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Update: Cold Weather Injuries, Active and Reserve Components, U.S. Armed Forces, July 2016–June 2021

From July 2020 through June 2021, a total of 539 members of the active (n=469) and reserve (n=70) components had at least 1 medical encounter with a primary diagnosis of cold injury. The crude overall incidence rate of cold injury for all active component service members in 2020–2021 (35.4 per 100,000 person-years [p-yrs]) was higher than the rate for the 2019–2020 cold season (27.5 per 100,000 p-yrs). In 2020–2021, frostbite was the most common type of cold injury among active component service members in all 4 services. Among active component members during the 2016–2021 cold seasons, overall rates of cold injuries were generally highest among male service members, non-Hispanic Black service members, the youngest (less than 20 years old), and those who were enlisted. The number of cold injuries associated with overseas deployments during the 2020–2021 cold season (n=10) was the lowest count during the 5-year surveillance period. Immersion foot accounted for half (n=5) of the cold weather injuries diagnosed and treated in service members deployed outside of the U.S. during the 2020–2021 cold season.

WHAT ARE THE NEW FINDINGS?

For all active component service members, the rate of cold weather injuries in 2020–2021 increased compared to the previous cold year. Cold injury rates were much higher among members of the Marine Corps and Army. The number of cold injuries associated with deployment during 2020–2021 was the same as last cold year and lower than the preceding cold years.

WHAT IS THE IMPACT ON READINESS AND FORCE HEALTH PROTECTION?

Military training and combat operations will require continued emphasis on effective cold weather injury prevention strategies and adherence to the policies and procedures in place to protect service members against such injuries.

Cold weather injuries are of significant military concern because of their adverse impact on operations and the high financial costs of treatment and disability.[1,2] In response, the U.S. Armed Forces have developed and improved training, doctrine, procedures, and protective equipment and clothing to counter the threat from cold environments.[3–8] Although these measures are highly effective, cold injuries have continued to affect hundreds of service members each year because of exposure to cold and wet environments.[9]

The term cold weather injuries is used to describe injuries that have a central effect, such as hypothermia, as well as injuries that primarily affect the peripheries of the body, such as frostbite and immersion injuries. The human physiologic response to cold exposure is to retard heat loss and preserve core body temperature, but this response may not be sufficient to prevent hypothermia if heat loss is prolonged.[9] Moreover, the response includes constriction of the peripheral (superficial) vascular system, which may result in non-freezing injuries or hasten the onset of actual freezing of tissues (frostbite).[9]

Hypothermia occurs when the core temperature of the body falls below 95 °F.[7] The most common mechanisms of accidental hypothermia are convective heat loss to cold air and conductive heat loss to water.[10] Freezing temperatures are not required to produce hypothermia.[10] In response to cold stress, peripheral blood vessels constrict and the hypothalamus stimulates heat production through shivering and elevated thyroid, adrenal, and catecholamine activity.[10] The sympathetic nervous system mediates further vasoconstriction to minimize heat loss by reducing blood flow to the extremities, where the most cooling occurs.[10] As the body's basal metabolic rate decreases, core temperature falls, body functions slow down, and muscular and cerebral functions are impaired.[10] Neurologic functioning begins declining even above a core body temperature of 95 °F.[11] Severe hypothermia can lead to pulmonary edema, reduced heart rate, coma, ventricular arrhythmias (including ventricular fibrillation), and asystole.[10–12]

Cold injuries affecting the body's peripheries can be classified as freezing and non-freezing injuries.[13] Freezing peripheral injury is defined as the damage sustained by tissues when exposed to temperatures below freezing.[13] The tissue damage of frostbite is the result of both direct cold-induced cell death and the secondary effects of microvascular thrombosis and subsequent ischemia.[14] Rapid freezing generally results in extra- and intracellular ice crystal formation.[15] These crystals cause direct injury to the cell membrane that results in cellular dehydration, lipid derangement, electrolyte fluxes as well as membrane lysis, and cell death.[14–16] An inflammatory process follows, resulting in tissue ischemia and additional cell death.[15] The initial cellular damage and the ensuing inflammatory processes are worsened with thawing of the affected area.[15,16] With rewarming, edema from melting ice crystals leads to epidermal blister formation and ischemia-reperfusion injury may be initiated[14–16]; vasoconstriction and platelet aggregation caused by inflammatory mediators, prostaglandins, and thromboxanes exacerbate ischemia.[17] The areas of the body most frequently affected by frostbite include the ears, nose, cheeks, chin, fingers, and toes.[18,19] A substantial proportion of patients with peripheral frostbite experience permanent changes in their microcirculation and disruption of local neurological functions (e.g., reduced sensation in the affected area).[19] Although most frostbite damage is minor, severe injury may lead to impaired functioning and ability to work because of cold hypersensitivity, chronic ulceration, vasospasm, localized osteoarthritis, and/or chronic pain.[14,19]

Non-freezing peripheral cold injury includes a spectrum of localized injuries to the soft tissues, nerves, and vasculature of distal extremities that result from prolonged exposure (12 to 48 hours) to wet, cold (generally 32 to 59 °F) conditions; the injury process generally happens at a slower rate in warmer water.[13,20] Although non-freezing peripheral cold injuries most often involve feet (immersion foot), any dependent body part can be affected by the condition, including the hands.[21] Immersion foot generally presents as waterlogging of the feet, with the most marked effect occurring in the soles.[17,20] The foot becomes hyperemic (increased blood flow), painful, and swollen with continuous exposure; progression to blistering, decreased blood flow, ulceration, and gangrene is gradual.[17,20] Long-term complications of non-freezing cold injury such as immersion foot are similar to (e.g., hypersensitivity to cold, chronic pain) and as debilitating as (e.g., severe pain provoked by walking) those produced by frostbite.[14,16,17,20]

Factors that increase the risk of cold weather injuries include outdoor exposure, inadequate and/or wet clothing, cold water submersion, older age, exhaustion, dehydration, inadequate caloric intake, alcohol use, smoking (frostbite), previous cold injury (frostbite or immersion foot), chronic disease (e.g., peripheral vascular disease, diabetes), and medications that impair compensatory responses (e.g., oral antihyperglycemics, beta-blockers, general anesthetic agents).[12–14,17–19] Situational factors that increase risk of immersion foot include immobility, wet socks, and constricting boots.[17,22]

Traditional measures to counter the dangers associated with cold environments include minimizing loss of body heat and protecting superficial tissues through such means as protective clothing, shelter, physical activity, and nutrition. However, military training or mission requirements in cold and wet weather may place service members in situations where they may be unable to be physically active, find warm shelter, or change wet or damp clothing.[2–4]

For the military, continuous surveillance of cold weather injuries is essential to inform steps to reduce their impact as well as to remind leaders of this predictable threat. Since 2004, the *MSMR* has published an annual update on the incidence of cold weather injuries that affected U.S. military members during the 5 most recent cold seasons.[23] The content of this 2021 report addresses the occurrence of such injuries during the cold seasons from July 2016 through June 2021. The timing of the annual updates is intended to call attention to the recurring risks of such injuries as winter approaches in the Northern Hemisphere, where most members of the U.S. Armed Forces are assigned.

METHODS

The surveillance period was 1 July 2016 through 30 June 2021. The surveillance population included all individuals who served in the active or reserve component of the U.S. Armed Forces at any time during the surveillance period. For analysis purposes, “cold years” or “cold seasons” were defined as 1 July through 30 June intervals so that complete cold weather seasons could be represented in year-to-year summaries and comparisons.

Because cold weather injuries represent a threat to the health of individual service members and to military training and operations, the U.S. Armed Forces require expeditious reporting of these reportable medical events (RMEs) via one of the service-specific electronic reporting systems; these reports are routinely incorporated into the Defense Medical Surveillance System (DMSS). For this analysis, the DMSS and the Theater Medical Data Store (which maintains electronic records of medical encounters of deployed service members) were searched for records of RMEs and inpatient and outpatient care for the diagnoses of interest (frostbite, immersion injury, and hypothermia). A case was defined by the presence of an RME or one of any qualifying International Classification of Diseases, 9th or 10th revision (ICD-9 and ICD-10, respectively) code in the first diagnostic position of a record of a health care encounter **(Table 1)**. The Department of Defense guidelines for RMEs require the reporting of cases of hypothermia, freezing peripheral injuries (i.e., frostbite), and non-freezing peripheral injuries (i.e., immersion injuries, chilblains).[24] Cases of chilblains are not included in this report because the condition is common, infrequently diagnosed, usually mild in severity, and thought to have minimal medical, public health, or military impacts. Because of an update to the Disease Reporting System internet (DRSi) medical event reporting system in July 2017, the type of RMEs for cold injury (i.e., frostbite, immersion injury, hypothermia) could not be distinguished using RME records in DMSS data. Instead, information on the type of RME for cold injury between July 2017 and June 2021 were extracted from DRSi and then combined with DMSS data.

To estimate the number of unique individuals who suffered a cold injury each cold season and to avoid counting follow-up health care encounters after single episodes of cold injury, only 1 cold injury per individual per cold season was included. A slightly different approach was taken for summaries of the incidence of the different types of cold injury diagnoses. In counting types of diagnoses, 1 of each type of cold injury per individual per cold season was included. For example, if an individual was diagnosed with immersion foot at one point during a cold season and then with frostbite later during the same cold season, each of those different types of injury would be counted in the tally of injuries. If a service member had multiple medical encounters for cold injuries on the same day, only 1 encounter was used for analysis (hospitalizations were prioritized over ambulatory visits, which were prioritized over RMEs).

Annual incidence rates of cold injuries among active component service members

TABLE 1. ICD-9/ICD-10 diagnostic codes for cold weather injuries

	ICD-9	ICD-10[a]
Frostbite	991.0,991.1, 991.2, 991.3	T33.*, T34.*
Immersion hand and foot	991.4	T69.0*
Hypothermia	991.6	T68.*

[a]An asterisk (*) indicates that any subsequent digit/character is included.
ICD, International Classification of Diseases.

were calculated as incident cold injury diagnoses per 100,000 person-years (p-yrs) of service. Annual rates of cold injuries among reservists were calculated as cases per 100,000 persons using the total number of reserve component service members for each year of the surveillance period. Counts of persons were used as the denominator in these calculations because information on the start and end dates of active duty service periods of reserve component members was not available.

The numbers of cold injuries were summarized by the locations at which service members were treated for these injuries as identified by the Defense Medical Information System Identifier (DMIS ID) recorded in the medical records of the cold injuries. Because such injuries may be sustained during field training exercises, temporary duty, or other instances for which a service member may not be located at his/her usual duty station, DMIS ID was used as a proxy for the location where the cold injury occurred.

It should be noted that medical data from sites that were using the new electronic health record for the Military Health System, MHS GENESIS, between July 2017 and October 2019 are not available in the DMSS. These sites include Naval Hospital Oak Harbor, Naval Hospital Bremerton, Air Force Medical Services Fairchild, and Madigan Army Medical Center. Therefore, medical encounter data for individuals seeking care at any of these facilities from July 2017 through October 2019 were not included in the current analysis.

RESULTS

2020–2021 cold season

From July 2020 through June 2021, a total of 539 members of the active (n=469) and reserve (n=70) components had at least 1 medical encounter with a primary diagnosis of cold injury **(Table 2)**. The Army contributed nearly five-eighths (62.0%; n=291) of all cold injury diagnoses in the active component during the 2020–2021 cold season; across the services during this period, active component Army members had the highest rate of cold injury diagnoses (61.0 per 100,000 p-yrs). Active component Marine Corps members had the second highest rate of cold injury diagnoses during the 2020–2021 cold season (54.4 per 100,000 p-yrs). Navy service members (n=25) had the lowest service-specific rate of cold injuries during the 2020–2021 cold season (7.4 per 100,000 p-yrs) **(Table 2, Figure 1)**.

This update for 2020–2021 represents the fifth time that annual rates of cold injuries for members of the reserve component were estimated. Army personnel (n=42) accounted for three-fifths (60.0%) of all reserve component service members (n=70) affected by cold injuries during 2020–2021 **(Table 2)**. Service-specific annual rates of cold injuries among reserve component members were highest among those in the Marine Corps (22.8 per 100,000 persons) and lowest

TABLE 2. Any cold injury (1 per person per year), by service and component, July 2016–June 2021

	Army		Navy		Air Force		Marine Corps		All services	
Active component	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]
All years (2016–2021)	1,305	55.7	138	8.4	238	14.8	459	50.2	2,140	32.9
Jul 2016–Jun 2017	209	45.4	36	11.3	45	14.4	91	50.0	381	30.0
Jul 2017–Jun 2018	299	64.3	29	9.1	46	14.5	93	50.7	467	36.3
Jul 2018–Jun 2019	275	59.1	21	6.4	46	14.3	118	63.9	460	35.4
Jul 2019–Jun 2020	231	48.7	27	8.1	46	14.0	59	32.0	363	27.5
Jul 2020–Jun 2021	291	61.0	25	7.4	55	16.7	98	54.4	469	35.4
Reserve component										
All years (2016–2021)	214		12		42		58		326	
Jul 2016–Jun 2017	38	17.0	1	12	8	10.5	11	58	58	14.1
Jul 2017–Jun 2018	54	25.0	3	1	5	6.6	17	11	79	19.6
Jul 2018–Jun 2019	44	20.7	1	3	6	7.9	16	17	67	16.7
Jul 2019–Jun 2020	36	16.9	2	1	10	13.1	4	16	52	13.0
Jul 2020–Jun 2021	42	20.1	5	2	13	17.0	10	4	70	17.8
Overall, active and reserve components				5				10		
All years (2016–2021)	1,519		150		280		517		2,466	
Jul 2016–Jun 2017	247		37		53		102		439	
Jul 2017–Jun 2018	353		32		51		110		546	
Jul 2018–Jun 2019	319		22		52		134		527	
Jul 2019–Jun 2020	267		29		56		63		415	
Jul 2020–Jun 2021	333		30		68		108		539	

*For active component, rate is per 100,000 person-years. For reserve component, rate is per 100,000 persons.
No., number.

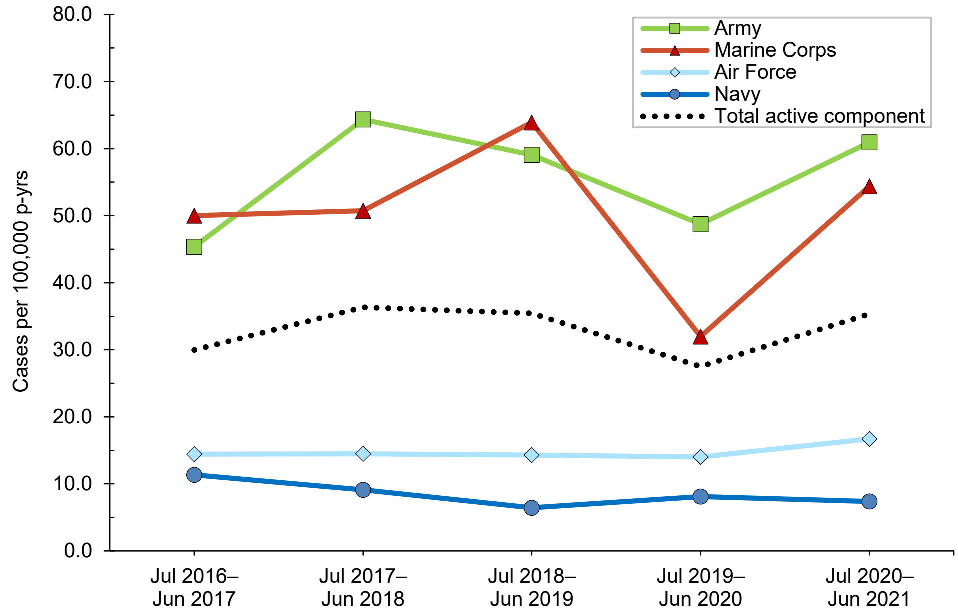
among those in the Navy (7.7 per 100,000 persons) **(Figure 2)**.

When all injuries were considered, not just the numbers of individuals affected, frostbite was the most common type of cold injury (n=287; 61.1% of all cold injuries) among active component service members in 2020–2021 **(Tables 3a–3d)**. In the Air Force during the 2020–2021 season, 81.8% of all cold injuries were frostbite, whereas the proportions in the Army (59.9%), Marine Corps (58.2%), and Navy (40.0%) were much lower. For all active component service members during 2020–2021, the proportions of total cold weather injuries that were hypothermia and immersion injuries were 16.0% and 23.0%, respectively **(Tables 3a–3d)**. Among active component Air Force members, the numbers and rates of frostbite and hypothermia injuries in the 2020–2021 cold season were the highest of the past 5 years while the number and rate of immersion foot were the lowest during this period **(Table 3c)**. Among active component Army and Marine Corps members, the numbers and rates of hypothermia injuries in the 2020–2021 cold season were the lowest during the 5-year **(Table 3a, Table 3d)**. The number and rate of frostbite injuries among Marine Corps members during the 2020–2021 season were the highest of the past 5 years.

Five cold seasons: July 2016–June 2021

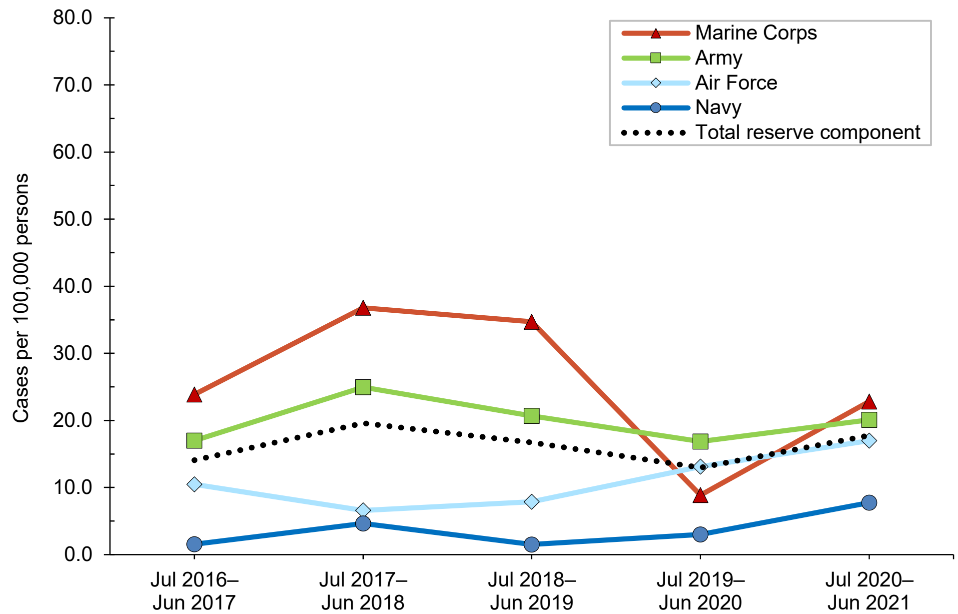
The crude overall incidence rate of cold injury for all active component service members in 2020–2021 (35.4 per 100,000 p-yrs) was 28.5% higher than the rate for the 2019–2020 cold season (27.5 per 100,000 p-yrs) **(Table 2, Figure 1)**. Throughout the surveillance period, the cold injury rates were consistently higher among active component members of the Army and the Marine Corps than among those in the Air Force and Navy **(Figure 1)**. In 2020–2021, the service-specific incidence rate for active component Army members (61.0 per 100,000 p-yrs) was higher than the 2019–2020 Army rate (48.7 per 100,000 p-yrs). For the Marine Corps, the active component rate for 2020–2021 increased 70.1% between the 2019–2020 season and the 2020–2021 season. Service-specific annual rates of cold injuries among reserve component members were consistently higher among those in the Army than among those in the Air Force or the Navy **(Figure 2)**. As was true for active component Marine Corps members, the 2020–2021 rate

FIGURE 1. Annual incidence rates of cold injuries (1 per person per year), by service, active component, U.S. Armed Forces, July 2016–June 2021



P-yrs, person-years.

FIGURE 2. Annual incidence rates of cold injuries (1 per person per year), by service, reserve component, U.S. Armed Forces, July 2016–June 2021



of cold injuries among reserve component Marine Corps members was higher (157.5%) than the rate for the previous season.

During the 5-year surveillance period, the rates of cold injuries among members of the active components of the Navy, Air Force, and Marine Corps were higher among male than female service members **(Tables 3a–3d)**. Among active component members in the Navy, Air Force, and Marine Corps, the overall rates among male service members ranged from 1.6 to 2.0 times higher than those among female service members. During 2016–2021, female service members had lower rates of immersion foot than did male service members. With the exception of the Army, female service members also had lower rates of frostbite; with the exception of the Marine Corps female service members had lower rates of hypothermia **(Tables 3a–3d)**. For active component service members in all 4 services combined, the overall rate of cold injury was 40.4% higher among male service members (35.4 per 100,000 p-yrs) than among female service members (25.3 per 100,000 p-yrs) **(data not shown)**.

In all of the services, overall rates of cold injuries were higher among non-Hispanic Black service members than among those of the other race/ethnicity groups. In particular, within the Marine Corps and Army and for all services combined, rates of cold injuries were more than twice as high among non-Hispanic Black service members as rates among either non-Hispanic White service members or those in the "other/unknown" race/ethnicity group **(Tables 3a–3d)**. The major underlying factor in these differences is that rates of frostbite among non-Hispanic Black members from all services combined was more than 3 times that of the other race/ethnicity groups, with the biggest differences apparent in the Marine Corps (more than 5 times) and the Army (more than 2.8 times) **(data not shown)**. Additionally, across the active components of all services during 2016–2021, non-Hispanic Black service members had incidence rates of cold injuries greater than the rates of other race/ethnicity groups in nearly every military occupational category **(data not shown)**.

Across the services, rates of cold injuries were highest among the youngest service members and tended to decrease with increasing age **(Tables 3a–3d)**. Enlisted members of all 4 services had higher rates than officers. In the Army, Air Force, and Marine Corps rates of all cold injuries combined were highest among service members in combat-specific occupations (infantry/artillery/combat engineering/armor) **(Tables 3a, 3c–3d)**. For active component Navy members, rates of cold injuries during the 5-year period were highest among those in motor transport occupations **(Table 3b)**.

During the 5-year surveillance period, the 2,466 service members who were affected by any cold injury included 2,140 (86.8%) from the active component and 326 (13.2%) from the reserve component. Of all affected reserve component members, 65.6% (n=214) were members of the Army **(Table 2)**. Overall, soldiers accounted for slightly more than three-fifths (61.6%) of all cold injuries affecting active and reserve component service members **(Table 2, Figure 3)**.

TABLE 3a. Counts and incidence rates of cold injuries (1 per type per person per year), active component, U.S. Army, July 2016–June 2021

	Frostbite		Immersion injury		Hypothermia		All cold injuries	
	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]
Total	742	31.7	405	17.3	202	8.6	1,349	57.6
Sex								
Male	606	30.5	364	18.3	175	8.8	1,145	57.6
Female	136	38.5	41	11.6	27	7.7	204	57.8
Race/ethnicity group								
Non-Hispanic White	270	20.8	186	14.3	109	8.4	565	43.6
Non-Hispanic Black	336	68.8	153	31.3	60	12.3	549	112.3
Other/unknown	136	24.4	66	11.8	33	5.9	235	42.2
Age group (years)								
<20	72	41.9	55	32.0	35	20.4	162	94.3
20–24	310	43.2	203	28.3	102	14.2	615	85.6
25–29	165	30.5	90	16.7	46	8.5	301	55.7
30–34	98	26.8	27	7.4	13	3.6	138	37.8
35–39	52	18.5	20	7.1	3	1.1	75	26.7
40–44	24	15.5	4	2.6	2	1.3	30	19.4
45+	21	18.9	6	5.4	1	0.9	28	25.3
Rank								
Enlisted	661	35.1	384	20.4	186	9.9	1,231	65.4
Officer	81	17.6	21	4.6	16	3.5	118	25.6
Military occupation								
Combat-specific[b]	265	45.6	181	31.2	102	17.6	548	94.4
Motor transport	24	32.6	14	19.0	4	5.4	42	57.1
Repair/engineering	115	23.9	69	14.3	25	5.2	209	43.4
Communications/intelligence	192	33.3	82	14.2	44	7.6	318	55.1
Health care	42	17.6	16	6.7	7	2.9	65	27.2
Other/unknown	104	26.7	43	11.0	20	5.1	167	42.8
Cold year (July–June)								
2016–2017	138	30.0	35	7.6	37	8.0	210	45.6
2017–2018	172	37.0	88	18.9	44	9.5	304	65.4
2018–2019	143	30.7	107	23.0	40	8.6	290	62.3
2019–2020	114	24.1	94	19.8	45	9.5	253	53.4
2020–2021	175	36.7	81	17.0	36	7.5	292	61.2

[a]Rate per 100,000 person-years.
[b]Infantry/artillery/combat engineering/armor.
No., number.

TABLE 3b. Counts and incidence rates of cold injuries (1 per type per person per year), active component, U.S. Navy, July 2016–June 2021

	Frostbite		Immersion injury		Hypothermia		All cold injuries	
	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]
Total	62	3.8	33	2.0	43	2.6	138	8.4
Sex								
Male	56	4.3	29	2.2	35	2.7	120	9.1
Female	6	1.9	4	1.2	8	2.5	18	5.6
Race/ethnicity group								
Non-Hispanic White	31	3.7	14	1.7	22	2.7	67	8.1
Non-Hispanic Black	17	6.7	4	1.6	9	3.6	30	11.9
Other/unknown	14	2.5	15	2.7	12	2.2	41	7.4
Age group (years)								
<20	2	2.1	3	3.2	6	6.4	11	11.7
20–24	13	2.7	14	2.9	14	2.9	41	8.4
25–29	27	6.6	8	2.0	16	3.9	51	12.5
30–34	8	2.9	6	2.1	3	1.1	17	6.1
35–39	7	3.5	1	0.5	4	2.0	12	6.0
40–44	1	1.0	1	1.0	0	0.0	2	1.9
45+	4	6.1	0	0.0	0	0.0	4	6.1
Rank								
Enlisted	50	3.7	32	2.4	41	3.0	123	9.0
Officer	12	4.4	1	0.4	2	0.7	15	5.5
Military occupation								
Combat-specific[b]	10	9.8	0	0.0	4	3.9	14	13.8
Motor transport	3	4.7	3	4.7	16	25.0	22	34.4
Repair/engineering	13	1.8	16	2.2	9	1.3	38	5.3
Communications/intelligence	8	3.1	3	1.1	5	1.9	16	6.1
Health care	14	7.8	1	0.6	3	1.7	18	10.0
Other/unknown	14	4.5	10	3.2	6	1.9	30	9.7
Cold year (July–June)								
2016–2017	8	2.5	15	4.7	13	4.1	36	11.3
2017–2018	15	4.7	9	2.8	5	1.6	29	9.1
2018–2019	15	4.6	1	0.3	5	1.5	21	6.4
2019–2020	14	4.2	6	1.8	7	2.1	27	8.1
2020–2021	10	2.9	2	0.6	13	3.8	25	7.4

[a]Rate per 100,000 person-years.
[b]Infantry/artillery/combat engineering/armor.
No., number.

Of all active component service members who were diagnosed with a cold injury (n=2,140), 117 (5.5% of the total) were affected during basic training. The Army (n=39) and Marine Corps (n=74) accounted for 96.5% of all basic trainees affected by cold injuries **(data not shown)**. Additionally, during the surveillance period, 62 service members who were diagnosed with cold injuries (2.9% of the total) were hospitalized, and the vast majority (83.9%) of the hospitalized cases were members of either the Army (n=39) or Marine Corps (n=13) **(data not shown)**.

Cold injuries during deployments

During the 5-year surveillance period, a total of 72 cold injuries were diagnosed and treated in service members deployed outside of the U.S. **(data not shown)**. Of these, 31 (43.0%) were frostbite, 31 (43.0%) were immersion injuries, and 10 (13.9%) were hypothermia. Of these 72 cold injuries, slightly more than one-eighth (13.8%) occurred in the most recent cold season (n=10). There were 10 cold injuries during the 2019–2020 cold season, 24 during 2018–2019, 17 during 2017–2018, and 11 during 2016–2017 **(data not shown)**. Immersion injuries accounted for half (n=5; 50.0%) of the cold weather injuries diagnosed and treated in service members deployed outside of the U.S. during the 2020–2021 cold season.

Cold injuries by location

During the 5-year surveillance period, 23 military locations had at least 25 incident cold injuries (1 per person per year) among active and reserve component service members **(Figure 4)**. Among these locations, those with the highest 5-year counts of incident injuries were Fort Wainwright, AK (n=270); Army Health Clinic Vilseck, Germany (n=95); Fort Campbell, KY (n=94); Naval Medical Center San Diego, CA (n=83); Camp Lejeune, NC (n=79); and Fort Carson, CO (n=77) **(data not shown)**. During the 2020–2021 cold season, the numbers of incident cases of cold injuries were higher than the counts for the previous 2019–2020 cold season at 12 of the 23 locations **(data not shown)**. The most noteworthy increase was observed at the Army's Fort Wainwright where there were 109 total cases diagnosed in 2020–2021, compared to 39 the year before **(data not shown)**. **Figure 4** shows the numbers of cold injuries during 2019–2020 and the median numbers of cases for the previous 4 years for those locations that had at least 25 cases during the surveillance period. For 13 of the 23 installations, the numbers of case in 2020–2021 were less than or equal to the median counts for the previous 4 years **(Figure 4)**.

EDITORIAL COMMENT

In 2019–2020 cold season, there was a moderate decrease in the crude overall incidence rate of cold injuries among U.S. active and reserve component service members; however, the overall rates increased in 2020–2021 in all services except active component Navy service members.

In 2020–2021, frostbite was the most common type of cold injury among active component service members in all 4 of the services. Factors associated with increased risk of cold injury in previous years were again noted during the most recent cold season. Compared to their respective counterparts, overall rates of cold injuries were higher among male service members, non-Hispanic Black service members, the youngest (less than 20 years old), and those who were enlisted. Increased rates of cold injuries affected nearly all enlisted and officer occupations among non-Hispanic Black service members. Of note, rates of frostbite were markedly higher among non-Hispanic Blacks compared to non-Hispanic Whites and those in the other/unknown race/ethnicity group. These differences have been noted in prior *MSMR* updates, and the results of several studies suggest that other factors (e.g., physiologic differences and/or previous cold weather experience) are possible explanations for increased susceptibility.[9,14,25–27] The number of cold injuries associated with deployment during 2019–2020 and 2020–2021 were the lowest number during the 5-year surveillance period; immersion injuries accounted for the majority of the cold weather injuries in service members deployed outside of the U.S. during the 2020–2021 cold season.

It should be noted that this analysis of cold injuries was unable to distinguish between injuries sustained during official military duties (training or operations) and injuries associated with personal activities not related to official duties. RMEs

TABLE 3c. Counts and incidence rates of cold injuries (1 per type per person per year), active component, U.S. Air Force, July 2016–June 2021

	Frostbite		Immersion injury		Hypothermia		All cold injuries	
	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]
Total	196	12.2	13	0.8	33	2.1	242	15.0
Sex								
Male	170	13.3	12	0.9	30	2.3	212	16.5
Female	26	7.9	1	0.3	3	0.9	30	9.2
Race/ethnicity								
Non-Hispanic White	106	10.8	8	0.8	20	2.0	134	13.7
Non-Hispanic Black	46	21.1	3	1.4	6	2.8	55	25.2
Other/unknown	44	10.7	2	0.5	7	1.7	53	12.8
Age group (years)								
<20	17	20.8	1	1.2	4	4.9	22	26.9
20–24	99	21.9	3	0.7	14	3.1	116	25.7
25–29	37	9.2	5	1.2	5	1.2	47	11.7
30–34	20	6.6	3	1.0	2	0.7	25	8.3
35–39	11	5.0	1	0.5	5	2.3	17	7.7
40–44	5	5.0	0	0.0	2	2.0	7	6.9
45+	7	14.5	0	0.0	1	2.1	8	16.6
Rank								
Enlisted	177	13.7	12	0.9	26	2.0	215	16.6
Officer	19	6.1	1	0.3	7	2.2	27	8.6
Military occupation								
Combat-specific[b]	3	25.5	0	0.0	0	0.0	3	25.5
Motor transport	3	25.3	0	0.0	0	0.0	3	25.3
Repair/engineering	78	15.3	6	1.2	5	1.0	89	17.5
Communications/intelligence	31	9.0	0	0.0	5	1.5	36	10.5
Health care	10	6.7	1	0.7	2	1.3	13	8.7
Other/unknown	71	12.2	6	1.0	21	3.6	98	16.8
Cold year (July–June)								
2016–2017	34	10.9	6	1.9	7	2.2	47	15.1
2017–2018	39	12.3	2	0.6	5	1.6	46	14.5
2018–2019	40	12.4	2	0.6	5	1.6	47	14.6
2019–2020	38	11.6	2	0.6	7	2.1	47	14.3
2020–2021	45	13.7	1	0.3	9	2.7	55	16.7

[a]Rate per 100,000 person-years.
[b]Infantry/artillery/combat engineering/armor.
No., number.

TABLE 3d. Counts and incidence rates of cold injuries (1 per type per person per year), active component, U.S. Marine Corps, July 2016–June 2021

	Frostbite		Immersion injury		Hypothermia		All cold injuries	
	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]
Total	221	24.2	136	14.9	109	11.9	466	51.0
Sex								
Male	215	25.7	131	15.7	99	11.8	445	53.3
Female	6	7.6	5	6.3	10	12.7	21	26.6
Race/ethnicity								
Non-Hispanic White	92	17.0	93	17.2	54	10.0	239	44.3
Non-Hispanic Black	85	94.1	10	11.1	19	21.0	114	126.3
Other/unknown	44	15.5	33	11.6	36	12.7	113	39.7
Age group (years)								
<20	27	21.4	71	56.2	41	32.5	139	110.1
20–24	140	31.8	52	11.8	52	11.8	244	55.5
25–29	29	18.5	9	5.7	13	8.3	51	32.5
30–34	14	16.1	3	3.4	2	2.3	19	21.8
35–39	8	13.2	1	1.7	1	1.7	10	16.6
40–44	2	7.0	0	0.0	0	0.0	2	7.0
45+	1	6.5	0	0.0	0	0.0	1	6.5
Rank								
Enlisted	199	24.6	129	16.0	104	12.9	432	53.5
Officer	22	20.6	7	6.6	5	4.7	34	31.8
Military occupation								
Combat-specific[b]	134	67.2	19	9.5	45	22.6	198	99.4
Motor transport	4	9.6	3	7.2	4	9.6	11	26.3
Repair/engineering	17	7.6	14	6.2	6	2.7	37	16.5
Communications/intelligence	35	16.5	8	3.8	8	3.8	51	24.1
Health care	0	0.0	0	0.0	0	0.0	0	0.0
Other/unknown	31	13.1	92	38.7	46	19.4	169	71.2
Cold year (July–June)								
2016–2017	48	26.4	25	13.7	19	10.4	92	50.6
2017–2018	36	19.6	36	19.6	25	13.6	97	52.9
2018–2019	54	29.3	36	19.5	30	16.3	120	65.0
2019–2020	26	14.1	15	8.1	18	9.8	59	32.0
2020–2021	57	31.6	24	13.3	17	9.4	98	54.4

[a]Rate per 100,000 person-years.
[b]Infantry/artillery/combat engineering/armor.
No., number.

for non-freezing peripheral injuries were excluded if "chilblains" was listed in the case comments; however, there may have been some RMEs for chilblains that were misclassified as immersion injury if chilblains was not listed in the case comments. To provide for all circumstances that pose the threat of cold weather injury, service members should know well the signs of cold injury and how to protect themselves against such injuries whether they are training, operating, fighting, or recreating under wet and freezing conditions.

The most current cold injury prevention materials are available at https://phc.amedd.army.mil/topics/discond/cip/Pages/Cold-Weather-Casualties-and-Injuries.aspx

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FIGURE 3. Numbers of service members who had a cold injury (1 per person per year), by service and cold season, active and reserve components, U.S. Armed Forces, July 2016–June 2021

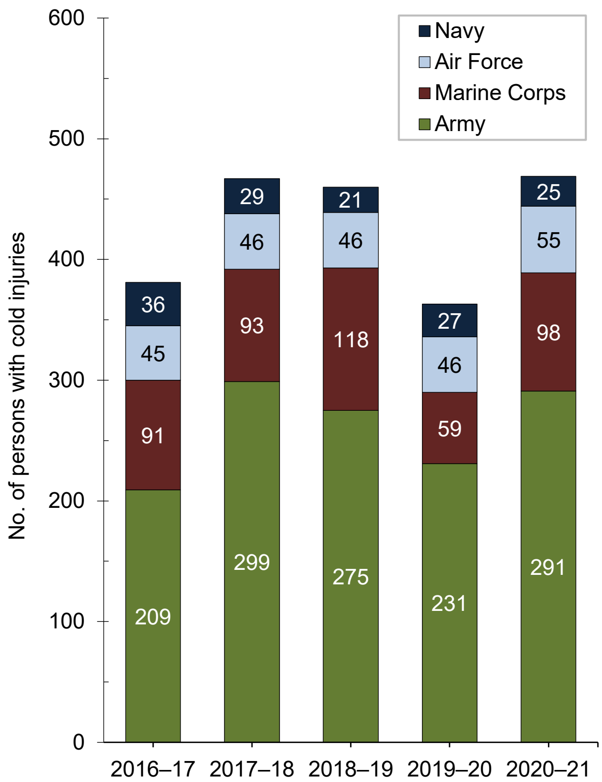

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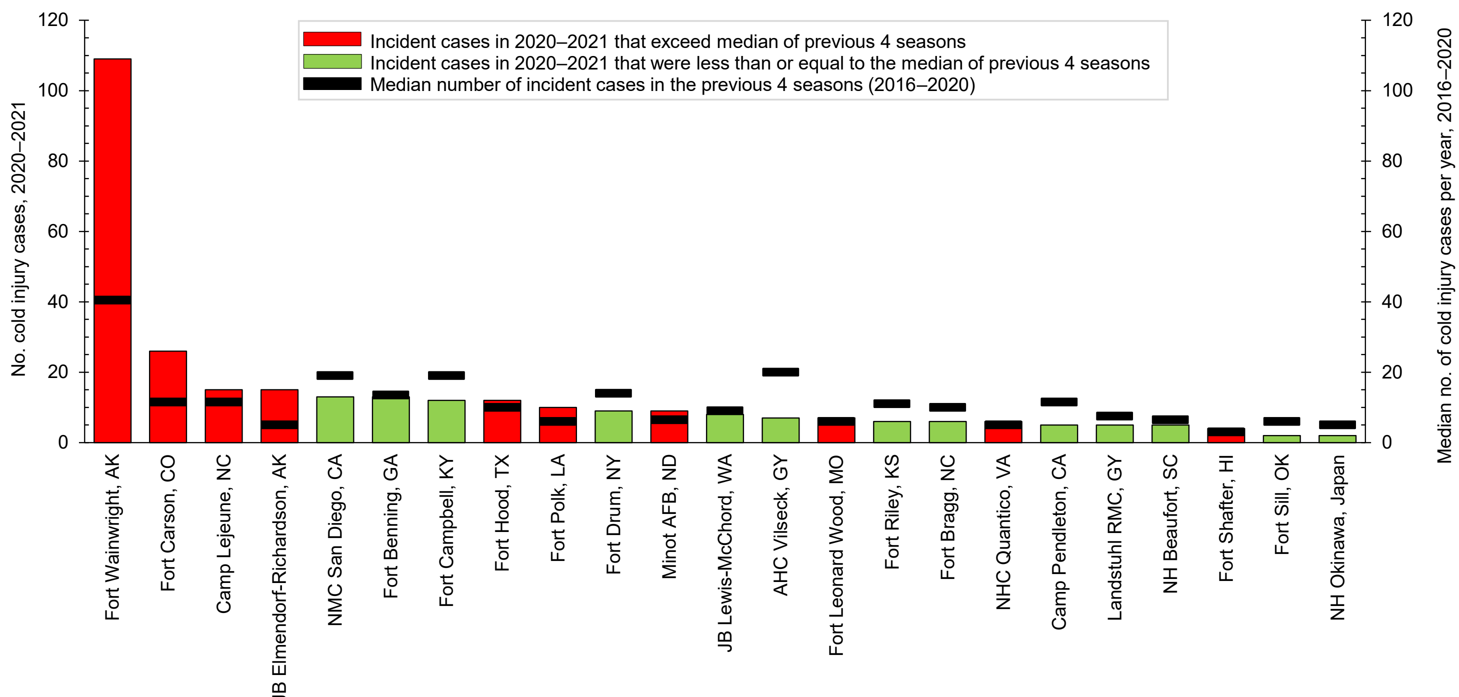
FIGURE 4. Annual numbers of cold injuries (cold season 2020–2021) and median numbers of cold injuries (cold seasons 2016–2020) at locations with at least 25 cold injuries during the surveillance period, active component, U.S. Armed Forces, July 2016–June 2021



No., number; JB, Joint Base; NMC, Naval Medical Center; AFB, Air Force Base; AHC, Army Health Clinic; NHC, Naval Health Clinic; GY, Germany; NH, Naval Hospital.

Brief Report

The Challenge of Interpreting Repeated Positive Tests for SARS-CoV-2 Among Military Service Members, Fort Jackson, SC, 2020–2021

Paul O. Kwon, DO, MPH (COL, MC, USA); Sarah K. Shadwick (1LT, USA); Sara L. Bazaco, PhD, MPH; Lindsay C. Morton, PhD, MS, MPH; Laurie J. Hartman, MS; Tara L. Hall, MPH, MSS (COL, USA); James D. Mancuso, MD, DrPH (COL, MC, USA)

Reinfection with SARS-CoV-2, the virus that causes coronavirus disease 2019 (COVID-19), is believed to be uncommon. However, suspected cases of reinfection have been reported from multiple countries, and many of these cases have been associated with SARS-CoV-2 variants.[1-3] As the spread of the variants increases, so may the risk of reinfection. Reinfection is defined here as persons who were infected once, recovered, and then later became infected again. Unfortunately, it is difficult to differentiate reinfection from 1) reactivation of the virus which persisted after the original infection (despite apparent clinical recovery), 2) persistence of non-viable viral debris, or 3) laboratory error or variation. In one large contact tracing study in Korea, for example, 285 patients were found to have persistent positive results for up to 12 weeks after initial infection, but the Korea Centers for Disease and Prevention (KCDC) found no evidence of transmissibility or ability to isolate replication-competent virus.[4]

It is important to know if a person is reinfected in order to understand the true burden of disease. In addition, public health interventions, including isolation, investigating unvaccinated contacts, and vaccination are required for each case. Although a history of prior infection has been associated with an 84% lower risk of infection,[5] subsequent reinfections have been increasing.[6,7] Letizia et al. reported the rate of new infections among those with positive antibodies, even in a rigidly controlled basic training environment, to be 1.1 cases per person-year.[7] Furthermore, belief that previous infection with SARS-CoV-2 leads to immunity from reinfection may result in behaviors which increase the likelihood of transmission and infection, including hesitancy and delays in vaccination.[8] For these reasons, it is important to understand the scope and impact of recurrent SARS-CoV-2 positive tests in military and civilian populations.

This report details a case series of service members with repeated positive tests for SARS-CoV-2 in a U.S. Army Training and Doctrine Command installation. The current findings underscore the need for a standardized approach to identify and respond to suspected cases of SARS-CoV-2 reinfection, and highlight the challenges of using this information to guide effective Force Health Protection (FHP) and communication strategies among Department of Defense (DoD) personnel.

Clinical presentations

SARS-CoV-2 positive cases were identified through public health surveillance activities within the Moncrief Army Community Hospital's Department of Preventive Medicine at Fort Jackson, SC. Suspected cases were tested using the Cepheid Xpert® Xpress SARS-CoV-2 test on the GeneXpert® System (Cepheid Inc., Lawrence Livermore National Labs, CA) and the BinaxNOW™ (Abbott Diagnostics Scarborough, Inc., Scarborough, ME) antigen card. Both are authorized for use under a Food and Drug Administration Emergency Use Authorization. The Xpert Xpress SARS-CoV-2 utilizes real-time reverse-transcription polymerase chain reaction (qRT-PCR) testing for qualitative and quantitative detection of viral nucleic acid from patients suspected of infection with the SARS-CoV-2 virus. Approved for use as a qualitative diagnostic, this assay (run on the GeneXpert system) generates a report that includes result interpretation and the cycle threshold (Ct) value, (i.e., the number of cycles required in order for the signal to cross and exceed the background threshold). The Ct value is inversely proportional to the number of copies of the target nucleic acid (i.e., copy number) and the number of whole viral genomes in the actual sample. Earlier or lower Ct values suggest a higher viral load, while later or higher values suggest a lower viral load. The BinaxNOW™ antigen card is a lateral flow immunoassay, point-of-care test (POCT) used strictly for the qualitative detection of SARS-CoV-2 nucleocapsid protein antigen.

Eight service members with recurrent positive SARS-CoV-2 tests were identified at Fort Jackson, SC between July 2020 and March 2021 **(Table)**. All were enlisted service members ranging in age from 18 to 31 years of age (mean=23.6 years) (data not shown). None of the 8 service members were identified as close contacts of one another. Six were male; 5 were originally identified as Army basic trainees; 6 had initially reported no symptoms, although 2 of the 6 later displayed symptoms upon reinfection; one had recently returned from an overseas location **(data not shown)**. None had any SARS-CoV-2 tests performed (qRT-PCR or POCT) other than those listed **(Table)**. The average number of days between 2 positive tests was 174 (range: 117–243 days). None had received any doses of COVID-19 vaccine by the time of the potential second infection. None of the patients were hospitalized at any time, and all recovered without any complications. Only one was employed in health care. Of note, all service members were isolated and had their contacts quarantined during both episodes.

All 8 of the service members met the Centers for Disease Control and Prevention (CDC) case definition for confirmed or probable infection with both the first and the second positive test;[9] and, therefore

TABLE. Characteristics of patients with recurrent positive tests for SARS-CoV-2

Case no.	First occurrence				Days between positive tests	Second occurrence				Assessment of re-infection likelihood
	Symptoms met COVID-19 clinical criteria	Positive test type	Ct value	RME case classification		Symptoms met COVID-19 clinical criteria	Positive test type	Ct value	RME case classification	
1	Y	qRT-PCR	41.4	Confirmed	117	Y	qRT-PCR	40.9	Confirmed	Unlikely
2	N	qRT-PCR	28.9	Confirmed	176	N	qRT-PCR	n/a	Confirmed	Insufficient information
3	N	qRT-PCR	n/a	Confirmed	127	Y	Rapid POCT	n/a	Probable	Insufficient information
4	Y	qRT-PCR	20.3	Confirmed	216	Y	qRT-PCR	18.9	Confirmed	Possible
5	N	qRT-PCR	34.9	Confirmed	182	N	qRT-PCR	38.1	Confirmed	Unlikely
6	N	qRT-PCR	n/a	Confirmed	204	Y	Rapid POCT	n/a	Probable	Insufficient information
7	N	qRT-PCR	n/a	Confirmed	127	N	qRT-PCR	39.1	Confirmed	Unlikely
8	N	qRT-PCR	28.1	Confirmed	243	N	qRT-PCR	23.4	Confirmed	Possible

SARS-CoV-2, severe acute respiratory syndrome coronavirus 2; No., number; Ct, cycle threshold; RME, reportable medical event; qRT-PCR, quantitative real-time reverse transcription polymerase chain reaction; POCT, point-of-care test; na, not available.

all were reported as COVID-19 cases both times as per DoD reporting requirements.[10] The confirmed cases all had a positive qRT-PCR, while the probable cases had symptoms, which met the clinical criteria, and a positive rapid test. The criteria for investigation of suspected reinfection from the CDC were used to assess the likelihood of COVID-19 reinfection.[11] The factors which make reinfection more likely included: presence of symptoms, interval ≥ 90 days between positive tests, lower or earlier Ct values (i.e., less than 33), and presence of at least 1 negative test between occurrences. The CDC also requires that a respiratory sample from each infection episode be available for further investigation using genomic sequencing, but no such specimens were available for any of these service members. Many of the Ct values seen in these service members were high or late (i.e., weakly positive), suggesting that they are more likely to be false positives or persistent low-level positives from an earlier infection. Based on these criteria, 2 were considered to be possible reinfections, 3 were unlikely, and 3 had insufficient information to assess.

EDITORIAL COMMENT

The risk of having a positive test for SARS-CoV-2 after prior infection has been estimated at 14.8%, but this includes both viral persistence as well as reinfections.[12] Younger patients, such as the service members seen in this report, have been shown to be more likely to have recurrent positives, and they are the predominant group with delayed (>90 days) recurrent positives.[13] However, in the absence of genome sequence data, it is difficult to determine if the cases are truly reinfections. In this study, 3 of the 8 patients identified were assessed as unlikely to have had a reinfection and 3 had insufficient information to assess reinfection. Complicating this assessment is the fact that there is no standardized or accepted definition of a SARS-CoV-2 reinfection, although several have been proposed.[14,15] Another limitation of this study that should be taken into consideration when interpreting the results was the use of quantitative data from the GeneXpert, which was approved as a qualitative but not a quantitative test. Finally, rapid POCTs can vary in sensitivity and specificity based on viral load and patient presentation.

For these reasons, a more thorough investigation is recommended for future suspected cases of reinfection using the CDC investigation protocol.[11] Specifically, viral culture and genomic sequencing of paired specimens (one from each episode) should be undertaken to confirm the presence of transmissible virus and to identify unique variants or infections.[11,16] The CDC protocol states that investigations of reinfection should prioritize persons in whom SARS-CoV-2 RNA has been detected ≥ 90 days since first SARS-CoV-2 infection whether or not symptoms were present.[11] Persons with COVID-19-like symptoms and detection of SARS-CoV-2 RNA 45–89 days since first SARS-CoV-2 infection may also be investigated if they had a symptomatic second episode and no obvious alternate etiology for COVID-19-like symptoms or close contact with a person known to have laboratory-confirmed COVID-19.[11] The investigation of both groups requires paired specimens and is only recommended for those with a cycle threshold (Ct) value <33 or if the Ct value is unavailable. Genomic testing can then provide evidence of whether the second positive test represents a true reinfection. Serial collection of respiratory specimens and serologic testing may also help to assess reinfection status.

The uncertainty in the reinfection status also has implications for surveillance data and public health response. If these are true cases of reinfection, then they should be counted as new incident cases. However, if they are false positives or persistent positives from the original infection, counting them will result in overestimates of the true disease burden. The reinfection status of most of these service members is doubtful or uncertain based on the criteria listed above, suggesting that service members should be counted only once as incident cases until more compelling evidence of true reinfection is presented. Additionally, the isolation of most of the service members in this study (and quarantine of their close contacts) was probably unnecessary given the low likelihood of transmissibility suggested by the Ct values. Nevertheless, due to the uncertainty around these cases, it was reasonable to take a conservative approach in the context of an ongoing pandemic. The uncertainty about such cases underscores the need for further investigation of patients with recurrent positive tests so that they may have their disease status correctly classified, which would enable more effective counseling regarding individual behaviors and a more targeted public health response.

Finally, these results suggest the need for clear public health risk communication to previously infected individuals, particularly regarding the risk of reinfection and the potential mitigating effects of vaccination. Previously infected individuals who believe that they are immune may be less likely to use masks, to adhere to social distancing requirements, or to receive the vaccine. Recent data has shown that service members who were previously infected with COVID-19 were less likely to receive vaccination, even after adjusting for demographics, comorbidities, and other factors.[8] Previously infected individuals who remain unvaccinated have been shown to have a 2.3 times higher likelihood of reinfection compared to those who were previously infected and then vaccinated,[6] and these individuals may then transmit the infection to others. Public health and medical personnel should consider specifically targeting previously infected individuals for vaccination campaigns.

Author affiliations: USAMEDDAC, Fort Jackson, SC (COL Kwon, 1LT Shadwick, and COL Hall); GEIS, AFSHD, Silver Spring, MD (Dr. Bazaco, Dr. Morton, and Ms. Hartman); Department of Preventive Medicine & Biostatistics, Uniformed Services University of the Health Sciences, Bethesda, MD (COL Mancuso).

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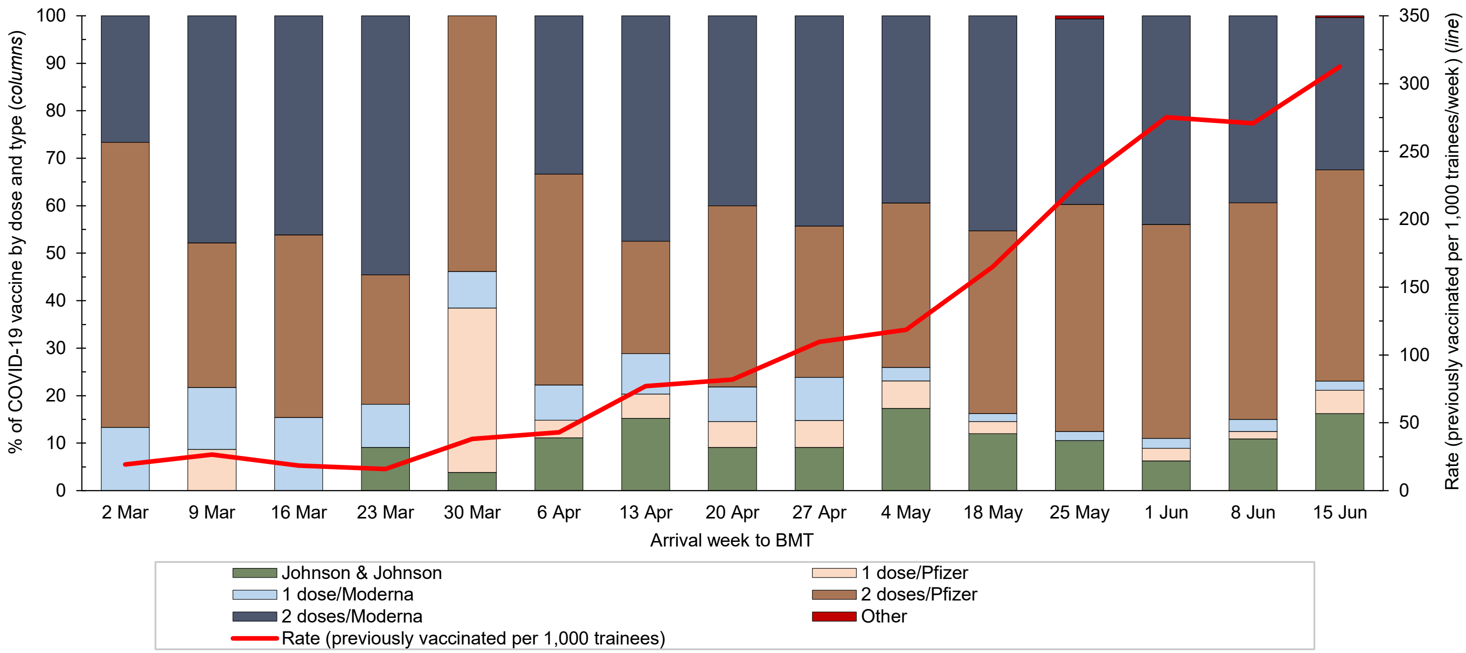
Surveillance Snapshot: History of COVID-19 Vaccination Among Air Force Recruits Arriving at Basic Training, 2 March–15 June 2021

Dianne Frankel, DO, MPH, MTM&H (Maj, MC, USAF)

FIGURE. U.S. Air Force recruits arriving at basic military training (BMT) partially or fully vaccinated against COVID-19, by week, dose, and vaccine type, 2 March–15 June 2021



COVID-19, coronavirus disease 2019.

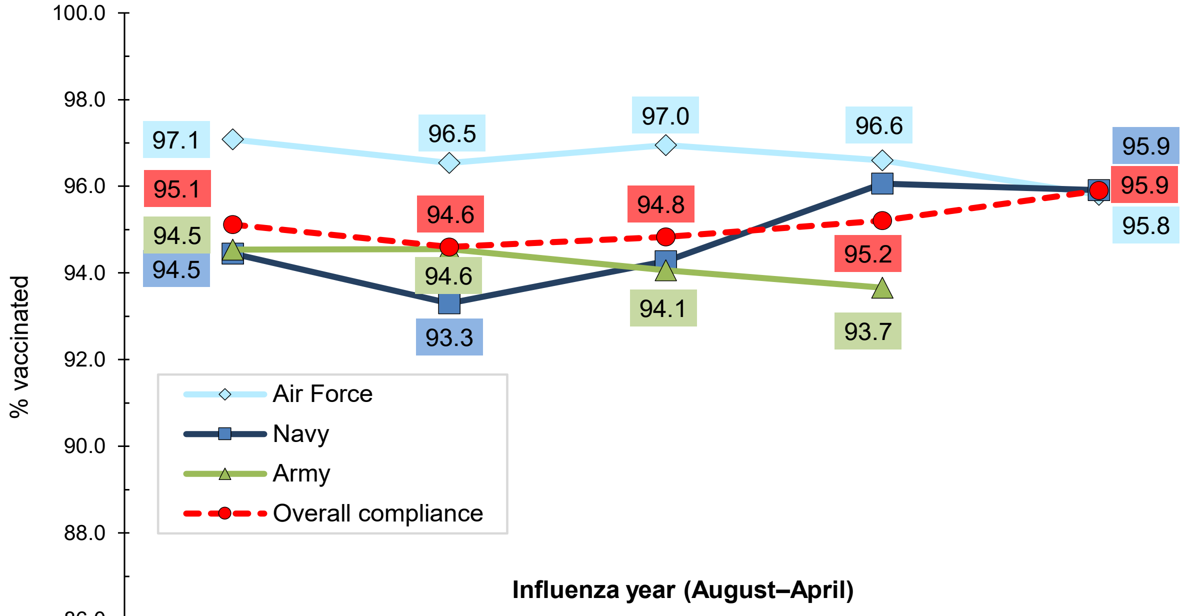
Early in 2021, Air Force basic military trainees began arriving at Lackland Air Force Base either partially or fully vaccinated against coronavirus disease 2019 (COVID-19). During the defined 15-week time frame (2 March–15 June), 600–900 trainees entered basic military training (BMT) on a weekly basis. The rate of trainees who arrived partially or fully vaccinated against COVID-19 per 1,000 trainees increased on a weekly basis in 12 out of the 15 weeks. The lowest rate was 16 previously vaccinated trainees per 1,000 trainees arriving in the week of 23 March 2021 and the peak rate was 313 per 1,000 trainees in the week of 15 June 2021. The Pfizer and Moderna vaccines were the predominant vaccines throughout the period. The majority of trainees who received vaccine against COVID-19 prior to arrival at BMT were fully vaccinated (range: 58%–98% per week).

Author affiliation: Office of the Command Surgeon, Headquarters Air Education and Training Command/SGPJ, Joint Base San Antonio-Randolph, TX (Maj Frankel).

Disclaimer: Material has been reviewed by the 59th Medical Wing Institutional Review Board, and there is no objection to its publication. The opinions or assertions contained herein are the views of the authors and do not necessarily reflect the official policy or position of the U.S. Air Force, the Department of Defense, or the U.S. Government.

Surveillance Snapshot: Influenza Immunization Among U.S. Armed Forces Health Care Workers, August 2016–April 2021

FIGURE. Percentage of health care specialists and officers with records of influenza vaccination, by influenza year (1 August through 30 April) and service, active component, U.S. Armed Forces, August 2016–April 2021



	2016–2017	2017–2018	2018–2019	2019–2020	2020–2021
Air Force	97.1	96.5	97.0	96.6	95.8
Navy	94.5	93.3	94.3	96.1	95.9
Army	94.5	94.6	94.1	93.7	a
Overall compliance	95.1	94.6	94.8	95.2	95.9

[a]Conflicting immunization rates for the Army for the 2020–2021 influenza season were ascertained from the Defense Enrollment Eligibility Reporting System (DEERS) maintained in the Defense Medical Surveillance System (DMSS). These data discrepancies are currently being investigated. Based on data from the Medical Protection System (MEDPROS), the overall influenza immunization rate among active component Army members was 94.4% for the 2020–2021 season.

The U.S. Advisory Committee on Immunization Practices recommends that all health care personnel be vaccinated against influenza to protect themselves and their patients.[1] The Joint Commission's standard on infection control emphasizes that individuals who are infected with influenza virus are contagious to others before any signs or symptoms appear. The Joint Commission requires that health care organizations have influenza vaccination programs for practitioners and staff and that they work toward the goal of 90% receipt of influenza vaccine. Within the Department of Defense, seasonal influenza immunization is mandatory for all uniformed personnel and for health care personnel who provide direct patient care and is recommended for all others (excluding those who are medically exempt).[2–5]

This snapshot covers a 5-year surveillance period (August 2016–April 2021) and presents the documented percentage compliance with the influenza immunization requirement among active component health care personnel of the Army, Navy, and Air Force. In the 2020–2021 influenza season, the compliance rates for the Navy and Air Force were 95.9% and 95.8%, respectively. Data issues impeded the calculation of compliance rates for the Army during the 2020–2021 season, but the overall influenza compliance rate for all active component soldiers for this period was 94.4%.

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Invitation to readers for manuscripts about injury for the July 2022 *MSMR*

The *Medical Surveillance Monthly Report (MSMR)* and the Armed Forces Health Surveillance Division (AFHSD) are planning a themed issue on the surveillance and epidemiology of injury (e.g., musculoskeletal injury, combat injury, traumatic brain injury) in military and military-associated populations to be published in July 2022.

This issue is intended to present timely articles on the surveillance and epidemiology of injury as well as programmatic and scientific interventions or strategies that have affected the burden, outcomes, or disparities associated with injuries in military and military-associated populations. Manuscripts examining risk factors and comorbidities associated with injuries in military populations are also suitable for this themed issue. Submissions focused on methodological issues will also be considered. Examples of methodology-related manuscripts include those focused on improving the collection and analysis of data related to injury and the development and validation of surveillance case definitions for these conditions.

The *MSMR*, in continuous publication since 1995, is a peer-reviewed journal indexed in PubMed, MEDLINE, and Scopus (CiteScore 1.4). The *MSMR* readership includes military and civilian public health professionals throughout the Military Health System, other federal government agencies (e.g., the Centers for Disease Control and Prevention, Department of Health and Human Services), and academia.

We are asking authors to submit their full manuscripts by April 1, 2022. For more details about specific article types and corresponding review criteria, please see the MSMR's instructions to authors at https://www.health.mil/Military-Health-Topics/Combat-Support/Armed-Forces-Health-Surveillance-Branch/Reports-and-Publications/Medical-Surveillance-Monthly-Report/Instructions-for-Authors.

CPT Kelly Scott, a physical therapist with the 2nd Brigade Combat Team, 82nd Airborne Division, demonstrates a leg-flexing technique on CPT Kelly Lavallee during musculoskeletal care training for Fort Bragg and Womack Army Medical Center healthcare providers.

ATLANTIC OCEAN (Oct. 23, 2021) Aviation Support Equipment Technician 1st Class Anthony Watkins, right, and Hospitalman Marcus Wooten, assigned to the San Antonio-class amphibious transport dock ship USS Arlington (LPD 24), assess victim's injuries on the flight deck during a mass casualty drill, Oct. 23, 2021. Arlington is underway in the Atlantic Ocean to support Amphibious Squadron and Marine Expeditionary Unit Integration (PMINT). PMINT is an opportunity to train for amphibious and maritime operations with embarked Marines in an integrated environment. (U.S. Navy photo by Mass Communication Specialist 2nd Class John Bellino).

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

MEDICAL SURVEILLANCE MONTHLY REPORT (MSMR), in continuous publication since 1995, is produced by the Armed Forces Health Surveillance Division (AFHSD). AFHSD is a designated public health authority within the Defense Health Agency. The *MSMR* provides evidence-based estimates of the incidence, distribution, impact, and trends of illness and injuries among U.S. military members and associated populations. Most reports in the *MSMR* are based on summaries of medical administrative data that are routinely provided to the AFHSD and integrated into the Defense Medical Surveillance System for health surveillance purposes.

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