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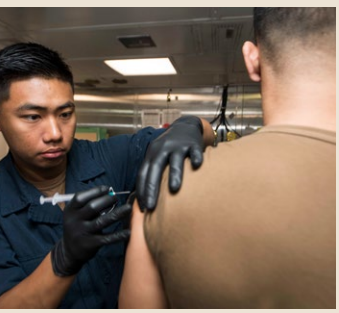

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Measles, Mumps, Rubella, and Varicella Among Service Members and Other Beneficiaries of the Military Health System, 1 January 2016–30 June 2019

Valerie F. Williams, MA, MS; Shauna Stahlman, PhD, MPH; Michael Fan, PhD

Measles, mumps, rubella, and varicella (MMR/V) are highly communicable infectious diseases whose causative agents are spread through contact with contaminated surfaces or airborne droplets. Individuals at highest risk for MMR/V infections include infants; unvaccinated or inadequately vaccinated persons; individuals living in communities with low vaccination rates or in crowded, unsanitary conditions; and persons with compromised immune systems. Between 1 January 2016 and 30 June 2019, there were 5 confirmed measles cases and 64 confirmed mumps cases among all Military Health System (MHS) beneficiaries. During this period, no cases of measles were reported among U.S. service members. There were 29 confirmed mumps cases among service members during the surveillance period; 2 cases occurred in 2016, 17 in 2017, 5 in 2018, and 5 in the first 6 months of 2019. There were 6 confirmed rubella cases among all MHS beneficiaries. Among service members, there were 39 confirmed cases of varicella during the surveillance period; 9 cases occurred in 2016, 11 in 2017, 11 in 2018, and 8 in the first 6 months of 2019. Recent trends in MMR/V in both military and civilian populations in the U.S. highlight the importance of primary and booster vaccinations.

WHAT ARE THE NEW FINDINGS?

In the 3.5-year period, the confirmed cases of varicella, mumps, rubella, and measles among service members numbered 39, 29, 1, and 0, respectively. Among non-service member beneficiaries, the counts of cases were similar, numbering 69, 35, 5, and 5, respectively. These low case counts confirm the effectiveness of the respective vaccine components among the large MHS beneficiary population.

WHAT IS THE IMPACT ON READINESS AND FORCE HEALTH PROTECTION?

The methodical use of the MMRV vaccine among new service members eliminates the associated morbidity for the protected individuals and the potential for outbreaks of these diseases, which can impair the readiness of military units. A similar beneficial impact among non-service member beneficiaries reduces the healthcare burden on the medical infrastructure that supports force readiness.

Measles, mumps, rubella, and varicella (MMR/V) were common in the U.S. before the introduction of licensed vaccines. Measles vaccine was introduced in 1963, mumps vaccine in 1967, rubella vaccine in 1969, and varicella vaccine in 1995.[1] Since then, these vaccines have been important components of routine pediatric preventive care. Individuals at highest risk for MMR/V infections include infants (because they are too young to be vaccinated); unvaccinated or inadequately vaccinated persons; individuals living in communities with low vaccination rates or in crowded, unsanitary conditions; and persons with compromised immune systems.[2]

Although the numbers of cases of MMR/V declined dramatically in the U.S. after vaccine implementation, outbreaks of these diseases occur sporadically. Between 1 January 2019 and 1 October 2019, a total of 1,249 measles cases and 22 measles outbreaks were reported to the Centers for Disease Control and Prevention (CDC) from 31 states.[3] The number of measles cases reported during this period represents the greatest number of cases reported in a calendar year in the U.S. since 1992; the majority of these cases occurred among individuals who were unvaccinated.[3] Overall, approximately 10% of those who contracted measles during this period were hospitalized.[3] Eighty-one of the measles cases reported so far in 2019 were imported from other countries.[3] In 2016, 2017, and 2018, totals of 86, 120, and 372 cases of measles were reported in the U.S., respectively.[4]

Mumps outbreaks continue to occur in the U.S., even among vaccinated individuals and in areas with high vaccination rates.[5] Two doses of the measles, mumps, and rubella (MMR) vaccine (which contains the live attenuated Jeryl Lynn mumps vaccine strain) are 88% effective at protecting against mumps.[6] When mumps infection does occur among vaccinated individuals, the illness is usually less severe; moreover, mumps outbreaks tend to be of limited size and duration in communities with high vaccination rates.[7,8] In the U.S., there has been an ongoing resurgence in mumps cases that began with a series of outbreaks on university campuses in 2006.[9] More recently, between 1 January 2016 and 30 June 2017, U.S. health departments reported 150 outbreaks (9,200 cases)

associated with schools, universities, athletics teams and facilities, households, church groups, workplaces, and large parties and events.[8] In 2018, a total of 2,251 mumps cases were reported to CDC.[4] Between 1 January and 13 September 2019, a total of 2,363 cases were reported from 47 states and the District of Columbia.[8]

Rubella is the leading vaccine-preventable cause of birth defects worldwide; infection in pregnant women may lead to fetal death or congenital defects.[10] In the U.S., rubella and the associated congenital rubella syndrome were documented as eliminated in 2004.[10] Elimination in this context means that the disease is no longer spread year-round in the U.S. or the Americas region.[10] Although rubella has been eliminated in the U.S., it remains endemic in many other parts of the world. During 2016–2017, fewer than 10 people in the U.S. were reported as rubella cases.[11] All people who were reported as cases of rubella infection since 2012 had evidence that they acquired the infection when they were living or traveling outside the U.S.[12]

Data on the number of chickenpox (varicella) outbreaks that occur each year in the U.S. are unavailable. Although chickenpox outbreaks are not notifiable at the national level, states are encouraged to report them to CDC annually.[13,14] States are also encouraged to conduct ongoing varicella surveillance to monitor vaccine impact on morbidity. Forty states were carrying out case-based varicella surveillance as of 2017.[14] Passive surveillance data collected between 1 August 2015 and 7 January 2017 indicate that 49 jurisdictions reported 89 outbreaks of varicella (1,030 cases), the majority of which occurred in schools and day care settings (57%).[13] Available passive surveillance data suggest that varicella outbreaks during 2005–2012 decreased in size (number of varicella cases per outbreak) and duration;[15] however, no U.S. reports on varicella outbreak trends are available for more recent time periods.

In the U.S., school vaccination requirements have been shown to be a very effective strategy for achieving and maintaining high varicella vaccination coverage among school-aged children.[16] The single-dose varicella vaccination program begun in 1996 was associated with significant decreases in disease burden from varicella.[17] However, outbreaks of varicella remained a problem even among school populations with high single-dose coverage.[18] In 2007, a universal 2-dose varicella childhood vaccine schedule with a catch-up vaccination for susceptible (i.e., only 1 dose of varicella vaccine) children, adolescents, and adults was recommended to improve protection and further decrease varicella cases and outbreaks.[18] Since these more recent recommendations were implemented, additional declines in varicella-related outpatient visits and hospitalizations have been documented.[19]

Because of the public health and military operational consequences of MMR/V infections, evidence of immunity to these viruses is required for service members. Certain military environments such as barracks and ships are conducive to person-to-person spread of diseases such as MMR/V. Furthermore, many service members are sent to overseas locations where the likelihood of exposure to these viruses is elevated. For example, from late December 2018 through early April 2019, 28 U.S. Navy and Marine Corps members aboard the USS Fort McHenry were diagnosed with viral parotitis, which the Navy later described as probable cases of mumps.[20] More recently, in late July 2019, several Army paratroopers showed symptoms of mumps while in Italy. One of these soldiers later tested positive for mumps while on temporary duty in Germany.[21] The infected soldier was up to date on all of his vaccinations, including MMR.[22] In response to this occurrence, Army medical staff administered the MMR vaccine to about 200 soldiers based in Italy.[21,22]

In October 2017, the *MSMR* reported on MMR/V diagnoses among service members and other Military Health System (MHS) beneficiaries.[23] The current analysis provides updated summaries of the numbers, trends, and demographics of diagnoses of these diseases among these MHS populations.

METHODS

The surveillance period was 1 January 2016 through 30 June 2019. The surveillance population included all individuals who were MHS beneficiaries (i.e., active and reserve/guard component service members, retired service members, family members and other dependents of service members and retirees, and other authorized government employees and family members) who accessed care through either a military medical facility/provider or a civilian facility/provider (if paid for by the MHS). It is Department of Defense (DoD) policy that cases of MMR/V (as well as many other diseases of public health importance) be reported electronically through military health channels for surveillance purposes.[24] Conditions covered by this policy are referred to as reportable medical events (RMEs). All data used to ascertain cases for this analysis were derived from the electronic records of the Defense Medical Surveillance System (DMSS).

For this analysis, a "confirmed" case was defined as an individual identified through an RME of MMR/V that was described as confirmed by meeting specified laboratory or epidemiologic criteria.[25–28] Because reporting policy for RMEs of varicella was limited to active duty service members before 2017, results pertaining to confirmed varicella cases in 2016 were limited to those reported among members of the active and reserve components.[24]

A "possible" case was defined as 1) an RME of MMR/V without laboratory or epidemiologic confirmation or 2) a record of an inpatient or outpatient medical encounter with a diagnosis of measles (International Classification of Diseases, 10th Revision [ICD-10]: B05.0, B05.1, B05.2, B05.4, B05.8, B05.89, B05.9), mumps (ICD-10: B26*), rubella (ICD-10: B06*), or varicella (ICD-10: B01.0, B01.11, B01.12, B01.2, B01.81, B01.89, B01.9) in the primary diagnostic position **(Tables 1–4)**. "Possible" MMR cases were also required to have an associated symptom code listed in another diagnostic position **(Tables 1–3)**. Encounters were excluded if there was either 1) a record of MMR/V vaccine administration or a positive test for serologic immunity to MMR/V within 7 days before or after the encounter date or 2) an ICD-10 diagnosis or a Current Procedural Terminology (CPT) code indicating MMR/V vaccination recorded for the same encounter as the diagnosis of MMR/V **(Tables 1–4)**.

TABLE 1. ICD-10 diagnostic and symptom codes used for classification as a "possible" measles case

Measles condition	Symptoms[a]	Exclusions
B05.0 (measles complicated by encephalitis)	Fever: R50, R50.8, R50.81, R50.9, P81.8, P81.9	CPT codes:
B05.1 (measles complicated by meningitis)	Rash: R21, B09	90705 (measles virus vaccine)
B05.2 (measles complicated by pneumonia)	Acute URI: J00, J01.* (excluding 5th digit = 1), J02.9, J03.9, J03.90, J04, J04.0, J04.1, J04.10, J04.11, J04.3, J04.30, J04.31, J05.*, J06.0, J06.9	90707 (MMR)
B05.4 (measles with intestinal complications)		90708 (measles and rubella vaccine)
B05.8 (measles with other complications)	Viral pneumonia: J12.89, J12.9, J16.8, J18.0, J18.9	90710 (MMRV)
B05.89 (other measles complications)		
B05.9 (measles without complication)	Malaise/fatigue: R53, R53.1, R53.8, R53.81, R53.83	
	Cough: R05	
	Conjunctivitis: H10.0*–H10.3*, H10.8, H10.89, H10.9	

[a]An asterisk (*) indicates any digit/character in this position.

ICD, International Classification of Diseases; URI, upper respiratory infection; CPT, Current Procedural Terminology; MMR, measles, mumps, and rubella vaccine; MMRV, measles, mumps, rubella, and varicella vaccine.

TABLE 2. ICD-10 diagnostic and symptom codes used for classification as a "possible" mumps case

Mumps condition	Symptoms[a]	Exclusions
B26 (mumps)	Sialoadenitis: K11.2, K11.20, K11.21	CPT codes:
B26.0 (mumps orchitis)	Lymphadenopathy/acute lymphadenitis: R59*, L04.0, L04.9	90704 (mumps virus vaccine)
B26.1 (mumps meningitis)	Hypertrophy of salivary gland: K11.1	90707 (MMR)
B26.2 (mumps encephalitis)	Sialolithiasis: K11.5	90709 (rubella and mumps vaccine)
B26.3 (mumps pancreatitis)	Swelling, mass, or lump in head/neck: R22.0, R22.1	90710 (MMRV)
B26.8 (mumps with other complications)	Jaw pain: R68.84	
B26.81 (mumps hepatitis)	Fever: R50.8, R50.81, R50.9, P81.8, P81.9	
B26.82 (mumps myocarditis)	Malaise/fatigue: R53, R53.1, R53.8, R53.81, R53.83	
B26.83 (mumps nephritis)	Headache: R51	
B26.84 (mumps polyneuropathy)	Anorexia: R63.0	
B26.85 (mumps arthritis)	Odynophagia/dysphagia: R13, R13.1*	
B26.89 (other mumps complications)	Generalized pain/myalgia: R52, M79.1	
B26.9 (mumps without complication)	Orchitis/epididymitis: N45.*	
	Abdominal pain: R10.1*, R10.2, R10.3*, R10.84, R10.9	
	Otalgia (ear ache): H92.0*	
	Acute pharyngitis: J02.9	
	Atypical face pain: G50.1	

[a]An asterisk (*) indicates any digit/character in this position.

ICD, International Classification of Diseases; CPT, Current Procedural Terminology; MMR, measles, mumps, and rubella vaccine; MMRV, measles, mumps, rubella, and varicella vaccine.

TABLE 3. ICD-10 diagnostic and symptom codes used for classification as a "possible" rubella case

Rubella condition	Symptoms[a]	Exclusions
B06 (rubella [German measles])	Fever: R50, R50.8, R50.81, R50.9, P81.8, P81.9	CPT codes:
B06.0 (rubella with neurological complications)	Rash: R21, B09	90706 (rubella vaccine)
B06.00 (rubella with neurological complication, unspecified)	Arthralgia: M25.*	90707 (MMR vaccine)
B06.01 (rubella encephalitis)	Arthritis: M13.1*	90708 (measles and rubella vaccine)
B06.02 (rubella meningitis)	Lymphadenopathy: R59.*	90709 (rubella and mumps vaccine)
B06.09 (other neurological complications of rubella)	Conjunctivitis: H10.0*–H10.3*, H10.8, H10.89, H10.9	90710 (MMRV vaccine)
B06.8 (rubella with other complications)		
B06.82 (rubella arthritis)		
B06.81 (rubella pneumonia)		
B06.89 (other rubella complications)		
B06.9 (rubella without complication)		

[a]An asterisk (*) indicates any digit/character in this position.

ICD, International Classification of Diseases; CPT, Current Procedural Terminology; MMR, measles, mumps, and rubella vaccine; MMRV, measles, mumps, rubella, and varicella vaccine.

TABLE 4. ICD-10 diagnostic and symptom codes used for classification as a "possible" varicella case

Varicella condition	Exclusions
B01 (varicella [chickenpox])	CPT codes:
B01.0 (varicella meningitis)	90716 (varicella vaccine)
B01.1 (varicella encephalitis, myelitis and encephalomyelitis)	90710 (MMRV vaccine)
B01.11 (varicella encephalitis and encephalomyelitis)	
B01.12 (varicella myelitis)	
B01.2 (varicella pneumonia)	
B01.8 (varicella with other complications)	
B01.81 (varicella keratitis)	
B01.89 (other varicella complications)	
B01.9 (varicella without complication)	

ICD, International Classification of Diseases; CPT, Current Procedural Terminology; MMRV, measles, mumps, rubella, and varicella vaccine.

TABLE 5. Confirmed and possible cases of measles, mumps, rubella, and varicella among MHS beneficiaries, 1 January 2016–30 June 2019

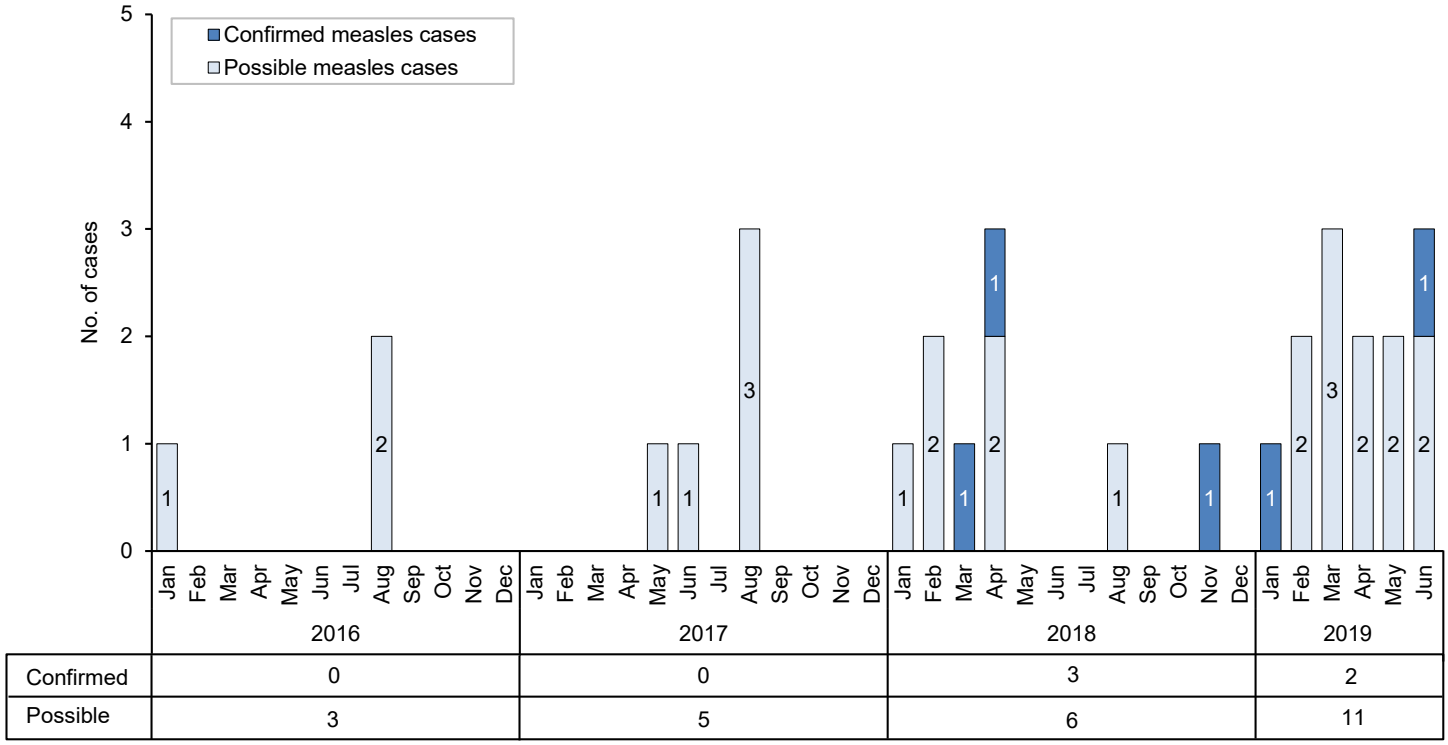
	Measles		Mumps		Rubella		Varicella	
	Confirmed	Possible	Confirmed	Possible	Confirmed	Possible	Confirmed[a]	Possible
Total	5	25	64	147	6	12	108	4,301
Active component	0	0	22	28	1	0	37	205
Reserve component	0	0	7	6	0	0	2	88
All other beneficiaries	5	25	35	113	5	12	69	4,008
Sex								
Male	2	13	43	86	2	6	63	2,031
Female	3	12	21	61	4	6	45	2,269
Unknown	0	0	0	0	0	0	0	1
Service[b]								
Army	0	0	16	20	0	0	14	145
Navy	0	0	7	8	0	0	11	58
Air Force	0	0	3	5	1	0	8	66
Marine Corps	0	0	3	1	0	0	6	24

[a]Confirmed cases of varicella in 2016 are limited to active and reserve component service members. Beneficiaries are included as confirmed cases in 2017 onward.

[b]Among active and reserve components.

MHS, Military Health System.

FIGURE 1. Confirmed and possible cases of measles among MHS beneficiaries, by year and month, 1 January 2016–30 June 2019



	2016	2017	2018	2019
Confirmed	0	0	3	2
Possible	3	5	6	11

MHS, Military Health System; No., number.

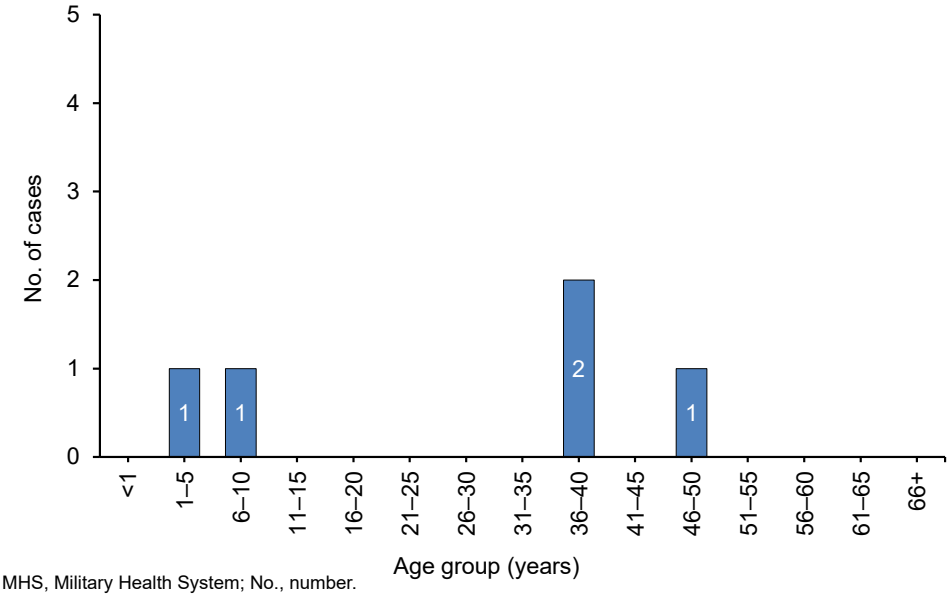
RESULTS

Confirmed cases

Measles: During the 3.5-year surveillance period, there were a total of 5 confirmed cases of measles among all MHS beneficiaries **(Table 5, Figure 1)**. There were no confirmed cases of measles among service members; all 5 cases were among non-service member beneficiaries and 3 of those cases affected women **(Table 5)**. Confirmed cases of measles were reported in 2018 (n=3) and during the first 6 months of 2019 (n=2) **(Figure 1)**. Both of the cases in the first 6 months of 2019 were diagnosed in Texas **(data not shown)**. Of the 5 confirmed measles cases reported during the surveillance period, 2 (40.0%) were among children 10 years old or younger **(Figure 2)**; of these 2 children, 1 was 1 year old and 1 was 7 years old **(data not shown)**. The remaining 3 cases were 37 years of age or older **(Figure 2)**.

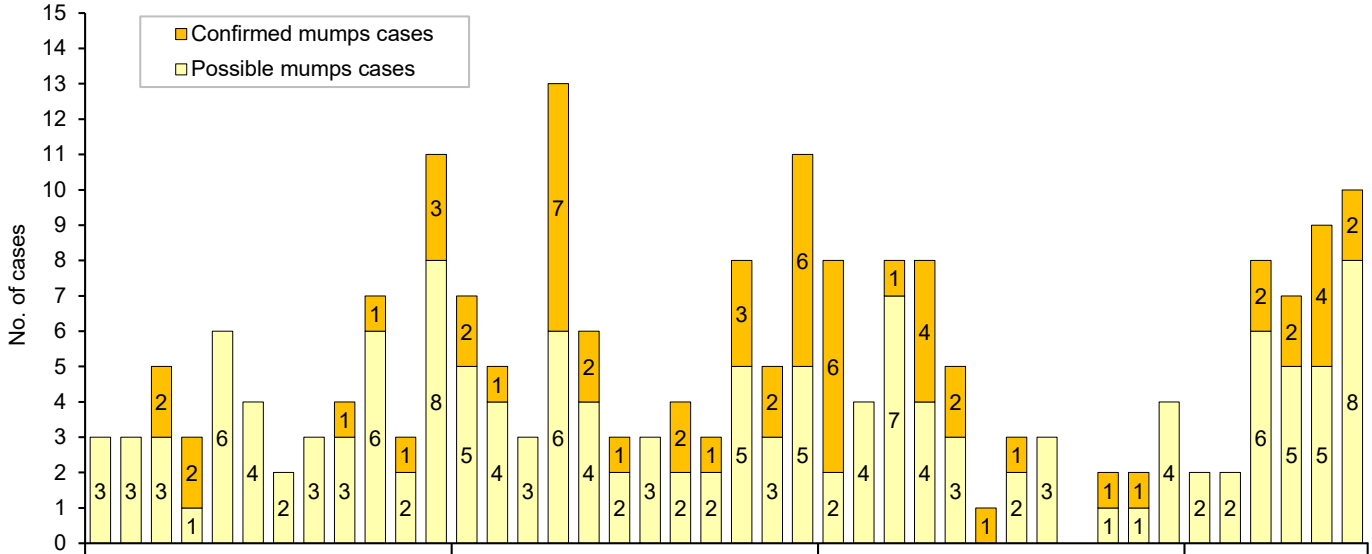
Mumps: There were 64 confirmed cases of mumps among all MHS beneficiaries during the surveillance period **(Table 5, Figure 3)**. Slightly more than two-thirds (67.2%) of the confirmed mumps cases were among men. Twenty-two cases (34.4%) were among active component service members and 7 cases were among reserve component service members. Of the 29 confirmed mumps cases in service members, 16 cases were among Army members, 7 among Navy, 3 among Air Force, and 3 among Marine Corps members **(Table 5)**.

FIGURE 2. Age distribution of confirmed cases of measles among all MHS beneficiaries, 1 January 2016–30 June 2019



MHS, Military Health System; No., number.

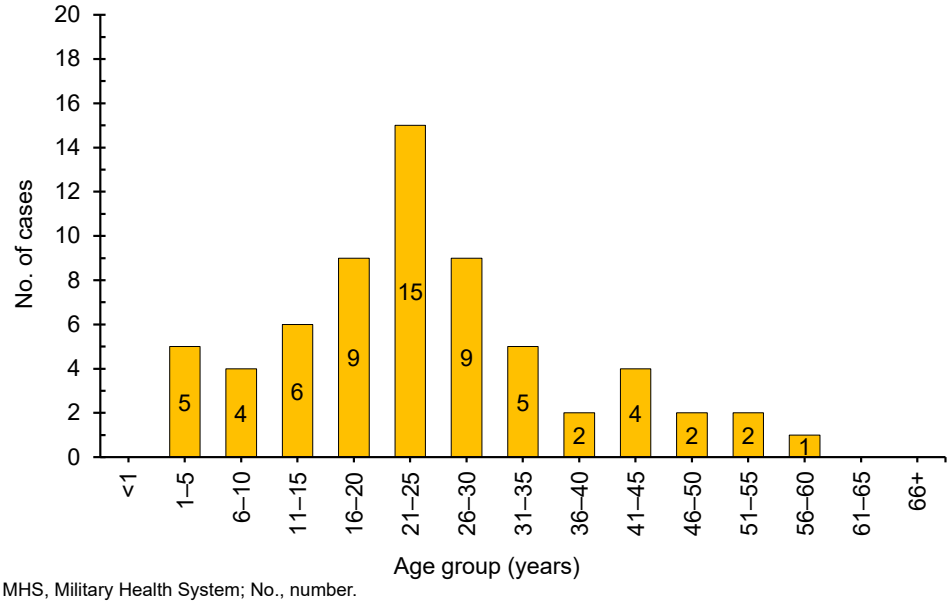
FIGURE 3. Confirmed and possible cases of mumps among MHS beneficiaries, by year and month, 1 January 2016–30 June 2019



	2016	2017	2018	2019
Confirmed	10	27	17	10
Possible	44	44	31	28

MHS, Military Health System; No., number.

FIGURE 4. Age distribution of confirmed cases of mumps among all MHS beneficiaries, 1 January 2016–30 June 2019



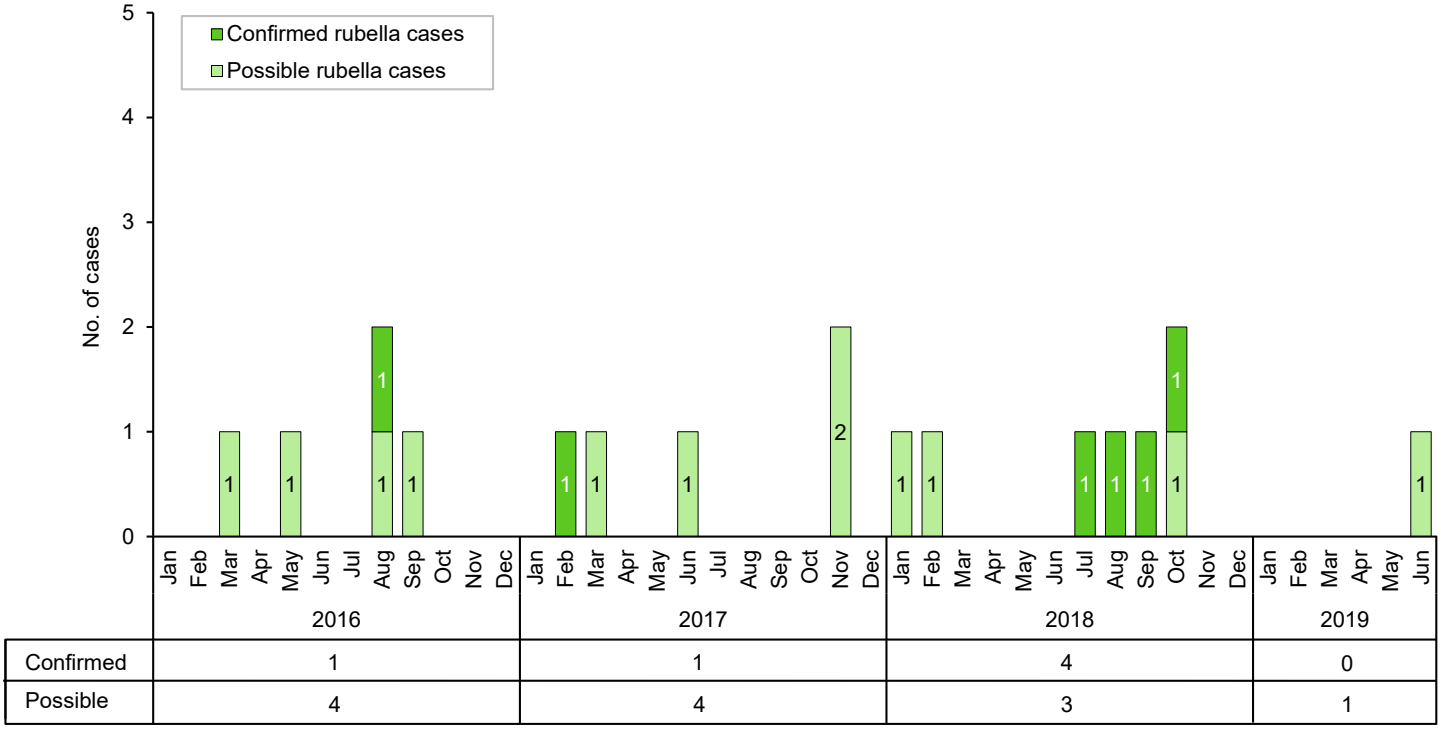
MHS, Military Health System; No., number.

The remaining 35 confirmed mumps cases were among non-service member beneficiaries. During the surveillance period, the greatest number of confirmed cases was reported in 2017 (n=27) **(Figure 3)**. There were 2 confirmed cases of mumps among service members in 2016, 17 in 2017, 5 in 2018, and 5 in the first 6 months of 2019 **(data not shown)**. Overall, the single month with the highest number of confirmed mumps cases was April 2017 (n=7) **(Figure 3)**. The 3 locations with the most confirmed mumps cases were Hawaii (n=13), Texas (n=12), and Alaska (n=6) **(data not shown)**. The age group with the most confirmed cases was young adults 21–25 years old (n=15; 23.4%) **(Figure 4)**.

Rubella: During the surveillance period, there were 6 confirmed rubella cases among all MHS beneficiaries **(Table 5, Figure 5)**. Two-thirds (66.7%) of confirmed rubella cases were among women. There was 1 confirmed case of rubella in an active component Air Force member diagnosed in October 2018 in Nebraska **(data not shown)**. The remaining 5 confirmed rubella cases were among non-service member beneficiaries **(Table 5)**. All 6 of the confirmed rubella cases were among adults 20–40 years old **(Figure 6)**. Whereas 4 confirmed rubella cases were reported in 2018, only single confirmed cases of rubella were reported in 2016 and 2017 **(Figure 5)**. No confirmed rubella cases were reported in the first 6 months of 2019.

Varicella: There were 108 confirmed cases of varicella during the surveillance period **(Table 5, Figure 7)**. Nearly three-fifths (58.3%) of confirmed varicella cases were

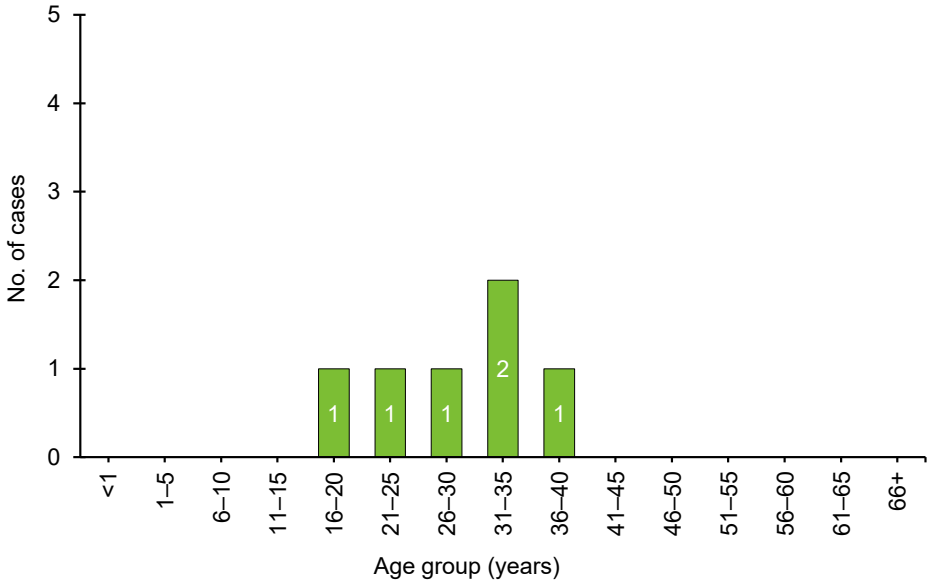
FIGURE 5. Confirmed and possible cases of rubella among MHS beneficiaries, by year and month, 1 January 2016–30 June 2019



	2016	2017	2018	2019
Confirmed	1	1	4	0
Possible	4	4	3	1

MHS, Military Health System; No., number.

FIGURE 6. Age distribution of confirmed cases of rubella among all MHS beneficiaries, 1 January 2016–30 June 2019



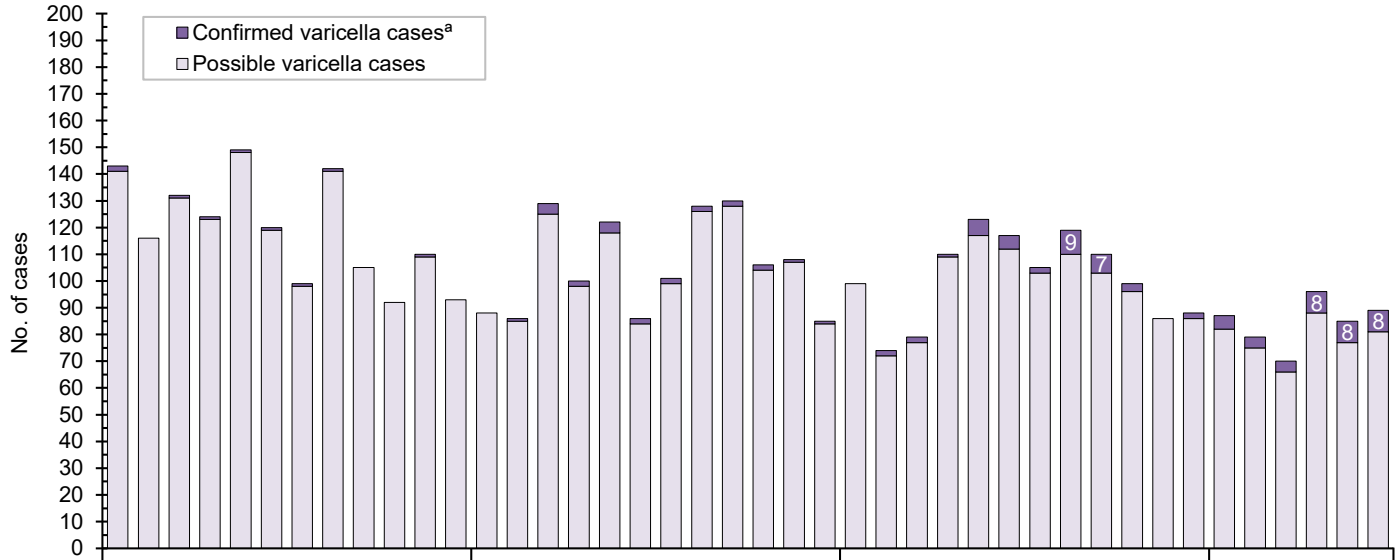
MHS, Military Health System; No., number.

among men. Thirty-nine (36.1%) of the confirmed cases of varicella were among service members. Of these 39 cases, 14 were among Army members, 11 among Navy members, 8 among Air Force, and 6 among Marine Corps members **(Table 5)**. The vast majority (94.9%) of service members with confirmed varicella infections were active component members. There were 9 confirmed cases of varicella among service members in 2016, 11 in 2017, 11 in 2018, and 8 in the first 6 months of 2019 **(data not shown)**. The time periods with the most confirmed varicella cases were 2018 (n=39) and the first 6 months of 2019 (n=37) **(Figure 7)**. Overall, the months with the greatest number of confirmed varicella cases were August 2018 (n=9) and April, May, and June 2019 (n=8, n=8, n=8, respectively) **(Figure 7)**. The 3 locations with the most confirmed cases of varicella were Texas (n=22), Florida (n=13), and Virginia (n=10) **(data not shown)**. The age groups with the most confirmed cases were infants less than 1 year old (n=15; 13.9%) and adults 31–35 years old (n=13; 12.0%) **(Figure 8)**.

Possible cases

Measles: During the 3.5-year surveillance period, there were 25 possible cases of measles among all MHS beneficiaries **(Table 5)**. None of the possible cases were among active or reserve component service members; all 25 of the possible cases were among non-service member beneficiaries. The number of possible measles cases reported in the first 6 months of 2019 (n=11) was more than 3 times the number reported in 2016 (n=3). The greatest number of

FIGURE 7. Confirmed and possible cases of varicella among MHS beneficiaries, by year and month, 1 January 2016–30 June 2019

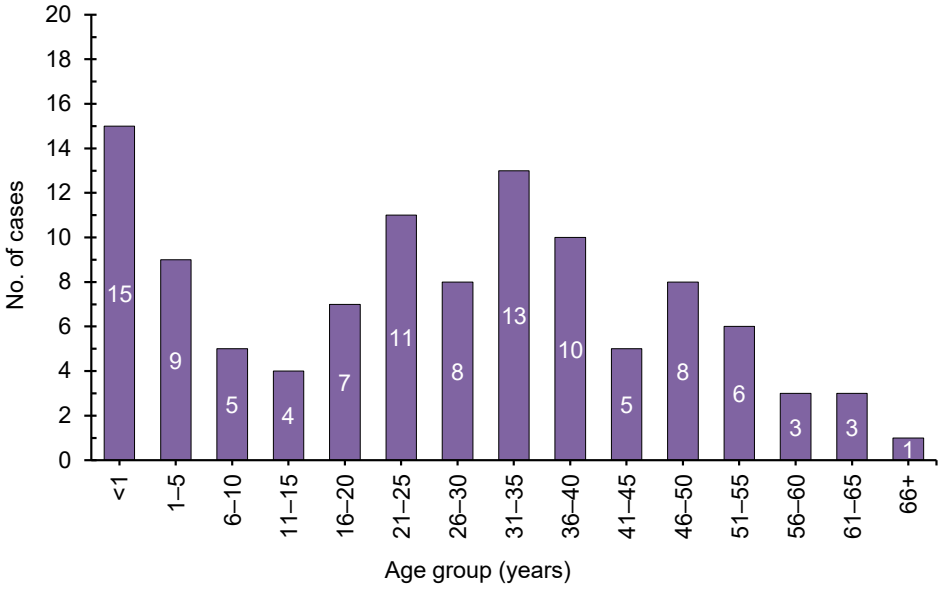


	2016	2017	2018	2019
Confirmed	9	23	39	37
Possible	1,416	1,246	1,170	469

[a]In 2016, confirmed cases of varicella were limited to active and reserve component service members. Beneficiaries are included as confirmed cases in 2017 onward.

MHS, Military Health System; No., number.

FIGURE 8. Age distribution of confirmed cases of varicella among all MHS beneficiaries,[a] 1 January 2016–30 June 2019



[a]In 2016, confirmed cases of varicella were limited to active and reserve component service members. Beneficiaries are included as confirmed cases in 2017 onward.
MHS, Military Health System; No., number.

possible measles cases was among children 5 years old or younger (n=18; 72.0%) **(data not shown)**.

Mumps: Overall, there were 147 possible cases of mumps among all MHS beneficiaries during the surveillance period **(Table 5)**. Of these, 28 possible cases were among active component service members and 6 were among reserve component service members. The remaining 113 possible cases were among non-service member beneficiaries. The age groups with the greatest numbers of possible mumps cases were children aged 1–5 years old (n=23; 15.6%) and children aged 6–10 years old (n=22; 15.0%) **(data not shown)**.

Rubella: During the surveillance period, there were 12 possible cases of rubella among all MHS beneficiaries **(Table 5)**. All 12 possible cases of rubella were among non-service member beneficiaries. The greatest number of possible rubella cases was among children aged 1–5 years old (n=6; 50.0%) **(data not shown)**.

Varicella: There were 4,301 possible cases of varicella during the surveillance period among all MHS beneficiaries **(Table 5)**. Of these, 205 (4.8%) possible cases were among active component service members and 88 (2.0%) were among reserve component service members. The remaining 4,008 possible varicella cases were among non-service member beneficiaries. The age groups with the greatest numbers of possible cases of varicella were children aged 1–5 years old (n=1,338; 31.1%) and children 6–10 years old (n=579; 13.5%) **(data not shown)**.

EDITORIAL COMMENT

Current DoD policy is to screen the immunization records of accessions during initial entry training and immunize if the primary series against MMR/V is incomplete.[29] Although DoD policy calls for serologic testing for antibodies to measles, rubella, and varicella (as well as hepatitis A and hepatitis B), current practice at military accession sites also includes mumps serology in accordance with CDC's Advisory Committee on Immunization Practices recommendations.[29,32]

Between 1 January 2016 and 30 June 2019, no cases (confirmed or possible) of measles were reported among service members. All of the measles cases identified in this analysis were among non-service member beneficiaries. Children 10 years old or younger accounted for two-fifths of all confirmed measles cases during the surveillance period. This finding and those of published reports of recent outbreaks suggest that some children who have not received 2 doses of MMR or MMRV vaccine are susceptible to infection when exposed to the measles virus.[30,31]

During the 3.5-year surveillance period, there were more than 12 times as many confirmed cases of mumps (n=64) as there were of measles (n=5). This finding is not unexpected given that the efficacy of the mumps vaccine (88% [range: 66%–95%] with 2 doses; 78% [range: 49%–92%] with 1 dose) is lower than that of the measles component of the vaccine.[32–34] It is also consistent with multiple studies showing that waning immunity may contribute to mumps outbreaks in settings where persons have close, prolonged contact.[35,36] In the current analysis, the greatest number of confirmed cases of mumps occurred among 21- to 25-year-olds. Results of a recent synthesis of data from 6 mumps vaccine effectiveness studies suggest that vaccine-derived immune protection against mumps wanes on average 27 years (95% confidence interval: 16–51 years) after vaccination.[5] This highlights the fact that increased outbreaks due to mumps are not fully explained and may be related to a combination of factors including waning immunity, vaccine escape mutations, and genetic differences in vaccine responsiveness.[37,38]

In the current analysis, Texas was the location associated with the greatest number of confirmed measles cases and the location associated with the second highest number of mumps cases among MHS beneficiaries. It is unknown whether these cases were associated with outbreaks within military or civilian communities.

The low number of confirmed rubella cases reported during the surveillance period is expected given the efficacy of the rubella component of the MMR vaccine and the low number of cases reported in the general U.S. population during this time.[4]

Across the services, the varicella vaccine is administered to susceptible trainees and other accessions within the first 2 weeks of initial entry training.[29] Serologic screening is one means of determining susceptibility

to varicella infection.[18] Those individuals without a personal history of chickenpox, documentation of 2 prior varicella vaccinations, or documentation of immunity based on serologic testing are considered susceptible.[29] Susceptible adults require 2 doses of varicella vaccine given 4–8 weeks apart.[29] In 2017, the reporting policy for RMEs for varicella was changed to include all beneficiaries and is no longer restricted to only active and reserve component service members.[24] The observed pattern of an increase in the numbers of confirmed varicella cases in 2017, 2018, and the first 6 months of 2019 relative to 2016 is likely due, at least in part, to this change in reporting policy.

As expected, this analysis identified many more possible cases of MMR/V than confirmed cases. One example of the challenges to complete ascertainment and counting of cases is provided by the recent, aforementioned outbreak of parotitis aboard the USS Fort McHenry in 2018. Although the final count of shipboard cases considered likely to be mumps was 28, only 23 cases (confirmed or possible) of mumps were reported for the entire DoD in this period. In the MHS, diagnoses of MMR/V require RME notifications. The published guidelines emphasize that the proper identification, treatment, control, and follow-up of cases requires prompt, accurate reporting of probable, suspected, or confirmed cases of these infections.[24] In addition, the guidelines discourage delaying the submission of RME reports while awaiting laboratory confirmation and call for the submission of additional reports once the diagnosis has been confirmed.[24] In the context of these guidelines, the current analysis searched the database of RMEs for cases that were identified as "confirmed." RMEs that characterized the diagnoses as either "probable" or "suspected" and were never amended as "confirmed" were treated as "possible" cases. Such cases were grouped with cases identified from records of inpatient and outpatient records. Consequently, "possible" cases may include both "true" cases for which there were no follow-up RMEs indicating confirmation and "true" cases for which diagnoses were documented in inpatient or outpatient records but no RMEs were ever submitted by local military public health officials. Because "possible" cases based upon diagnoses in the primary diagnostic position for inpatient or outpatient encounters required an additional diagnostic code for an associated symptom, some cases of true MMR/V infections are likely not captured as "possible" cases because documentation of a specific diagnosis was not accompanied by documentation of a symptom. This aspect of the case definition could lead to underestimation of total counts of "possible" cases. Civilian healthcare providers who diagnose and confirm cases of any of these 4 viral infections outside of the MHS would not be expected to submit RME reports; however, the diagnoses are captured in the DMSS if such care is underwritten by the MHS. Moreover, for 2017, 2018, and 2019, medical data from sites that were using MHS GENESIS, the new electronic health record for the MHS, 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 during 2017–2019 were not included in the analysis. The scenarios and situations described above may result in the underestimation of the actual incidence of cases of MMR/V among MHS beneficiaries.

Conversely, other circumstances may tend to result in overestimation of the number of incident cases. For example, diagnoses of MMR/V recorded in electronic health records may represent misdiagnoses, tentative (rule-out) diagnoses that are not confirmed, and/or miscoding of medical encounters for vaccinations or laboratory testing. Because of this inherent uncertainty, counts of confirmed cases were the main focus of this report.

Recent trends in MMR/V in both military and civilian populations in the U.S. highlight the importance of primary and booster vaccinations. Current recommendations for the MMR vaccine include 2 doses—the first between 12 and 15 months and the second between 4 and 6 years old.[39] Adults with only 1 dose or who lack laboratory evidence for MMR immunity are encouraged to receive the vaccine, particularly those who work in healthcare settings.[39] Current recommendations for varicella vaccination correspond to the MMR vaccination schedule (2 doses—the first between ages 12 and 15 months and the second between ages 4 and 6 years), with a catch-up vaccination for susceptible children, adolescents, and adults.[39] Because they are required to have evidence of immunity for MMR/V, it is not surprising that service members account for a relatively small proportion of all cases of these diseases in the MHS.

REFERENCES

1. Immunization Action Coalition. Vaccine timeline. http://www.immunize.org/timeline/. Accessed 29 August 2019.
2. Centers for Disease Control and Prevention. Atkinson W, Wolfe C, Hamborsky J. eds. *Epidemiology and Prevention of Vaccine-Preventable Diseases*. 12th ed. Washington, DC: Public Health Foundation; 2011.
3. Patel M, Lee AD, Clemmons NS, et al. National update on measles cases and outbreaks—United States, January 1–October 1, 2019. *MMWR Morb Mortal Wkly Rep*. 68(40):893–896.
4. Centers for Disease Control and Prevention. National Notifiable Diseases Surveillance System (NNDSS). Notifiable infectious disease and conditions data tables. https://wwwn.cdc.gov/nndss/infectious-tables.html. Accessed 5 September 2019.
5. Lewnard JA, Grad YH. Vaccine waning and mumps re-emergence in the United States. *Sci Transl Med*. 2018;10(433). pii:eaao5945.
6. Harling R, White JM, Ramsay ME, Macsween KF, van den Bosch C. The effectiveness of the mumps component of the MMR vaccine: a case control study. *Vaccine*. 2005;23(31):4070–4074.
7. Clemmons N, Hickman C, Lee A, Marin M, Patel M. Chapter 9: Mumps. In: Centers for Disease Control and Prevention. *Manual for the surveillance of vaccine-preventable diseases*. 5th ed. Atlanta, GA: Centers for Disease Control and Prevention.
8. Centers for Disease Control and Prevention. Mumps cases and outbreaks. https://www.cdc.gov/mumps/outbreaks.html. Accessed 21 October 2019.
9. Dayan GH, Quinlisk MP, Parker AA, et al. Recent resurgence of mumps in the United States. *N Engl J Med*. 2008;358(15):1580–1589.
10. Centers for Disease Control and Prevention. Elimination of rubella and congenital rubella syndrome—United States, 1969–2004. *MMWR Morb Mortal Wkly Rep*. 2005;54(11):279–282.
11. World Health Organization. WHO vaccine-preventable diseases: monitoring system. 2019 global summary. Incidence time series for United States of America (the) (USA). http://apps.who.int/immunization_monitoring/globalsummary/incidences?c=USA. Accessed 6 September 2019.
12. Centers for Disease Control and Prevention. Rubella (German measles, three-day measles). https://www.cdc.gov/rubella/index.html. Accessed 6 September 2019.
13. Lopez AS, Leung J, Marin M. Varicella outbreak surveillance in the United States, 2015–2016. *Open Forum Infect Dis*. 2017;4(suppl 1):s461.
14. Centers for Disease Control and Prevention. Chickenpox (varicella). Varicella reporting and surveillance. https://www.cdc.gov/chickenpox/

health-departments/conducting-surveillance.html. Accessed 9 September 2019.
15. Centers for Disease Control and Prevention. Chickenpox (varicella). Monitoring the impact of varicella vaccination. https://www.cdc.gov/chickenpox/surveillance/monitoring-varicella.html. Accessed 9 September 2019.
16. Lopez AS, Kolasa MS, Seward JF. Status of school entry requirements for varicella vaccination and vaccination coverage 11 years after implementation of the varicella vaccination program. *J Infect Dis*. 2008;197(suppl 2):s76–s281.
17. Lopez AS, Zhang J, Brown C, Bialek S. Varicella-related hospitalizations in the United States, 2000–2006: the 1-dose varicella vaccination era. *Pediatrics*. 2011;127(2):238–245.
18. Marin M, Guris D, Chaves SS, et al. Prevention of varicella: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep*. 2007;56(RR-4):1–40.
19. Leung J, Harpaz R. Impact of the maturing varicella vaccination program on varicella and related outcomes in the United States: 1994–2012. *J Pediatric Infect Dis Soc*. 2016;5(4):395–402.
20. Pickrell R. The crew of this Navy warship has gone without a port of call thanks to a viral mumps outbreak. *Task & Purpose*. 2 May 2019. https://taskandpurpose.com/uss-fort-mchenry-mumps-outbreak. Accessed 6 September 2019.
21. Montgomery N. Hundreds receive vaccinations after soldiers show signs of mumps in Italy. *Stars and Stripes*. 13 August 2019. https://www.stripes.com/news/hundreds-receive-vaccinations-after-soldiers-show-signs-of-mumps-in-italy-1.594165. Accessed 11 September 2019.
22. Egnash M. Army stresses vaccinations after soldier treated for mumps in Germany. *Stars and Stripes*. 10 August 2019. https://www.stripes.com/news/europe/army-stresses-vaccinations-after-soldier-treated-for-mumps-in-germany-1.593891. Accessed 9 September 2019.
23. Williams VF, Stahlman S, Fan M. Measles, mumps, rubella, and varicella among service members and other beneficiaries of the Military Health System, 2010–2016. *MSMR*. 2017;24(10):2–11.
24. Armed Forces Health Surveillance Branch. Armed Forces Reportable Medical Events. Guidelines and Case Definitions, 2017. https://health.mil/Reference-Center/Publications/2017/07/17/Armed-Forces-Reportable-Medical-Events-Guidelines.
25. Armed Forces Health Surveillance Branch. Surveillance Case Definitions: Measles. https://health.mil/Reference-Center/Publications/2015/09/01/Measles. Accessed 29 August 2019.
26. Armed Forces Health Surveillance Branch. Surveillance Case Definitions: Mumps. https://health.mil/Reference-Center/Publications/2015/05/01/Mumps. Accessed 29 August 2019.
27. Armed Forces Health Surveillance Branch. Surveillance Case Definitions: Rubella. https://health.mil/Reference-Center/Publications/2018/01/01/Rubella. Accessed 29 August 2019.
28. Armed Forces Health Surveillance Branch. Surveillance Case Definitions: Varicella. https://health.mil/Reference-Center/Publications/2018/01/01/Varicella. Accessed 29 August 2019.
29. Headquarters, Departments of the Army, the Navy, the Air Force, and the Coast Guard. Army Regulation 40-563, BUMEDINST 6230.15B, AFI 48–110_IP, CG COMDTINST M6230.4G. Medical Services: Immunizations and Chemoprophylaxis for the Prevention of Infectious Diseases. 7 November 2013.
30. Hall V, Banerjee E, Kenyon C, et al. Measles Outbreak–Minnesota April–May 2017. *MMWR Morb Mortal Wkly Rep*. 2017;66(27):713–717.
31. Patel M, Lee AD, Redd SB, et al. Increase in Measles Cases–United States, January 1–April 26, 2019. *MMWR Morb Mortal Wkly Rep*. 2019;68(17):402–404.
32. McLean HQ, Fiebelkorn AP, Temte JL, Wallace GS, Centers for Disease Control and Prevention. Prevention of measles, rubella, congenital rubella syndrome, and mumps, 2013: summary recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep*. 2013;62(RR-04):1–34.
33. Centers for Disease Control and Prevention. Mumps vaccination. https://www.cdc.gov/mumps/vaccination.html. Accessed 29 August 2019.
34. Centers for Disease Control and Prevention. Measles Vaccination. https://www.cdc.gov/measles/vaccination.html. Accessed 29 August 2019.
35. Hamami D, Cameron R, Pollock KG, Shankland C. Waning immunity is associated with periodic large outbreaks of mumps: a mathematical modeling study of Scottish data. *Front Physiol*. 2017;8:233.
36. Marshall HS, Plotkin S. The changing epidemiology of mumps in a high vaccination era. *Lancet Infect Dis*. 2019;19(2):188–119.
37. Zengel J, Phan SI, Pickar A, Xu P, He B. Immunogenicity of mumps virus vaccine candidates matching circulating genotypes in the United States and China. *Vaccine*. 2017;35:3988–3994.
38. Scepanovic P, Alanio C, Hammer C, et al. Human genetic variants and age are the strongest predictors of humoral immune responses to common pathogens and vaccines. *Genome Med*. 2018;10(59):1–13.
39. Centers for Disease Control and Prevention. Vaccine information statements (VISs). https://www.cdc.gov/vaccines/hcp/vis/current-vis.html. Accessed 28 August 2019.

Animal Bites and Rabies Post-exposure Prophylaxis, Active and Reserve Components, U.S. Armed Forces, 2011–2018

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During 2011–2018, there were 22,729 diagnoses of animal bites among active and reserve component members of the U.S. Armed Forces. Of these, 899 (4.0%) were documented during medical encounters associated with deployments to overseas theaters of operations. Army, Navy, Air Force, and Marine Corps members were affected by 55.6%, 23.5%, 14.2%, and 6.7% of all animal bites diagnosed in theater, respectively. More than four-fifths of total animal bite cases (82.4%) and bites diagnosed in theater (88.4%) affected enlisted members. The crude overall incidence rate of animal bite diagnoses was 175.7 per 100,000 person-years (p-yrs) among active component service members between 2011 and 2018. Overall rates were highest among active component service members who worked in law enforcement (462.5 per 100,000 p-yrs) or veterinary occupations (437.8 per 100,000 p-yrs). Among active component service members, the crude annual rate of animal bite diagnoses in 2018 was more than twice that in 2001 (191.4 per 100,000 p-yrs and 85.1 per 100,000 p-yrs, respectively). Dog bites accounted for approximately three-quarters (74.8%) of total animal bites during the surveillance period. Only a small proportion of animal bites were associated with documentation of exposure to or post-exposure prophylaxis for rabies. Animal bite avoidance and rabies education should be reinforced before service members travel or deploy to areas where rabies is highly enzootic.

WHAT ARE THE NEW FINDINGS?

On average, there were approximately 8 animal bite diagnoses per day among active and reserve component members during 2011–2018. Annual rates of bite diagnoses among active component service members doubled during this period. More than one-third of service members treated for bites in theater received rabies post-exposure prophylaxis. Of 72 bite diagnoses in theater in 2018, only 4 (5.6%) resulted in a confirmed Medical Event Report for rabies post-exposure prophylaxis.

WHAT IS THE IMPACT ON READINESS AND FORCE HEALTH PROTECTION?

Human animal-bite injuries remain an important public health concern for the U.S. military. Bite injuries are common, and the risk of transmission of rabies, a fatal disease, makes it essential that medical care providers, especially those in rabies enzootic areas, be knowledgeable about when and how to provide pre-exposure rabies immunizations and post-exposure prophylaxis whenever indicated.

Human animal-bite injuries are relatively common worldwide and represent a significant public health problem because of the associated risk of rabies virus exposure, skin infection, and tissue damage. Most animal bites produce only minor injuries; however, depending on the size and type of biting animal, wounds can range from minimal to life-threatening.[1] Risk of infectious complications increases if animal bites are left untreated or if treatment is delayed.[1]

Despite the potential public health consequences of human animal-bites, such injuries have not been routinely tracked at the local or regional level in the U.S.[2,3] Retrospective reviews of hospital records have estimated that between 2 and 5 million animal bites occur annually in North America; these injuries accounted for about 1% of emergency department visits and an estimated 10,000 inpatient admissions annually.[3–5]

Rabies is the most important public health concern associated with human animal-bite injuries. This disease is caused by infection with viruses in the family *Rhabdoviridae*, genus *Lyssavirus*, the most common of which is *Rabies lyssavirus*.[6] Rabies virus is generally transmitted through exposure to the saliva of an infected animal, most commonly through bite wounds, open cuts in skin, or mucous membranes.[7] In mammals, including humans, rabies virus spreads via peripheral nerves to the central nervous system.[8] Viral replication and shedding of rabies viruses occurs in highly innervated areas such as the salivary glands.[8] Infection of the brain causes acute, progressive inflammation leading to difficulty swallowing, hydrophobia, neurologic deficits, abnormal behavior, paralysis, seizures, coma, and ultimately death.[9]

In the U.S., wild animals are the most likely source of human exposure to rabies.[9] Rabies surveillance in the U.S. has identified bats (with multiple rabies virus variants in multiple species), raccoons, skunks, and foxes as the 4 major animal reservoirs.[10,11] During 2017, 49 states reported 4,423 rabid animals and 2 human rabies cases to the Centers for Disease Control and Prevention.[12] Wildlife accounted for 91.3% of rabies cases reported in the U.S. in 2017; bats were the most frequently reported rabid wildlife species (32.4% of all animal cases), followed by raccoons (28.8%), skunks (21.2%), and foxes (7.1%).[12]

Currently, there is no known effective treatment for symptomatic rabies, and

progression to death is rapid once symptoms appear.[7] Human rabies survival is exceptionally rare and, when it does occur, is often associated with severe neurologic sequelae.[13] However, if exposure to rabies is identified early, post-exposure prophylaxis (PEP), which includes immediate wound care and the administration of human rabies immune globulin (HRIG) and rabies vaccine, is highly effective in preventing progression of the infection and clinical manifestations.[3,14,15] Individuals who have been previously vaccinated or are receiving pre-exposure prophylaxis (PrEP) for rabies should receive only rabies vaccine and any necessary wound care. Administration of HRIG is unnecessary in such cases because the vaccination booster stimulates an effective anamnestic antibody response.[14]

Service members are at risk for animal bites and rabies exposures in the U.S. and during deployment to areas of the world where canine rabies is enzootic, including Africa, Asia, and parts of Central and South America.[16,17] Risk of exposure to rabies is higher for service members in certain military occupations such as veterinary service personnel, working dog handlers, personnel who have animal control duties, certain laboratory workers who work with rabies-suspect samples, and special operations personnel.[7,9,18–20] Department of Defense (DoD) instruction mandates personnel in these occupations receive rabies PrEP[18–20]; however, exposure to a potentially rabid animal still requires administration of rabies PEP.[19] PrEP is also considered for service members with longer-term assignments to regions where rabies is enzootic.[18–20]

In 2011, the *MSMR* summarized the numbers and types (but not rates) of animal bite diagnoses and rabies PEP among active and reserve component service members during 2001–2010.[21] The current analysis updates and expands on this earlier work by describing the incidence rates of animal bite diagnoses among active component service members between 2001 and 2018 and examining the number of reportable medical event (RME) records of "confirmed" rabies PEP for all animal bite cases in 2018.

METHODS

The surveillance period for the update of incidence rates was 1 January 2001 to 31 December 2018. For the more detailed analyses of demographic and military characteristics of bite victims, the surveillance period was limited to 2011–2018. The surveillance population included all individuals who served in the active or reserve component of the Army, Navy, Air Force, or Marine Corps at any time during the surveillance period. Diagnoses indicative of animal bites were ascertained from Defense Medical Surveillance System (DMSS) electronic records of all medical encounters of individuals who received care in fixed (i.e., not deployed or at sea) medical facilities of the Military Health System (MHS) or civilian facilities in the purchased care system. Records of healthcare encounters of deployed service members are maintained in the Theater Medical Data Store (TMDS), which is incorporated into the DMSS.

For the current analysis, a case was defined as an individual with an inpatient or outpatient International Classification of Diseases, 9th Revision [ICD-9] or International Classification of Diseases, 10th Revision [ICD-10] diagnosis code of "animal bite" in any diagnostic position **(Table 1)**. In order to prevent the counting of follow-up encounters for single animal bite episodes as new cases, each service member could be counted as a case only once per calendar year. In each calendar year, animal bite diagnoses associated with deployments to overseas theaters of operations (TMDS, "in theater") were prioritized over those from non-deployed settings (DMSS, "outside of

TABLE 1. ICD-9 and ICD-10 diagnostic codes indicative of animal bites

ICD-9[a]	ICD-10[a]
E906.0 (dog bites)	W54.0* (bitten by dog)
E906.1 (rat bite)	W53.11* (bitten by rat)
E906.3 (bite of other animal except arthropod)	W55.01* (bitten by cat)
	W55.11* (bitten by horse)
	W55.21* (bitten by cow)
	W55.31* (bitten by other hoof stock)
	W55.41* (bitten by pig)
	W55.51* (bitten by raccoon)
E906.5 (bite by unspecified animal)	W55.81* (bitten by other mammals)

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

TABLE 2. Diagnostic, CVX, and CPT codes used to identify rabies vaccine and immunoglobulin administration

	ICD-9	ICD-10	CVX codes	CPT codes
Exposure to rabies	V01.5	Z20.3	.	.
Rabies vaccine[a]	.	.	018, 040, 090, 175, 176	90675, 90676
Rabies immune globulin[b]	.	Z29.14	034	90375, 90376
Unspecified immune globulin[c]	.	.	014, 086, 087	

[a]Also used DRUG_NAME field from PDTS/TMDS_MEDS where field contained "RABIES VACCINATION," "RABIES VACCINE," or "RABIES VIRUS VACCINE."
[b]Also used DRUG_NAME field from PDTS/TMDS_MEDS where field contained "RABIES IGB," "RABIES IMM GLOB," "RABIES IMMUNE GLOB," "RABIES IMMGLOB," or "RABIES IMMUNE GLOBULIN."
[c]Also used DRUG_NAME field from PDTS/TMDS_MEDS where field contained "IMMUNE GLOB" or "GLOBULIN IMMUNE."
CVX, (product type) code for vaccine administered; CPT, Current Procedural Terminology; ICD, International Classification of Diseases; PDTS, Pharmacy Data Transaction Service; TMDS_MEDS, Theater Medical Data Store medications; IGB, immune globulin; IMM, immune.

TABLE 3a. Animal bite diagnoses by demographic and military characteristics, reserve and active components, U.S. Armed Forces, 2011–2018

	Outside of theater		In theater		Total	
	No.	%	No.	%	No.	%
Total	21,830	100.0	899	100.0	22,729	100.0
Sex						
Female	4,876	22.3	146	16.2	5,022	22.1
Male	16,954	77.7	753	83.8	17,707	77.9
Age group (years)						
17–19	481	2.2	29	3.2	510	2.2
20–29	12,113	55.5	596	66.3	12,709	55.9
30–39	6,304	28.9	201	22.4	6,505	28.6
40+	2,932	13.4	73	8.1	3,005	13.2
Race/ethnicity						
Non-Hispanic white	15,509	71.0	649	72.2	16,158	71.1
Non-Hispanic black	1,694	7.8	71	7.9	1,765	7.8
Hispanic	2,537	11.6	106	11.8	2,643	11.6
Asian/Pacific Islander	650	3.0	18	2.0	668	2.9
American Indian/Alaska Native	222	1.0	11	1.2	233	1.0
Other/unknown	1,218	5.6	44	4.9	1,262	5.6
Service						
Army	10,331	47.3	500	55.6	10,831	47.7
Navy	3,740	17.1	211	23.5	3,951	17.4
Air Force	5,646	25.9	128	14.2	5,774	25.4
Marine Corps	2,113	9.7	60	6.7	2,173	9.6
Rank						
Junior enlisted (E1–E4)	7,876	36.1	418	46.5	8,294	36.5
Senior enlisted (E5–E9)	10,058	46.1	377	41.9	10,435	45.9
Junior officer (O1–O3; W1–W3)	2,473	11.3	72	8.0	2,545	11.2
Senior officer (O4–O10; W4–W5)	1,423	6.5	32	3.6	1,455	6.4
Military occupation						
Combat-specific[a]	2,886	13.2	268	29.8	3,154	13.9
Motor transport	553	2.5	23	2.6	576	2.5
Pilot/air crew	751	3.4	11	1.2	762	3.4
Repair/engineering	5,496	25.2	221	24.6	5,717	25.2
Communication/intelligence	4,753	21.8	131	14.6	4,884	21.5
Veterinarian	511	2.3	26	2.9	537	2.4
Healthcare (not including veterinarian)	2,359	10.8	41	4.6	2,400	10.6
Law enforcement	2,181	10.0	120	13.3	2,301	10.1
Other/unknown	2,340	10.7	58	6.5	2,398	10.6

[a]Infantry/artillery/combat engineering.
No., number.

theater"). Incidence rates of animal bite diagnoses were calculated for active component service members between 2001 and 2018. Incidence rates were not calculated for reserve/guard members because the DMSS does not contain activated service time for reserve/guard personnel.

For all service members identified as animal bite cases during 2011–2018, the number of such cases whose records contained diagnostic codes for "exposure to rabies" (ICD-9: V01.5; ICD-10: Z20.3) was determined. In addition, for all bite cases, the number who received rabies PEP as shown in immunization records (i.e., rabies vaccine, HRIG, and unspecified immune globulin) within 90 days of animal bite diagnoses were ascertained. The codes used to identify instances of rabies vaccine (CVX codes) and immunoglobulin administration are presented in **Table 2**.[22]

RME records of "confirmed" rabies PEP were also identified for all animal bite cases. It is DoD policy that administration of PEP against rabies must be reported electronically through military health channels for surveillance purposes.[23] However, because the reporting policy for RMEs of rabies PEP took effect in 2017, the current analysis was limited to those events reported among members of the active and reserve components during 2018.

The new electronic health record for the MHS, MHS GENESIS, was implemented at several military treatment facilities during 2017. Medical data from sites that are using MHS GENESIS 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 encounters for individuals seeking care at any of these facilities during 2017–2018 were not included in this analysis.

RESULTS

During the 8-year surveillance period, there were 22,729 diagnoses of animal bites among U.S. service members in the active and reserve components; on average, there were approximately 8 animal bite diagnoses per day throughout the period. Of all animal bite diagnoses among active and reserve component service members, 899 (4.0%) were documented during medical encounters in theater **(Table 3a)**.

Male service members accounted for over three-quarters (77.9%) of animal bite diagnoses overall and 83.8% of those diagnosed in theater. More than one-half (55.9%) of all animal bites and almost two-thirds (66.3%) of those diagnosed in theater affected 20–29 year old service members. Non-Hispanic white service members were affected by almost three-quarters of all animal bites—both overall (71.1%) and

TABLE 3b. Animal bite diagnoses by demographic and military characteristics, active component, U.S. Armed Forces, 2011–2018

	Total			Outside of theater		In theater	
	No.	%	Rate[a]	No.	%	No.	%
Total	18,778	100.0	175.7	18,012	100.0	766	100.0
Sex							
Female	3,960	21.1	241.9	3,843	21.3	117	15.3
Male	14,818	78.9	163.7	14,169	78.7	649	84.7
Age group (years)							
17–19	444	2.4	63.0	415	2.3	29	3.8
20–29	11,306	60.2	190.4	10,780	59.8	526	68.7
30–39	5,203	27.7	177.8	5,038	28.0	165	21.5
40+	1,825	9.7	163.3	1,779	9.9	46	6.0
Race/ethnicity							
Non-Hispanic white	13,155	70.1	208.7	12,611	70.0	544	71.0
Non-Hispanic black	1,511	8.0	87.9	1,450	8.1	61	8.0
Hispanic	2,276	12.1	153.8	2,182	12.1	94	12.3
Asian/Pacific Islander	540	2.9	131.7	524	2.9	16	2.1
American Indian/Alaska Native	191	1.0	173.2	181	1.0	10	1.3
Other/unknown	1,105	5.9	166.9	1,064	5.9	41	5.4
Service							
Army	8,253	44.0	204.2	7,857	43.6	396	51.7
Navy	3,578	19.1	139.6	3,376	18.7	202	26.4
Air Force	4,904	26.1	191.4	4,793	26.6	111	14.5
Marine Corps	2,043	10.9	134.5	1,986	11.0	57	7.4
Rank							
Junior enlisted (E1–E4)	7,247	38.6	155.6	6,882	38.2	365	47.7
Senior enlisted (E5–E9)	8,322	44.3	199.9	8,003	44.4	319	41.6
Junior officer (O1–O3; W1–W3)	2,149	11.4	185.8	2,092	11.6	57	7.4
Senior officer (O4–O10; W4–W5)	1,060	5.6	149.1	1,035	5.7	25	3.3
Military occupation							
Combat-specific[b]	2,685	14.3	174.1	2,453	13.6	232	30.3
Motor transport	424	2.3	137.0	403	2.2	21	2.7
Pilot/air crew	615	3.3	153.0	605	3.4	10	1.3
Repair/engineering	4,904	26.1	157.0	4,711	26.2	193	25.2
Communication/intelligence	3,746	19.9	161.2	3,636	20.2	110	14.4
Veterinarian	503	2.7	437.8	482	2.7	21	2.7
Healthcare (not including veterinarian)	2,007	10.7	216.5	1,981	11.0	26	3.4
Law enforcement	2,055	10.9	462.5	1,951	10.8	104	13.6
Other/unknown	1,839	9.8	122.7	1,790	9.9	49	6.4

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

in theater (72.2%)—that were documented on electronic healthcare records during medical encounters **(Table 3a)**.

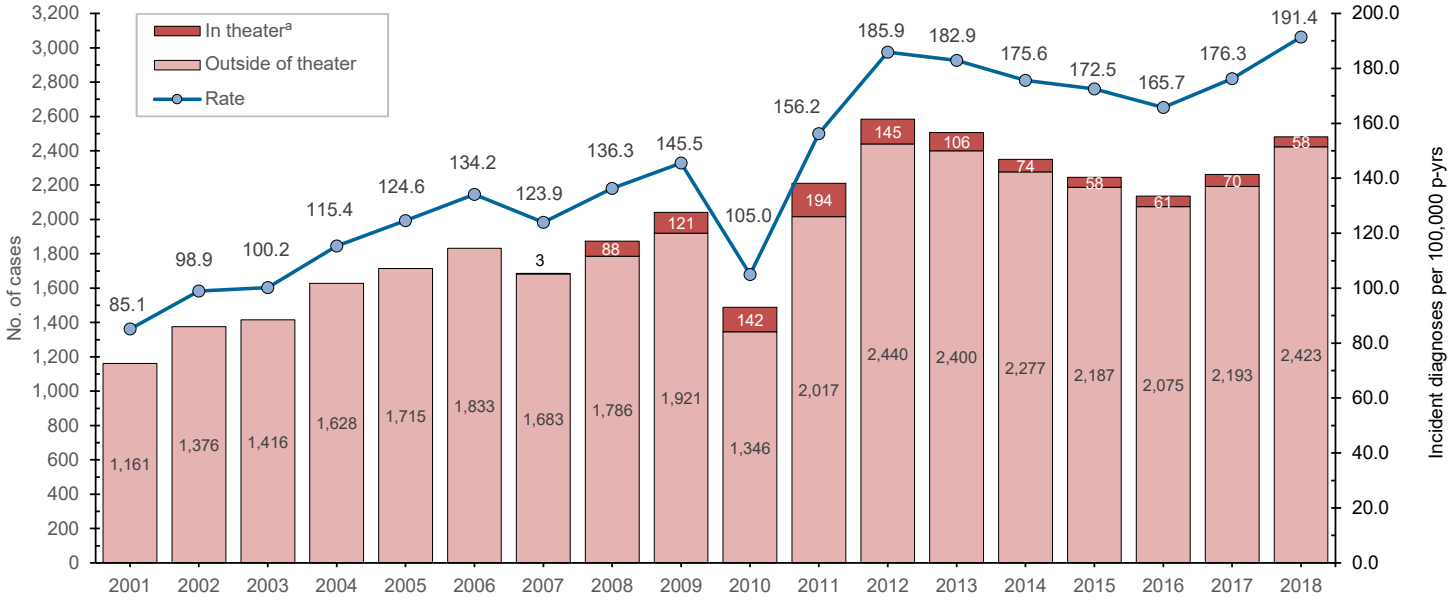
Army, Navy, Air Force, and Marine Corps members were affected by 55.6%, 23.5%, 14.2%, and 6.7% of all animal bites that were diagnosed in theater. Compared to their in-theater counterparts, Army and Navy members in non-deployed settings accounted for relatively lower percentages (47.3% and 17.1%, respectively) and Air Force and Marine Corps members had relatively higher percentages (25.9% and 9.7%, respectively) of cases. More than four-fifths of total animal bite cases (82.4%) and bites diagnosed in theater (88.4%) affected enlisted members **(Table 3a)**.

Among active and reserve component service members deployed in theater, those in combat-specific (n=268; 29.8%) or repair/engineering occupations (n=221; 24.6%) accounted for the most animal bite diagnoses; together, service members in these occupational groups accounted for more than one-half (54.4%) of animal bites diagnosed in theater **(Table 3a)**. Among service members outside of theater, those in repair/engineering (n=5,492; 25.2%) and communication/intelligence (n=4,753; 21.8%) occupations accounted for the greatest percentages of animal bite diagnoses. These occupational groups accounted for 46.9% of all animal bite diagnoses outside of theater. Veterinarians and other veterinary medicine workers (e.g., animal care specialists, animal health technicians) accounted for 26 (2.9%) animal bite cases in theater and 511 (2.3%) cases outside of theater during the surveillance period.

The crude overall incidence rate of animal bite diagnoses was 175.7 per 100,000 person-years (p-yrs) among active component service members between 2011 and 2018 **(Table 3b)**. Compared to their respective counterparts, active component service members who were female (241.9 per 100,000 p-yrs), 20–29 years old (190.4 per 100,000 p-yrs), members of the Army (204.2 per 100,000 p-yrs), and senior enlisted (199.9 per 100,000 p-yrs) tended to have higher overall rates of animal bite diagnoses. Across military occupations, overall rates of animal bite diagnoses were highest among active component service members working in law enforcement (462.5 per 100,000 p-yrs) and those in veterinary occupations (437.8 per 100,000 p-yrs) **(Table 3b)**. Among service members in the active component, the crude annual rate of animal bite diagnoses in 2018 was more than twice that in 2001 (191.4 per 100,000 p-yrs and 85.1 per 100,000 p-yrs, respectively) **(Figure 1)**.

Among active and reserve component service members, dog bites accounted for the majority of animal bites diagnosed outside of (75.4%) and in theater (58.2%)

FIGURE 1. Numbers and rates of animal bite diagnoses per year, active component, U.S. Armed Forces, 2001–2018

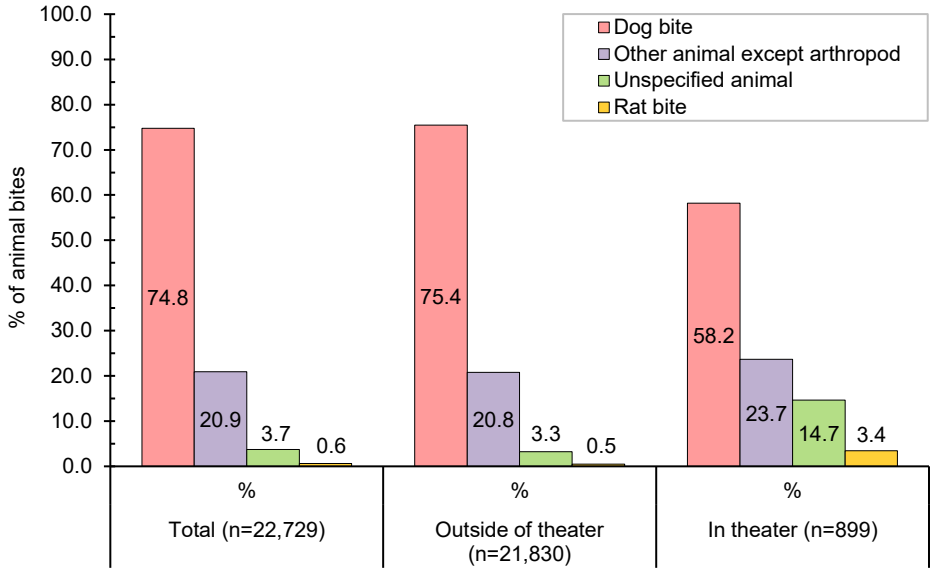


[a]Records of medical encounters in theater were not completely reported in TMDS before 2007.
No., number; p-yrs, person-years; TMDS, Theater Medical Data Store.

(Figure 2). Almost 1 in 4 (23.7%) of the animal bites diagnosed in theater were classified as having been attributed to "other animals" including cats, horses, cows, other hoof stock, pigs, and raccoons. Of note, rat bites accounted for 3.4% of animal bite cases in theater and less than 1% of cases outside of theater.

Of all animal bite diagnoses recorded outside of theater (n=21,830) during 2011–2018, 658 (3.0%) were associated with a diagnosis of exposure to rabies during a medical encounter within 90 days after the animal bite diagnosis **(Table 4)**. Almost three-quarters (n=490; 74.5%) of exposures to rabies diagnoses were documented within 1 week after the animal bite diagnosis. Fifty-nine (9.0%) of the 658 exposures to rabies diagnoses were documented 31–90 days after the animal bite diagnosis. Approximately one-eighth (12.6%; n=2,745) of the animal bite diagnoses recorded outside of theater were associated with rabies vaccination that was administered within 90 days after the diagnosis of the bite; less than 5% (3.8%; n=830) of the animal bites were associated with HRIG administration within 90 days after the animal bite diagnosis **(Table 4)**. Almost seven-eighths (87.1%) of the animal bite cases who were reportedly vaccinated and 89.2% of the cases who received HRIG received the respective PEP within 1 week after the bite diagnoses.

FIGURE 2. Animal bite diagnoses by type, reserve and active components, U.S. Armed Forces, 2011–2018



Of all animal bite cases diagnosed in theater, 28 (3.1%) were documented as exposure to rabies; more than three-eighths (39.3%) of the exposure to rabies diagnoses were documented within 1 week after the animal bite diagnosis and one-quarter (25.0%) were documented 31–90 days after the animal bite diagnosis **(Table 4)**. Of the 899 in-theater animal bite cases, 316 (35.2%) reportedly received rabies vaccine and 139 (15.5%) received HRIG within 90 days of the bite diagnoses. The vast majority of PEP associated with animal bite diagnoses recorded in theater were documented during medical

TABLE 4. Frequency of reports of "exposure to rabies" and rabies PEP associated with animal bite diagnoses, reserve and active components, U.S. Armed Forces, 2011–2018

	Outside of theater[a] (n=21,830)							In theater[a] (n=899)						
Follow-up time after animal bite diagnosis		0–7 days		8–30 days		31–90 days			0–7 days		8–30 days		31–90 days	
	Total	No.	%	No.	%	No.	%	Total	No.	%	No.	%	No.	%
Exposure to rabies diagnosis	658	490	74.5	109	16.6	59	9.0	28	11	39.3	10	35.7	7	25.0
Received rabies vaccine	2,745	2,392	87.1	239	8.7	114	4.2	316	291	92.1	15	4.7	10	3.2
Received HRIG	830	740	89.2	73	8.8	17	2.0	139	127	91.4	9	6.5	3	2.2
Received rabies vaccine and HRIG	793	707	89.2	71	9.0	15	1.9	132	120	90.9	9	6.8	3	2.3
Received rabies vaccine but no HRIG	1,952	1,684	86.3	171	8.8	97	5.0	184	165	89.7	11	6.0	8	4.3
Received unspecified immune globulin	8	8	100.0	.	.	.	.	.	.	.	.	.	.	.

[a]Source of animal bite diagnosis only; follow-up can be from either source.
PEP, post-exposure prophylaxis; No., number; HRIG, human rabies immune globulin.

TABLE 5. Frequency of reports of "exposure to rabies" and rabies PEP, reserve and active components, U.S. Armed Forces, 2018

	Outside of theater[a] (n=3,031)							In theater[a] (n=72)						
Follow-up time after animal bite diagnosis		0–7 days		8–30 days		31–90 days			0–7 days		8–30 days		31–90 days	
	Total	No.	%	No.	%	No.	%	Total	No.	%	No.	%	No.	%
Exposure to rabies diagnosis	151	127	84.1	17	11.3	7	4.6	4	3	75.0	.	.	1	25.0
Received rabies vaccine	374	331	88.5	23	6.1	20	5.3	19	18	94.7	1	5.3	.	.
Received HRIG	161	144	89.4	13	8.1	4	2.5	4	4	100.0	.	.	.	.
Received rabies vaccine and HRIG	148	133	89.9	11	7.4	4	2.7	4	4	100.0	.	.	.	.
Received rabies vaccine but no HRIG	226	194	85.8	17	7.5	15	6.6	15	14	93.3	1	6.7	.	.
Received unspecified immune globulin	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Confirmed RME for rabies PEP[b]	117	107	91.5	4	3.4	6	5.1	4	4	100.0	.	.	.	.

[a]Source of animal bite diagnosis only; follow-up can be from either source.
[b]Reporting policy for RMEs took effect in 2017.
PEP, post-exposure prophylaxis; No., number; HRIG, human rabies immune globulin; RME, reportable medical event.

encounters within 1 week after the respective bite diagnoses.

In 2018, of the 3,031 animal bite diagnoses recorded outside of theater, less than 5% (n=117; 3.9%) resulted in a confirmed RME for rabies PEP **(Table 5)**. Of the 72 animal bite diagnoses recorded in theater in 2018, 4 (5.6%) resulted in a confirmed RME for rabies PEP **(Table 5)**.

EDITORIAL COMMENT

Human animal-bite injuries remain an important public health concern for the U.S. military.[17,24,25] There were an average of 8 animal bite diagnoses per day among active and reserve component service members between 2011 and 2018. During this period, approximately 1 of every 25 animal bites overall were diagnosed in theater. Crude annual rates of animal bite diagnoses more than doubled from 2001 to 2018.

While this report documents about 55 clinically diagnosed animal bite cases among U.S. active and reserve component service members each week during 2011–2018, it undoubtedly significantly underestimates the actual numbers of animal bites. For example, most injuries from animal bites are minor; in such cases, service members are unlikely to seek medical care. However, even minor animal bite injuries can have serious consequences—particularly bites inflicted by wild animals (including bats, foxes, skunks, and raccoons), feral cats and dogs, and pets with unknown rabies vaccination statuses.[3]

In the current analysis, dog bites accounted for the largest proportion of animal bites of service members overall. Among service members in the U.S., dog bites are most likely inflicted by pets or military working dogs.[26,27] Such dogs are generally known to the bite victim and have almost always been vaccinated against rabies.[27] As such, it is not surprising that a small proportion of all service members who were treated for animal bites outside

TABLE 6. Recommendations for rabies PEP schedule[14–16]

Vaccination status	Treatment	Regimen
Not previously vaccinated	Wound cleansing	Wound(s) should be immediately and thoroughly cleansed with soap and water. If available, a virucidal agent such as povidone-iodine solution should be used to irrigate the wounds.
	HRIG	On day 0 at the time of PEP initiation, the wound(s) should be infiltrated with HRIG at a dose of 20 IU/kg body weight. Any remaining dose that cannot be infiltrated into the wound(s) because of space limitations may be administered intramuscularly but at an anatomic site distant from vaccine administration. Because HRIG might partially suppress active production of antibody, no more than the recommended dose should be administered. If HRIG was not administered when vaccination was begun on day 0, it can be administered up to and including day 7 of the PEP series.
	Vaccine	Four doses of 1.0 mL of HDVC or PCECV should be given intramuscularly into 1 site on days 0, 3, 7, and 14. Administer vaccine in the deltoid areas in adults and older children and in the outer aspect of the thigh for younger children. The vaccine should never be administered in the gluteal area. Doses of vaccine on days 3, 7, and 14 can be administered in the same anatomic location in which HRIG was administered. For immunosuppressed individuals, rabies PEP should be administered using all 5 doses of vaccine on days 0, 3, 7, 14, and 28. The rabies vaccine schedule should be followed as closely as possible; if the schedule is not followed exactly, doses may be given farther apart but no closer together in time.
Previously vaccinated[a]	Wound cleansing	Wound(s) should be immediately and thoroughly cleansed with soap and water. If available, a virucidal agent such as povidone-iodine solution should be used to irrigate the wounds.
	HRIG	HRIG should not be administered.[b]
	Vaccine	Administer 2 doses of HDVC or PCECV (1.0 mL each in the deltoid areas). The first dose should be given immediately, and the second dose on day 3.

[a]Previously vaccinated persons are those who have received 1 of the ACIP-recommended PrEP or PEP regimens (with cell-culture vaccines) or those who received another vaccine regimen (or vaccines other than cell-culture vaccine) and had a documented, adequate rabies virus-neutralizing antibody response.
[b]HRIG should not be administered to previously vaccinated persons to avoid possible inhibition of the relative strength or rapidity of an expected anamnestic response.
PEP, post-exposure prophylaxis; HRIG, human rabies immune globulin; HDVC, human diploid vaccine; PCECV, purified chick embryo cell vaccine; ACIP, Advisory Committee on Immunization Practices; PrEP, pre-exposure prophylaxis.

of theater received rabies PEP (i.e., rabies vaccination, HRIG). In contrast, more than one-third of service members who were treated for animal bites in theater reportedly received rabies PEP. It is likely that instances of diagnoses of "exposure to rabies" that were associated with HRIG administration but no rabies vaccine were the result of termination of PEP when the biting animal was deemed to be rabies free.

When considering the percentage of animal bite cases in 2018 that were associated with confirmed RMEs for rabies PEP, it is important to note that guidelines specify that cases must meet 1 or more of 3 exposure criteria. These criteria include a bite, scratch, or other contact situation in which saliva or central nervous system tissue of a rabid or potentially rabid animal could have entered an open wound or come into contact with a mucous membrane (i.e., eye, mouth, or nose); inadvertent contact with a bat or situation in which bat contact cannot be ruled out (e.g., finding a bat in a room with a sleeping person); or receipt of donated organ tissue from suspected or known human cases of rabies.[23] Guidelines also specify that an RME for PEP should not be reported in cases where PEP was initiated but subsequently deemed unnecessary because a full rabies exposure risk assessment found that none of the criteria were met.[23] Among the animal bite cases diagnosed outside of theater, the discordance between the number of cases who reportedly received PEP based on immunization data and the number of confirmed RMEs for PEP suggests that information on a subset of PEP administrations was not captured, accurately classified, and/or submitted through the Disease Reporting System internet (DRSi). Similar gaps in RME surveillance have been noted for other diseases.[28] Findings of the current analysis highlight the importance of training DRSi reporters at military treatment facilities on the critical reporting elements and the exposure criteria that inform final case classification.

Given the potentially lethal consequences of rabies, all service members should be educated regarding the importance of avoiding wild and stray animals (particularly feral dogs and cats) and protecting against and seeking medical care for animal bites. Animal bite avoidance and rabies education should be reinforced before service members travel or deploy to areas where rabies is highly enzootic; service members at high risk should be considered for pre-exposure rabies vaccination.[19,29] Medical care providers at all levels—and particularly those serving in areas

where rabies is enzootic—should communicate with veterinary providers as needed in assessing risk and determining need for PEP as well as be knowledgeable and capable of providing pre-exposure rabies immunizations and PEP whenever indicated **(Table 6)**.

The range of destinations for U.S. military deployments, including humanitarian assistance, peacekeeping, and partnership-building missions, has broadened in recent years, making the potential for rabies exposure more variable and difficult to predict.[17,29] The increased likelihood of rabies exposure when conducting operations in areas where rabies is enzootic requires accurate risk assessment, ongoing risk communication, robust surveillance, and strong leadership engagement to prevent service member exposure to potentially rabid animals.[17,30]

REFERENCES

1. Hargrove JR, Freer L. Wild animal attacks and injuries. In: Bledsoe GH, Manyak MJ, Townes, DA, eds. *Expedition and Wilderness Medicine*. New York, NY: Cambridge University Press; 2009:27–28.
2. Gilchrist J, Sacks JJ, White D, Kresnow MJ. Dog bites: still a problem? *Inj Prev.* 2008;14(5):296–301.
3. Lyu C, Jewell MP, Piron J, et al. Burden of bites by dogs and other animals in Los Angeles County, California, 2009–2011. *Public Health Rep*. 2016;131(6):800–808.
4. Stevens DL, Bisno AL, Chambers HF, et al. Practice guidelines for the diagnosis and management of skin and soft tissue infections: 2014 update by the Infectious Diseases Society of America. *Clin Infect Dis.* 2014;59(2): e10–52
5. Centers for Disease Control and Prevention. Nonfatal dog bite-related injuries treated in hospital emergency departments—United States, 2001. *MMWR Morb Mortal Wkly Rep*. 2003;52(26):605–610.
6. Begeman L, GeurtsvanKessel C, Finke S, et al. Comparative pathogenesis of rabies in bats and carnivores, and implications for spillover to humans. *Lancet Infect Dis*. 2018;18(4):e147–e159.
7. Manning SE, Rupprecht CE, Fishbein D, et al. Human rabies prevention—United States, 2008: recommendations of the Advisory Committee on Immunization Practices. *MMWR Recomm Rep*. 2008;57(RR-3):1–28.
8. Warrell MJ, Warrell DA. Rabies and other lyssavirus diseases. *Lancet*. 2004;363(9413):959–969.
9. Brown CM, Slavinski S, Ettestad P, Sidwa TJ, Sorhage FE. Compendium of animal rabies prevention and control, 2016. *J Am Vet Med Assoc*. 2016;248(5):505–517.
10. Birhane MG, Cleaton JM, Monroe BP, et al. Rabies surveillance in the United States during 2015. *J Am Vet Med Assoc*. 2017;250(10):1117–1130.
11. Feder HM Jr, Petersen BW, Robertson KL, Rupprecht CE. Rabies: still a uniformly fatal disease? Historical occurrence, epidemiological trends, and paradigm shifts. *Curr Infect Dis Rep*. 2012;14(4):408–422.
12. Ma X, Monroe BP, Cleaton JM, et al. Rabies surveillance in the United States during 2017. *J Am Vet Med Assoc*. 2018;253(12):1555–1568.
13. Jackson AC. Human rabies: a 2016 update. *Curr Infect Dis Rep*. 2016;18(11):38.
14. Rupprecht CE, Briggs D, Brown CM, et al. Use of a reduced (4-dose) vaccine schedule for postexposure prophylaxis to prevent human rabies: recommendations of the Advisory Committee on Immunization Practices. *MMWR Recomm Rep*. 2010;59(RR-2);1–9.
15. Defense Health Agency, Immunization Healthcare Division. Information paper. Rabies disease and rabies vaccine. https://health.mil/Reference-Center/Fact-Sheets/2019/07/03/Rabies-Disease-and-Rabies-Vaccine. Published 3 July 2019. Accessed 12 September 2019.
16. Wallace RM, Petersen BW, Shlim DR. Rabies. In: Brunette GW, Nemhauser JB, eds. *CDC Yellow Book 2020: Health Information for International Travel*. New York, NY: Oxford University Press; 2019:316.
17. Johnson LA, Lennon RP. Expeditionary force health protection for global health engagement: lessons learned from Continuing Promise 2017. *Mil Med*. 2018;183(5–6): e166–e173.
18. Headquarters. Departments of the Army, Navy, and the Air Force. Army Regulation 40-905, SECNAVINST 6401.1B, AFI 48-131. Medical Services: Veterinary Health Services. 29 August 2006.
19. Woodson J. Assistant Secretary of Defense for Health Affairs. Memorandum: Human Rabies Prevention During and After Deployment. Washington, DC: Department of Defense; 14 November 2011.
20. Headquarters, Departments of the Army, the Navy, the Air Force, and the Coast Guard. Army Regulation 40-562, BUMEDINST 6230.15B, AFI 48–110_IP, CG COMDTINST M6230.4G. Medical Services: Immunizations and Chemoprophylaxis for the Prevention of Infectious Diseases. 7 October 2013.
21. Armed Forces Health Surveillance Center. Animal bites, active and reserve components, U.S. Armed Forces, 2001–2010. *MSMR*. 2011;18(9)12–15.
22. Centers for Disease Control and Prevention. Immunization information systems (IIS). IIS: HL7 standard code set mapping CVX to vaccine groups. https://www2a.cdc.gov/vaccines/iis/iisstandards/vaccines.asp?rpt=vg#vg. Accessed 9 September 2019.
23. Armed Forces Health Surveillance Branch. Armed Forces Reportable Medical Events. Guidelines and Case Definitions, 2017. https://health.mil/Reference-Center/Publications/2017/07/17/Armed-Forces-Reportable-Medical-Events-Guidelines. Accessed 12 September 2019.
24. Cooper ED, Debboun M. The relevance of rabies to today's military. *US Army Med Dep J*. 2012;Jul-Sep:4–11.
25. Garges EC, Taylor KM, Pacha LA. Select public health and communicable disease lessons learned during Operations Iraqi Freedom and Enduring Freedom. *US Army Med Dep J*. 2016;(2-16):161–166.
26. Royal J, Taylor CL. Planning and operational considerations for units utilizing military working dogs. *J Spec Oper Med*. 2009;9(1):5–9.
27. Schermann H, Eiges N, Sabag A, et al. Estimation of dog-bit risk and related morbidity among personnel working with military dogs. *J Spec Oper Med*. 2017;17(3):51–54.
28. Ambrose JF, Kebisek J, Gibson KJ, White DW, O'Donnell FL. Commentary: Gaps in reportable medical event surveillance across the Department of the Army and recommended training tools to improve surveillance practices. *MSMR*. 2019;26(8):17–21.
29. Moe CD, Keiser PB. Should U.S. troops routinely get rabies pre-exposure prophylaxis? *Mil Med*. 2014;179(7):702–703.
30. Mease LE, Whitman S, Lawrence RE. Brief report: Increased number of possible rabies exposures among U.S. healthcare beneficiaries treated in military clinics in southern Germany in 2016. *MSMR*. 2018;25(11):18–20.

Surveillance Snapshot: Trends in Opioid Prescription Fills Among U.S. Military Service Members During Fiscal Years 2007–2017

Zachary J. Peters, MPH; Melissa W. Kincaid, PhD; Ruth F. Quah, MPH; Jennifer G. Greenberg, MPH; Justin C. Curry, PhD

FIGURE 1. Percentages of active duty and retired service members with 1 or more opioid prescription fills, fiscal years 2007–2017

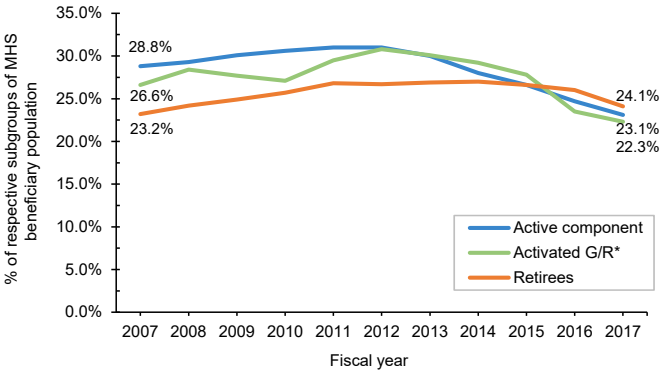


FIGURE 2. Percentages of opioid prescription fills exceeding 90 daily MMEs, active and retired service members, fiscal years 2007–2017

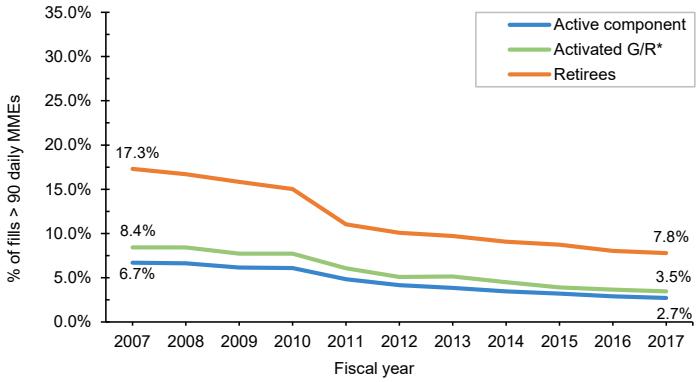


TABLE. Summary of percentages of beneficiaries with 1 or more opioid prescriptions, of median numbers of prescription fills per patient per year, and of percentages of opioid prescription fills that exceeded 90 daily MMEs, fiscal years 2007–2017

Metric	Beneficiary category	Fiscal year										
		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
% with 1+ opioid fill (Figure 1)	Active component	28.8%	29.3%	30.1%	30.6%	31.0%	31.0%	30.0%	28.0%	26.6%	24.7%	23.1%
	Activated G/R*	26.6%	28.4%	27.7%	27.1%	29.5%	30.8%	30.1%	29.2%	27.8%	23.5%	22.3%
	Retirees	23.2%	24.2%	24.9%	25.7%	26.8%	26.7%	26.9%	27.0%	26.6%	26.0%	24.1%
Median fills/patient w/ 1+ fill (not displayed)	Active component	3	3	3	3	3	3	3	3	2	2	2
	Activated G/R*	3	3	3	4	4	4	4	4	3	3	2
	Retirees	7	7	7	7	8	8	8	8	8	8	7
% of fills > 90 daily MMEs (Figure 2)	Active component	6.7%	6.6%	6.2%	6.1%	4.8%	4.2%	3.9%	3.5%	3.2%	2.9%	2.7%
	Activated G/R*	8.4%	8.4%	7.7%	7.7%	6.1%	5.1%	5.1%	4.5%	3.9%	3.6%	3.5%
	Retirees	17.3%	16.7%	15.8%	15.0%	11.0%	10.1%	9.7%	9.1%	8.7%	8.0%	7.8%

*Activated Guard and Reserves.
Data source: MHS Data Repository, Pharmacy Data Transaction Service, and Defense Enrollment Eligibility Reporting System data tables.
MHS, Military Health System; MME, morphine milligram equivalent.

This snapshot highlights unadjusted metrics of opioid prescription fills among active duty and retired service members using data from the Pharmacy Data Transaction Service of the Military Health System (MHS). The metrics described include

- the percentage of active component, reserve component, and military retirees who filled at least 1 opioid prescription (therapeutic class = opiate agonist) in a given year **(Figure 1, Table)**;
- the median number of fills per year among those with at least 1 fill **(Table)**; and
- the percentage of opioid fills that exceeded 90 daily morphine milligram equivalents (MMEs) **(Figure 2)**.[a]

Despite decreasing fill rates in recent years, nearly 1 in 4 active duty and retired service members had a filled opioid prescription in 2017 **(Figure 1)**. Active duty and activated Guard/Reserve members who received an opioid prescription had a median of 2 fills per patient in 2017, while retirees had a median of 7 fills per patient **(Table)**. Moreover, a higher percentage of retirees' opioid prescriptions were for high-dose prescriptions (as determined by MMEs)[1,2] compared to active duty and activated Guard/Reserve, although rates were not adjusted for age **(Figure 2)**. While increased duration and prescriptions greater than 90 MME per day are not necessarily problematic in and of themselves, both are risk factors for potential misuse and may be indicators of potentially concerning prescribing practices.[3] These findings highlight the importance of tracking opioid fills in the MHS, monitoring patients with opioid prescriptions, expanding surveillance efforts to assess prescription practices, and limiting opportunities for opioid misuse and abuse. Despite substantial rates of opioid prescription fills, opioid use disorders are diagnosed infrequently among service members in the MHS (0.2% prevalence from 2010–2015).[4] It is important to emphasize and sustain initiatives such as the Defense Health Agency's Opioid Prescriber Safety Training Program as well as regulatory guidance[5] aimed at facilitating the responsible use of this important facet of pain management.

[a]Daily MME = (strength per unit) x (number of units/days' supply) x (MME conversion factor).[1,2,5]

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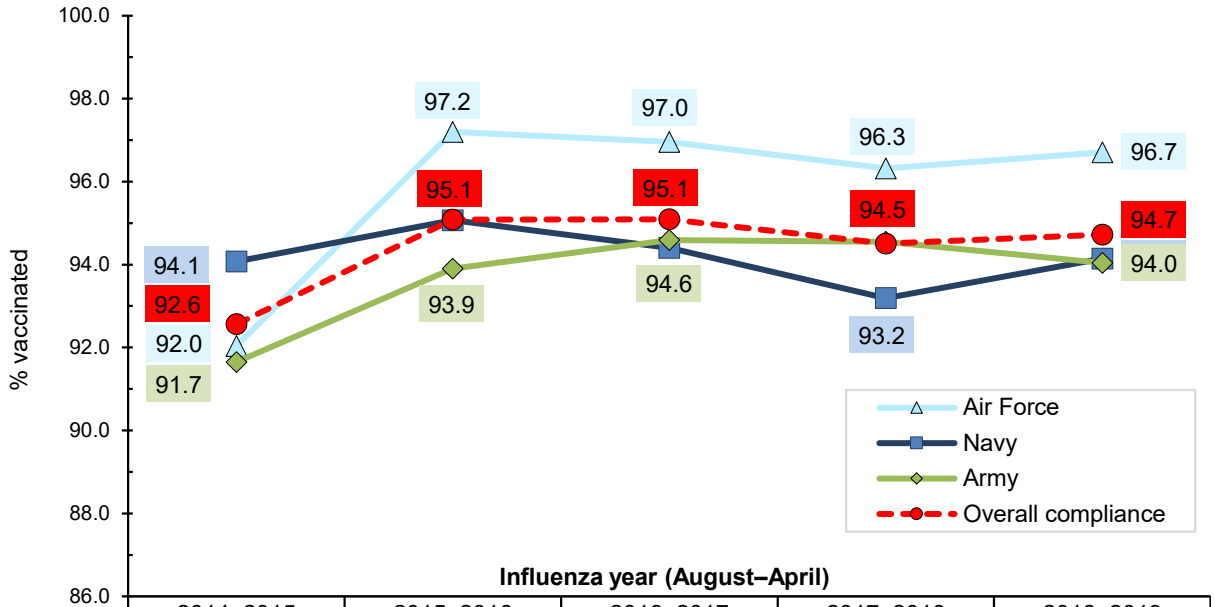
REFERENCES

1. Centers for Disease Control and Prevention. Opioid oral morphine milligram equivalent (MME) conversion factors. https://www.cms.gov/Medicare/Prescription-Drug-Coverage/PrescriptionDrugCovContra/Downloads/Opioid-Morphine-EQ-Conversion-Factors-Aug-2017.pdf. Accessed 24 June 2019.
2. Centers for Disease Control and Prevention. Calculating total daily dose of opioids for safer dosage. https://www.cdc.gov/drugoverdose/pdf/calculating_total_daily_dose-a.pdf. Accessed 24 June 2019.
3. Centers for Disease Control and Prevention. Vital signs: opioid prescribing. https://www.cdc.gov/vitalsigns/pdf/2017-07-vitalsigns.pdf. Published July 2017. Accessed 24 June 2019.
4. Office of the Secretary of Defense. Report to Congress on prescription drug abuse. https://health.mil/Reference-Center/Reports/2016/04/15/Prescription-Drug-Abuse. Published March 2016. Accessed 24 June 2019
5. Defense Health Agency. Procedural Instruction 6025.04. Pain Management and Opioid Safety in the MHS. 8 June 2018.

Surveillance Snapshot: Influenza Immunization Among U.S. Armed Forces Healthcare Workers, August 2014–April 2019

FIGURE. Percentage of healthcare 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 2014–April 2019



	2014–2015	2015–2016	2016–2017	2017–2018	2018–2019
Air Force	92.0	97.2	97.0	96.3	96.7
Navy	94.1	95.1	94.4	93.2	94.1
Army	91.7	93.9	94.6	94.6	94.0
Overall compliance	92.6	95.1	95.1	94.5	94.7

The U.S. Advisory Committee on Immunization Practices recommends that all healthcare 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 healthcare 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 healthcare personnel who provide direct patient care and is recommended for all others (excluding those who are medically exempt).[2–4]

This snapshot covers a 5-year surveillance period (August 2014–April 2019) and presents the documented percentage compliance with the influenza immunization requirement among active component healthcare personnel of the Army, Navy, and Air Force. During the 2018–2019 influenza season, each of the 3 services had compliance rates of 94.0% or higher among healthcare personnel **(Figure).** For all services together, the compliance rate was 94.7%, very similar to the rate from the previous year.

REFERENCES

1. Centers for Disease Control and Prevention. Immunization of health-care personnel: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep*. 2011;60(RR-7):1–45.
2. Headquarters, Departments of the Army, the Navy, the Air Force, and the Coast Guard. Army Regulation 40-562, BUMEDINST 6230.15B, AFI 48-110_IP, CG COMDTINST M6230.4G. Medical Services: Immunizations and Chemoprophylaxis for the Prevention of Infectious Diseases. 7 October 2013.
3. Assistant Secretary of Defense for Health Affairs. Policy for Mandatory Seasonal Influenza Immunization for Civilian Health Care Personnel Who Provide Direct Patient Care in Department of Defense Military Treatment Facilities. Health Affairs Policy 08-005. 4 April 2008.
4. Assistant Secretary of Defense for Health Affairs. Addition of Pandemic Influenza Vaccine or Novel Influenza Vaccine to the Policy for Mandatory Seasonal Influenza Immunization for Civilian Health Care Personnel Who Provide Direct Patient Care in Department of Defense Military Treatment Facilities. Health Affairs Policy 11-010. 28 July 2011.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