Management of COVID-19 in a Deployed Setting

LTCOL Christian Medby*, †; CAPT Sandra Larsen Clifford (Res.); LCDR Miranda Norquay‡; MAJ Therese Killi Hansen*; COL Jennifer Gurney∥, ¶

ABSTRACT
Introduction: 
Hamid Karzai International Airport is a NATO military base connected to the international airport in Kabul, Afghanistan. It is one of the larger NATO installations in Afghanistan, and with its location being one of the main hubs for international transit, the base has been at the frontline since the beginning of the COVID-19 pandemic. Hamid Karzai International Airport base commanders and medical staff have been at the forefront, continually developing policies and procedures to mitigate the pandemic in a deployed setting.

Material and Methods: 
On base, approximately 4,000 people from 58 different nations lived within 0.5 km². Diagnosis of COVID-19 was made by the detection of nucleic acid from the SARS-CoV-2 virus in nasopharyngeal/oropharyngeal swabs using real-time polymerase chain reaction (BioFire or GeneXpert). Serological tests (detecting IgM and IgG antibodies) were used as a screening tool. Data were reported from April 1 to September 12, 2020.

Results: 
Three thousand four hundred and sixty-six PCR tests were run in the reported period. Four hundred and seventy-eight positive cases were identified. Of these, only 106 reported symptoms. Seventy-eight presented spontaneously to the emergency room, while the remaining positive cases were identified as a result of aggressive testing of close contacts, base screening and surge testing. Twenty-two patients required oxygen treatment. One patient required mechanical ventilation and later died after strategic evacuation.

Discussion: 
Mitigation of COVID-19 was achieved by measures to reduce the spread of the virus, measures to reduce the population, and a medical response plan. To manage the logistic burden of isolating and quarantining a large portion of the population, a multinational and multidisciplinary COVID Task Force was formed.

Conclusions: 
In a military population of mostly young and healthy individuals, the majority of COVID-positive patients will have fewer symptoms, and therefore, the aggressive screening of asymptomatic personnel is necessary. Outbreaks of COVID-19 in a military base could have a detrimental impact on missions but may be contained and controlled with quarantine, isolation, and aggressive contact tracing.

INTRODUCTION
The military trauma system in the Combined Joint Operation Area Afghanistan (CJOA-A) was not designed to manage the global COVID-19 pandemic. In January and February 2020, initial reports from China and Italy suggested high mortality rates from SARS-CoV-2 infections.¹ ² Additionally, the COVID-19 outbreak on the U.S. aircraft carrier U.S.S. Theodore Roosevelt in March 2020 demonstrated the vulnerability of military populations living in close quarters and the potential for large mission impact.³

Hamid Karzai International Airport (HKIA) is a NATO military base located in the Kabul airport in Afghanistan. As a large NATO installation with proximity to the international airport, HKIA has been on the frontline and led the way to develop policies and procedures to mitigate the COVID-19 pandemic in a deployed setting since the beginning. It was the first NATO base in Afghanistan to have an outbreak of COVID-19 and the first base to receive an intensive care unit (ICU) patient with COVID-19. To respond to the emerging threat, the multinational (MN) Role 2 medical treatment facility (MTF) situated at HKIA was reorganized to face the pandemic while still maintaining its trauma capability.

¹Norwegian Armed Forces Joint Medical Services, Sessvollmoen 2058, Norway
²Clinic of Anesthesia and Intensive Care, St. Olav’s University Hospital, Trondheim 7006, Norway
³Department of Anesthesia and Intensive Care, Levanger Hospital, Levanger 7600, Norway
⁴Royal Australian Navy, Maritime Operational Health Unit, HMAS Penguin, Mosman, NSW 2088, Australia
⁵US Army Institute of Surgical Research, San Antonio, TX 78234, USA
⁶Defense Committee on Trauma, Joint Trauma System, Falls Church, VA 22042, USA

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MATERIAL AND METHODS

Ethics
The project was reviewed by the Regional Committee for Medical and Health Research Ethics for South East Norway and considered to be exempt from formal approval (REK #262774). All patient data were collected and reported as anonymous data.

Population
The base population was approximately 4,000 personnel from 58 different nations (April 2020). Approximately 50% were coalition military members, and the rest were civilian DoD employees or contractors. In addition, the HKIA Role 2 MTF provisioned health care to patients from other nearby bases, the embassies, and the international community in Kabul with the total population served over 10,000. Afghan local nationals (LNs) could be seen but required an exception to policy.

The HKIA military base is approximately 0.5 km\(^2\), resulting in a population density of 8,000 per km\(^2\). Personnel mostly live in shared rooms in barracks, with common bathroom, dining, and recreation facilities.

Diagnosis
Diagnosis of COVID-19 was made by the detection of nucleic acid from the SARS-CoV-2 virus in nasopharyngeal/oropharyngeal swabs using real-time polymerase chain reaction, either BioFire (BioFire Defense, Salt Lake City, UT, USA) or GeneXpert (Cepheid AB, Sunnyvale, CA, USA). Asymptomatic carriers were often identified using serological tests (Cellex qSARS-CoV-2 IgG/IgM Rapid test, Wondfo SARS-CoV-2 Antibody Test; Cleartest IgG- und IgM-Antikörpern gegen 2019-nCoV, and others), followed by confirmation with PCR testing. Serology-positive/PCR-negative personnel were considered recovered COVID patients and released after a second negative PCR test. Identification of positive cases was followed by an aggressive contact tracing protocol in order to detect asymptomatic carriers.

For screening of low-risk populations, pooled PCR testing was utilized.\(^4\) Samples from five individuals were pooled and analyzed using BioFire or GeneXpert. For positive tests, the five samples were reanalyzed individually.

All personnel were encouraged to report to the hospital if they had symptoms, including fever or chills, cough, shortness of breath or difficulty breathing, fatigue, muscle or body aches, headache, new loss of taste or smell, sore throat, congestion or runny nose, nausea/vomiting, or diarrhea for isolation and testing.\(^5\) A large public health initiative to include education about symptoms was done by the medical staff in order to encourage early presentation and decrease overall transmission on the base.

In addition, 10-15% of the base population were randomly screened monthly, using serology tests or later by pooled PCR. Serology-positive cases were tested with PCR, and any PCR-positive cases resulted in aggressive contact tracing. All positive cases were isolated for a minimum of 14 days. To be released, they required two negative PCR tests, separated by 48 hours. In July 2020, this was supplemented by time- and symptom-based release criteria on day 21. All close contacts were quarantined for 14 days, with a serology or PCR test on days 5-7 and again before release on day 14.

Data Collection
As part of a command-directed surveillance and tracking, data were collected from April 1 2020. We report data from April 1 to September 12, 2020, during the deployment of the first Norwegian contingent at the HKIA MN Role 2 MTF. The primary purpose of data collection was to comply with required reporting and to maintain a diligent public health posture with continuous process improvement. All positive cases were registered in an Excel spreadsheet and reported through the chain of command.

RESULTS
Three thousand four hundred and sixty-six PCR tests were analyzed during the reported period. Four hundred and seventy-eight positive cases were identified. Of these, 106 (22%) reported symptoms on presentation. Seventy-eight positive cases were identified as a result of aggressive testing of close contacts, base screening testing, and surge testing in response to a positive case or case cluster. Figure 1 shows new and accumulated cases during the period of data collection. Twenty-two patients at HKIA required inpatient oxygen therapy. One patient required mechanical ventilation. In addition, three other patients requiring ICU treatment were accepted from other Kabul populations (non-military). Two patients died after being evacuated from HKIA Role 2 to a higher level of care: one coalition military, after strategic evacuation to home country, and one LN at Role 3.

DISCUSSION
The theater-wide strategy for COVID-19 mitigation had three pillars: “flatten the curve,” reduce the population, and a medical response plan. The military approach to flattening the curve at HKIA was quite aggressive: everyone was required to maintain a social distance of 2 m, strict hand hygiene was enforced, face masks were compulsory starting in early May both indoors and outdoors, park benches were removed, and strict routines were enforced in dining facilities and in stores. In addition, there was an aggressive and targeted base population screening strategy put in place, to remove contagious asymptomatic patients with COVID-19 from the population.

The base population was reduced in order to not overwhelm the medical system. All non-mission essential personnel were redeployed. Mission critical personnel with one or more close contacts were identified, tested, and isolated. The total population served over 10,000. Afghan local nationals (LNs) could be seen but required an exception to policy.

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several risk factors for a more severe COVID-disease were required to have an exception to policy to remain in the CJOA-A. Other efforts were accelerated to reduce the population at risk and lower the chance of infringing on medical capacity. Fortunately, this was accomplished before we had the first outbreak of COVID-19.

The initial medical response plan aimed to evacuate all positive cases from the CJOA-A; however, it was uncertain if there was going to be full aeromedical evacuation support. Medical facilities were staffed and equipped to be able to meet the estimated patient burden. Specifically, personal protection equipment (PPE), oxygen, and ICU drugs were acquired in large amounts.

The hospital response was aimed at maintaining a full trauma capability. The HKIA MN Role 2 MTF was strictly divided into “clean” and “contaminated” zones, where PPE had to be worn. An outside screening area was set up to avoid bringing COVID patients into clean zones. The ICU was equipped with more ventilators. The lab was expanded and equipped with PCR capabilities (BioFire and GeneXpert), in order to detect SARS-CoV-2. In addition, a NATO-funded, contracted PCR lab with a multichannel GeneXpert analyzer was integrated with the hospital in order to increase the testing capacity for the entire theater. The increased testing capability and capacity at HKIA resulted in turnaround times for PCR testing in as little as a couple of hours.

A dedicated COVID Task Force (TF) was assembled to manage the different challenges posed by the pandemic. The COVID TF was able to get support from non-hospital personnel on the base, which provided the necessary manpower to manage the huge logistical task of isolating and quarantining a substantial portion of the base population. The COVID TF also included a patient administration cell to track all tests, patients, and quarantined personnel. The preventive medicine unit was tasked with contact tracing, with support from COVID TF. Hospital leadership was included as medical advisors in Base Command, to improve public health measures and infection control.

Given the strategic location and mission requirements of the base at HKIA, closing the base completely to avoid COVID-19 infection was not feasible. Therefore, the risk of the virus getting into the base population was continuous with the two biggest risks being introduction through interactions with LNs or by infected personnel deploying to the CJOA-A.
To mitigate these risks, LNs working on base were required to live on base to limit external exposure. Personnel deploying to CJOA-A were required to do a 2-week strict quarantine before deploying and present proof of a negative PCR test upon arrival. However, not all nations were able to comply with this. In addition, it became evident that some soldiers were reluctant to present to the emergency room for testing, despite having symptoms. We found this to be very much influenced by culture and leadership, where some NATO nations were less willing to be tested.

Barracks were designated as facilities for quarantine, COVID isolation, and non-COVID isolation. Figure 2 depicts the number of patients in isolation and quarantine during the reported period. Patients with confirmed COVID were allowed to intermingle within the isolation facility. Patients with symptoms but a negative PCR were kept isolated from each other. Personnel in quarantine were also required to maintain social distancing. Enforcing social distancing within the quarantine facilities without resorting to draconian measures proved to be very challenging, and as a result, we had several outbreaks within quarantine.

Outbreaks were managed with aggressive contact tracing and adjunctive testing of close contacts. We used the CDC definition of a close contact: any individual who was within 6 feet of an infected person for at least 15 minutes starting from 2 days before symptom onset until the time the patient is isolated. The time frame for the trace was sometimes extended beyond 2 days based on detection of antibodies (serology), indicating that the patient might have been infected earlier. Our experience was that the infection most often spread in the workspace. Living quarters (except roommates), dining facilities, shops, and so on did not pose a high risk for spreading the disease (with the social distancing measures in place). Optimizing facilities to reduce the risk of virus transmission was however an extensive logistical challenge, which consumed a lot of time and resources from the COVID TF.

One of the concerns during the planning period was not just hospital bed capacity but also the risk to hospital staff if there were to be an outbreak among hospital personnel. Two and a half months into consistent COVID-19 cases at HKIA, there was an outbreak in the hospital. From a total of 82, 13 health-care providers were infected by COVID-19 and isolated. Seven were put in quarantine as close contacts. To decrease
the burden on the remaining hospital staff and allow continuous medical operations, infected asymptomatic healthcare personnel were used to look after patients in isolation. The contingency plan for mass casualty situations included using infected personnel in full PPE for trauma management. At the time, there was some controversy regarding the ability of asymptomatic carriers to transmit the virus. However, we empirically observed asymptomatic transmission on multiple occasions. Our data show that as many as 77.8% of all the identified positive cases were asymptomatic at the time of testing. However, some of these developed symptoms while in isolation. This is consistent with the findings from U.S.S, Theodore Roosevelt. The trend became evident early on in the reported period. For every case that reported to the emergency room, we therefore assumed that there were more asymptomatic carriers in their surroundings. To find these, we would do surge testing in their workspace or in their units, in addition to quarantining and testing their immediate close contacts.

During the largest outbreak in June, PCR tests were resource-constrained; therefore serological testing was used for diagnostics. IgM-positive patients were isolated as COVID positive. With a high prevalence in the population tested, the false positive rate will be low. However, we were still concerned that false-positive personnel may have been exposed to and infected with COVID-19 while in isolation. Based on our experience with serological tests, we recommend always confirming a positive test with PCR.

Pooled PCR was utilized to conserve resources. GeneExpert test panels were a particularly limited resource during this period. In low-risk populations, such as base screening, this proved to be a resource-conserving strategy. All symptomatic patients were tested individually.

The policies in the CJOA-A were force protective, given the population densities and the inability to shelter in place as a reaction to large outbreaks. Before July 2020, isolation release guidelines required two consecutive negative PCR tests. This was based on the original CDC recommendations. The original medical response plan aimed to evacuate all positive cases of COVID-19. Many coalition force members were quickly evacuated out of the CJOA-A, but getting civilian contractors evacuated proved to be challenging. This resulted in a few patients being isolated for up to 107 days. Although emerging evidence suggested that a positive PCR did not necessarily correlate with infectivity, we remained conservative, being cautious to ensure mission protection while additional evidence emerged. Other tests, such as viral cultures, were not available in the CJOA-A. Time- and symptoms-based criteria were finally implemented in July 2020, lessening the burden on our patients and isolation facilities. However, the approved criteria remained more conservative than CDC and WHO recommendations.

**CONCLUSIONS**

In a military population of mostly young and healthy individuals, the majority of COVID-positive patients will have fewer symptoms, and therefore, the aggressive screening of asymptomatic personnel is necessary to prevent the spread to more vulnerable individuals and to detect pockets of infection within the population.

The mission impact of COVID-19 in a deployed military setting can be significant, but public health measures such as quarantine, isolation, testing, and aggressive contact tracing can be successful in this environment.

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**CONFLICT OF INTEREST STATEMENT**

None declared.

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