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# Seroepidemiologic Investigation of a COVID-19 Outbreak Aboard a U.S. Navy Ship

*Brian W. Legendre, MD, MPH (CDR, MC, USN); Jessamyn Boltz, MPH; Asha Jindal Riegodedios, MSPH; Amy M. Brown, MPH (LT, MSC, USNR); Michael R. Kaplan, DO (CAPT, MC, USN); Jeffrey H. Feinberg, MD, MPH (CAPT, MC, USN); Andrew J. Sullivan, DO, MS (LCDR, MC, USN); Dawn M. Whiting, MPH (LCDR, MSC, USN); Tina M. Luse, MPH; Christine E. Glasheen, MPH; Beth T. Poitras, MPH; Ewell Hollis III, MD, MPH (CAPT, MC, USN); Christopher Myers, MS, PhD*

The crew of USS Kidd experienced a COVID-19 outbreak identified in April 2020. This is the earliest documented COVID-19 study with RT-PCR, serology, and pre-exposure test data on the entirety of the exposed population (n=333). Case definitions included 121 confirmed (36.3% of crewmembers) and 18 probable (5.4% of crewmembers) based on laboratory diagnostic test results. At the time of testing positive, 62 (44.6%) cases reported no symptoms. Hispanic ethnicity (AOR: 2.71, CI: 1.40-5.25) and non-smoker status (AOR: 2.28, CI: 1.26-4.12) were identified as statistically significant risk factors. This study highlights the value of rapid, onboard diagnostic testing to quickly identify an outbreak and enumerate cases, as well as the serological testing to flag potential cases missed with standard viral case identification methodologies.

**What are the new findings?**

One hundred twenty-one of the 333 crewmembers (36.3%) were confirmed COVID-19 cases. At the time of testing positive, 62 (44.6%) cases reported no symptoms. This high rate of asymptomatic infection presents a serious challenge to communicable disease control onboard ships.

**What is the impact on readiness and force health protection?**

This report helps highlight the value of placing real-time diagnostic testing capabilities in outbreak scenarios with high transmission rates.

The Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) virus, the cause of coronavirus disease 2019 (COVID-19), has been responsible for the largest respiratory illness pandemic since the influenza pandemic of 1918.[1–3] After January 2020, when the first case of COVID-19 in the United States (U.S.) was identified, public health departments were quickly overwhelmed with outbreaks across the country.[4] Ships were not exempt from the spread of the virus, as evidenced by outbreaks aboard the Diamond Princess cruise ship and USS Theodore Roosevelt aircraft carrier. COVID-19 spread rapidly on those ships, and the outbreaks received international media attention early in the year 2020.[5] The impact of respiratory virus outbreaks on the health and readiness of both naval and civilian shipboard populations has been well documented for both highly lethal and comparatively less virulent diseases. For example, in 1918, following a port of call to take on coal in Freetown, South Africa, a staggering 6.6% of the crew of the battleship HMS Africa died from influenza A (H1N1) infection while at sea.[6] In the first instance of a widespread SARS-CoV-2 outbreak aboard ship, the Diamond Princess cruise ship outbreak demonstrated the virus's ability to quickly spread throughout a confined population. Despite guest cabins allowing for isolation, 712 persons out of a total population of 3,711 (19.2%) on board the cruise ship became infected.[7] Shortly thereafter, the aircraft carrier USS Theodore Roosevelt experienced a COVID-19 outbreak during which 26.6% of the crew contracted a SARS-CoV-2 infection, with one fatality.[5] Both of these outbreaks required substantial supplementary support to put an end to the fast-spreading infection.

In April 2020, the USS Kidd, a U.S. Navy guided missile destroyer on deployment in the Pacific Ocean, experienced a COVID-19 outbreak. Lessons learned from the USS Theodore Roosevelt outbreak prompted the dispatch of a Medical Rapid Response Team (RRT) from the Naval Medical Readiness and Training Command (NMRTC) Jacksonville and the amphibious assault ship USS Makin Island to provide increased medical support and critical care, as well as increased isolation and quarantine capacity, for several USS Kidd crewmembers while at sea. On 28 April, USS Kidd pulled into port in San Diego, CA. U.S. Naval Surface Force Pacific-Medical Readiness Division (SURFPAC-MRD) stood up Task Force Victory, which included members from the Navy Environmental and Preventive Medicine Unit FIVE (NEPMU-5), Navy Reserve (NR) Expeditionary Medical Facility (EMF) Camp Pendleton, and the Naval Health Research Center (NHRC), to answer the need for a fast and effective testing and care response for USS Kidd crewmembers. The objective of this report is to describe the epidemiology of SARS-CoV-2 infection within an unvaccinated, closely confined, and previously healthy crew of the USS Kidd using diagnostic, epidemiologic, and reported symptom data.

## Methods

### Outbreak Timeline

Outbreak investigations concluded that the initial COVID-19 exposure must have occurred sometime during a port visit from 9 March to 19 March 2020. The first suspected case was not identified until 11 April, while the USS Kidd was at sea, when a Sailor reported persistent COVID-like illness (CLI) symptoms. This Sailor was medically evacuated to shore several days later due to worsening symptoms and tested positive for COVID-19 on 22 April. The USS Makin Island arrived the following day, on 23 April 2020, to assist with outbreak response activities. The RRT embarked on 23 April with RT-PCR testing supplies and began testing suspect cases with nasal swabs (in addition to meeting other outbreak response needs). On 28 April USS Kidd arrived at Naval Base San Diego. Upon arrival, all crewmembers who had not already tested positive were tested with reverse transcription-polymerase chain reaction (RT-PCR) using nasopharyngeal swabs as they disembarked onto the pier. Additionally, all crewmembers were offered counseling and the option for serological blood testing for COVID-19. RT-PCR testing and serological blood sample processing were then completed at NHRC. Apart from a caretaker crew remaining on the ship, the crew were then individually quarantined or isolated on shore while receiving continued medical care and diagnostic testing. After 14 days, the caretaker crew went into quarantine or isolation and was replaced by crewmembers who had completed quarantine and had two negative RT-PCR COVID-19 tests.

Prior to re-embarkation, along with RT-PCR tests crewmembers were again offered serological testing on 13 May 2020. Beginning 2 May 2020, crewmembers also submitted self-reports of symptoms experienced through the Defense Digital Service's (DDS) The Dawn Project, a modified version of DDS's mysymptoms.mil symptom checker application.[8] All crewmembers were required to report absence or presence of symptoms twice a day on this electronic application while in quarantine or isolation. The last RT-PCR test was conducted on 15 June. The case definitions for confirmed, probable, and CLI cases are illustrated in **Figure 1**.

### Sample Population and Study Variables

Demographic data for military crews were pulled from the Defense Enrollment Eligibility Reporting System (DEERS) and Defense Manpower Data Center (DMDC) personnel rosters from February 2020. Age at time of outbreak was calculated from date of birth as reported on 3 March 2020. Medical and symptomatic variables utilized for this analysis were assembled from information collected by the outbreak response team. Available data included work center/department, laboratory results, symptom information, and smoking status. Symptom data were supplemented by The Dawn Project symptom checker application.

### Laboratory Testing

Testing by RT-PCR for the presence of SARS-CoV-2 virus was conducted via two methods on three platforms. Initially, nasal swabs were processed for point-of-care testing with the Abbott 2020 ID NOW COVID-19 isothermal nucleic acid amplification test on board the ship until 28 April. Thereafter, nasopharyngeal swabs were collected into viral transport medium (VTM) for analysis on an Applied Biosystems 7500 Fast Dx Real-Time PCR instrument or on a bioMérieux BioFire FilmArray Torch platform. Samples were processed for viral nucleic acid extraction by the Qiagen QiaAmp-Viral RNA mini kit, and RT-PCR testing for SARS-CoV-2 was performed using the CDC's Emergency Use Authorization RT-PCR assay.

RT-PCR testing for non-COVID-19 respiratory viral pathogens was performed on a Luminex MAGPIX instrument with the FDA-approved NxTag Respiratory Pathogen Panel. This tested nasopharyngeal/VTM samples for the presence of nucleic acids from influenza A (pan)/A-H1/A-H3, influenza B (pan), respiratory syncytial virus A/B, rhinovirus/enterovirus, parainfluenza viruses 1/2/3/4, human metapneumovirus, adenovirus, and the seasonal coronaviruses HKU1/NL63/229E/OC43.

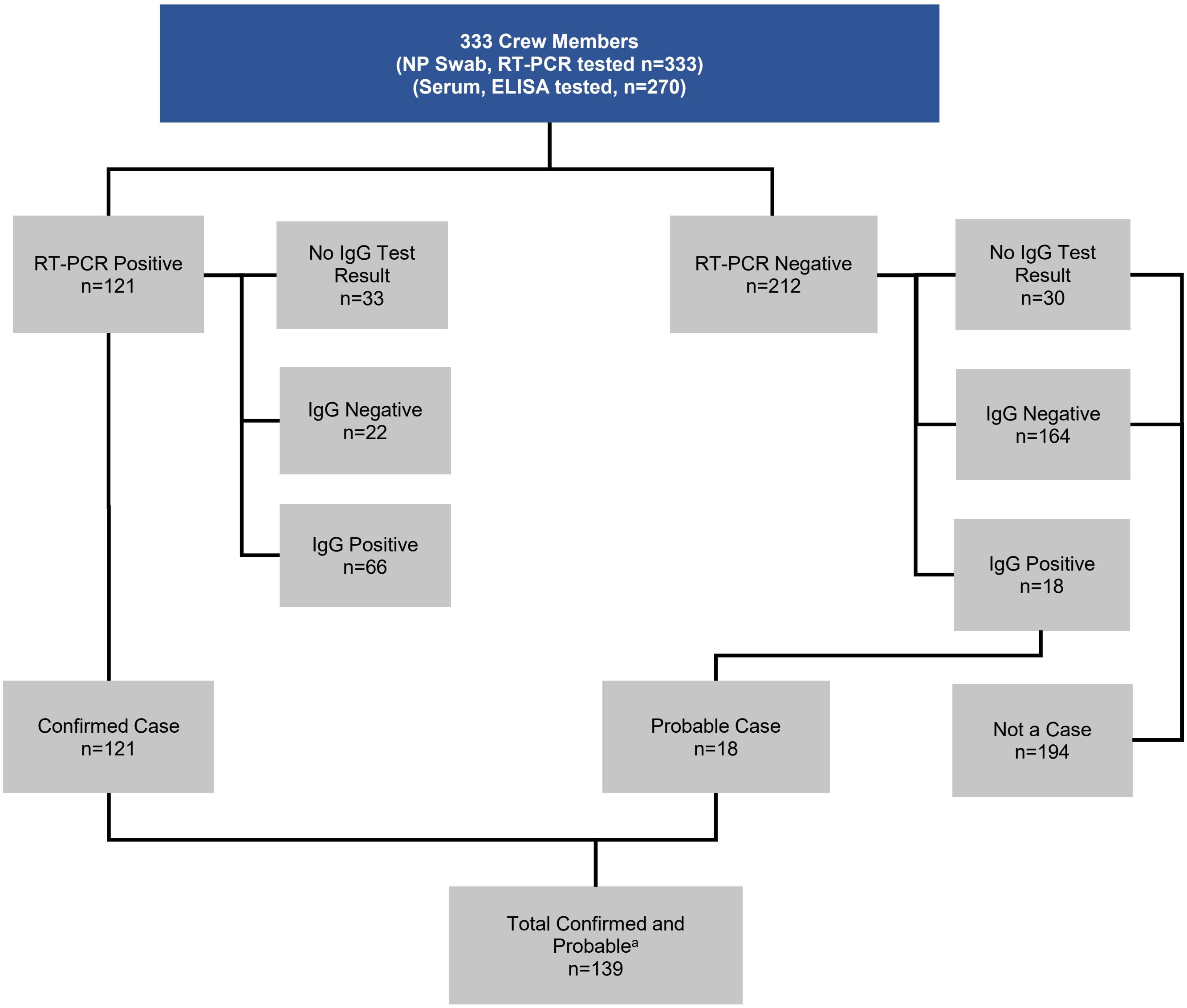
Serology samples voluntarily donated on 28 April or 13 May (whole blood collected by venipuncture) were collected and processed by NHRC and stored as serum. For each crew member who provided a serum specimen, an individually matched serum sample was obtained from the DOD Serum Repository, consisting of the most recent serum sample collected prior to October 2019, which served as a negative control for samples collected during the outbreak. All serum samples were tested for the presence of SARS-CoV-2 specific IgG antibodies using an enzyme-linked immunosorbent assay (ELISA) reactive to the SARS-CoV-2 nucleocapsid protein from Epitope Diagnostics. Tests were performed on an automated Dynex DS2 instrument.

### Case Definitions

A "confirmed" case was defined as a USS Kidd crewmember with a RT-PCR positive test. A "probable" case was defined as a USS Kidd crewmember with an IgG positive serology test and a negative RT-PCR test. Given the lack of diagnostic testing capabilities that highlighted the importance of symptomatic screening during the early days of the pandemic,[9,10] a symptom-based COVID-19-like illness (CLI) classification was also developed in this paper, although it was not included within the definition of a COVID-19 case. Crewmembers included within this classification exhibited symptoms consistent with COVID-19 but IgG and IgM serological testing was negative or RT-PCR test results were negative, and additional respiratory panel testing conducted retrospectively by NHRC after the outbreak was contained was also negative. Symptomatic cases were grouped into two categories of known COVID-19 symptoms at the time of the outbreak, based on the 5 April 2020 Council for State and Territorial Epidemiologists (CSTE) published clinical criteria. These criteria included at least one of the following: cough or shortness of breath (Category A); or at least two of the following: fever, chills, body aches, headaches, sore throat, and altered taste or smell (Category B).[11]

Confirmed and probable cases were further classified as symptomatic (symptom onset before first positive laboratory test),

**FIGURE 1.** Case flow chart




[a]Confirmed cases had a RT-PCR+ test. Probable cases had a RT-PCR- test and IgG+ test.

pre-symptomatic (first positive laboratory test before subsequent symptom onset), or no symptoms reported (positive laboratory test but never met clinical criteria) utilizing CSTE published criteria noted above.

## Statistical Analyses

Statistical analyses were conducted using SAS version 9.4 (SAS Institute Inc.) and R statistical software version 3.6.2 (R Core Team, 2019). Frequencies, attack rates, and unadjusted odds ratios across all case classifications (confirmed, probable, and CLI) were calculated; adjusted odds ratios with 95% confidence intervals were generated to control for all study demographic and military variables without missing data. Lastly, the symptom presentations for each case classification were compared using chi-square test or Fisher's exact test and a significance level of 5% ($P$<0.05).

## Institutional Review

The study protocol was approved by the Naval Health Research Center Institutional Review Board in compliance with all applicable Federal regulations governing the protection of human subjects. Research data were derived from an approved Naval Health Research Center Institutional Review Board protocol, number NHRC.2020.0007.

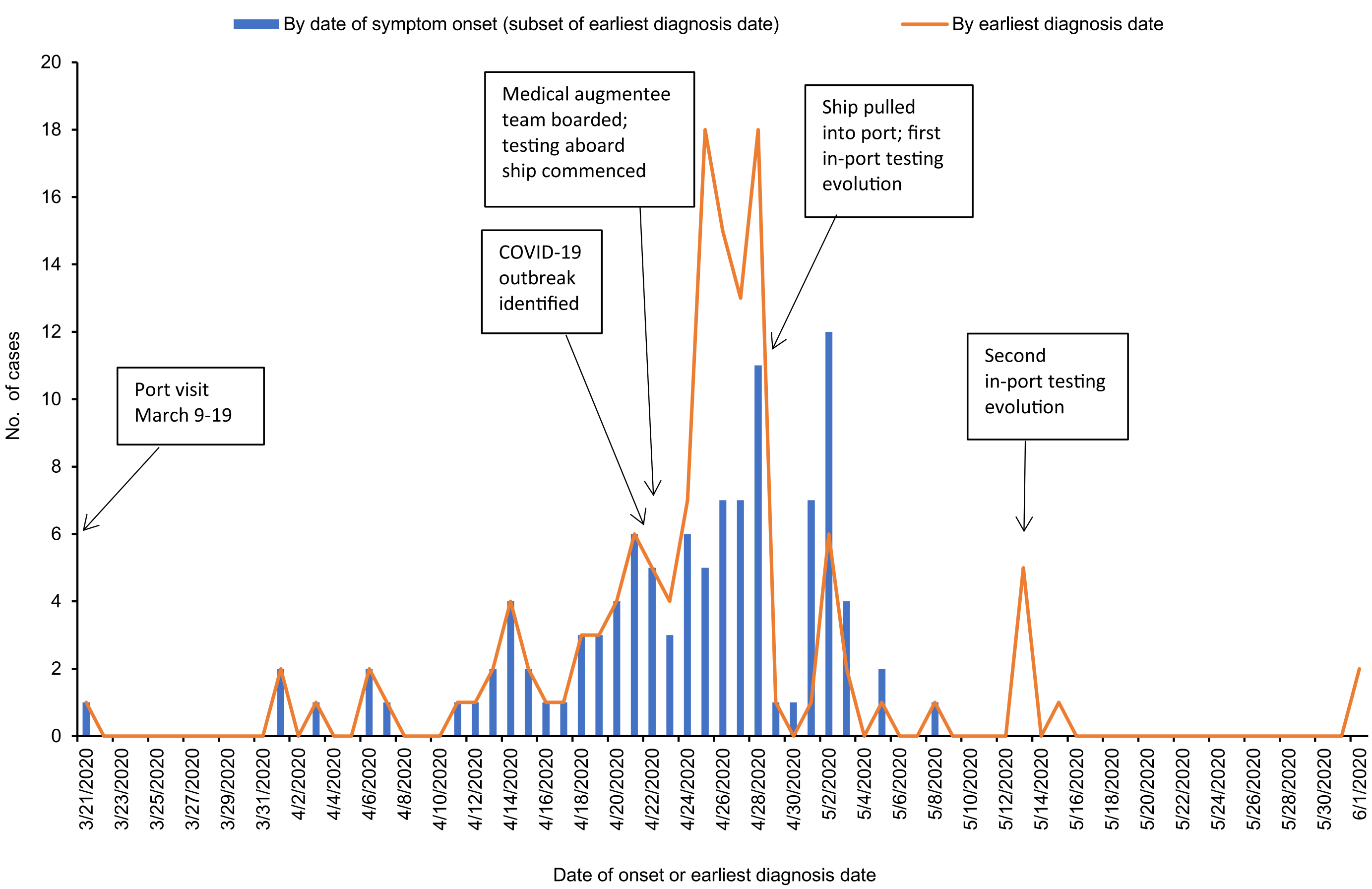
## Results

The crew were predominantly young adults (31.5% were 22-25 years of age), male (82.3%), White (50.8%), enlisted (83.2%), and self-reported as non-smokers (76.3%) **(Table 1)**. One hundred twenty-one of the 333 crewmembers (36.3%) were confirmed COVID-19 cases. A total of 270 crewmembers (81.1%) volunteered to provide additional blood samples for serological testing. An additional 18 probable cases (5.4%) were identified by the presence of serum IgG antibodies specific for SARS-CoV-2 virus. Additional laboratory testing for non-COVID-19 respiratory viral pathogens was conducted retrospectively on 75 crewmembers, including: all probable cases (n=18), all crewmembers classified as CLI (n=17) and 40 randomly selected COVID-19-negative crewmembers. Only one positive case for bocavirus and one positive case for rhinovirus were identified, and neither of those cases were within the probable case group (or CLI classification). Of the 139 confirmed and probable cases, 77 (55.4%) were symptomatic, 32 (23.0%) reported no symptoms, and 30 (21.6%) were pre-symptomatic at the time of testing. Additionally, 13 (72.2%) of the 18 cases that were discovered through serology testing also had no symptoms at the time of RT-PCR testing **(Figure 1 and Table 2)**. All results for IgM testing aligned with IgG positivity.

**Figure 2** shows the distribution of cases over time by earliest symptoms of infection. Based on symptom onset data, the outbreak appears to have expanded in three waves, with each wave successively larger than the previous. When cases were graphed based on diagnosis date (subset by first symptom of infection for asymptomatic cases), the peak of the outbreak shifted from 2 May to 25 April.

When looking at symptom presentation, the top 10 reported symptoms among the three COVID-19 case definitions are depicted in **Figure 3**. Confirmed (58%) and probable (100%) cases reported headache the most. Loss of taste or smell, a unique symptom of COVID-19 illness, showed

**FIGURE 2.** Distribution of COVID-19 cases by date of onset, 21 March 2020-1 June 2020




* Includes all COVID-19 confirmed and probable cases graphed by date of symptom onset or date of collection of first lab positive result, whichever was earlier. Confirmed cases had a RT-PCR+ test. Probable cases had a RT-PCR- test and IgG+ test.

**TABLE 1.** Shipboard population, case frequencies, attack rates, and characteristics associated with COVID-19 case classification through adjusted and unadjusted models

| Characteristic | Shipboard population | | COVID-19 cases[a] | Attack rate | Unadjusted model (n=333) | | Adjusted model (n=321)[b] | |
|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | OR (95% CI) | *P* value | AOR (95% CI) | *P* value |
| Total | 333 | - | 139 | 41.7 | - | - | - | - |
| Sex | | | | | | | | |
| Female | 59 | 17.7 | 27 | 45.8 | 1.06 (0.56-2.01) | 0.85 | 1.08 (0.57-2.03) | 0.82 |
| Male | 274 | 82.3 | 112 | 40.9 | ref | - | ref | - |
| Department | | | | | | | | |
| Air | 26 | 7.8 | 7 | 26.9 | 0.66 (0.23-1.92) | 0.45 | 0.42 (0.15-1.17) | 0.48 |
| Combat support | 68 | 20.4 | 27 | 39.7 | ref | - | ref | - |
| Engineering | 66 | 19.8 | 23 | 34.8 | 0.78 (0.36-1.69) | 0.53 | 0.66 (0.32-1.36) | 0.43 |
| Executive | 24 | 7.2 | 8 | 33.3 | 0.72 (0.23-2.13) | 0.55 | 0.40 (0.14-1.15) | 0.42 |
| Operations | 55 | 16.5 | 32 | 58.2 | 1.92 (0.86-4.30) | 0.11 | 1.42 (0.65-3.09) | 0.07 |
| Other | 12 | 3.6 | 4 | 33.3 | 1.56 (0.17-14.69) | 0.69 | 0.61 (0.16-2.25) | 0.43 |
| Plans and tactics | 21 | 6.3 | 8 | 38.1 | 0.69 (0.24-2.00) | 0.49 | 0.59 (0.21-1.66) | 0.51 |
| Supply | 31 | 9.3 | 15 | 48.4 | 1.28 (0.50-3.30) | 0.60 | 0.89 (0.36-2.23) | 0.58 |
| Weapons | 30 | 9 | 15 | 50.0 | 1.44 (0.58-3.58) | 0.44 | 0.95 (0.39-2.32) | 0.44 |
| Smoking Status | | | | | | | | |
| Yes | 75 | 22.5 | 19 | 25.3 | ref | - | ref | - |
| No | 254 | 76.3 | 118 | 46.5 | 3.11 (1.61-6.01) | 0.01 | 2.28 (1.26-4.12) | 0.01 |
| Unknown | 4 | 1.2 | 2 | 50.0 | 2.96 (0.32-27.67) | 0.34 | 2.34 (0.27-20.36) | 0.24 |
| Rank | | | | | | | | |
| Junior enlisted | 258 | 77.5 | 114 | 44.2 | ref | - | - | - |
| Senior enlisted | 19 | 5.7 | 6 | 31.6 | 0.56 (0.17-1.82) | 0.33 | - | - |
| Officer (Officer/Chief Warrant Officer) | 44 | 13.2 | 16 | 36.4 | 0.81 (0.39-1.68) | 0.57 | - | - |
| Unknown | 12 | 3.6 | - | 0.0 | - | - | - | - |
| Age groups (years) | | | | | | | | |
| 18-21 | 56 | 16.8 | 29 | 51.8 | ref | - | - | - |
| 22-25 | 105 | 31.5 | 44 | 41.9 | 0.74 (0.36-1.51) | 0.40 | 0.74 (0.37-1.48) | 0.39 |
| 26-30 | 80 | 24 | 30 | 37.5 | 0.81 (0.37-1.78) | 0.60 | 0.70 (0.33-1.49) | 0.36 |
| 31-53 | 92 | 27.6 | 36 | 39.1 | 0.86 (0.37-1.91) | 0.71 | 0.77 (0.37-1.60) | 0.57 |
| Race/ethnicity | | | | | | | | |
| American Indian/Alaskan Native | 13 | 3.9 | 6 | 46.2 | 2.34 (0.65-8.63) | 0.19 | 1.86 (0.55-6.25) | 0.31 |
| Asian or Pacific Islander | 27 | 8.1 | 6 | 22.2 | 0.42 (0.15-1.19) | 0.10 | 0.42 (0.15-1.18) | 0.10 |
| Black, not Hispanic | 46 | 13.8 | 19 | 41.3 | 0.93 (0.44-1.98) | 0.85 | 0.92 (0.44-1.92) | 0.83 |
| Hispanic | 62 | 18.6 | 36 | 58.1 | 2.74 (1.38-5.47) | 0.01 | 2.71 (1.40-5.25) | 0.01 |
| White, not Hispanic | 169 | 50.8 | 63 | 37.3 | ref | - | - | - |
| Other | 16 | 4.8 | 9 | 56.3 | 1.81 (0.60-5.51) | 0.29 | 1.87 (0.62-5.64) | 0.27 |

[a] Includes confirmed and probable cases, confirmed cases had a RT-PCR+ test. Probable cases had a RT-PCR- test and IgG+ test.
[b] Sex, department, smoking status, age, and race/ethnicity were controlled for in the adjusted model; rank was not included.
CI, confidence interval; ref, reference group; OR, odds ratio; AOR, adjusted odds ratio

similar proportions among confirmed (49%) and probable (40%) cases. Shortness of breath also was experienced similarly among confirmed (41%) and probable cases (40%). Reports of fever were greater among probable cases (40%) than among confirmed cases (27%). Additionally, there were statistically significant differences in reported symptoms, as evidenced in **Table 2** across all three symptom categories: no symptoms, pre-symptomatic, and symptomatic.

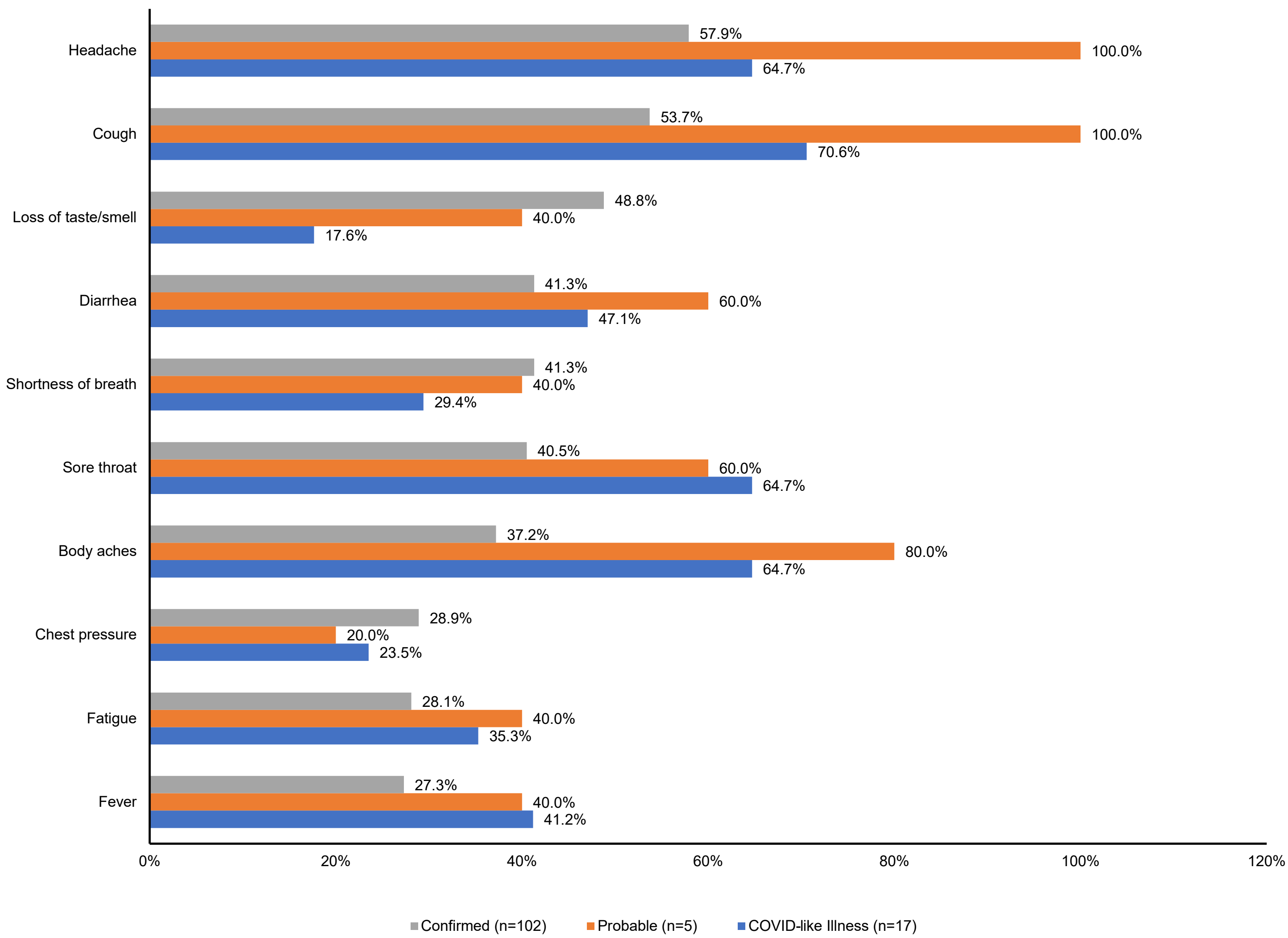
Of the 194 crewmembers who tested negative through both methodologies,

**TABLE 2.** Comparison of symptomatic presentation profiles among confirmed and probable cases[a]

| Symptom presentation | Confirmed cases (n=121) | | | Probable cases (n=18) | | |
|---|---|---|---|---|---|---|
| | No. | % | *P* value[b] | No. | % | *P* value[c] |
| | | | <0.0001 | | | <0.0001 |
| No symptoms reported | 19 | 15.7 | | 13 | 72.2 | |
| Presymptomatic | 26 | 21.5 | | 4 | 22.2 | |
| Symptomatic | 76 | 62.8 | | 1 | 5.6 | |

[a]Confirmed cases had a RT-PCR+ test. Probable cases had a RT-PCR- test and IgG+ test. Statistical significance was assessed both within each case definition as well as overall.
[b]Chi-Square Test
[c]Fisher's Exact Test

**FIGURE 3.** Percentage of reported symptom presentation among confirmed and probable cases, and COVID-like Illness (CLI) classifications




[a]Includes all COVID-19 confirmed and probable cases as well as CLI (Covid-like Illness) classifications graphed by date of symptom onset or date of collection of first lab positive result, whichever was earlier. Confirmed cases had a RT-PCR+ test. Probable cases had a RT-PCR- test and IgG+ test.

17 crewmembers fit the CLI classification due to reporting symptomatic profiles consistent with the 5 April 2020 CSTE published criteria.[11] These 17 crewmembers also had negative RT-PCR test results and negative IgG/IgM serology, and also had negative results from additional respiratory panel testing conducted retrospectively by NHRC after the outbreak was contained. **Figure 3** demonstrates that CLI cases most often reported cough (71%) and least often reported a loss in taste or smell (18%).

Hispanic ethnicity was found to be associated with COVID-19 positivity, with an adjusted odds ratio and confidence interval of 2.71 (1.40-5.25) **(Table 1)**. Interestingly, being a smoker was associated with a lower risk of becoming a confirmed case, as non-smokers had an adjusted odds ratio and confidence interval of 2.28 (1.26-4.12). There were no other significant findings among the additional military and demographic characteristics of rank, sex, or age.

Lastly, 9 crewmembers were sent to the emergency department (ED); and while all were eventually confirmed cases, 2 of these 9 were initially referred to the ED for mental health reasons. Five crewmembers were hospitalized for COVID-19-related treatment needs (average length of the first hospital stay was 2.8 days), and no cases were admitted to the Intensive Care Unit (ICU).

## Editorial Comment

The COVID-19 outbreak aboard USS Kidd illustrates the speed and breadth with which a highly transmissible respiratory virus can disseminate through closed congregate settings where social distancing measures are not possible and the population is immunologically naïve. With an attack rate of 41.7%, nearly half of the ship population tested positive for COVID-19 by RT-PCR or IgG diagnostic testing. A unique aspect of this outbreak response was the use of a RRT bringing RT-PCR testing capabilities aboard the ship shortly after identification of the first case. This resulted in the outbreak peaking three days after embarkation of the team and before the ship pulled into port. In fact, 64 of the 139 cases (46.0%) were diagnosed between 23 April, when the RRT embarked, and 27 April, the day before arriving to port in San Diego. By shifting case counts earlier in time, outbreak response was able to start earlier. Of note, this RT-PCR equipment was not a normal organic asset present on most ships.

Comprehensive diagnostic testing during this outbreak further improved understanding of how vital laboratory support was to identify and mitigate respiratory illnesses through serological testing capabilities once in port in San Diego. An additional 5% of the crew who were likely infected with COVID-19 had tested negative by RT-PCR. Confidence in the validity of the serological detection of COVID-19 within these probable cases was higher due to the use of individually matched pre-pandemic negative control samples obtained from the DOD Serum Repository. Only one sample from the serum repository showed an inconclusive serological reactivity for SARS-CoV-2, as opposed to a negative or positive result, to which this same individual then tested negative in April 2020 when re-tested. At the time of this study, average rates of asymptomatic infection by SARS-CoV-2 in the community were about one third of cases.[12] This high rate of asymptomatic infection presents a serious challenge to communicable disease control aboard ships where syndromic cases presenting at morning sick call is often the first notice of an outbreak.

At the time of testing positive, 62 (44.6%) of cases reported no symptoms, including 13 of the 18 cases that tested positive by serology but negative by RT-PCR. For symptomatic cases, the majority of confirmed cases presented as symptomatic or pre-symptomatic (84%). The majority of probable cases, however, had no symptoms reported (72%), as illustrated by **Table 2**. One study suggested that the global prevalence for loss of taste or smell for those with COVID-19 was about 48%, a comparable percentage to the symptomatic confirmed case group from USS Kidd (49%), and slightly higher than the symptomatic probable cases (40%), who also exhibited loss of taste or smell.[13] A loss of taste or smell has been a key symptom separating COVID-19 cases from other respiratory illnesses.[14] With less than half of cases from this outbreak reporting this symptom, however, loss of taste or smell should not be considered a reliable indicator of COVID-19 infection when diagnosing a respiratory illness.

The CLI classification was explored due to the unique circumstances of containing outbreaks on a military vessel where testing for respiratory pathogens is limited or non-existent. Had diagnostic testing not been available, USS Kidd would have had to rely on identifying cases based on the accepted symptom presentation for a COVID-19 case at that time. Additionally, the wealth of laboratory diagnostic data for an enumerated population permitted the investigative team to conduct additional testing to support the conclusion that no other pathogens were responsible for CLI symptom presentations at the time of the outbreak. Without diagnostic capabilities, these crewmembers would have been considered cases, and it is curious they exhibited COVID-like symptoms yet failed to test positive via RT-PCR or IgG. Had it been possible, follow up serological testing for COVID-19 on the crew (and particularly these members) would have been interesting. Additional possible causes for their reported symptoms could be non-infection-related causes such as: allergies, responses to weather (e.g., colder days may lead to runny noses, etc.), responses to not enough sleep (i.e., resulting in fatigue or headaches), or other factors that should be considered in future investigations of CLI classifications.

Given the size of USS Kidd and its dense population, most departments showed attack rates higher than 30%, with only the Air department lower, at 27% **(Table 1)**. The close confines of shipboard spaces present intrinsic challenges to social distancing and other public health measures. Crewmembers continue to be inherently vulnerable to outbreaks of novel respiratory pathogens.[15] This outbreak also showed an increased risk of infection among those of reported Hispanic ethnicity, even when controlling for department and rank. While racial and ethnic disparities have been identified for COVID-19 infection,[16] further research is needed to eliminate any possible confounders not accounted for within this analysis (e.g., shared duty stations, meal arrangements, etc.) in order to best mitigate risk factors in future COVID-19 outbreaks. Another curious finding is that smokers were less likely to be diagnosed as cases. While literature has found that smoking increased the risk of severe SARS-CoV-2 infection, the research at the time of this study was inconclusive about whether it may mitigate risk of contracting the virus.[17] One study that investigated the literature on nicotine's prophylactic potential for COVID-19 found not enough evidence reliably available for this theory, with more research needed to study this aspect of possible COVID-19 risk factors.[18]

In addition, medical care received by USS Kidd's crew highlighted the complexity of responding to a shipboard outbreak; 9 crewmembers were sent to the emergency department (ED), but not all were for direct COVID-19 treatment reasons. While all were eventually confirmed cases, 2 of these 9 were initially referred to the ED for mental health reasons. Although not directly related to COVID, being in isolation, combined with the stress of being infected with a novel virus, may have contributed to the mental health issues.

## Limitations

There were several limitations to this study. First, symptoms were self-reported and therefore potentially underreported; the reported experience of COVID-19 symptoms led many patients to discount their illness, particularly when mild and construed as "allergy related." As symptom data were collected through a variety of methods, this potential bias is likely limited. Second, given that this outbreak occurred prior to readily accessible RT-PCR testing onboard, it is possible the number of potential cases (RT-PCR negative but IgG positive cases) would have been RT-PCR positive cases if tested earlier. Furthermore, symptoms may also not have been reported reliably in these earlier cases due to potential recall bias, leading to an overestimation of asymptomatic cases. Prior infection unrelated to the USS Kidd outbreak is unlikely, based on the absence of prior infection from serologic samples provided in December 2019, coupled with the fact that the ship was underway a few months after that collection point, leading to a very small window for new infection to occur unrelated to time aboard the Kidd. RT-PCR sampling was not homogeneous in methodology throughout the duration of the outbreak, as evidenced by one RT-PCR platform using nasal swabs at sea and another using nasopharyngeal swabs in port. These differences could lead to inaccurate test results; however, crewmembers were tested multiple days while in quarantine or isolation in port and therefore had the opportunity for verifying prior test results.

In addition, it was not possible to directly measure other potential shipboard exposure risk factors such as frequency of use of personal protective equipment (PPE). When USS Kidd departed its port call on 20 March 2020, there was no mask requirement in place, and limited medical grade masks were available for distribution. It was not until 6 April 2020 that crewmembers were instructed to use undershirts as makeshift cloth face coverings. The timing of face covering initiation and consistency of PPE use may have contributed to differences in SARS-CoV-2 infection risk.

## Conclusion

This study is one of several that highlights the complexities of responding to a highly infectious respiratory virus outbreak among a shipboard population. It also highlights the value of serology in documenting a complete picture of an outbreak by identifying additional cases that evade detection by syndromic surveillance and molecular testing. Rapid, onboard diagnostic testing of the entire crew informed case identification and isolation measures, likely contributing to an earlier peak of cases during the outbreak and possibly leading to fewer cases. This report helps highlight the value of placing real-time diagnostic testing capabilities in outbreak scenarios with high transmission rates. While the urgency of COVID-19 has dissipated, respiratory illness-caused pandemics are still a very real threat, and public health agencies responsible for preventive and responsive actions should take the time now to dissect the many layers that exist within a novel respiratory virus outbreak. With respect to COVID-19, continued study is warranted as largely vaccinated crews undertake future deployments, to understand the risk of COVID-19 outbreaks underway and the characteristics of those outbreaks.

*Author affiliations: Naval Hospital Bremerton (CDR Legendre, CAPT Feinberg); Naval Health Research Center (Ms. Boltz, Dr. Myers); Leidos, Inc. (Ms. Boltz); Navy & Marine Corps Public Health Center (Ms. Jindal Riegodedios, Ms. Luse, Ms. Glasheen, Ms. Poitras); 4th Marine Logistics Group, 4th Medical Battalion, Surgical Company Bravo (LT Brown); Naval Hospital Jacksonville (CAPT Kaplan); Commander, Naval Surface Force Pacific Fleet (LCDR Sullivan); Navy Environmental Preventive Medicine Unit No. 5 (LCDR Whiting); II Marine Expeditionary Force (CAPT Hollis).*

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## References

1. Zhou P, Yang XL, Wang XG, et al. A pneumonia outbreak associated with a new coronavirus of probable bat origin. *Nature*. 2020;579(7798):270-273. doi:10.1038/s41586-020-2012-7
2. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet Lond Engl*. 2020;395(10223):497-506. doi:10.1016/S0140-6736(20)30183-5
3. Feehan J, Apostolopoulos V. Is COVID-19 the worst pandemic? *Maturitas*. 2021;149:56-58. doi:10.1016/j.maturitas.2021.02.001
4. Holshue ML, DeBolt C, Lindquist S, et al. First case of 2019 novel coronavirus in the United States. *N Engl J Med*. 2020;382(10):929-936. doi:10.1056/NEJMoa2001191
5. Kasper MR, Geibe JR, Sears CL, et al. An outbreak of Covid-19 on an aircraft carrier. *N Engl J Med*. 2020;383:2417-2426. doi:10.1056/NEJMoa2019375
6. Shanks GD, Waller M, MacKenzie A, Brundage JF. Determinants of mortality in naval units during the 1918-19 influenza pandemic. *Lancet Infect Dis*. 2011;11(10):793-799. doi:10.1016/S1473-3099(11)70151-7
7. Tokuda Y, Sakihama T, Aoki M, et al. COVID-19 outbreak on the Diamond Princess cruise ship in February 2020. *J Gen Fam Med*. 2020;21(4):95-97. doi:10.1002/jgf2.326
8. Dawn Project. The Dawn Project. Accessed March 8, 2022. https://dawnproject.com/
9. Dollard P. Risk assessment and management of COVID-19 among travelers arriving at designated U.S. airports, January 17–September 13, 2020. *MMWR*. 2020;69. doi:10.15585/mmwr.mm6945a4
10. Hamilton JJ, Turner K, Lichtenstein Cone M. Responding to the pandemic: challenges with public health surveillance systems and development of a COVID-19 national surveillance case definition to support case-based morbidity surveillance during the early response. *J Public Health Manag Pract*. 2021;27:S80. doi:10.1097/PHH.0000000000001299
11. Centers for Disease Control and Prevention. Coronavirus Disease 2019 (COVID-19) 2020 Interim Case Definition. https://ndc.services.cdc.gov/case-definitions/coronavirus-disease-2019-2020/. Approved April 5, 2020. Accessed February 18, 2022.
12. Oran DP, Topol EJ. The proportion of SARS-CoV-2 infections that are asymptomatic. *Ann Intern Med*. Published online January 22, 2021:M20-6976. doi:10.7326/M20-6976
13. Ibekwe TS, Fasunla AJ, Orimadegun AE. Systematic review and meta-analysis of smell and taste disorders in COVID-19. *OTO Open*. 2020;4(3):2473974X20957975. doi:10.1177/2473974X20957975
14. Centers for Disease Control and Prevention. Similarities and Differences Between Flu and COVID-19. https://www.cdc.gov/flu/symptoms/flu-vs-covid19.htm. Published January 18, 2022. Accessed February 18, 2022.
15. Vera DM, Hora RA, Murillo A, et al. Assessing the impact of public health interventions on the transmission of pandemic H1N1 influenza A virus aboard a Peruvian navy ship. *Influenza Other Respir Viruses*. 2014;8(3):353-359. doi:10.1111/irv.12240
16. Centers for Disease Control and Prevention. Community, Work, and School. https://www.cdc.gov/coronavirus/2019-ncov/community/health-equity/racial-ethnic-disparities/increased-risk-illness.html. Published February 11, 2020. Accessed March 15, 2022.
17. Shastri MD, Shukla SD, Chong WC, et al. Smoking and COVID-19: what we know so far. *Respir Med*. 2021;176:106237. doi:10.1016/j.rmed.2020.106237
18. Korzeniowska A, Ręka G, Bilska M, Piecewicz-Szczęsna H. The smoker's paradox during the COVID-19 pandemic? The influence of smoking and vaping on the incidence and course of SARS-CoV-2 virus infection as well as possibility of using nicotine in the treatment of COVID-19—Review of the literature. *Przegl Epidemiol*. 2021;75(1):27-44. doi:10.32394/pe.75.03

# Emergency Mental Health Care Utilization and the COVID-19 Pandemic Among U.S. Armed Forces and Dependents, 1 January 2017 to 31 March 2021

*Eero Dinkeloo, MPH; Tina Luse, MPH*

The COVID-19 pandemic brought with it concerns for the effects on mental health, from both the disease itself and the steps taken to combat it. Given the readiness ramifications of those effects, it is necessary to understand them as they apply to members of the U.S. Armed Forces and their families. This study aimed to analyze temporal trends in mental health-related emergency room (ER) visits before and during the COVID-19 pandemic among active duty service members (ADSMs) and dependents. A total of 5,205,259 healthcare visits in an ER setting between 1 January 2017 to 31 March 2021 were included. Multivariate logistic regressions showed significantly increased odds of ER visits related to mental health during the COVID-19 pandemic when compared to a 3 year period before, both among active duty service members and adult dependents (adjusted odds ratio, AOR: 1.13, 95%CI: 1.12, 1.14), and dependents under 18 years of age (AOR: 1.44, 95%CI: 1.42, 1.48). These findings document significant increases in demand for emergency mental health services during the COVID-19 pandemic, especially within younger cohorts.

**What are the new findings?**

During the COVID-19 pandemic, monthly emergency room (ER) visits decreased by 30% but those related to mental health increased by 24.3% among ADSMs and dependents. Dependents under 18 years of age had 1.44 times the odds of an ER visit relating to mental health during the pandemic when compared to the 3 years prior.

**What is the impact on readiness and force health protection?**

An increase in the frequency of ADSM and dependent populations seeking mental health care can increase the burden on military health systems and decrease readiness. Understanding the impacts of the COVID-19 pandemic on mental health of both ADSMs and dependents may better prepare the U.S. Armed Forces to respond quickly should another pandemic arise.

Concerns over the psychological effects of the COVID-19 pandemic[1-3] are increasing.[4-8] Surveys of the general population following stay-at-home orders and social distancing precautions show increased levels of psychological distress,[6,7] with 78% of respondents feeling that their mental health worsened since the outbreak.[6] To date, these effects are less understood in active duty service members (ADSMs) and their family members (dependents).

Mental health disorders among the U.S. Armed Forces contribute to morbidity, health care utilization, and attrition.[9-11] Therefore, it is important to fully understand the impact of the COVID-19 pandemic on mental health in order to prevent, target, intervene, and mitigate negative health outcomes among ADSMs and dependents. The objective of this analysis was to evaluate temporal trends in the proportion of emergency room (ER) visits for mental health among ADSMs and dependents, in the first year of the COVID-19 pandemic compared to previous years.

## Methods

This was a secondary, cross-sectional analysis using medical encounter data from the Comprehensive Ambulatory/Professional Encounter Record (CAPER) and Tricare Encounter Data, Non-Institutional (TED-NI). Visits that occurred in an ER setting from 1 January 2017 to 31 March 2021 for ADSMs or dependents aged 60 years or younger were included for this analysis. Visits generated from military hospitals and clinics that transitioned record management to Military Health System (MHS) GENESIS were excluded from the entire analysis.

ER visits were grouped into periods as pre-COVID-19 (1 January 2017 to 29 February 2020) or during the COVID-19 pandemic (1 March 2020 to 31 March 2021). Mental health-related ER visits, the outcome of interest, were defined by the International Classification of Diseases, 10th Edition, Clinical Modification (ICD-10-CM) codes indicating diagnosis for disorders related to adjustment, anxiety, depression, post-traumatic stress, substance or alcohol use, suicide-related behaviors, other mental, behavioral and neurodevelopmental disorders, or a visit documenting specific symptoms or factors potentially influencing mental health **(Table 1)**. Mental, behavioral, and neurodevelopmental disorders outside the six specific disorder categories listed above were pooled into an additional category designated "other," as these codes reflect a wide-ranging number of disorders, but are still applicable to the intended objective of

**TABLE 1.** International Classification of Diseases (ICD) codes to classify mental health-related ER encounters

| Condition Grouping | ICD-10-CM Code |
| --- | --- |
| Adjustment disorders | F43.2*, F43.8, F43.9 |
| Anxiety disorders | F40.*, F41.*, F42.* |
| Depressive disorders | F32.*, F33.*, F34.3, F34.8*, F34.9, F39 |
| Post-traumatic stress disorder | F43.1* |
| Substance use disorder | F11.1*, F11.2*, F12.1*, F12.2*, F13.1*, F13.2*, F14.1*, F14.2*, F15.1*, F15.2*, F16.1*, F16.2*, F18.1*, F18.2*, F19.1*, F19.2* |
| Alcohol use disorder | F10.1*, F10.2*, F10.93* |
| Suicide-related behaviors | Z91.5*, R45.851, T14.91*, T36.*X2*-65.*X2* [b] |
| Other mental, behavioral and neurodevelopmental disorders | Any F code not classified elsewhere |
| Factors potentially influencing mental health[a] | |
| Persons with potential health hazards related to socioeconomic and psychosocial circumstances | Z55*-Z65* |
| Persons encountering health services in other circumstances | Z69*-Z73*, Z76.5 |
| Personal history of mental and behavioral disorders | Z86.5* |
| Patient's noncompliance with medical treatment and regimen | Z91.1* |
| Personal history of psychological trauma, not elsewhere classified | Z91.4* |
| Personal history of military deployment | Z91.82 |
| Other specified personal risk factors, not elsewhere classified | Z91.89 |

[a]Grouping includes codes that have been determined by subject matter experts to be factors with the potential to influence mental health outcomes.
[b]Within the poisoning and toxic effect codes (T36-T65), the "X2" extension indicates self-harm.
*Indicates that all subsequent digits/characters are included.
ICD-10-CM, International Classification of Diseases, 10th revision

this study. The selected codes for symptoms or factors potentially influencing mental health included visits with documentation of potential hazards related to socioeconomic and psychosocial circumstances (e.g., problems related to employment, housing and economic circumstances, psychosocial circumstances, etc.); visits for mental health services for other circumstances such as abuse, sexual behavior/orientation, lifestyle, and life management; personal history of mental and behavioral disorders; patient non-compliance with a medical treatment regimen; personal history of psychological trauma; personal history of military deployment; and other specified personal risk factors, not elsewhere classified. The specific ICD-10 codes and groupings were selected based on guidance from the Centers for Disease Control and Prevention (CDC),[12] Diagnostic and Statistical Manual of Mental Disorders (DSM-V),[13] and advice from Navy behavioral health providers. Demographic characteristics were analyzed and compared for ER visits taking place before and during the COVID-19 pandemic period, displayed in frequencies and tested for significance using a chi-square test. Data were stratified into three groups: ADSMs, dependents ages 18 years and older, and dependents less than 18 years of age. A multivariate logistic regression was used to explore the differences between the periods before and during the COVID-19 pandemic with respect to ER visits related to mental health, accounting for relevant demographic variables. Results were reported as odds ratios (OR) with 95% confidence intervals. This regression analysis was stratified into two models: 1 for adults (ADSMs and dependents ages 18 years and older) and 1 for dependents under 18 years of age. Statistical analysis was performed using SAS software version 9.4 (SAS Institute Inc.).

## Results

Overall, 5,205,259 ER visits for all causes were included in this analysis, 20% of which occurred during the COVID-19 pandemic. Average monthly ER visits (for any cause) decreased from 109,702 before the pandemic to 79,739 during the COVID-19 pandemic, representing a 27% decrease in monthly visits **(data not shown)**. The proportion of ER visits within the adult population increased during the pandemic, with a higher percentage from ADSMs **(Table 2)**. Monthly ER visits related to mental health averaged 7,502 visits pre-COVID-19 and dropped to an average of 6,780 during the pandemic, representing a 10% decrease **(data not shown)**. Despite this decrease, the proportion of all ER visits related to mental health saw a relative increase of 11.4% among ADSMs, 12.2% among dependents 18 years of age and older, and 48.4% among dependents less than 18 years of age, with an upward monthly trend throughout the COVID-19 timeframe **(Figure)**.

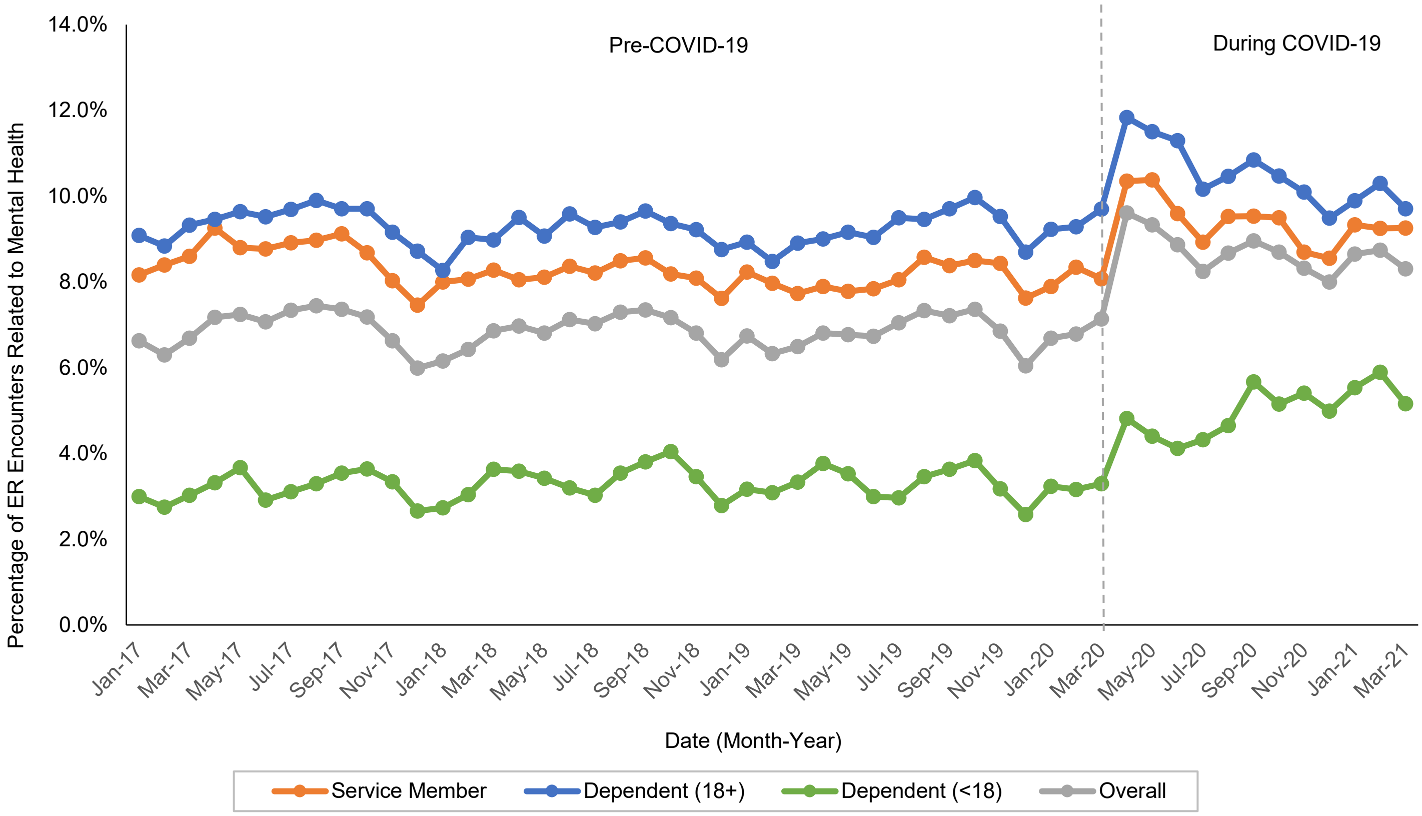
Consistent for both time periods, the most common conditions cited for mental health-related ER visits among ADSMs were suicide-related behaviors, for factors potentially influencing mental health (lifestyle-related problems [64%]; counseling and medical advice, not elsewhere classified [19%]; and problems related to primary support group [4%]; **data not shown**), and depression. Anxiety and depression were cited in over half the mental health-related ER visits among dependents 18 years of age and older, with an increase in anxiety-related visits during the pandemic. Among dependents under 18 years of age, factors potentially influencing mental health (counseling/medical advice, not elsewhere classified [70%]; problems related to primary support group [6%]; and problems related to upbringing [5%]; **data not shown**), suicide-related behaviors, and other mental, behavioral and neurodevelopmental disorders (behavioral/emotional disorders

**TABLE 2.** Demographic characteristics of emergency room visits, pre-COVID-19 and during COVID-19, 1 January 2017-31 March 2021 (n=5,205,259)

| Variable | Pre-COVID ER Visits (n=4,168,659) | | COVID ER Visits (n=1,036,600) | | |
|---|---|---|---|---|---|
| | No. | % | No. | % | *P* value |
| ER visits related to mental health | 285,043 | 6.8 | 88,133 | 8.5 | <0.0001 |
| Group | | | | | <0.0001 |
| Active duty service members | 1,542,980 | 37.0 | 465,810 | 44.9 | |
| Dependents, 18 and older | 1,202,722 | 28.9 | 316,484 | 30.5 | |
| Dependents, 17 and younger | 1,422,957 | 34.1 | 254,306 | 24.6 | |
| Sex | | | | | <0.0001 |
| Male | 1,920,213 | 46.1 | 481,101 | 46.4 | |
| Female | 2,248,441 | 53.9 | 555,499 | 53.6 | |
| Age Groups | | | | | <0.0001 |
| <12 | 1,210,900 | 29.1 | 211,532 | 20.4 | |
| 12-14 | 112,282 | 2.7 | 22,184 | 2.2 | |
| 15-17 | 101,384 | 2.4 | 21,047 | 2.0 | |
| 18-29 | 1,677,674 | 40.3 | 481,369 | 46.4 | |
| 30-39 | 760,147 | 18.2 | 214,314 | 20.7 | |
| 40-49 | 251,024 | 6.0 | 70,323 | 6.8 | |
| 50-60 | 55,283 | 1.30 | 15,831 | 1.5 | |

ER, Emergency Room

**FIGURE.** Percentage of emergency room visits related to mental health, by group, 1 January 2017-31 March 2021



[52%]; pervasive/specific developmental disorders [10%]; mental disorders due to known physiological conditions [6%]; **data not shown**) were associated with 83% of the ER visits related to mental health. During the COVID-19 pandemic, the proportion of visits related to mental health behaviors and suicide-related behaviors among dependents under 18 years of age increased by 14.3% and 23.0%, respectively **(Table 3)**.

For both service member/adult dependents and dependents under age 18, the odds of mental health-related ER visits being higher during COVID compared to the pre-COVID period were statistically significant ($P<0.05$). Among the combined group of ADSMs and dependents 18 and older, the COVID-19 timeframe's higher odds for mental health-related ER visits remained significant after adjustment for age, sex, and beneficiary group (OR: 1.13, 95%CI: 1.12, 1.14) **(Table 4a)**. The same was true for dependents under 18 years, after adjustment for age and sex (OR: 1.44, 95%CI: 1.42, 1.48) **(Table 4b)**.

**TABLE 3.** Breakdown of mental health-related emergency room visits, by group, 1 January 2017-31 March 2021 (n=373,228[a])

| Group Mental Health Classification | Pre-COVID[b] No. | Pre-COVID[b] % | COVID[b] No. | COVID[b] % |
|---|---|---|---|---|
| **Active duty service members** | | | | |
| Suicide-related behaviors | 33,189 | 26.0 | 11,855 | 27.6 |
| Factors potentially influencing mental health | 32,860 | 25.8 | 11,810 | 27.5 |
| Depression | 28,354 | 22.2 | 9,003 | 20.9 |
| Anxiety | 26,088 | 20.5 | 8,894 | 20.7 |
| Alcohol use | 18,935 | 14.9 | 6,193 | 14.4 |
| Other mental, behavioral and neurodevelopmental disorders | 16,193 | 12.7 | 5,029 | 11.7 |
| Adjustment disorder | 13,144 | 10.3 | 4,689 | 10.9 |
| Post-traumatic stress disorder | 4,581 | 3.6 | 1,404 | 3.3 |
| Substance use disorder | 2,389 | 1.9 | 740 | 1.7 |
| **Dependents, 18 years of age and older** | | | | |
| Anxiety | 50,740 | 45.6 | 15,774 | 48.0 |
| Depression | 31,426 | 28.2 | 8,907 | 27.1 |
| Other mental, behavioral and neurodevelopmental disorders | 22,791 | 20.5 | 6,849 | 20.9 |
| Factors potentially influencing mental health | 20,938 | 18.8 | 6,398 | 19.5 |
| Suicide-related behaviors | 13,969 | 12.6 | 4,028 | 12.3 |
| Alcohol use | 8,451 | 7.6 | 2,416 | 7.4 |
| Substance use disorder | 5,403 | 4.9 | 1,554 | 4.7 |
| Post-traumatic stress disorder | 4,802 | 4.3 | 1,393 | 4.2 |
| Adjustment disorder | 3,467 | 3.1 | 946 | 2.9 |
| **Dependents, less than 18 years of age** | | | | |
| Factors potentially influencing mental health | 14,240 | 30.7 | 4,321 | 35.1 |
| Suicide-related behaviors | 12,714 | 27.4 | 4,143 | 33.7 |
| Other mental, behavioral and neurodevelopmental disorders | 16,460 | 35.5 | 3,821 | 31.1 |
| Depression | 10,780 | 23.2 | 3,273 | 26.6 |
| Anxiety | 7,416 | 16.0 | 2,309 | 18.8 |
| Adjustment disorder | 2,376 | 5.1 | 590 | 4.8 |
| Post-traumatic stress disorder | 789 | 1.7 | 299 | 2.4 |
| Substance use disorder | 847 | 1.8 | 256 | 2.1 |
| Alcohol use | 432 | 0.9 | 111 | 0.9 |

[a]Encounters could be counted in more than one category. As a result, the counts in this table may exceed the total number of mental health related encounters

[b]Pre-COVID timeframe includes emergency room visits from 01 January 2017-29 February 2020; COVID timeframe includes emergency room visits from 01 March 2020-31 March 2021

## Editorial Comment

These findings build on previously published studies that show increases in self-reported mental health symptoms during the pandemic.[5-7] Observed increases in the proportions of ER visits related to mental health among ADSMs and their dependents in the first year of the COVID-19 pandemic were modest yet significant. During COVID-19, ERs restricted access to only those most in need of urgent care, including those seeking mental health care, thus impacting the proportions in this analysis. Although monthly average ER visits decreased by 30%, the proportion of visits related to mental health experienced a relative increase of 24.3%. It is indeterminable if this difference was due to increased mental health concerns caused by the pandemic or to the altered access to care within ERs and associated triage efforts; however, results in this study point to changes in the mental health of the population during the COVID-19 pandemic.

Similar to previous findings, this study showed that ER visits during COVID-19 were 1.44 times more likely to relate to mental health among dependents under 18 years of age compared to the pre-COVID-19 period, after adjustments for age and sex.[5,8] During the first year of the COVID-19 pandemic, this younger cohort experienced a relative increase in the proportion of mental health-related ER visits citing depression (+14.7%), anxiety (+17.5%), and most notably, suicide-related behaviors (+23%), reproducing a similar trend noted by other research in the immediate aftermath of the pandemic.[5]

**TABLE 4a.** Unadjusted and adjusted odds ratios for mental health-related emergency room visits, active duty service members and adult dependents, 1 January 2017-31 March 2021 (n=3,527,991)

| Variable | Unadjusted | | Adjusted | |
|---|---|---|---|---|
| | OR (95% confidence interval) | | AOR (95% confidence interval) | |
| COVID timeframe | | | | |
| Pre-COVID (1 January 2017-29 February 2020) | 1.00 | (referent) | 1.00 | (referent) |
| COVID (1 March 2020-31 March 2021) | 1.12[a] | (1.12-1.14) | 1.13[a] | (1.12-1.14) |
| Group | | | | |
| Active duty service members | 1.00 | (referent) | 1.00 | (referent) |
| Dependents, 18 and older | 1.13[a] | (1.12-1.14) | 1.42[a] | (1.41-1.43) |
| Sex | | | | |
| Male | 1.00 | (referent) | 1.00 | (referent) |
| Female | 0.91[a] | (0.90-0.91) | 0.73[a] | (0.72-0.74) |
| Age group | | | | |
| <18 | 1.84[a] | (1.64-2.01) | 1.98[a] | (1.76-2.23) |
| 18-29 | 1.00 | (referent) | 1.00 | (referent) |
| 30-39 | 0.86[a] | (0.86-0.87) | 0.84[a] | (0.84-0.85) |
| 40-49 | 0.77[a] | (0.76-0.78) | 0.74[a] | (0.73-0.75) |
| 50-60 | 0.55[a] | (0.53-0.57) | 0.52[a] | (0.50-0.53) |

[a]Statistically significant ($P < 0.05$)
OR, odds ratio; AOR, adjusted odds ratio

**TABLE 4b.** Unadjusted and adjusted odds ratios for mental health-related emergency room visits, dependents under 18, 1 January 2017-31 March 2021 (n=1,677,263)

| Variable | Unadjusted | | Adjusted | |
|---|---|---|---|---|
| | OR (95% Confidence Interval) | | AOR (95% Confidence Interval) | |
| COVID timeframe | | | | |
| Pre-COVID (1 January 2017-29 February 2020) | 1.00 | (referent) | 1.00 | (referent) |
| COVID (1 March 2020-31 March 2021) | 1.5[a] | (1.47-1.54) | 1.44[a] | (1.42-1.48) |
| Sex | | | | |
| Male | 1.00 | (referent) | 1.00 | (referent) |
| Female | 1.22[a] | (1.20-1.24) | 1.09[a] | (1.07-1.11) |
| Age group | | | | |
| <12 | 1.00 | (referent) | 1.00 | (referent) |
| 12-14 | 5.65[a] | (5.53-5.77) | 5.6[a] | (5.48-5.72) |
| 15-17 | 7.48[a] | (7.33-7.64) | 7.4[a] | (7.22-7.52) |

[a]Statistically significant ($P < 0.05$)
OR, odds ratio; AOR, adjusted odds ratio

The main limitations of this study come from its cross-sectional nature. The same individual could not be followed over time, limiting the ability to draw causal conclusions. Due to the nature of these data, one cannot definitively identify the primary reason for a visit. Additionally, the codes within the "factors potentially influencing mental health" grouping are typically used to indicate the presence of an issue, short of a diagnosable condition, but variation in coding practices could have influenced the outcomes of interest.[14] Data from facilities transferring to MHS GENESIS during the study timeframe were excluded from this analysis, due to known data gaps and lack of data validation, which might have biased results. Lastly, due to the large sample size being analyzed in this study, even small differences will be statistically significant. Consequently, it is important to delineate between results that are statistically significant and clinically significant.

Poor mental health of ADSMs and their families negatively affects force readiness. The COVID-19 pandemic illustrates the importance of considering all types of external stressors when supporting service members and their families.

*Author Affiliations: General Dynamics Information Technology, Inc. (Mr. Dinkeloo); Navy and Marine Corps Public Health Center (Mr. Dinkeloo, Ms. Luse).*

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## References

1. Hossain MM, Tasnim S, Sultana A, et al. Epidemiology of mental health problems in COVID-19: a review. *F1000Res.* 2020;9:636.
2. Singh S, Roy D, Sinha K, Parveen S, Sharma G, Joshi G. Impact of COVID-19 and lockdown on mental health of children and adolescents: a narrative review with recommendations. *Psychiatry Res.* 2020;293:113429.
3. Lancet Public Health. COVID-19: From a PHEIC to a public mental health crisis? *Lancet Public Health.* 2020;5(8):e414.4.
4. Clark L, Fan M, Stahlman S. Surveillance of mental and behavioral health care utilization and use of telehealth, active component, U.S. Armed Forces, 1 January 2019–30 September 2020. *MSMR.* 2021;28(8):22-27.
5. Czeisler ME, Lane RI, Petrosky E, et al. Mental health, substance use, and suicidal ideation during the COVID-19 pandemic—United States, June 24-30, 2020. *MMWR.* 2020;69(32):1049-1057.
6. Newby JM, O'Moore K, Tang S, Christensen H, Faasse K. Acute mental health responses during the COVID-19 pandemic in Australia. *PLoS One.* 2020;15(7):e0236562.
7. Pierce M, Hope H, Ford T, et al. Mental health before and during the COVID-19 pandemic: a longitudinal probability sample survey of the UK population. *Lancet Psychiatry.* 2020;7(10):883-892.
8. Ridout KK, Alavi M, Ridout SJ, et al. Emergency department encounters among youth with suicidal thoughts or behaviors during the COVID-19 pandemic. *JAMA Psychiatry.* 2021;78(12):1319-1328.
9. Update: mental health disorders and mental health problems, active component, U.S. Armed Forces, 2016-2020. *MSMR.* 2021;28(8):2-9.
10. Defense Health Agency. DOD Health of the Force 2019. https://health.mil/Reference-Center/Reports/2020/11/24/DoD-Health-of-the-Force-2019. Accessed November 15, 2022.
11. Stahlman S, Oetting AA. Mental health disorders and mental health problems, active component, U.S. Armed Forces, 2007-2016. *MSMR.* 2018;25(3):2-11.
12. Center for Disease Control and Prevention. Social Determinants of Health. https://www.cdc.gov/nchs/data/icd/social-determinants-of-health.pdf. Accessed November 15, 2022.
13. Association Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders.* 5th Edition 2013.
14. Truong HP, Luke AA, Hammond G, Wadhera RK, Reidhead M, Joynt Maddox KE. Utilization of social determinants of health ICD-10 z-codes among hospitalized patients in the United States, 2016-2017. *Med Care.* 2020;58(12):1037-1043.

# Brief Review: Clinical and Epidemiologic Characteristics of Genital Skin Lesions Due to Infectious Causes

*Nicole M. Hsu, MD (Lt Col, USAF, MC); David R. Sayers, MD, MTM&H (Lt Col, USAF, MC)*

During the current global mpox outbreak, many cases have presented atypically with skin lesions localized to the genital and perianal areas.[1,2] The rash associated with mpox can be confused, or occur concurrently, with various sexually transmitted infections. The following text and **Table** provide a brief comparison of mpox characteristics to those of other infectious causes of genital skin lesions.

## Methods

Literature from two textbooks, *Genital Ulcer Adenopathy Syndrome* and *Hunter's Tropical Medicine and Emerging Infectious Diseases,* were reviewed and summarized to compare clinical aspects of infectious disease skin lesions to include: incubation period, lesion characteristics (i.e., type, number, progression pattern, border, depth, induration), and presence of pain or lymphadenopathy.[3,4] Mpox skin lesion features recorded in historical and current outbreaks were incorporated as well. Additionally, U.S. and military disease rates (where available) were added to provide epidemiologic context for the frequency of these infectious diseases.

## Results

### Mpox

Mpox classically presents with fever, myalgia, and lymphadenopathy, followed 1-3 days later by a centrifugal rash that starts on the face and extremities and then disseminates across the body. In the current outbreak, however, early lesions have often been localized to the genital and perineal/perianal areas because of close sexual or intimate contact.[1,2] The incubation period is 6-13 days, and lesions typically evolve synchronously through four stages—macular, papular, vesicular, to pustular—before scabbing and resolving over the subsequent 2-4 weeks. The 2-10 mm lesions usually are painful, firm, well-circumscribed, and centrally umbilicated.[5]

### Herpes simplex virus

In the U.S., herpes simplex virus (HSV-1 or HSV-2) is the most common cause of genital ulcers, affecting 5.6% of the U.S. adult population, with over half a million new cases annually.[6] Among active component service members, the incidence rate of HSV infections from 2013 through 2021 was 23.3 cases per 10,000 person-years (p-yrs), and the rate was 4.5 times higher in females (68.0 cases per 10,000 p-yrs) compared to males.[7] The incubation period is 2-12 days, and herpetic lesions begin as a cluster of multiple, 2-4 mm vesicles with an underlying erythematous base. These fragile lesions rupture, progressing to painful erosions and shallow ulcerations that gradually heal over 4-10 days.

### Syphilis

Syphilis, caused by the bacterium *Treponema pallidum,* is the second most common cause of genital ulcers in the U.S.[7] Among active component service members, the incidence rate of syphilis was 5.0 cases per 10,000 p-yrs from 2013 through 2021.[8] The primary syphilis lesion (chancre) begins as a solitary, firm papule that quickly becomes a painless ulcer with well-defined margins and indurated base. The incubation period is 10-90 days, and the ulcer heals spontaneously within 3-6 weeks. Although the maculopapular rash associated with secondary syphilis usually appears 4-10 weeks after the primary chancre, primary and secondary syphilis findings overlap in 15% of cases.[9]

### Chancroid

The gram-negative bacterium *Haemophilus ducreyi* causes chancroid, which is rarely diagnosed in the U.S., with less than 10 cases reported annually.[10] Sporadic outbreaks occur in Africa and the Caribbean.[9,11] The incubation period is 4-10 days, and begins as an erythematous papule that rapidly evolves into a pustule and erodes into a deep ulcer. These painful 1-2 cm ulcers have clearly demarcated borders with a friable base covered by a gray or yellow exudate. It is common to have multiple ulcers.

### Lymphogranuloma venereum (LGV)

LGV is predominantly found in tropical or subtropical regions, but outbreaks have been reported among men who have sex with men in Europe, North America, and Australia.[12,13] The true incidence rate of this bacterial infection in the U.S. and among service members is unknown because national reporting of LGV ended in 1995. LGV is caused by *Chlamydia trachomatis* serovars L1, L2, or L3. A 2011 report of surveillance data from multiple sites in the U.S. found that less than 1% of rectal swabs obtained from military service members positive for *Chlamydia trachomatis* were positive for LGV serovars.[14] LGV infection has three stages: ulceration, regional lymphadenopathy, anogenital fibrosis. The incubation period is 3-12 days, and the primary stage of LGV is characterized by small, painless genital papules or ulcers that heal spontaneously within a few days.

**TABLE.** Differential Diagnosis of Genital Ulcers/Lesions

| | Mpox[b] | Herpes[a,b] | Syphilis[a,b] | Chancroid[a,b] | LGV[a,b] | Granuloma inguinale[a,b] | Varicella Zoster[b] |
|---|---|---|---|---|---|---|---|
| Primary lesions | Macule, evolves to papule,vesicle, pustule, then crust/scab | Vesicles, then ulcer | Papule, then ulcer (chancre) | Papule, pustule, then ulcer | Papule, pustule, or vesicle, then ulcer | Papule, then ulcer | Papules, evolve to vesicles, then crust/scab |
| Number of lesions | Typically multiple; but may be a few or even single during current outbreak | Multiple, may coalesce | 70% single ulcer, 30% multiple | Usually one to three, may be multiple | Usually one | Single or multiple | Multiple |
| Incubation period | 6-13 days | 2-12 days | 10-90 days | 4-10 days | 3-12 days | 1-90 days | 14-16 days |
| Border | Well-circumscribed | Erythematous, scalloped | Sharply demarcated | Erythematous and undermined | Variable | Rolled and elevated | Erythematous |
| Depth | Deep-seated | Superficial | Superficial | Excavated | Superficial | Elevated | Superficial |
| Base | Variable | Red and smooth | Red and smooth | Yellow to gray | Variable | Red and rough | Red and smooth |
| Secretion | Variable | Serous | Serous | Purulent and hemorrhagic | Variable | Rare, may be hemorrhagic | Serous |
| Induration | Firm | None | Firm | Rare, soft | None | Firm | None |
| Pain | Common | Common, prodromal tingling | Rare | Common | Variable | Rare | Common, associated burning sensation |
| Lymph nodes | Tender, firm | Tender, firm | Non-tender, firm | Tender, may be suppurative | Tender, may be suppurative | Pseudo-adenopathy | Rare |
| Other Notes for Diagnosis | Systemic symptoms, rash with synchronized progression (centrifugal distribution) | Primary infection: systemic symptoms; Recurrent infection: history of recurrent episodes | Overlap of secondary syphilis with primary disease in 15% of cases | Rare outside areas where infection is endemic (Africa, Caribbean, Southwest Asia) | Systemic symptoms common | Rare outside areas where infection is endemic (Papua New Guinea, India, South Africa, South America) | Chickenpox: systemic symptoms, rash asynchronous progression (centripetal distribution); Shingles: rash limited to dermatome |

[a] Kraus SJ. Genital ulcer adenopathy syndrome. Holmes KK, Mardh PA, Sparling PF, Wiesner PJ, eds. *in Sexually Transmitted Diseases*. New York, McGraw-Hill, 1984, pp 706-714.
[b] Magill AJ., et al. *Hunter's Tropical Medicine and Emerging Infectious Disease: Expert Consult*-Online and Print. Elsevier Health Sciences, 2012

## Granuloma inguinale (Donovanosis)

Donovanosis is a rare disease caused by the intracellular bacterium *Klebsiella granulomatis* and is sporadically found in Asia, South Africa, and South America.[9] In a recent *MSMR* surveillance snapshot on donovanosis among active component service members, only 50 incident cases were identified between 2011 and 2020, with 3-10 cases reported annually.[15] It is characterized by painless, progressive ulcers on the genitals or perineum that are highly vascular, have a beefy red appearance, and easily bleed. The incubation period ranges from 1-90 days.

## Varicella-zoster virus (Chickenpox/Shingles)

The incidence rate of chickenpox infections in the U.S. dramatically decreased following the implementation of the national varicella vaccination program in 1995, with a 97% decline from pre-vaccine years.[16] Among active component service members, only 37 confirmed and 205 possible cases were reported between 2016 and 2019.[17] Chickenpox presents as multiple red papules in a centripetal distribution, involving the scalp, face, and trunk, then spreading across the body (including the genital area). The incubation period is 14-16 days with prodromal symptoms (fever, headache, malaise, decreased appetite) prior to rash appearance. The itchy lesions progress asynchronously from papules to vesicles (1-4mm) and then rupture and crust or scab over during a final 5-10 days.[18] Reactivation of varicella-zoster virus (shingles) presents as multiple, small vesicles in a unilateral dermatomal distribution and may be associated with severe pain, pruritus, and/or burning sensation in the affected dermatome. Vesicles crust over in 7-10 days.

## Editorial Comment

While mpox is not traditionally known as a sexually transmitted disease, in the current outbreak transmission has primarily been reported with intimate or close sexual contact. This highlights the importance of understanding the differential diagnosis for infectious causes of genital skin lesions, especially in a predominantly young adult military population. Summarizing other infectious diseases provides a framework to more expeditiously diagnose and treat mpox. The table and accompanying text in this article provide a succinct review to compare and contrast these infectious diseases. Additionally, reports of disease rates of each infection provide perspective for the U.S. military population. As the mpox outbreak is new and evolving, case rates are not yet well described. Infectious genital skin lesions and other sexually transmitted infections may occur concurrently, thus testing for co-infections is important to quickly identify all pathogens and appropriately treat individuals.

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*Author affiliations: Department of Preventive Medicine and Biostatistics, Uniformed Services University of the Health Sciences, Bethesda, Maryland (Lt Col Hsu); Air Force Medical Readiness Agency, Falls Church, VA (Lt Col Sayers).*

## References

1. Minhaj FS, Ogale YP, Whitehill F, et al. Monkeypox outbreak—nine states, May 2022. *MMWR* 2022;71(23):764-769.
2. Thornhill JP, Barkati S, Walmsley S, et al. Monkeypox virus infection in humans across 16 countries—April–June 2022. *N Engl J Med* 2022:387:679-691.
3. Kraus SJ. Genital ulcer adenopathy syndrome. In: Holmes KK, Mardh PA, Sparling PF, Wiesner PJ, eds. *Sexually Transmitted Diseases*. New York, McGraw-Hill, 1984, pp 706-714.
4. Magill, AJ, Ryan ET, Hill DR. Hunter's Tropical Medicine and Emerging Infectious Disease: Expert Consult—Online and Print. Elsevier Health Sciences, 2012.
5. Macneil A, Reynolds MG, Braden Z, et al. Transmission of atypical varicella-zoster virus infections involving palm and sole manifestations in an area with monkeypox endemicity. *Clin Infect Dis* 2009;48(1):e6-e8. doi:10.1086/595552
6. Kreisel KM, Spicknall IH, Gargano JW, et al. Sexually transmitted infections among U.S. women and men: prevalence and incidence estimates, 2018. *Sex Transm Dis* 2021;48(4):208-214. doi:10.1097/OLQ.0000000000001355
7. Roett MA, Mayor MT, Uduhiri KA. Diagnosis and management of genital ulcers. *Am Fam Physician* 2012:85(3):254-262.
8. Armed Forces Health Surveillance Department. Update: sexually transmitted infections, active component, U.S. Armed Forces, 2012-2020. *MSMR* 2021;28(3):13-22
9. Dombrowski JC, Celum C, Baeten J. Chapter 43: Syphilis. In: Sanford CA, Pottinger PS, Jong EC, eds. *The Travel and Tropical Medicine Manual*. 5th ed. Elsevier; 2017:535-544.
10. Centers for Disease Control and Prevention. Table 43. Chancroid — Reported Cases and Rates of Reported Cases by State/Territory in Alphabetical Order, United States, 2015-2019. https://www.cdc.gov/std/statistics/2019/tables/43.htm. Published April 12, 2022. Accessed July 29, 2022.
11. Workowski KA, Bachmann LH, Chan PA, et al. Sexually transmitted infections treatment guidelines, 2021. *MMWR Recomm Rep* 2021;70(4):1-187. doi: 10.15585/mmwr.rr7004a1.
12. de Voux A, Kent JB, Macomber K, et al. Notes from the field: cluster of lymphogranuloma venereum cases among men who have sex with men —Michigan, August 2015–April 2016. *MMWR* 2016;65:920–921. doi: http://dx.doi.org/10.15585/mmwr.mm6534a6
13. Simms I, Ward H, Martin I, Alexander S, Ison C. Lymphogranuloma venereum in Australia. *Sex Health* 2006;3(3):131-133. doi:10.1071/sh06039
14. Hardick J, Quinn N, Eshelman S, et al. O3-S6.04 Multi-site screening for lymphogranuloma venereum (LGV) in the USA. *Sex Transm Infect* 2011;87(Suppl 1):A82-A82. doi:10.1136/sextrans-2011-050109.136
15. Daniele D, Wilkerson T. Surveillance snapshot: Donovanosis among active component service members, U.S. Armed Forces, 2011-2020. *MSMR*. 2021;28(12):22.
16. Lopez A, Harrington T, Marin M. Chapter 22: Varicella. U.S. Department of Health and Human Services. *Epidemiology and Prevention of Vaccine-Preventable Diseases, 14th ed*. https://www.cdc.gov/vaccines/pubs/pinkbook/varicella.html. Published September 20, 2021. Accessed September 3, 2022.
17. Williams VF, Stahlman S, Fan M. Measles, mumps, rubella, and varicella among service members and other beneficiaries of the Military Health System, 1 January 2016–30 June 2019. *MSMR* 2019;26(10):2-12.
18. Hall E, Wodi A P, Hamborsky J., et al., eds. Centers for Disease Control and Prevention. *Epidemiology and Prevention of Vaccine-Preventable Diseases*. 14th ed. Washington, DC, Public Health Foundation, 2021.

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