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Feature Article

Large-Scale Air Medical Operations in the Age of Coronavirus Disease 2019: Early Leadership Lessons From the Front Lines of British Columbia

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A B S T R A C T

In late 2019, a novel coronavirus was identified as the cause of a cluster of atypical pneumonia cases in Wuhan, China. It subsequently spread throughout China and around the world, quickly becoming a public health emergency. In March 2020, the World Health Organization declared coronavirus disease 2019 a pandemic. This article explores the preparation and early experiences of a large Canadian critical care transport program during the coronavirus disease 2019 pandemic focused on 6 broad strategic objectives centered around staff welfare, regular and transparent communication, networking, evidenced-based approach to personal protective equipment, agile mission planning, and an expedited approach to clinical practice and policy updates and future state modeling.

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In late 2019, a novel coronavirus was identified as the cause of a cluster of atypical pneumonia cases in Wuhan, China. It subsequently spread throughout China and around the world, quickly becoming a public health emergency. In March 2020, the World Health Organization (WHO) declared coronavirus disease 2019 (COVID-19) a pandemic.[1]

As a result, the British Columbia Emergency Health Services (BCEHS) critical care transport (CCT) program began to prepare for the complex task of moving the province's sickest patients to higher levels of care. This article explores the preparation and early experiences of a large Canadian CCT program during the COVID-19 pandemic.

Staff Welfare: Communicating to Increase Resiliency

As the CCT leadership team began preparations in the early stages of the pandemic, staff welfare was at the forefront of every decision. The initial steps included continuous staff consultation and collaboration to ensure that every paramedic and aircrew had a voice. Early actions ensured high levels of cooperation as well as lowering staff anxiety and increasing morale and resilience.

Senior managers and frontline supervisors met regularly with safety representatives, aviation partners, educators, and paramedic crews to identify, analyze, and resolve real-time issues as quickly and safely as possible. Early issues encountered by the team included personal protective equipment (PPE) shortages, uncertainty regarding the correct donning and doffing technique, and aircraft cleaning schedules. Each issue was resolved successfully by issuing reusable PPE, educating regarding the best technique, and contracting an aviation cleaning company, respectively.

Additionally, the leadership team met every 48 hours to discuss a range of topics, with staff welfare solidified as the priority. Finally, leaders produced an update for staff and aircrew that was distributed every 48 hours. The update ensured the team was kept appraised and could see that their input was considered and implemented. We continue to work on the ethos that our staff members are our biggest asset and that we must work hard to turn ideas into action with minimal red tape.

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Table 1
A List of the Air Medical Providers Within the Coronavirus Disease 2019 International Aeromedical Information Sharing Network

Air Medical Provider	Country
Airlift Northwest	WA, US
British Columbia Emergency Health Services	BC, Canada
Alberta Emergency Medical Services	AB, Canada
Shock Trauma Air Rescue Service Air Ambulance	AB Canada
Ornge Air Ambulance	ON, Canada
Royal Flying Doctor Service	SA & NT, Australia
SAAS MedSTAR emergency medical retrieval services	SA, Australia
Air Ambulance Victoria	VIC, Australia
LifeFlight Queensland	QLD, Australia
Sydney HEMS	NSW, Australia

Networking in a Time of Uncertainty

In the initial days of the evolving international crisis, our team observed and analyzed health intelligence coming from countries with higher cases of COVID-19. A key piece of advice from other health networks was to avoid information silos. The formation of specialist information networks to collaborate and support other air medical systems around the world was recommended as a mitigating solution.

On March 7, 2020, the BCEHS CCT leadership created the COVID-19 International Aeromedical Information Sharing Network. The network is an informal online collaboration of 9 large air medical providers from Australia, the United States, and Canada (Table 1). The network seeks to facilitate dialogue and information sharing for improving our collective response to the global COVID-19 pandemic.

Members of the network all shared similar operational features including a large workforce serving a sparse population spread over a significant geographic area. A critical feature to the group's success is the inclusion of air medical systems, primarily from the United States, who are dealing with a higher caseload of incidents. This inclusion provides near real-time lessons and after-action reports to the network members.

The group continues to meet every 48 hours to share information, clinical expertise, real-time health intelligence, and policies. Regular standing agenda items include updates on unique approaches to PPE use in the aviation environment; cleaning solutions for aircraft; identifying and resolving staff and aircrew welfare issues; and discussion around patient trends, treatment, and challenges. Regular meetings support the collaborative effort through shared experience and an agile approach toward troubleshooting clinical and operational issues.

PPE: The Evolving Challenges in the Flight Environment

Based on the available evidence, the COVID-19 virus is transmitted from person to person through close contact and droplets, resembling the spread of influenza.[2] The WHO and British Columbia Center for Disease Control recommend the use of standard, contact, and droplet precautions including a surgical mask, eye protection (eg, goggles and/or face shield), gown, and gloves when providing direct care to patients with confirmed or suspected COVID-19. Droplet precautions including an N95, FFP2, or equivalent respirator; eye protection; gown; and gloves should be used during any aerosol-generating medical procedures (AGMPs).[3,4]

Our air medical teams operate in challenging, space-restricted environments in both fixed and rotary wing aircraft. The confined space, limited airflow, and inability to stop and exit the aircraft mean that our crews use PPE differently than our ground-based colleagues. The BCEHS CCT program quickly identified challenges associated with the WHO's recommended PPE use including the changing of soiled N95 masks in close proximity to patients and the snag risks associated to gowns and aprons. As a result, we opted to adapt our PPE to include hospital scrubs, 1-piece Tyvek suits with hoods, and half facepiece reusable silicone respirators with extended life particulate filters for enhanced durability and increased comfort. The use of powered air-purifying respirators and patient isolation pods continue to be investigated.

The COVID-19 pandemic has resulted in significant anxiety among paramedics and aircrew regarding appropriate PPE, in particular the donning and doffing of PPE. As a result, BCEHS has focused on demonstrations and regular PPE simulation exercises to ease this anxiety. Additionally, BCEHS is also recommending that PPE should be donned and doffed with a partner who is experienced in its use to avoid the risk of accidental exposure.

Mission Planning and Logistics: Adapt and Overcome

The BCEHS CCT program works collaboratively with our health care partners to provide tertiary level intensive care unit care and highly specialized primary and secondary air medical evacuation of critically ill or injured patients across the province of British Columbia. The BCEHS CCT program operates 24 hours a day from 5 strategically located bases via ground ambulance and rotary and fixed wing aircraft (Sikorsky S76C+, King Air 350, and Citation V Encore, respectively) and undertakes nearly 9,000 missions per year.[5] Early lessons regarding the transport of confirmed or suspected COVID-19 patients highlight the importance of crew resource management and a systematic stepwise approach that emphasizes safety before, during, and after transport. Careful escalation of oxygen therapy and a lower threshold to intubate these patients were thought to mitigate the risks associated with managing a deteriorating patient in an uncontrolled scenario.[6] The use of continuous positive airway pressure was limited, and the use of bag valve mask ventilation was adapted to include a filter and a 2-person technique. Additionally, the regular use of COVID-19–specific rapid sequence induction[7] (Appendix 1) and influenzalike illness (ILI) patient transfer checklists is also recommended and was implemented by the BCEHS CCT program on March 12, 2020.

Decontamination of the aircraft is an essential element to consider after the air medical evacuation of a suspected or confirmed COVID-19 patient. Although the WHO provides advice on PPE, they do not provide specific information or a standard operating procedure regarding the decontamination of an ambulance or an aircraft.[8] After consultation with our organizational certification in infection control –certified infection prevention and control specialists and aviation partners, BCEHS paramedics are wiping all surfaces within 2 m of the patient with an accelerated hydrogen peroxide solution. This decontamination practice is consistent with all members of the COVID-19 International Aeromedical Information Sharing Network.

Modifying Clinical Practice: Innovation and Updates in Unprecedented Times

Because of the dynamic nature of the COVID-19 pandemic, urgent changes in clinical guidelines and best practice were implemented. All clinical practice changes for patient care were made with a focus on paramedic safety. As with any clinical practice change, the process involved an examination of the best available evidence, environmental scans of jurisdictional best practice, and clinical consensus among BCHES clinical and medical programs leadership. Unfortunately, as with most air medical practice, there was a dearth of best practice literature on COVID-19 in this setting. Thankfully, the network of international professionals provided strong support for informing this practice change in an agile way.

It was quickly realized that the main risk to paramedic staff was the increased chance of exposure during the use of AGMPs. BCEHS paramedic practice leaders identified some high-risk AGMPs such as intubation, high-flow nasal cannula oxygenation, noninvasive positive-pressure ventilation, nebulization, and the risk of mechanical ventilator circuit breach. The clinical practice updates were

disseminated to staff by various means, including the BCEHS handbook phone application, e-mail memos, leadership updates, practice update videos, and face-to-face learning sessions. All of the changes have been archived in the BCEHS handbook phone application and consolidated into a dashboard for easy reference.

This network informed the following BCEHS clinical practice changes:

- The introduction of COVID-19 dispatch call screening tools: the ProQA Emergency Infectious Disease Surveillance screening tool (Appendix 2) for 911 calls as well as for interfacility transfers through the Patient Transfer Network[9]
- Tracheal intubation in the setting of the COVID-19 pandemic: high-risk procedures to be limited to rapid sequence induction with video laryngoscopy and AGMP PPE
- Mechanical ventilator best practice update: best practice document for limiting the risk of a breach in the mechanical ventilator circuit (heat and moisture exchanger filters, taping connections, and shutting off the ventilator during transition)
- Nonessential medical escorts policy: policy discontinuing the transport of any nonessential medical escort
- ILI flight checklist update: crew resource management document to be implemented between pilots and paramedics before transport to limit unnecessary exposure

Making organizational changes in clinical practice is challenging at the best of times. These challenges are exacerbated during the real-time response to an evolving pandemic. The air medical network provided an expert consensus group to run ideas by; not only was the group faced with similar clinical challenges, but also they came up with similar solutions. Having broad international consensus on best practice has helped ease anxiety among the flight paramedic staff because they know that they were practicing in the same manner as other providers in this setting. However, best practice continues to evolve as more information becomes available. Thus, continual review and revision of practice updates are required on an ongoing basis.

Patient Trends and Expected Future Disposition

Since the onset of the COVID-19 pandemic, BCEHS CCT teams have transported 38 ILI patients who were suspected or positively screened for COVID-19 (Table 2). We have found that in the early stages the majority of our patients have been transported by ground-based CCT units (24) with fewer being transported by aircraft (14). Resource use continues to be based on distance and availability, with some longer ground transports being considered.

The number of transports for suspected COVID-19 patients was initially low. However, as the trajectory of the positively tested cases in the province increased, so did the number of transports. Organizational BCEHS modeling suggests a growing rise in demand for the BCEHS CCT program. Capacity assessments for BCEHS transport teams and critical care equipment have been undertaken in preparation for this expected increase in service demand with an expected peak in demand from mid to late April 2020.

Table 2
A Breakdown of Transport Mode

Transport Type	Patient Number
Ground ambulance	24
Fixed wing air ambulance	10
Rotary wing air ambulance	4

Conclusion

In response to the COVID-19 global pandemic, the BCEHS CCT leadership team focused on 6 broad strategic objectives centered around staff welfare; regular and transparent communication; networking; evidenced-based approach to PPE; agile mission planning; and an expedited approach to clinical practice, policy updates, and future state modeling. These 6 key objectives have strengthened our program's ability to prepare and respond to the growing demand for CCT expected in the coming days to weeks.

Supplementary material

Supplementary material associated with this article can be found in the online version at https://doi.org/10.1016/j.amj.2020.04.015.

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