



Critical Care Education in a Pandemic through Tele-ICU

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Medical education is rooted in hands-on experience. Growth as a physician is built on speaking to patients, discovering subtleties on physical examination, practicing and performing procedures at the bedside, and guiding families through the challenges of understanding and coping with the ailments of their loved ones. These foundations are even more vital to the critical care physician, caring for patients when the threat to life and need for this hands-on experience is at its greatest.

However, the coronavirus disease (COVID-19) pandemic has, by necessity, erected numerous barricades between residents, fellows, and the traditional education previously cultivated during their time in the intensive care unit (ICU). Limitations to time at the bedside, rational preservation of personal protective equipment, and the various methods of mitigating potential exposure to the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus have significantly restrained bedside teaching (1–3). As a result, the skill-based learning from

attending-led physical examination rounds, direct waveform or ventilator management, first-hand procedure training, or in-person family discussions have been greatly attenuated. Even with things as fundamental as cardiopulmonary arrest, learner involvement has been reduced (4).

While acknowledging these limitations to the learning experience, it is important to remember that calamity leads to adaptation and can also inspire innovations. At the University of California San Diego (UCSD), one of the strategies we developed to improve critical care education despite these barriers was the creation of a Tele-ICU learning experience. This intervention, the UCSD “TREAT” (Team-based Remote E-Learning and Tele-ICU) program, allows our experienced critical care physicians to provide remote guidance and consultation for ICU patients in areas without access to local intensivists while simultaneously training our residents and these local providers in the foundations of both general and remote critical care.

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METHODS

The Tele-ICU system at the core of the UCSD TREAT program was launched April 6, 2020, as a teleconferencing consultation service with the goal of improving provider education and patient outcomes in remote critical care environments without access to intensivists or the other resources of a large academic medical center. The format of these consultative services are via two-way audio–video telemedicine sessions with the local multidisciplinary care team (physicians, respiratory therapists, nurses, and patients), for 4+ hours/day, led by experienced pulmonary and critical care medicine physicians associated with UCSD and other institutions. These sessions run from 8:00 A.M. to 12:00 P.M. Pacific Daylight Time, with the teleintensivist able to directly visualize each patient together with their digital or waveform monitors. Care for each patient in the ICU is thoroughly discussed as the teleintensivist and local providers round together. This time frame can also be extended as patient needs dictate, and a teleintensivist is available for urgent after-hours calls as well.

The primary site of intervention thus far has been El Centro Regional Medical Center (ECRMC), a 110-bed hospital in Imperial County, an agricultural region of southern California at the United States–Mexico border with high rates of COVID-19 cases and hospitalizations. At the time of this report, June 15, 2020, patients suffering from COVID-19 made up approximately 95% of all ICU admissions (5). Data regarding the benefits, limitations, and impact of these Tele-ICU services were collected from local physicians, respiratory therapists, and nurses via electronic survey.

Beginning on May 14th, residents from the UCSD Internal Medicine Residency Program began joining these Tele-ICU calls as part of the underserved medicine rotation. Their primary role has been to participate actively

in rounds by engaging in patient care discussions, interpret waveform and laboratory data for the team, and summarize care plan tasks in the context of these resource-limited settings. The data regarding their experience and perceived benefits were also collected via survey after the conclusion of their 2-week rotation.

RESULTS

When Tele-ICU between UCSD and ECRMC began, it was set at 3 hours per day for 10 days a month. However, it was received so positively by the local providers, teams, and patients that within the first 2 weeks of its launch, this initial consultative interaction time rapidly expanded to 4 hours per day, every single day. This enthusiasm has sustained as well, as offers from UCSD to reduce Tele-ICU time several months later were opposed unanimously by ECRMC. Instead, providers at every level entreated that these interactions continue or even increase beyond their current daily duration.

Survey data was also collected, with 7 physicians, 10 respiratory therapists, and 10 nurses at ECRMC responding. When asked what aspect of the Tele-ICU program benefited them most, 62% stated it was access to expertise regarding mechanical ventilation, 19% identified the ability to ask critical care questions to an expert, 8% argued it was the relationship allowing for smooth interfacility transfer, and another 11% identified something else entirely (Figure 1).

In addition to this feedback from local providers at ECRMC, six internal medicine residents at UCSD have engaged in this Tele-ICU experience to date with their experiences surveyed as well (Figure 2), and new residents are getting involved every 2 weeks. Residents unanimously believed that the Tele-ICU program improved their understanding of ICU care in resource-limited settings, improved

What do you think is the highest value of the Tele-ICU service? (n = 27)

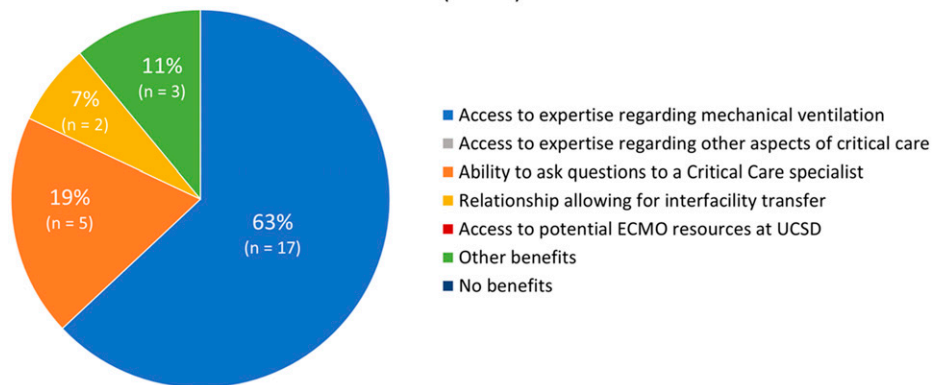


Figure 1. Specific multidisciplinary provider feedback regarding University of California San Diego (UCSD) TREAT (Team-based Remote E-Learning and Tele-ICU) experience. The responses to an education-focused survey question several months after the launch of the Tele-intensive care unit (ICU) experience between UCSD and El Centro Regional Medical Center (ECRMC) are shown. Multidisciplinary providers working in the ICU at ECRMC who participated in this program were asked the highest value component of the Tele-ICU experience (n = 27). The respondents were composed of 7 physicians, 10 respiratory therapists, and 10 ICU nurses. All possible responses are displayed in the legend. ECMO = extracorporeal membrane oxygenation.

their ability to deliver ICU-level care in these environments, and enhanced their evidence-based care of patients with COVID-19. Most believed their communication skills with multidisciplinary teams also improved, and all residents reported that they would be interested in the educational benefits of this Tele-ICU program again in the future.

DISCUSSION

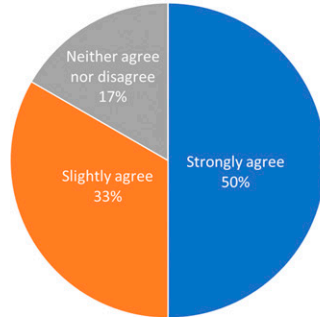
Although the impact of Tele-ICU on patient outcomes and adherence to evidence-based critical care has been studied elsewhere, we believe this unique clinical environment also harbors novel opportunities in medical education (6). Leading and educating multidisciplinary teams in underresourced areas benefits not only the local providers but can also greatly inform and broaden the scope of clinical care for residents and fellows involved. These learners get to experience and manage patients in a distinct setting from

those encountered at academic medical centers, with unique challenges and limitations, while still practicing and honing their skills in critical care medicine. Both these groups, through their survey responses and enthusiasm for continued involvement, have clearly communicated the benefit they believe these Tele-ICU interactions provide.

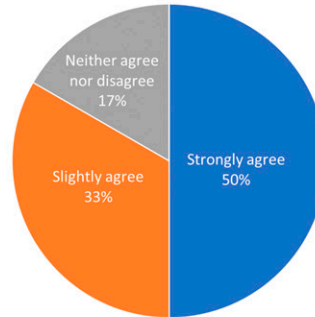
The COVID-19 pandemic has created numerous necessary restrictions on behalf of safety and a mentality of survival, which permeate into medical education as well. However, there is also great opportunity for innovation, new ways and environments in which learning can flourish, and if we continue to approach this crisis mindful of this perspective, we as educators may be able to set our learners on a path even more beneficial than before.

Author disclosures are available with the text of this article at www.atsjournals.org.

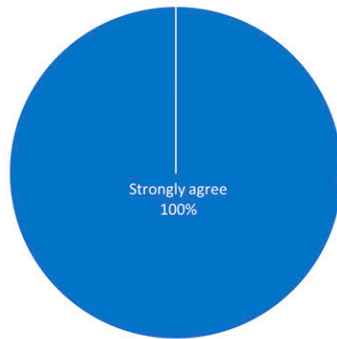
The Tele-ICU experience taught me how to lead interdisciplinary rounds effectively through a telemedicine interface



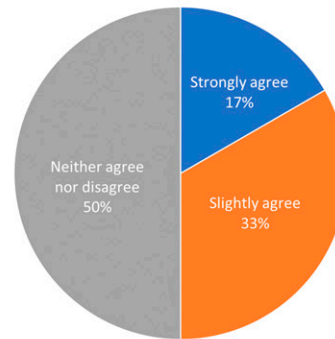
The Tele-ICU experience increased my communication skills with bedside staff in order to achieve critical care goals



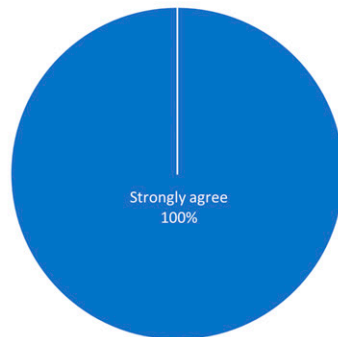
I gained and/or reinforced my understanding of evidence-based interventions in the management of critically ill COVID+ patients through the Tele-ICU experience



I gained and/or reinforced my understanding of evidence-based interventions in the management of critically ill non-COVID patients through the Tele-ICU experience



The Tele-ICU experience allowed me to appreciate the differences between critical care delivery in academic centers and resource-limited settings



I felt more prepared and confident to deliver evidence-based critical care interventions in resource-limited settings by participating in the Tele-ICU experience

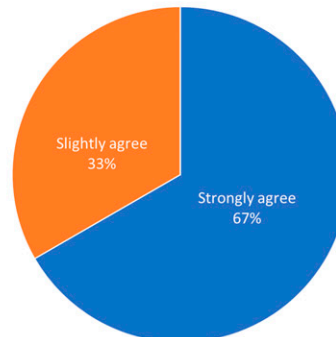


Figure 2. Specific resident feedback regarding University of California San Diego TREAT (Team-based Remote E-Learning and Tele-ICU) experience. A proportion of University of California San Diego internal medicine resident responses ($n = 6$) to various survey questions after the Tele-ICU experience at El Centro Regional Medical Center are shown. The possible responses included strongly agree, slightly agree, neither agree nor disagree, slightly disagree, or strongly disagree. COVID = coronavirus disease; ICU = intensive care unit.

REFERENCES

1. Rose S. Medical student education in the time of COVID-19. *JAMA* 2020;323:2131–2132.
2. Newsome HA, Davies OMT, Doerfer KW. Coronavirus disease 2019—an impetus for resident education reform? *JAMA Otolaryngol Head Neck Surg* 2020;146:785–786.
3. O’Carroll O, Lyn E, Keane MP, Gallagher CG, McCarthy C. The impact of COVID-19 on pulmonary fellowship training in an Irish setting. *ATS Scholar* [online ahead of print] 1 Jun 2020; DOI: 10.34197/ats-scholar.2020-0083LE.
4. Edelson DP, Sasson C, Chan PS, Atkins DL, Aziz K, Becker LB, *et al.*; American Heart Association ECC Interim COVID Guidance Authors. Interim guidance for basic and advanced life support in adults, children, and neonates with suspected or confirmed COVID-19: from the emergency cardiovascular care committee and get with the guidelines-resuscitation adult and pediatric task forces of the American Heart Association. *Circulation* 2020;141:e933–e943.
5. Imperial County Public Health Department. COVID-19. Imperial County Health Department; 2020. [accessed 2020 Jun 15]. Available from: www.icphd.org/health-information-and-resources/healthy-facts/covid-19/.
6. Fusaro MV, Becker C, Scurlock C. Evaluating tele-ICU implementation based on observed and predicted ICU mortality: a systematic review and meta-analysis. *Crit Care Med* 2019;47:501–507.