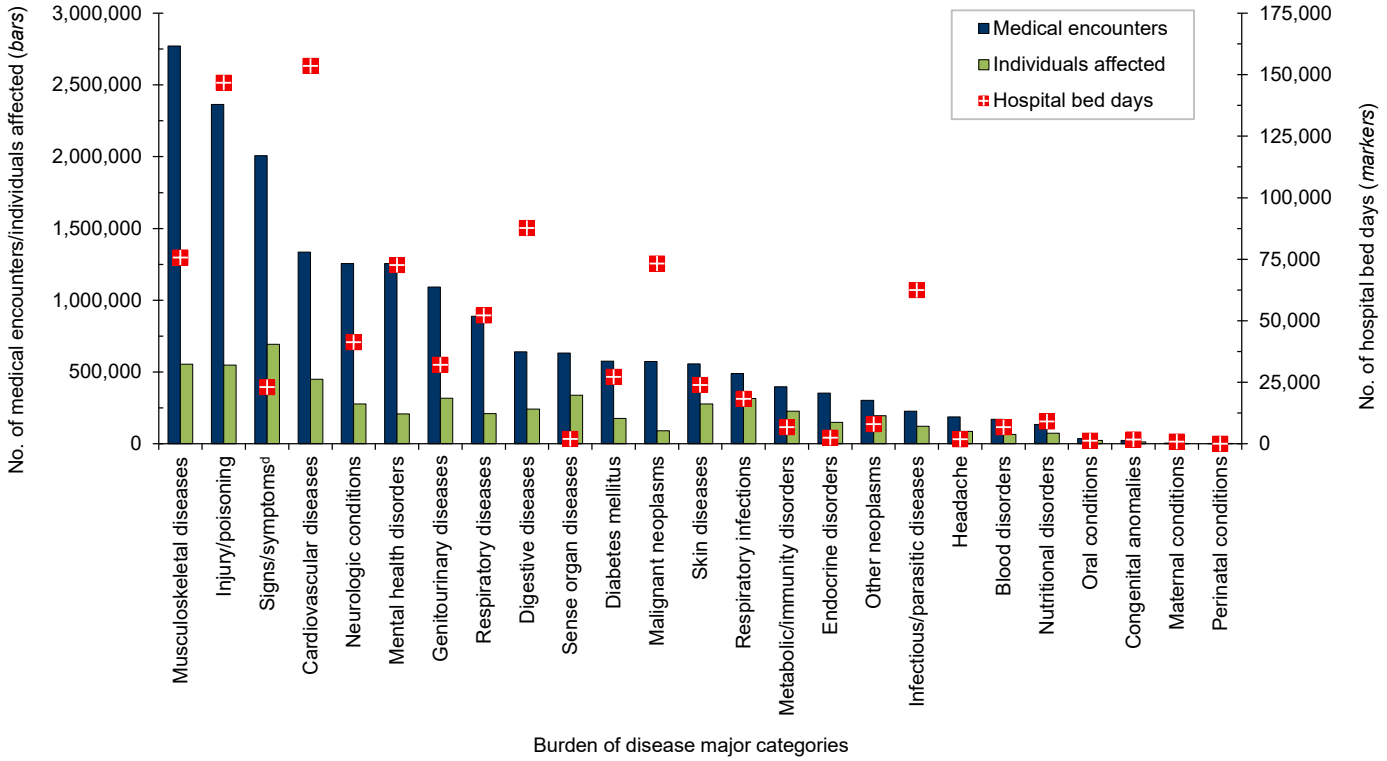
days (n=38,679; 7.6%) **(Figures 4a, 4b)**. Of note, among pediatric beneficiaries with at least 1 illness or injury-related diagnosis, those with malignant neoplasms had the second highest number of related encounters per affected individual (13.5). The highest numbers of malignant neoplasm-related encounters were attributable to leukemias, "all other malignant neoplasms," and brain neoplasms, while the highest numbers of bed days were attributable to leukemias, brain neoplasms, and "all other malignant neoplasms" **(data not shown)**.

Finally, respiratory infections (including upper and lower respiratory infections and otitis media) accounted for relatively more medical encounters and bed days among pediatric beneficiaries (12.3% and 4.3%, respectively) when compared to any older age group of beneficiaries **(Figures 4b, 5b, 6b, and 7b)**.

Beneficiaries (aged 18–44 years)

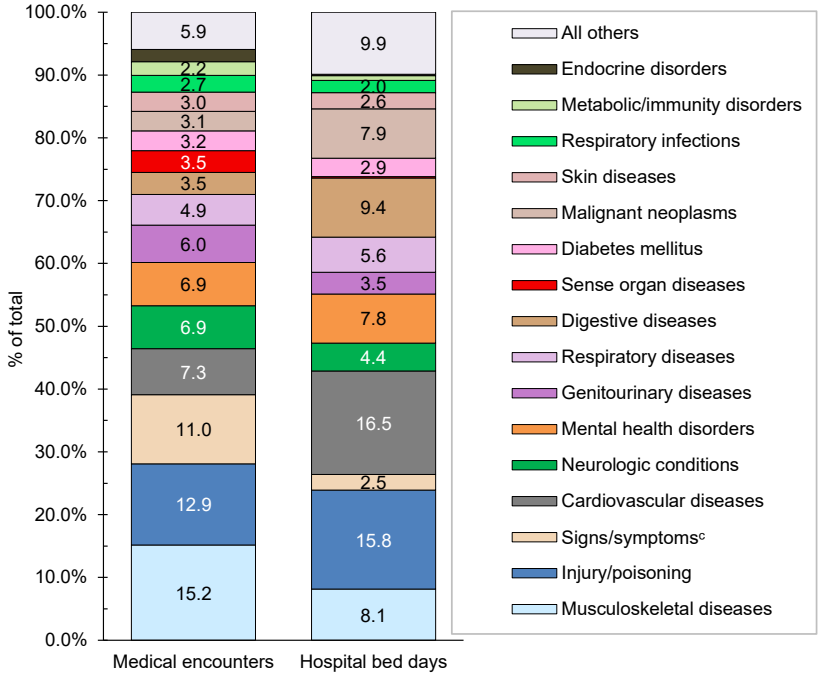
In 2019, non-service member beneficiaries aged 18–44 years accounted for

FIGURE 6a. Medical encounters,[a] individuals affected,[b] and hospital bed days, by burden of disease major category,[c] non-service member beneficiaries, aged 45–64 years, 2019



[a]Medical encounters include total hospitalizations and ambulatory visits for the condition (with no more than 1 encounter per individual per day per condition).
[b]Individuals with at least 1 hospitalization or ambulatory visit for the condition.
[c]Burden of disease major categories based on a modified version of those defined in the Global Burden of Disease Study.[3]
[d]Includes ill-defined conditions.
No., number.

FIGURE 6b. Percentages of medical encounters[a] and hospital bed days, by burden of disease major category,[b] non-service member beneficiaries, aged 45–64 years, 2019



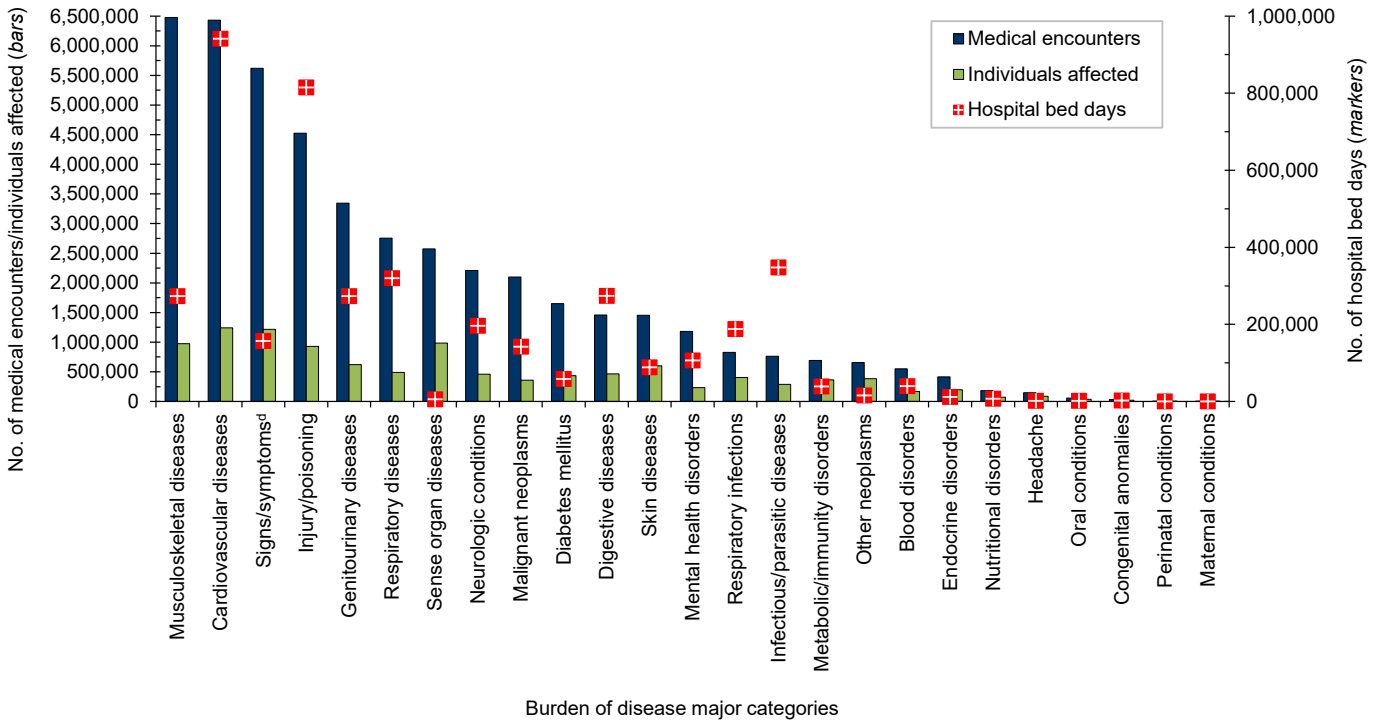
[a]Medical encounters include total hospitalizations and ambulatory visits for the condition (with no more than 1 encounter per individual per day per condition).
[b]Burden of disease major categories based on a modified version of those defined in the Global Burden of Disease Study.[3]
[c]Includes ill-defined conditions.

13.7% of all medical encounters, 22.0% of all individuals affected, and 11.1% of hospital bed days **(Table)**. On average, each individual affected with an illness or injury (any cause) had 8.5 medical encounters during the year.

Among beneficiaries aged 18–44 years, the morbidity-related category that accounted for the most medical encounters was mental health disorders (n=2,356,465; 19.2% of all encounters) **(Figures 5a, 5b)**. Among these adult beneficiaries, mental health disorders accounted for 20.7% of all bed days, and, on average, each adult affected by a mental health disorder had 6.9 mental health disorder-related encounters during the year. Mood disorders (32.7%), anxiety disorders (28.8%), and adjustment disorders (17.2%) accounted for nearly four-fifths (78.7%) of all mental health disorder-related medical encounters among beneficiaries aged 18–44 years **(data not shown)**.

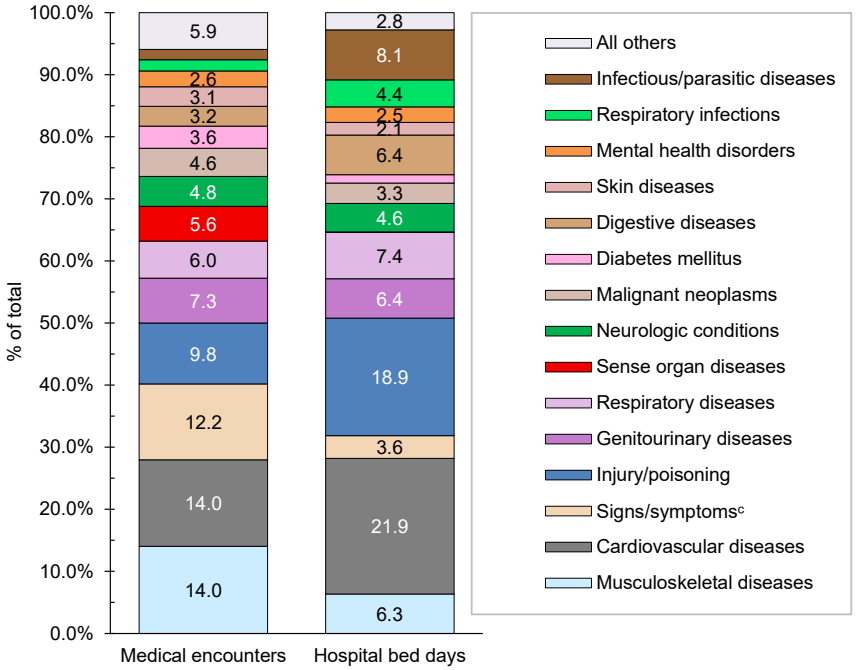
Among adults aged 18–44 years, maternal conditions accounted for more

FIGURE 7a. Medical encounters,[a] individuals affected,[b] and hospital bed days, by burden of disease major category,[c] non-service member beneficiaries, aged 65 years or older, 2019



[a]Medical encounters include total hospitalizations and ambulatory visits for the condition (with no more than 1 encounter per individual per day per condition).
[b]Individuals with at least 1 hospitalization or ambulatory visit for the condition.
[c]Burden of disease major categories based on a modified version of those defined in the Global Burden of Disease Study.[3]
[d]Includes ill-defined conditions.
No., number.

FIGURE 7b. Percentages of medical encounters[a] and hospital bed days, by burden of disease major category,[b] non-service member beneficiaries, aged 65 years or older, 2019



[a]Medical encounters include total hospitalizations and ambulatory visits for the condition (with no more than 1 encounter per individual per day per condition).
[b]Burden of disease major categories based on a modified version of those defined in the Global Burden of Disease Study.[3]
[c]Includes ill-defined conditions.

than two-fifths (45.4%) of all bed days and, on average, 6.3 medical encounters per affected individual **(Figures 5a, 5b)**. Normal deliveries accounted for 10.7% of maternal condition-related medical encounters **(data not shown)**. Adults aged 18–44 years accounted for nearly all (99.3%) maternal condition-related bed days among beneficiaries not in military service. Although adults aged 18–44 years had the lowest percentage of total medical encounters (13.7%), if morbidity burdens associated with maternal conditions were excluded from the overall analysis, this age group would account for even lower percentages of total medical encounters (12.8%) and the lowest percentage of total hospital bed days (6.4%) when compared to any other age group **(data not shown).**

Among beneficiaries aged 18–44 years with at least 1 illness or injury-related diagnosis, those with malignant neoplasms had the second most (along with maternal conditions) category-specific encounters per affected individual (6.3). Of all malignant

neoplasms, breast cancer accounted for the most malignant neoplasm-related encounters (28.9% of the total) **(data not shown)**.

Beneficiaries (aged 45–64 years)

In 2019, non-service member beneficiaries aged 45–64 years accounted for 20.4% of all medical encounters, 22.9% of all individuals affected, and 14.4% of hospital bed days **(Table)**. On average, each affected individual had 12.1 medical encounters during the year.

Of all morbidity-related categories, musculoskeletal diseases accounted for the most medical encounters (n=2,771,318; 15.2%) among older adult beneficiaries **(Figures 6a, 6b)**. In addition, in this age group, back problems accounted for 44.4% of all musculoskeletal disease-related encounters **(data not shown)**. Cardiovascular diseases accounted for more hospital bed days (16.5% of the total) than any other category of illnesses or injuries, and cerebrovascular disease and ischemic heart disease accounted for 32.4% and 18.0%, respectively, of all cardiovascular disease-related bed days **(data not shown)**. Digestive diseases accounted for a larger percentage (9.4%) of total hospital bed days among beneficiaries in this age group compared to those in the other age groups.

The most medical encounters per affected individual were associated with malignant neoplasms (6.3), mental health disorders (6.0), maternal conditions (5.3), musculoskeletal diseases (5.0), neurologic conditions (4.5), injury/poisoning (4.3), and respiratory diseases (4.2) **(data not shown)**. Malignant neoplasms (7.9%) accounted for a larger proportion of total bed days among beneficiaries aged 45–64 years than among the other age groups of beneficiaries. Breast cancer accounted for nearly one-fourth (24.0%) of all malignant neoplasm-related encounters among older adult beneficiaries **(data not shown)**.

Beneficiaries (aged 65 years or older)

In 2019, non-service member beneficiaries aged 65 years or older accounted for slightly more than half (51.6%) of all medical encounters, nearly one-third (31.9%) of all individuals affected, and slightly more than two-thirds (66.7%) of hospital bed days **(Table 1)**. On average, each affected individual had 22.0 medical encounters during the year.

Of all morbidity-related categories, musculoskeletal diseases (n=6,476,843; 14.0%) and cardiovascular diseases (n=6,297,744; 14.0%) accounted for the most medical encounters, but cardiovascular diseases accounted for the most bed days (941,244 days; 21.9%) **(Figures 7a, 7b)**. Back problems accounted for a little more than one-third (36.3%) of all musculoskeletal disease-related medical encounters but only 1.6% of hospital bed days **(data not shown)**. Essential hypertension (26.3%), ischemic heart disease (14.3%), and cerebrovascular disease (9.8%) accounted for slightly more than half (50.4%) of all cardiovascular disease-related medical encounters, and cerebrovascular disease accounted for over one-quarter (29.1%) of all cardiovascular disease-related bed days **(data not shown)**.

Among the oldest age group of beneficiaries, the most medical encounters per affected individual were associated with musculoskeletal diseases (6.6), malignant neoplasms (5.8), respiratory diseases (5.7), diseases of the genitourinary system (5.4), cardiovascular diseases (5.2), and mental health disorders (5.1) **(Figure 7a)**. In this age group, melanomas and other skin cancers (20.2%); prostate cancer (14.5%); breast cancer (12.2%); and trachea, bronchus, and lung cancers (10.6%) accounted for more than half (57.5%) of all malignant neoplasm-related encounters **(data not shown)**. Chronic obstructive pulmonary disease accounted for more than two-fifths of all medical encounters (41.4%) and approximately one-third of all bed days (35.3%) attributable to respiratory diseases **(data not shown)**.

Infectious and parasitic diseases (8.1%) accounted for a larger proportion of total bed days among the oldest age group compared to the other age groups of beneficiaries **(Figures 7a, 7b)**. In contrast, mental health disorders accounted for smaller percentages of medical encounters (2.6%) and bed days (2.5%) among the oldest age group compared to the younger age groups.

EDITORIAL COMMENT

This report describes the seventh estimate of overall morbidity burdens among non-service member beneficiaries of the MHS. The report notes that a large majority of the healthcare services for current illness and injury (excluding encounters with diagnoses identified by Z-codes) that are provided through the MHS to non-service member beneficiaries are delivered in non-military medical facilities (i.e., outsourced [purchased] care). The report also documents that there are pronounced differences in the types of morbidity and the natures of the care provided for evaluation and treatment across age groups of beneficiaries. Of particular note, individuals aged 65 years or older—31.9% of all non-service member beneficiaries—accounted for more than half (51.6%) of all medical encounters and two-thirds (66.7%) of all hospital bed days delivered to all such beneficiaries.

In 2019, as in previous years, mental health disorders accounted for the largest proportions of the morbidity and healthcare burdens that affected the pediatric (aged 0–17 years) and younger adult (aged 18–44 years) beneficiary age groups. Among pediatric beneficiaries, 68.3% of medical encounters for mental health disorders were attributable to autistic disorder, developmental speech/language disorders, or attention deficit disorders. Of particular note, children affected by autistic disorder had, on average, 49.2 autism-related encounters each during the 1-year surveillance period.

Although mental health disorders also accounted for more medical encounters among young adult (18–44 years) beneficiaries than any other major category of illnesses or injuries, the proportion of all encounters attributable to mental health disorders was markedly lower among young adult (19.2%) than pediatric (35.0%) beneficiaries. Also, as expected, the mental health disorders that accounted for the largest healthcare burdens among younger adults (18–44 years)—mood, anxiety, and adjustment disorders—differed from those that most affected the pediatric age group.

It is not surprising that the highest numbers and proportions of hospital bed

days among adults aged 18–44 years were for maternal conditions because this age group encompasses nearly all women of childbearing age. Among older adults (aged 45–64 years), musculoskeletal diseases were the greatest contributors to morbidity and healthcare burdens, and among adults aged 65 years or older, cardiovascular diseases accounted for the most morbidity and healthcare burdens.

Of musculoskeletal diseases, back problems were a major source of healthcare burden; of cardiovascular diseases, essential hypertension, ischemic heart disease, and cerebrovascular disease accounted for the largest healthcare burdens. These findings are not surprising and reflect the inevitable effects of aging on the health and healthcare needs of the older segment of the MHS beneficiary population. However, many of the health conditions associated with the largest morbidity and healthcare burdens among beneficiaries in older age groups are also associated with unhealthy lifestyles (e.g., unhealthy diet, inadequate exercise, or tobacco use). As such, to varying extents, the most costly health conditions may be preventable and their disabling or life-threatening long-term consequences may be avoidable. Illnesses and injuries that disproportionately contribute to morbidity and healthcare burdens in various age groups of MHS beneficiaries should be targeted for early detection and treatment by comprehensive prevention and research programs.

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Special Report

Prevalence of Selected Underlying Health Conditions Among Active Component Army Service Members with Coronavirus Disease 2019, 11 February–6 April 2020

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The novel coronavirus (severe acute respiratory syndrome coronavirus 2, or SARS-CoV-2) that causes coronavirus disease 2019 (COVID-19) is exhibiting widespread community transmission throughout most of the world. Previous reports have evaluated the risk of serious illness in civilians diagnosed with COVID-19; however, similar reports have not been compiled for the Army active component (AC) population. COVID-19 has been a reportable condition for the Department of Defense since 5 February 2020, and, as of the morning of 6 April, a total of 873 cases were reported to the Disease Reporting System internet from Army installations. Of these cases, a total of 219 (25.1%) were identified as Army AC service members. The majority of these cases did not require hospitalization (n=207; 94.5%). The most common comorbidities present in nonhospitalized cases included other chronic illnesses (43.5%), neurologic disorders (24.6%), and obesity (21.7%). Overall, 12 cases (5.5%) required hospitalization. Hospitalized cases had a history of obesity (58.3%), neurologic disorder (50.0%), other chronic illnesses (41.7%), and hypertension (25.0%). No comorbidities were present among 27.1% (n=56) of nonhospitalized cases and 25.0% (n=3) of hospitalized cases.

WHAT ARE THE NEW FINDINGS?

The burden of COVID-19 in the Army AC population is being evaluated through active and passive surveillance daily; however, a summary of the prevalence of comorbidities in confirmed COVID-19 cases in the Army AC has not yet been published. The most common comorbidities in Army service members hospitalized for COVID-19 were history of obesity, hypertension, obstructive sleep apnea, and neurologic conditions.

WHAT IS THE IMPACT ON READINESS AND FORCE HEALTH PROTECTION?

COVID-19 is a highly infectious and potentially serious respiratory illness that can lead to hospitalization or death. Individuals with pre-existing medical conditions should exercise extreme caution to prevent this illness.

In early January 2020, the China Centers for Disease Control announced they had identified a novel coronavirus (severe acute respiratory syndrome coronavirus 2, or SARS-CoV-2) as the cause of a cluster of viral pneumonia of previously unknown etiology in Wuhan, China. As more countries continued to report widespread community transmission, the World Health Organization (WHO) declared a pandemic of coronavirus disease 2019 (COVID-19) on 11 March 2020. As of 8 April 2020, over 1.35 million cases and over 79,000 deaths had been reported by WHO.[1] As of the morning of 6 April 2020, a total of 873 cases of COVID-19 had been reported to the Disease Reporting System internet (DRSi) from Army installations and some joint installations; the case counts include all cases reported from these installations, regardless of service, patient, or beneficiary status.[2] The majority of cases were not hospitalized (n=773; 88.5%); 96 cases (11.0%) were hospitalized for this illness and 4 died (0.4%) **(data not shown)**. Of the reported cases, a total of 328 (37.6%) were identified as active component (AC) service members from any military service **(data not shown)**.

Several preliminary reports have summarized the epidemiology and clinical characteristics of COVID-19 patients.[3–8] The SARS-CoV-2 virus is highly infectious and appears to have more negative impacts on patients 60 years or older than on adults under 40 years old or children.[2,3,5,9–11] Several underlying health conditions are thought to increase the risk of severe illness, including pre-existing conditions such as immunocompromised status, history of cancer, cardiovascular disease, and diabetes mellitus.[9] The U.S. Centers for Disease Control and Prevention (CDC) COVID-19 Response Team examined these conditions and other select underlying health conditions among the first 122,653 reported cases in the U.S. and concluded that persons with underlying health conditions such as diabetes mellitus, chronic lung disease, or cardiovascular disease had a higher risk for severe COVID-19–associated disease than those without these conditions.[9]

Service members in the U.S. Army have to meet occupational health and fitness standards in order to continue their careers in the Armed Forces. As such, compared to the general U.S. population, service members are typically characterized as younger, more physically fit, and with lower rates of chronic disease; this is sometimes referred to the healthy soldier effect. However, a study of cardiovascular disease comparing 2012 Periodic Health Assessment data to data from the 2011–2012 National Health and Nutrition

Examination Survey noted that service members had an increased prevalence of elevated blood pressure and had a similar prevalence of body mass index in the overweight and obese ranges compared to the general population.[12] Periodic reports by the U.S. Army Public Health Center (APHC) echo these findings for the prevalence of certain chronic diseases among AC Army members.[13] For example, in 2018, among the AC service members evaluated in the APHC reports, 19% had 1 or more diagnosed chronic conditions[13] and prevalence ranged from 13% to 37% across Army installations. Arthritis (9.3%) was the most common of the conditions assessed, followed by cardiovascular conditions (6.0%) and hypertension (5.6%).[13] Additionally, 17% of service members were classified as obese during Army physical fitness tests, with the prevalence of obesity ranging from 11% to 25% across Army installations.[13]

This report provides preliminary information on the prevalence of select underlying conditions among confirmed cases of COVID-19 among U.S. Army AC service members. Of interest was the distribution of these conditions by hospitalization status and age. Causal relationships were not explored.

METHODS

Study population

All confirmed cases of COVID-19 reported to the DRSi from 11 February 2020 through 6 April 2020 by 0500 EDT were evaluated for this report. Per Department of Defense (DoD) Office of the Under Secretary of Defense memorandum "Force Health Protection Guidance for the Novel Coronavirus Outbreak," all cases of COVID-19 must be reported to the DRSi.[14] The DRSi is a passive surveillance system for selected diseases identified as reportable medical events and has served as the main system of record for surveillance of all cases of COVID-19 in the Army population. Identities of cases were confirmed by patient identifiers (e.g., social security number) for an existing electronic medical record. To confirm that all reported cases were valid cases, the laboratory and encounter sections of all case patients' medical records were searched for a report of a positive COVID-19 laboratory result.

Throughout the study period, confirmed cases of COVID-19 included all patients with positive or presumptive positive laboratory results. At the time of this study, the only laboratory tests performed within the Military Health System (MHS) and civilian hospitals were SARS-CoV-2 polymerase chain reaction tests. All confirmed cases among Army AC service members reported to the DRSi from 11 February 2020 through 6 April 2020 (by 0500 EDT) from any military treatment facility (MTF) were included in the analysis. A COVID-19 reporting page was not available in the DRSi until 11 February 2020. Until this time, a temporary reporting page was used; however, no confirmed cases of COVID-19 were reported in the Army AC service member population before 11 February 2020. National Guard members and Army Reserve active duty members, dependents, and retirees were excluded from the analysis, as reportable medical events among these groups are not as reliably reported to the DRSi because of differences in procedural policies. Because the processes for validating cases of COVID-19 reported to the DRSi differ between the Army, Air Force, Navy, and Marine Corps, all cases among Air Force, Navy, and Marine Corps AC service members reported to the DRSi were also excluded from the analysis.

February 2020 population data for active duty Army soldiers were extracted by age group and sex from the Defense Enrollment Eligibility Reporting System population summary. This summary contains aggregate demographic information for service members, civilians, and their eligible family members. These data were extracted using the MHS Management Analysis and Reporting Tool.

Study design

All COVID-19 patients meeting the case definition during the study period were identified, and their healthcare histories were searched for the underlying health conditions under consideration. Medical record reviews were performed using the Armed Forces Health Longitudinal Technology Application (AHLTA) electronic medical records system. AHLTA is the global electronic health record system used by the DoD. Each case's medical records include a listing of all past diagnoses. These lists for each case were examined by epidemiologists for the select underlying conditions of interest.

The same list of underlying health conditions considered in the CDC COVID-19 Response Team report was used in this analysis.[9] In brief, these include chronic lung disease (i.e., asthma, chronic obstructive pulmonary disease, and emphysema), cardiovascular disease, chronic renal disease, cancer or history of cancer, diabetes, current pregnancy, current or former smoking, liver disease, and neurologic disorder. The "neurologic disorder, neurodevelopmental, intellectual disability" category in the CDC report included headache/migraine. For the current study, cases with a diagnosis history of headaches were counted as having a neurologic disorder if they also had a diagnosis history of migraine or a concurrent history of a diagnosed head injury, such as traumatic brain injury. The other neurologic conditions included in the CDC report (i.e., dementia, memory loss or Alzheimer disease, seizure disorder, stroke, autism, aneurysm, multiple sclerosis, neuropathy, hereditary spastic paraplegia, myasthenia gravis, intracranial hemorrhage, and altered mental status) were also included in the current analysis. Some common conditions found in the study population, such as obesity and hypertension, were analyzed separately. The CDC report also included the overarching category "other chronic disease." This category included thyroid disease, gastrointestinal disorder, hyperlipidemia, rheumatologic disorder, hematologic disorder, arthritis, mental health condition, urologic disorder, cerebrovascular disease, obstructive sleep apnea, fibromyalgia, gynecologic disorder, pulmonary or venous embolism, ophthalmic disorder, hypertriglyceridemia, endocrine disorder, substance abuse disorder, dermatologic disorder, and genetic disorder.

Analyses were conducted using Microsoft Excel 2013 (Microsoft Corporation, Redmond, WA) and SAS/STAT software,

version 9.4 (2014, SAS Institute, Cary, NC). The frequencies of underlying health conditions were calculated for AC service members by hospitalization status (nonhospitalized vs. hospitalized), sex, and age group. No statistical comparisons were performed in this analysis.

RESULTS

A total of 219 AC service member case patients were identified with COVID-19 symptom onset dates ranging from 17 February to 2 April **(Figure 1)**. The vast majority of cases did not require hospitalization (n=207; 94.5%). Although four-fifths of cases were males (n=175; 79.9%), the overall incidence rate of COVID-19 infection was higher among females (5.9 per 10,000 soldiers) than males (4.2 per 10,000 soldiers) **(Table 1)**. The highest rate of COVID-19 infection was among the oldest (45 years or older) age group for both hospitalized cases (1.6 per 10,000 soldiers) and nonhospitalized cases (15.2 per 10,000 soldiers). The highest incidence rate of COVID-19 infection among males was among those 45 years or older (17.9 per 10,000 soldiers), while the highest incidence rate among females was among those aged 35–44 years (11.3 per 10,000 soldiers).

Medical record data for the 219 confirmed cases of COVID-19 were examined for 10 underlying conditions of interest **(Table 2)**. About one-third of the total case patients (33.8%; n=74) had none of the selected comorbidities in their medical histories. Among the 207 COVID-19 patients who did not require hospitalization, 34.3% had no comorbidities (n=71). No case patients were pregnant or had a history of chronic liver disease. Among the 10 underlying conditions that were present, prevalence ranged from less than 1% (cardiovascular disease) to 43.4% (other chronic disease). The broad category "other chronic disease," which included numerous diagnoses, was most prevalent among all case patients (n=95), followed by neurologic disorder (n=57; 26.0%) and obesity (n=52; 23.7%). Obstructive sleep apnea (n=42; 44.2%), hyperlipidemia (n=39; 41.1%), and mental health conditions (n=51; 53.7%) were the most common "other chronic diseases" for all case patients.

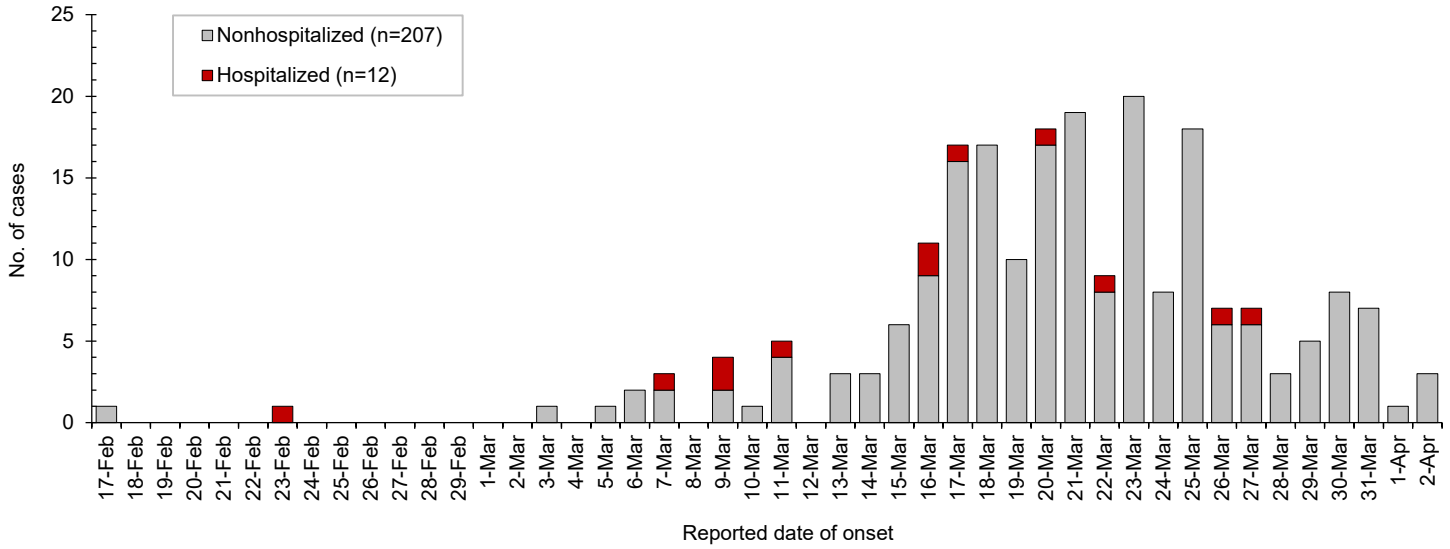
In comparing the distribution of underlying conditions among hospitalized and nonhospitalized confirmed cases, the small number of hospitalized cases precluded definitive conclusions about differences between the 2 groups.

Of the 12 (5.5%) case patients who were hospitalized, 4 (33.3%) were admitted to an intensive care unit (ICU) **(Table 3)**. None of the hospitalized cases, including those that were admitted to the ICU, required a ventilator. The underlying conditions with the highest prevalence among hospitalized COVID-19 patients included hypertension (25.0%), obesity (58.3%), and neurologic disorder (50.0%) **(Table 2)**. All 4 of the patients who were admitted to an ICU had 3 or more underlying conditions present **(Table 3)**. In contrast, of the 8 patients who were hospitalized without admission to an ICU, 2 (25.0%) had 3 or more underlying conditions present and 3 (37.5%) had no underlying conditions present. Of the 207 COVID-19 cases who were not hospitalized, 32 (15.5%) had 3 or more underlying conditions **(Table 3)**.

EDITORIAL COMMENT

Because the nature of the population for this report differs from the CDC COVID-19 Response Team's civilian population, direct comparisons are not possible. The patient population for this preliminary report is significantly smaller than the population described in the CDC report. In addition, the Army AC service member population does not include soldiers with underlying health conditions that would disqualify service members from enlistment in the Army, such as Alzheimer disease, Parkinson disease, intellectual

FIGURE 1. Hospitalized and nonhospitalized COVID-19 cases by onset date, active component, U.S. Army, 11 February–6 April 2020



COVID-19, coronavirus disease 2019; No., number.

TABLE 1. Cases and incidence rates of COVID-19 by sex and age group, active component, U.S. Army, 11 February–6 April 2020

		All cases		Hospitalized		Nonhospitalized	
	Population	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]
Total	487,100	219	4.5	12	0.2	207	4.2
Sex							
Male	412,500	175	4.2	11	0.3	164	4.0
Female	74,600	44	5.9	1	0.1	43	5.8
Age group (years)							
<25	186,600	34	1.8	2	0.1	32	1.7
25–34	185,900	76	4.1	0	-	76	4.1
35–44	89,600	67	7.5	6	0.7	61	6.8
45+	25,000	42	16.8	4	1.6	38	15.2
Sex by age group (years)							
Male							
<25	156,100	26	1.7	2	0.1	24	1.5
25–34	157,400	57	3.6	0	-	57	3.6
35–44	77,200	53	6.9	5	0.6	48	6.2
45+	21,800	39	17.9	4	1.8	35	16.1
Female							
<25	30,500	8	2.6	0	-	8	2.6
25–34	28,500	19	6.7	0	-	19	6.7
35–44	12,400	14	11.3	1	0.8	13	10.5
45+	3,200	3	9.4	0	-	3	9.4

[a]Rate per 10,000 soldiers.
COVID-19, coronavirus disease 2019; No., number.

TABLE 2. Underlying health conditions among COVID-19 cases by hospitalization status, active component, U.S. Army, 11 February–6 April 2020

Underlying health condition or risk factor for severe outcomes from respiratory infection	Nonhospitalized (n=207)		Hospitalized (n=12)		Total (n=219)	
	No.[a]	%	No.[a]	%	No.[a]	%
One or more conditions	136	65.7	9	75.0	145	66.2
Diabetes	5	2.4	1	8.3	6	2.7
Chronic lung disease[b]	10	4.8	0	0.0	10	4.6
Cardiovascular disease	0	0.0	1	8.3	1	0.5
Hypertension	22	10.6	3	25.0	25	11.4
Chronic renal disease	5	2.4	1	8.3	6	2.7
Neurologic disorder[c]	51	24.6	6	50.0	57	26.0
Current or former smoker	25	12.1	1	8.3	26	11.9
Cancer or history of cancer	5	2.4	1	8.3	6	2.7
Obesity	45	21.7	7	58.3	52	23.7
Other chronic disease[d]	90	43.5	5	41.7	95	43.4
None of the above conditions	71	34.3	3	25.0	74	33.8

[a]The sum of the number of cases does not equal the group total because a patient could have more than 1 condition.
[b]Includes any of the following: asthma (9), chronic obstructive pulmonary disease (0), and emphysema (0).
[c]For neurologic disorder, the following was specified: dementia (0), memory loss (0), Alzheimer disease (0), seizure disorder (1), Parkinson disease (0), migraine (28), headache (42), stroke (0), autism (0), aneurysm (0), multiple sclerosis (0), neuropathy (0), hereditary spastic paraplegia (0), myasthenia gravis (0), intracranial hemorrhage (0), altered mental status (0), or traumatic brain injury (21). Patients may have had more than 1 condition.
[d]The other chronic disease category includes the following conditions and disorders: thyroid disease (3); gastrointestinal disorder (15); hyperlipidemia (39); rheumatologic disorder (2); hematologic disorder (0); arthritis (any) (22); mental health condition (51); urologic disorder (0); cerebrovascular disease (0); obstructive sleep apnea (42); fibromyalgia (1); gynecologic disorder (3); embolism, pulmonary or venous (0); ophthalmic disorder (2); hypertriglyceridemia (0); endocrine disorder (0); substance abuse disorder (8); dermatologic disorder (15); genetic disorder (0). Patients may have had more than 1 condition.
COVID-19, coronavirus disease 2019; No., number.

disability, and others. On the other hand, conditions like hypertension, obesity, and neurologic disorders were observed often in soldiers. Diabetes mellitus was a significant underlying factor in the CDC report, with 10.9% of cases having this condition,[9] whereas only 2.7% of the Army study population had this disease (including prediabetes). Finally, the neurologic disorder category was associated with just 0.7% of case patients in the CDC's report,[9] whereas 26.0% of Army patients had some history of neurologic disorder; many had a history of diagnosed migraines (n=28) and/or traumatic brain injury (n=21) **(Table 2)**.

Because obesity was a common underlying condition for both hospitalized and nonhospitalized Army cases—the prevalence of obesity was 17% in the Army AC service member population in 2018—this condition may be a prominent risk factor for more severe COVID-19 infection in this particular population.[13] While the highest rates of COVID-19 occurred among service members aged 45 years or older (16.8 per 10,000 soldiers), the Army study population was on average younger (mean=34.6 years) than the age groups that are considered most at risk for serious illness due to COVID-19. This age difference may be a major contributing factor to why only 5.5% of Army case patients required hospitalization for this illness compared to 8.5% of case patients in the CDC report (of 74,439 total cases with a completed case report form, 5,285 were hospitalized without ICU admission and 1,069 were hospitalized with ICU admission).[9] It is also notable that the rate of nonhospitalized COVID-19 infection was higher among female compared to male service members (5.8 vs. 4.0 per 10,000 soldiers, respectively). The rate of hospitalized COVID-19 infection was lower among female cases compared to male cases (0.1 vs. 0.3 per 10,000 soldiers, respectively); however, the low case count of hospitalized female service members precludes making generalizations about the influence of sex on hospitalization rates among Army AC service members.

This report included several important limitations. First, this visual scan of underlying conditions, although thorough and performed by experienced epidemiologists, may not have captured all underlying

TABLE 3. Counts of underlying conditions by hospitalization status, active component, U.S. Army, 11 February–6 April 2020

Hospitalization status	Number of selected underlying conditions								Total
	0		1		2		3+		
	No.	%	No.	%	No.	%	No.	%	
Never hospitalized	71	34.3	55	26.6	49	23.7	32	15.5	207
Hospitalized without ICU	3	37.5	2	25.0	1	12.5	2	25.0	8
Hospitalized with ICU	0	0.0	0	0.0	0	0.0	4	1.0	4
Total	74	33.8	57	26.0	50	22.8	38	17.4	219

No., number; ICU, intensive care unit.

conditions of interest. Although most Army AC service members receive medical care through the MHS, some conditions diagnosed by providers outside of the MHS may not have been captured in the AHLTA electronic medical record. Regardless, all case patients had diagnosis histories available to review in the MHS, and all of the underlying health conditions of interest diagnosed by MHS providers were captured by reviewing electronic medical records for each patient.

Secondly, although the DRSi is the main system of record for surveillance of all cases of COVID-19 in the DoD, there are gaps in this reporting system that are well known.[15] It is likely that the DRSi does not capture all confirmed cases of COVID-19; however, several mitigating procedures were put into practice early on in the pandemic. COVID-19 surveillance training was provided to all DRSi reporters on 25 February 2020 in anticipation of an increase in the incidence of COVID-19 in the DoD population. Additionally, the Defense Health Agency (DHA) Army Satellite COVID-19 Surveillance Team has provided weekly training to Army personnel who have been assigned to report cases to the DRSi since mid-March 2020. The DHA Army Satellite COVID-19 Surveillance Team has also been collecting MHS laboratory data for all confirmed cases and contacting MTFs that have not yet reported cases as identified in the laboratory data. These efforts have led to a considerable increase in the usage of the DRSi for reporting COVID-19 cases, and MTFs have generally reported all known cases of COVID-19 as captured in other data sources to the DRSi within 24 hours of the diagnosis, per Army policy.

Finally, only the more serious cases that require diagnosis from a provider and laboratory confirmation are being captured in this surveillance study. Asymptomatic patients and those with mild illness that did not seek treatment would not be captured in this surveillance system; therefore, selection bias exists. The overall prevalence of COVID-19 is not yet well understood, including within the Army population.

All Army AC service members that are experiencing symptoms of COVID-19, including fever, cough, shortness of breath, or other symptoms should immediately contact their healthcare providers. Many Army installations have implemented higher health protection condition levels as their population sees widespread community transmission of COVID-19; the DHA Army Satellite COVID-19 Surveillance Team, in collaboration with the APHC COVID-19 Taskforce, is evaluating the impact of these strategies on the burden of COVID-19 at each installation.

Acknowledgments: The authors would like to thank the diligent work of the Army public health nurses, epidemiology technicians, and other public health professionals who have worked tirelessly in response to this pandemic.

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Special Report

Early Use of ICD-10-CM Code "U07.1, COVID-19" to Identify 2019 Novel Coronavirus Cases in Military Health System Administrative Data

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This report describes early exploratory analysis of ICD-10-CM code U07.1 (2019-nCoV acute respiratory disease [COVID-19]) to assess the use of administrative data for case ascertainment, syndromic surveillance, and future epidemiological studies. Out of the 2,950 possible COVID-19 cases identified between 1 April 2020 and 4 May 2020, 600 (20.3%) were detected in the Defense Medical Surveillance System (DMSS) and not in the Disease Reporting System internet (DRSi) or in Health Level 7 laboratory data from the Composite Health Care System. Among the 150 out of 600 cases identified exclusively in the DMSS and selected for Armed Forces Health Longitudinal Technology Application (AHLTA) review, 16 (10.7%) had a certified positive lab result in AHLTA, 17 (11.3%) met Council of State and Territorial Epidemiologists (CSTE) criteria for a probable case, 46 (30.7%) were not cases based on CSTE criteria, and 71 (47.3%) had evidence of a positive lab result from an outside source. Lack of full capture of lab results may continue to be a challenge as the variety of available tests expands. Administrative data may provide an important stopgap measure for detecting lab positive cases, pending incorporation of new COVID-19 tests and standardization of test and result nomenclature.

WHAT ARE THE NEW FINDINGS?

This study identified possible cases of COVID-19 in distinct data record systems that included laboratory tests for the coronavirus, DRSi reports of cases, and records of healthcare encounters that included the new ICD-10 code U07.1 for the disease. Examination of 150 encounter records for individuals who were not identified in the laboratory or DRSi records revealed that 69% had confirmatory lab results in separate records or met clinical criteria for a case of COVID-19.

WHAT IS THE IMPACT ON READINESS AND FORCE HEALTH PROTECTION?

The findings provide evidence that use of the new ICD-10 diagnostic code for COVID-19 is occurring more frequently since its introduction. Search of encounter records for this code will augment the other methods of performing surveillance for this disease. Such enhanced surveillance will enable actions to prevent and control the current COVID-19 epidemic, which threatens the health of the force.

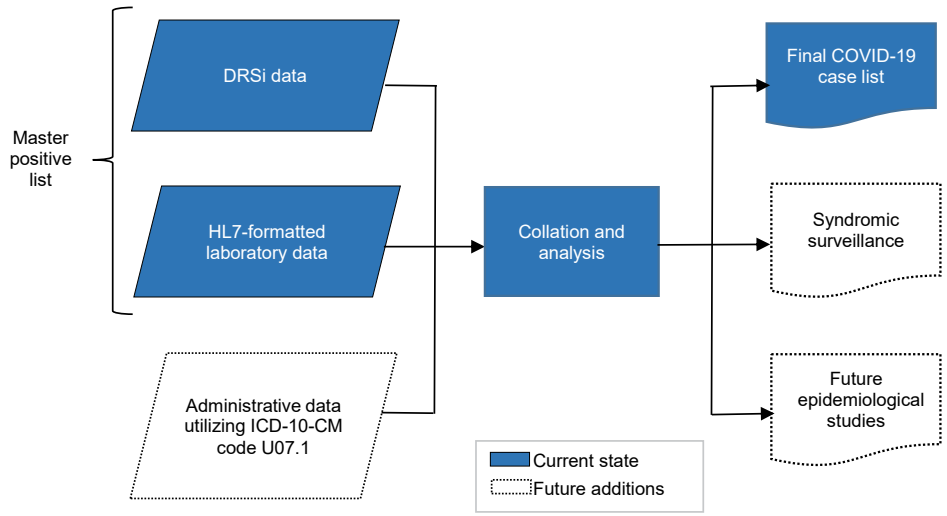
On 30 January 2020, the World Health Organization (WHO) declared that an outbreak of disease named 2019-nCoV, later named coronavirus disease 2019 (COVID-19), was a Public Health Emergency of International Concern.[1] One day later, on 31 January 2020, WHO convened an emergency meeting of the WHO Family of International Classifications Network and Statistics Advisory Committee to create a specific International Classification of Diseases, 10th Revision, Clinical Modification (ICD-10-CM) code for the new coronavirus: U07.1, 2019-nCoV acute respiratory disease.[2] On 20 February 2020, the U.S. Centers for Disease Control and Prevention (CDC) National Center for Health Statistics announced that it would implement the new ICD-10-CM code on 1 October 2020.[3]

Following the WHO declaration that the novel coronavirus was a global pandemic (11 March 2020)[4] and the President's activation of the Stafford Act (13 March 2020),[5] CDC, under sections 201 and 301 of the U.S. National Emergencies Act, announced that the effective date of the new diagnosis code would be moved from 1 October 2020 to 1 April 2020.[6]

The Military Health System (MHS) made ICD-10-CM code U07.1 available for selection by appointers and other administrative personnel in MHS GENESIS and the Composite Health Care System (CHCS) in early April 2020. Soon thereafter, the code became available to medical providers utilizing MHS GENESIS and the Armed Forces Health Longitudinal Technology Application (AHLTA) to document the diagnosis of COVID-19. Since the end of April 2020, epidemiologists and analysts have been able to query administrative databases including the MHS Data Repository (MDR), MHS Mart (M2), the CHCS, and the Defense Medical Surveillance System (DMSS) using the new code.

The Armed Forces Health Surveillance Branch (AFHSB) creates a daily master positive list of COVID-19 cases by combining data from the Disease Reporting System internet (DRSi) and Health Level 7 (HL7)-formatted laboratory data (HL7 data) extracted from the CHCS and MHS GENESIS by the Navy and Marine Corps Public Health Center. The availability of the specific ICD-10-CM code U07.1 provides a new source of data for identification of possible cases of COVID-19 using the electronic health record (EHR). It also provides an opportunity to create a COVID-19-like illnesses (CLI) case definition for syndromic surveillance modeled after influenza-like illness (ILI) surveillance. This report documents early exploratory analysis of ICD-10-CM code U07.1 to assess the potential use of administrative

FIGURE 1. COVID-19 data sources and products



COVID-19, coronavirus disease 2019; DRSi, Disease Reporting System internet; HL7, Health Level 7; ICD-10-CM, International Classification of Diseases, 10th Revision, Clinical Modification.

data for case ascertainment and use of the code for syndromic surveillance and future epidemiological studies **(Figure 1)**.

METHODS

On 4 May 2020, the DMSS was searched for all patient encounters that contained ICD-10-CM code U07.1 in any diagnostic position. This list of possible COVID-19 cases was compared to the master positive list (cases identified based on positive test for severe acute respiratory syndrome coronavirus 2, or SARS-CoV-2, the virus that causes COVID-19, and/or those who were reported as cases in the DRSi between 1 April 2020 and 4 May 2020). A convenience sample (25%) of these cases was selected for record review in AHLTA. Within AHLTA, for each case, information contained in the lab, radiology, previous encounters, Joint Legacy Viewer, and Health Artifact and Image Management Solution sections was reviewed by a licensed medical provider using a standardized Excel spreadsheet and systematic AHLTA review process. Cases in the DMSS-only subset were categorized as *probable*, *confirmed*, or *determined not to be a case* based on the guidelines established by the Council of State and Territorial Epidemiologists (CSTE)[7] **(Table)**.

On 8 May 2020, a 10-day "look-back" was performed. A separate DMSS list (U07.1 ICD-10-CM code list) from 28 April 2020 was compared with the master positive list (DRSi and/or HL7 data list) from 8 May 2020 to determine the number of DMSS U07.1 coded cases that were subsequently identified on the master positive list and, therefore, would have been captured without the use of administrative data.

Note that MHS GENESIS medical encounters did not become available in the DMSS until after this analysis was performed. While laboratory results from MHS GENESIS sites were included in this analysis, MHS GENESIS medical encounters were not included here.

RESULTS

There were 2,350 individuals captured on the master positive list (cases identified based on positive lab test and/or those who were reported as cases in the DRSi between 1 April 2020 and 4 May 2020) and 865 individuals who were identified as having an encounter for COVID-19 (ICD-10-CM code U07.1) during the same time period. Among the 2,950 total individuals identified, 2,085 were exclusively on the master positive list, 600 were exclusively on the ICD-10-CM U07.1 diagnosis code list, and 265 were on both **(Figure 2)**.

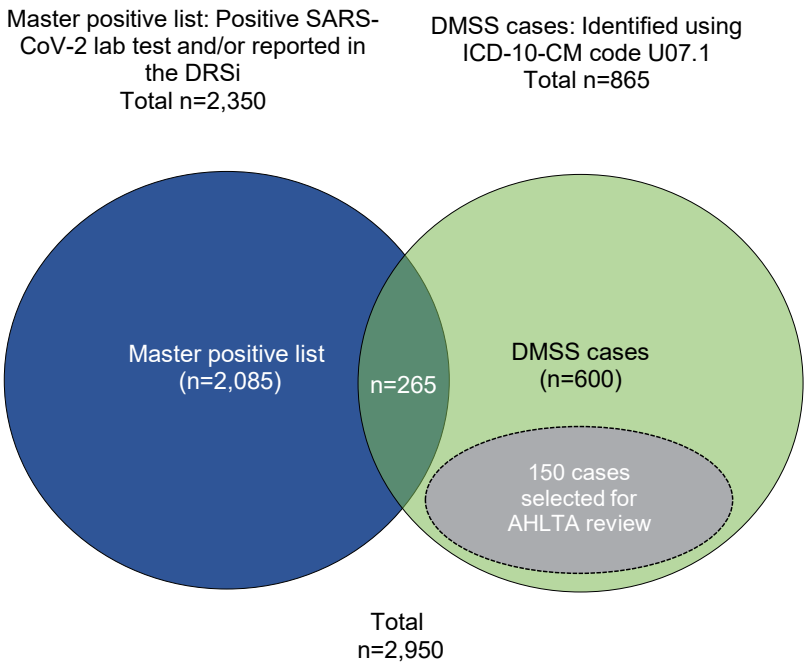
Among the 150 out of 600 cases identified exclusively in the DMSS and selected for AHLTA review, 16 (10.7%) had a certified positive lab result in the laboratory section of AHLTA, 17 (11.3%) met CSTE criteria for a probable case, 46 (30.7%) were not cases based on CSTE criteria, and 71 (47.3%) had evidence of a positive lab result from an outside source **(Figure 3)**. Among the 46 cases that were determined not to be cases, 26 (56.5%) were

TABLE. CSTE standardized surveillance case definition for COVID-19

CONFIRMED:
• Meets confirmatory laboratory evidence.
PROBABLE:
• Meets clinical criteria AND epidemiologic evidence with no confirmatory laboratory testing performed for COVID-19.
• Meets presumptive laboratory evidence AND either clinical criteria OR epidemiologic evidence.
• Meets vital records (i.e., death certificate) criteria with no confirmatory laboratory testing performed for COVID-19.

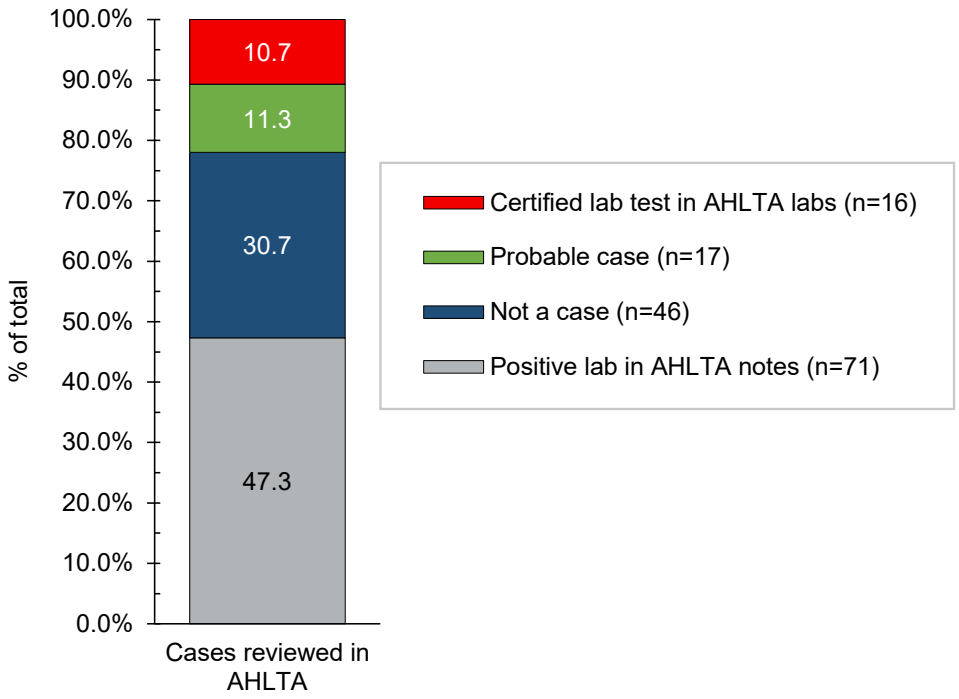
CSTE, Council of State and Territorial Epidemiologists; COVID-19, coronavirus disease 2019.

FIGURE 2. COVID-19 case identification using the master positive list and ICD-10-CM code U07.1, 1 April 2020–1 May 2020



COVID-19, coronavirus disease 2019; ICD-10-CM, International Classification of Diseases, 10th Revision, Clinical Modification; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2; DRSi, Disease Reporting System internet; DMSS, Defense Medical Surveillance System; AHLTA, Armed Forces Health Longitudinal Technology Application.

FIGURE 3. Cases reviewed in AHLTA (150 cases out of 600 total)



AHLTA, Armed Forces Health Longitudinal Technology Application.

seen for screening (e.g., pre-deployment screening rather than COVID-19 itself).

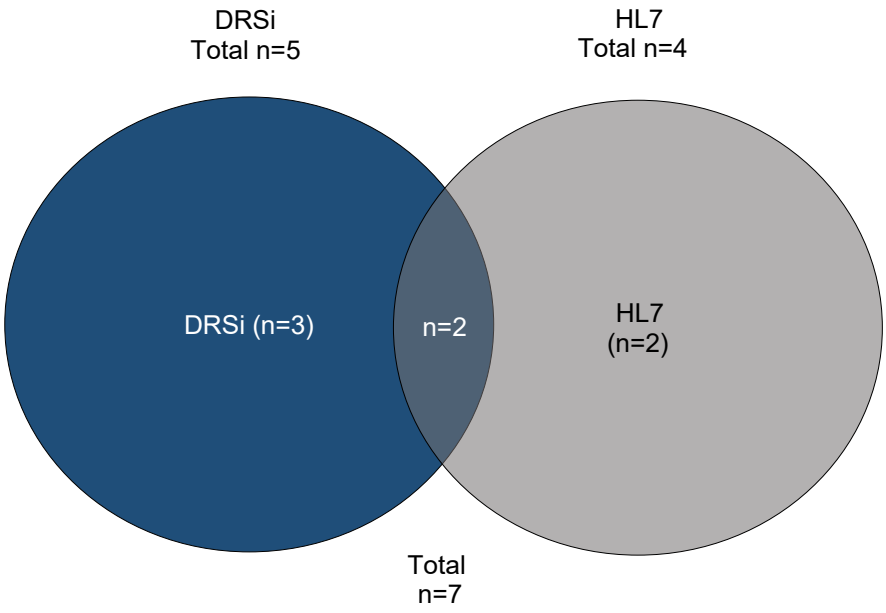
On 28 April 2020, there were 64 individuals on the U07.1 code-only list. By 8 May 2020, 7 (10.9%) had made it onto the master positive list (3 cases were represented exclusively in the DRSi, 2 cases were represented exclusively in HL7 data, and 2 were represented in both data sources) **(Figure 4)**.

EDITORIAL COMMENT

Availability of ICD-10-CM code U07.1 in administrative data is an important new development in COVID-19 surveillance. Given that 600 out of the 2,950 possible cases (20.3%) reviewed here were detected in administrative data and not in DRSi or HL7 data, addition of encounter data appears to be important to ensuring complete case capture moving forward.

Among the 150 cases selected for AHLTA review, 16 cases (10.7%) identified in encounter data were found to have a military treatment facility (MTF)-certified lab result in the AHLTA labs section but were not identified in the DRSi or the HL7 data and, therefore, were not represented on the master positive list. The 10-day look-back revealed that 7 cases were subsequently identified and entered into the master positive list, 2 of which were found exclusively in HL7 data, 3 of which were exclusively in DRSi data, and 2 of which were in both. While some of the remaining lab cases may eventually make it into the HL7 data, 2 of the missed lab results were from early April (2 April 2020 and 3 April 2020), suggesting that they might escape recognition altogether. Given that SARS-CoV-2 laboratory test names and results are not standardized in CHCS or HL7 data, this is understandable. While capture of these cases will likely improve as naming conventions are standardized and algorithms aimed at capturing COVID-19 test results evolve, lack of full capture of lab results may continue to be a challenge as the variety of tests available continues to expand. Administrative data may provide an important stopgap measure for detecting lab positive cases, pending incorporation of new COVID-19

FIGURE 4. Ten-day look-back for identification of cases that were initially not found but subsequently identified in DRSi and/or HL7 data



DRSi, Disease Reporting System internet; HL7 data, Health Level 7-formatted laboratory data.

tests and standardization of test and result nomenclature.

The CSTE definitions for confirmed and probable cases of COVID-19 are provided in the **Table.**[7] Among the 150 cases reviewed, there were 17 probable cases of COVID-19: 2 had presumptive positive lab test results and met clinical or epidemiologic criteria; 15 met clinical and epidemiologic criteria. Among the 150 cases reviewed, 8 patients were hospitalized and 11 had chest imaging (x-ray or computed tomography [CT] scan) consistent with COVID-19.

It could be argued that cases with both clinical and radiographic evidence of COVID-19 should be categorized as cases. This approach is substantiated by Ai and colleagues, who performed serial analyses of reverse transcriptase polymerase chain reaction (RT-PCR) and CT scans and found that, using RT-PCR as a reference, the sensitivity of chest imaging for COVID-19 was 97%.[8] Use of radiographic criteria for case identification would increase the proportion of individuals identified as cases in the EHR from 87 total cases (58.0%) to 98 total cases (65.3%). In this analysis, the CSTE case definition was applied to remain consistent with current public health practice.

Among the 150 AHLTA cases reviewed, the largest group of patients, 71 (47.3%), received lab testing at an outside facility, such as an urgent care center, hospital, or state health department, along with a documented encounter (most frequently a telephone consult) at an MTF. Lab results were sometimes scanned into the record and the test location was documented in 51/71 cases (71.8%). Given that these tests were not entered into the CHCS, they had no opportunity to be detected in HL7 data. The DRSi, a passive surveillance system with known limitations related to personnel, training, and accessibility, also did not identify these cases.[9] This again demonstrates the value of using administrative data for comprehensive case capture.

Outsourced medical encounter data are available in MHS systems (e.g., the MDR, M2, and DMSS) after an encounter is billed. The billing process can take weeks to months, especially if a patient is hospitalized for a prolonged period of time. In the current analysis, many outsourced encounters not reported in the DRSi were detected because they were associated with a telephone consult undertaken for case management or public health purposes. Coding of the telephone consultations in the EHR allowed identification of cases at the time of illness rather than weeks later, as would be the case had these consults not been recorded. This finding suggests that the EHR may be an important adjunct to the DRSi for identification of cases requiring contact tracing.

The current analysis included 46 individuals (30.7%) who did not meet CSTE criteria for COVID-19 but who were, nonetheless, documented as having COVID-19, based solely on the ICD-10-CM U07.1 code. This misclassification was due to the use of ICD-10-CM code U07.1 for documentation of pre-deployment screening among asymptomatic service members rather than the appropriate screening code (ICD-10-CM code Z11.59, encounter for screening for other viral disease) in 56.5% of the 46 cases. Given the prospect of increased screening among recruits and other large military groups, continued improper use of this code for screening purposes could lead to significant misclassification of cases in the future, undermining the value of ICD-10-CM code U07.1 for case identification and development of a case definition for CLI syndromic surveillance. "ICD-10-CM Official Coding and Reporting Guidelines, 1 April 2020 through 30 September 2020" advises against assigning ICD-10-CM code U07.1 to unconfirmed cases, including suspected, possible, probable, and inconclusive cases. It further directs the use of ICD-10-CM code Z11.59 for asymptomatic screening.[10] The 13 May 2020 Defense Health Agency memorandum "Standardizing COVID-19 Laboratory Orders to Distinguish Among Diagnostic, Screening and Surveillance Testing Purposes" elaborates on these recommendations.[11] Wide dissemination of these guidelines is warranted.

This review attempted to rapidly evaluate early use of ICD-10-CM code U07.1 in order to assure the accuracy of AFHSB's master positive list and to develop of a reliable CLI case definition. In the interest of timeliness, information in the medical record was extracted by a single individual rather than multiple providers, as would be required in a formal case series or systematic review. In addition, a convenience sample

(the first 150 out of 600 cases) rather than a randomly selected sample of AHLTA cases was designated for review. These factors limit the validity and generalizability of the analysis. This analysis is further limited by the small number of cases reviewed and the fact that it was performed soon after adoption of ICD-10-CM code U07.1. Recognizing these limitations, it appears that use of ICD-10-CM code U07.1 to query administrative databases allows identification of cases that would not otherwise be detected using DRSi and HL7 data alone. Advocacy for use of administrative data to identify cases is tempered somewhat not only by the potential for misclassification but also by the manpower required to review the electronic medical record and apply CSTE guidelines for appropriate case classification. Lipstitch and colleagues astutely recognized that "case-based surveillance places exponentially increasing burdens on public health systems" and highlighted the importance of transitioning from case-based surveillance to automated syndromic surveillance as pandemics evolve.[12]

The use of ICD-10-CM code U07.1 for syndromic surveillance and future epidemiological studies warrants continued exploration, especially given use of this code for screening purposes and resultant misclassification. Continued addition of codes such as ICD-10-CM U07.2 COVID-19, virus not detected[13] and refinement of codes sets used for syndromic surveillance will provide greater understanding of how COVID-19 is affecting military members and military-associated populations and ensure the integrity of future epidemiological studies related to COVID-19.

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Medical Surveillance Monthly Report (MSMR)
Armed Forces Health Surveillance Branch
11800 Tech Road, Suite 220
Silver Spring, MD 20904

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ISSN 2158-0111 (print)
ISSN 2152-8217 (online)