

COVID-19 Outbreak in A Forward-Deployed Expeditionary Military Command: A Retrospective Review on Preventative Measures and Outbreak Characteristics

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ABSTRACT

Background:

An outbreak of coronavirus disease 2019 (COVID-19) occurred within a land based 2,000-member cohort stationed on a remote air base in the Middle East from June to August 2020. We retrospectively reviewed base characteristics and mitigation measures instituted during the outbreak. We also reviewed documentation on the individuals that were either quarantined or placed in isolation and provide data on demographics, real-time reverse transcriptase polymerase chain reaction (rRT-PCR) results, occupation, and workdays lost.

Results:

During the reporting period, 46 individuals or 3.84% of the population had a positive COVID-19 rRT-PCR test. Aviation personnel represented 50% of the COVID-19 positive tests. Sixteen percent of health care personnel were tested positive. Overall, 10% of personnel were placed in isolation or quarantine, resulting in the loss of 1,552 workdays.

Conclusions:

The data show a disproportionate impact on healthcare workers and personnel involved in aviation operations. The purpose of this study is 2-fold: to describe the characteristics of the outbreak and to highlight the effectiveness of mitigation measures implemented to control it during military operations. This study may serve to inform medical professionals and military leaders in the management of a similar outbreak in a congregate living setting.

BACKGROUND

In early 2020, a task force was deployed to a remote air base in the Middle East to conduct operations within the U.S. Force Central Command area of responsibility. Concurrently, the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic was spreading throughout the world and began to surge in multiple countries in their area of operations (AO), leading to an outbreak within the task force.¹ This report aims to describe the characteristics of the outbreak and preventative measures taken to protect the force while minimizing impacts on daily operations.

Before arrival in May of 2020, the pandemic was concentrated in Europe, the USA, and China, with the number of confirmed cases and deaths from coronavirus disease-2019

(COVID-19) in the Eastern Mediterranean (Middle East) area at ~18,060 and 1,010 respectively.¹ The majority of the cases were initially reported in the civilian population of Iran.¹ However, in the ensuing months, the virus spread throughout the Eastern Mediterranean region, reaching a cumulative case count of 1,723,673, with 45,704 deaths by the end of the reporting period on August 10, 2020.²

COHORT COMPOSITION

The 1,197 members of the cohort task force were sub-divided into subordinate units, which include the Command Element (CE), Aviation Combat Element (ACE), Logistic Combat Element (LCE), and Ground Combat Element (GCE). The GCE was the largest component of the task force, comprising 50% of the personnel, followed by the ACE at 30%, the LCE at 10%, and the CE at 10%. The task force also is based with other service components totaling ~1,000 additional individuals.

Before deployment, all forces conducted a pre-deployment health screening and a 14-day quarantine either at their home base in their country of origin or immediately after arriving to the AO. Under this quarantine, individuals were sequestered in a barracks type facility with no interaction with individuals outside of the cohort.

BASE CHARACTERISTICS

The forward operating base is expeditionary in nature where enlisted service members typically share quarters with four people in each room with a common bathing facility between

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This is a simple observational report not performed under the oversight of an Institutional Review Board (IRB). No HIPAA information was collected and no review of medical records was performed. The views expressed are solely those of the authors and do not reflect the official policy or position of the U.S. Navy, U.S. Marine Corps, the DoD, or the U.S. Government. The article has been reviewed and validated for public release by the public affairs office of U.S. Marine Forces, Central Command.

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40 individuals. One to two Junior Officers lived in a room with a shared bathroom between two to four people. Senior Officers and senior enlisted personnel lived in individual rooms with private bathrooms. There were three dining facilities for the entire base population; one large facility with a maximum occupancy of 600 and two smaller auxiliary dining areas with maximum occupancies of 96 each. The base has two gyms which were eventually closed after the start of the outbreak.

MITIGATION MEASURES

Mitigation policies in place mirrored U.S. CDC recommendations, including face coverings, 6 feet of social distancing, frequent hand washing and sanitizing of high-touch surfaces. During the outbreak, as personal protective equipment (PPE) supplies increased, surgical masks were issued to all individuals. Group gatherings of over 10 people were prohibited, and virtual teleconferences were used as much as possible. The ability to move on and off base was limited to mission essential trips. In the dining facilities, personnel were required to wear masks when not eating, and sit more than six feet apart from one another.

Dedicated areas on the base were identified to function as quarantine and isolation facilities. Quarantine facilities included 10 large tents capable of housing 10 individuals each. These tents were used for asymptomatic individuals identified as close contacts of persons under investigation (PUI) or close contacts of individuals with confirmed COVID-19 infection by polymerase chain reaction (PCR) testing of a nasopharyngeal sample. The definition of a close contact paralleled the CDC definition: intimate contact, any individual who was within 6 feet of a PUI or confirmed-positive individual for more than 15 minutes for the 48 hours preceding symptom onset or testing, whichever came first. Close contacts were kept in quarantine for 14 days as long as they remained asymptomatic. Initially, if a close contact developed symptoms, they were tested for COVID-19 and moved into isolation. During the course of the outbreak, additional guidance was released by the CDC in regard to testing close contacts, and subsequently, all close contacts were tested upon entry into quarantine to identify asymptomatic spreaders of COVID-19.

In alignment with CDC guidelines at that time, health care workers that were named as close contacts and deemed essential to responding to the outbreak were allowed to conduct a modified quarantine. This modified quarantine allowed the health care workers to go to work and their quarters only. They were not allowed to eat in the dining facilities. They were required to wear PPE that included N95 masks while indoors or within six feet of another individual and have their temperatures and symptoms checked twice daily.

Personal protective equipment for health care workers included the wearing of a surgical mask at all times while in the clinic. In addition, when evaluating a PUI, PPE included N95 mask, gown, eye protection, and gloves. N95 masks were allowed to be re-used as long as a surgical mask was worn over the N95 mask.

TABLE I. Demographics. Number of Positive Individuals by Demographic Characteristic

Characteristic	Number	Percentage of positive Cases
RT-PCR positive		
Symptomatic	40	87
Asymptomatic	6	13
Sex		
Male	38	82.6
Female	8	17.4
Clinic exposure		
Healthcare worker	9	19.6
Non Healthcare worker	37	80.4
Subordinate element		
Command	10	21.7
Ground	5	10.9
Logistics	8	17.4
Aviation	23	50.0
Aviation component		
Aircrew	12	52.2
Non-aircrew	11	47.2

Abbreviation: RT-PCR, real-time reverse transcriptase polymerase chain reaction.

Concordant with then-current CDC guidance, PUIs, and confirmed positive cases were kept in isolation for 10 days and were released once they had at least 24 hours without symptoms and were afebrile without the use of fever reducing medications. If a PUI's test returned negative, it was then up to the discretion of the treating physician to decide whether or not COVID-19 was still the most likely diagnosis. If COVID-19 was not the most likely diagnosis, the individual and their close contacts were released. Upon release from quarantine or isolation, the individual was allowed to re-enter the base general population.

RESULTS

The average number of personnel within the cohort during the study period, 21 June through 10 August, was 1,197. Of that population, 46 (3.84%) had positive PCR test results for COVID-19. The mean age of those who tested positive was 29.4 years old and 83% were male. Among those who tested positive, 40 (87%) presented as symptomatic and none required hospitalization related to COVID-19 (Fig. 1). Overall, 15 officers (33%) and 31 enlisted personnel (67%) tested positive. Among the positive tests, 9 (20%) were health care workers and 37 (80%) were non-healthcare workers. Twenty-three (50%) of positive cases were within the ACE, 10 (22%) were in the CE, 8 (17%) were in the LCE, and 5 (11%) were in the GCE (Table I).

Nine of 56 (16%) healthcare workers tested positive, while 37 of 1,143 (3.2%) of non-healthcare workers tested positive. Healthcare workers in the study population were 4.96 times more likely to test positive for COVID-19 than non-healthcare workers. Twenty-three out of 46 (50%) of total positive cases were assigned to the ACE. Personnel assigned to the ACE had

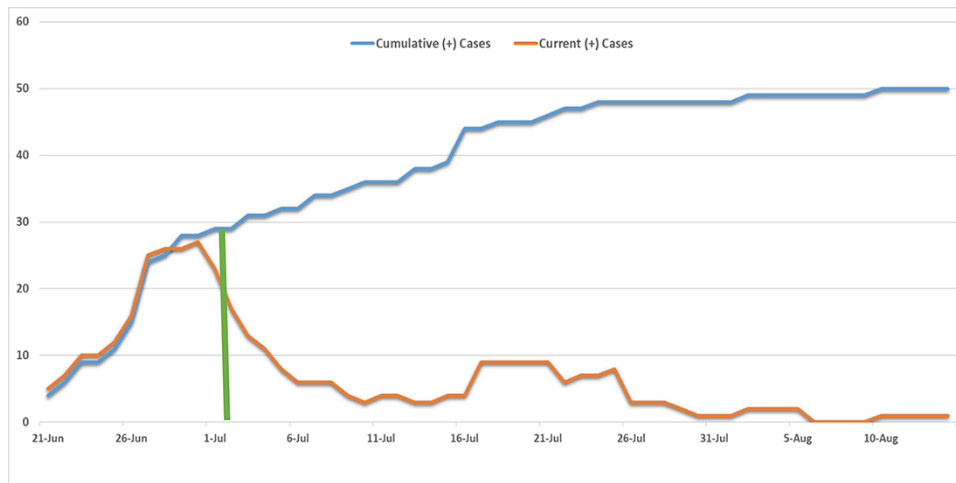


FIGURE 1. Cumulative and active COVID-19 cases during the study period. Vertical bar represents start date of surgical mask policy.

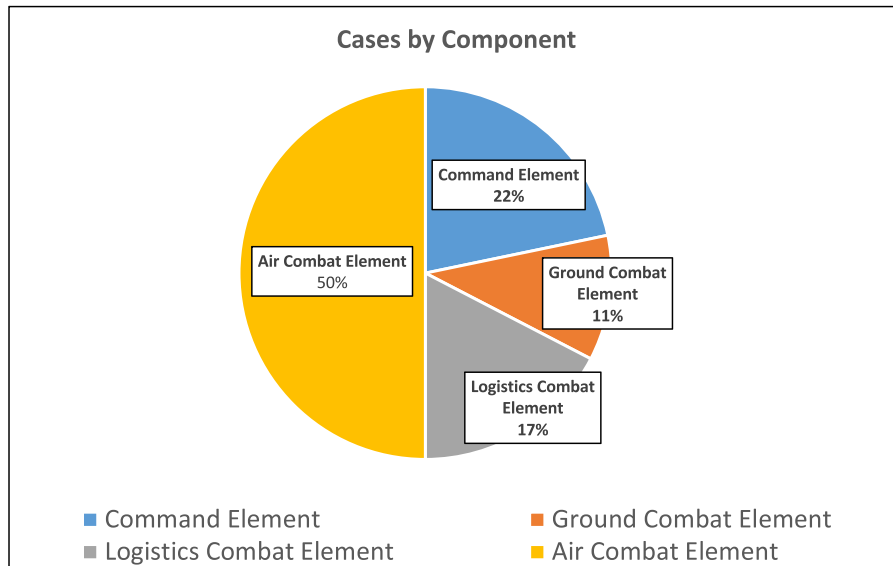


FIGURE 2. Positive cases by each element within the task force.

1.94 times the risk of testing positive compared to personnel assigned to all other elements.

In addition to the 46 positive cases placed in isolation during the study period, 78 personnel were placed in quarantine as close contacts. 41 (53%) of personnel placed in quarantine were assigned to the ACE. However, flight crews primarily operated in bubbles so that when someone acquired COVID, the close contacts were limited to personnel within that bubble cohort rather than the entire unit. This helped preserve flight operations which was a critical capability necessary for the unit. After being released from quarantine, no individuals subsequently presented as a PUI during the reporting period. In total, 124 (10%) of 1,197 personnel during the study period were placed in either isolation or quarantine, equating to ~1,552 lost workdays during the study period.

DISCUSSION

The review study highlights the difficulty in preventing the initial spread of a highly infectious virus within a population living in congregate accommodations. Within a short amount of time the total number of personnel infected with COVID rose to 46 individuals and necessitated the quarantining or isolation of 124 individuals leading to over 1,500 lost workdays. The subsets of populations affected were not uniform across the task force, as aviation personnel and health care workers were disproportionately affected.

The ACE constitutes nearly 30% of the cohort; however, they had 50% of the positive tests (Fig. 2). The increased relative risk of contracting the virus is likely multi-factorial. Aviation personnel are required to maintain and fly aircraft throughout the AO, leading to an increased number of potential exposures from other personnel in the region. In

addition, this element was unique in that it required personnel to commute 15 minutes daily on busses to the flight line for work, creating ideal conditions to transmit the virus. Furthermore, recent studies have suggested poor ventilation can increase the likelihood of contracting SARS-CoV-2.³ The cabin environments within the aircrafts have the potential to recirculate aerosolized particles leading to an increased likelihood of an individual acquiring the virus. Lastly, the altered sleep schedule and difficult work environment of ACE personnel could potentially suppress an individual's immune system leading to a higher risk for infection.⁴

The outbreak also disproportionately affected the health-care worker population, as they were found to be 4.96 times more likely to test positive for COVID-19. Again contributing to the increased risk was the congregate living conditions. Many lived together in close quarters and several lived in the same room. While these living conditions were not unique to health care workers on base, when taken in conjunction with their increased occupational exposure, it likely led to the higher relative risk for testing positive through contact. Another contributing factor may have been the reuse of N-95 masks because of shortages of PPE in the initial stages of the outbreak as it has been reported that reusing PPE can lead to an increased risk for a positive COVID-19 test.⁵

The effectiveness of the quarantine and isolation measures appeared to be high. There were no individuals who were released from quarantine at the end of their 14 day period who later presented with symptoms and became a PUI. In addition, contact tracing did not identify any positive cases that had exposure to individuals who were previously in quarantine or isolation. There were zero positive tests from the health care workers who conducted a modified quarantine, suggesting that this may be an adequate measure to control the spread

of the virus rather than a mandatory quarantine for 14 days. This helped preserve that capability as well.

As the outbreak was worsening, additional mitigation measures were instituted which may have shortened its duration. COVID-19 screening forms were developed for all passengers utilizing the task force's aircraft. These forms included questions regarding symptoms consistent with COVID-19 and a temperature check before boarding aircraft. Surgical masks were also distributed to the entire cohort and were mandated to be worn by all passengers aboard aircraft and when traveling in a vehicle. There did appear to be a sustained decrease in cases reported after instituting the surgical mask policy (Fig. 3). Furthermore, billeting was rearranged from all individuals within a specific component/work function sharing the same rooms to interspersing individuals with members of other components. This potentially decreased the operational impact of having a positive individual and multiple close contacts from the same component/work function go into isolation or quarantine at the same time.

Although the spread of the virus was rapid and led to substantial impacts because of lost work days, the morbidity and mortality was low. All positive cases had improvement of symptoms by the end of their isolation period and were able to be released on day 10. There were zero hospitalizations and only mild symptoms reported, which was likely secondary to the age of our study population and lack of comorbidities (health screenings took place before deploying a military member). These findings are consistent with prior reports, such as by Huang et al. who in their review of confirmed COVID-19 infections found that the majority had mild symptoms resembling those of the common cold.⁶

The current study has multiple limitations. Testing of asymptomatic individuals was only done on close contacts

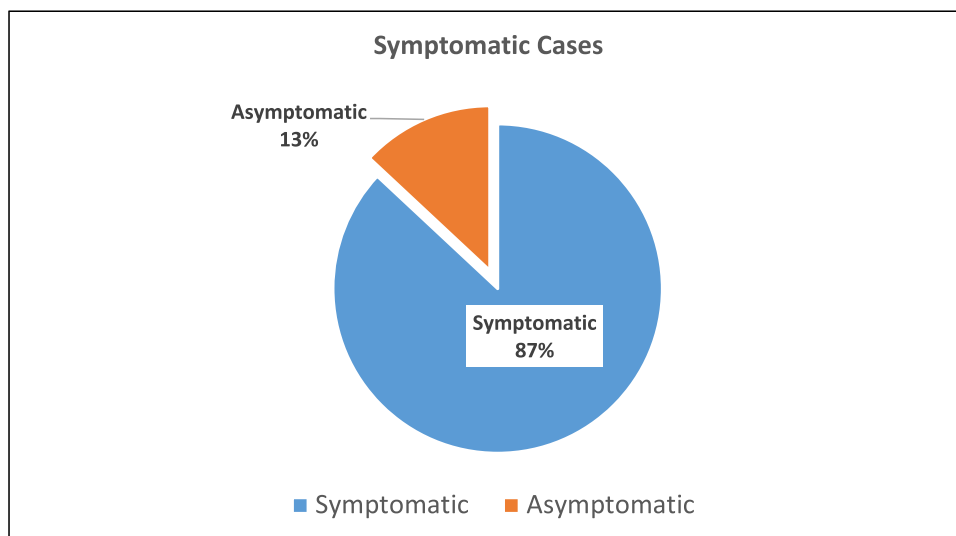


FIGURE 3. Percentage of symptomatic and asymptomatic positive cases during the reporting period.

and was started after the initial outbreak began which made it difficult to determine the true extent of the outbreak and the effect of our mitigation measures as asymptomatic infections were possibly missed. This is also likely the reason for the high positivity rate of tests conducted as the majority of tests were done on symptomatic individuals. Although a high percentage of our positive test results were found in males, we do not feel that this suggests any increased risk in that population as males made up the majority of the task force. We do not have data on compliance with mitigation measures; however, these measures were issued as an order in a military population. Furthermore, individuals outside of the task force were also affected by the outbreak; however, we were unable to include their data in the current study.

CONCLUSIONS

Our experience with a COVID-19 outbreak in a land-based force living in a forward deployed environment with congregate living accommodations highlights the substantial impact on military operations that can potentially occur if mitigation measures are not properly employed. This can result in considerable loss in work hours because of contact tracing and degraded warfighting capabilities that can have significant operational impacts if not planned for. We also reaffirmed the low morbidity and mortality rate in a young and healthy population. We suggest that our review can inform future planning on the importance of force health protection measures that can be applied to at-risk population cohorts in order to preserve the mission and maintain a healthy force. In addition to the standard recommendations from the CDC, we recommend using surgical masks if supplies are sufficient, dispersing living arrangements to limit the impacts within sections of the task force and strict symptom screening of individuals before using aircraft. In addition, consideration and further research

into a modified isolation and quarantine protocol with the continued use of stringent PPE may be adequate to control a similar outbreak while decreasing the amount of work hours lost in an operational setting.

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FUNDING

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CONFLICT OF INTEREST STATEMENT

None declared.

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