# Chapter 16
# Turning "Night into Day": Challenges, Strategies, and Effectiveness of Re-engineering the Workflow to Enable Continuous Electronic Intensive Care Unit Collaboration Between Australia and U.S.

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Safe and effective care of critically ill patients requires a team of professionals including intensivists and critical care nurses experienced in providing care for patients in the intensive care unit (ICU). While critical illness can strike at any time and demands continuous attention, allocation of scarce staff follows a predictable pattern. The night shift is more likely to have disproportionately newer and thus less experienced nurses, and the experienced nurses on that shift are engaged in providing care to their own set of patients (Claffey 2006; Floyd 2003). At times this leaves them unable to sufficiently supervise the newer staff. There is also evidence of increased risks at night time with higher in-hospital mortality for admissions at night (Coiera et al. 2014).

There is also a maldistribution of intensivists in the United States with the southeastern region experiencing a greater need, and there are no intensivists present at many hospitals during the overnight hours. This combination leaves most ICUs in our region struggling with less experienced and diminishing numbers of staff at night with less physician support. There are fewer resources in many departments of the hospital during nighttime hours, requiring these staff to be more independent and resourceful in providing vital care. These novice nurses are not yet prepared for autonomy and are less sure of themselves and of where they might turn for advice or counsel.

To mitigate that nighttime challenge, Emory Healthcare (EHC) supports bedside caregivers with remote guidance from senior intensivists and critical care nurses using an efficient telehealth system, "eICU™" (Lilly et al. 2014). This platform

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allows the remote caregivers to observe, collaborate and prescribe at 10 ICUs in 5 hospitals from a single clinical operations room (COR) located in Dunwoody, Georgia. The Emory eICU program has data flowing from the electronic medical records and bedside monitors allowing the remote staff to have continuous access to all patients. The novel displays of data and the corresponding alerts driven by Boolean and trending algorithms in the eICU™ system, augments situation awareness and allows early detection when a patient veers off of the expected trajectory.

Every eICU nurse (eRN) has a minimum of 5 years hands on experience at the bedside and each is certified as a critical care nurse (CCRN) by the American Academy of Critical Care Nurses (AACN). They provide the novice night nurses in the ICUs with "just in time" education and support during hours when onsite resources are not readily available. The bedside nurse pushes a button on the wall in a patient's room to access the eRN who comes on camera in about 15 seconds. The eRNs provide the newer nurses with insight and support that comes from the in-depth knowledge they acquire after years of providing bedside care to critically ill patients.

The physicians in the eICU are Emory faculty, all board-certified intensivists, have acquired additional training in critical care after completing specialty training in their field of choice. The intensivists in the eICU also provide many forms of support to bedside staff that might otherwise be delayed or not occur at all. That support ranges from just in time education about a drug the staff has never previously had prescribed or administered, to providing support to patients and families approaching the end of a prolonged course of illness.

The caregivers in the eICU are challenged to provide outstanding care throughout the night despite the obvious disruption in their normal wake-sleep cycles. Working through the night time hours exposes clinicians to adverse alterations in their physical, emotional and cognitive abilities. Night shift workers have been shown to exhibit detrimental changes in their health and wellbeing, with the WHO even classifying night work as a "probable carcinogen" in 2007 (Gu et al. 2015). Though these detriments to health have been widely acknowledged, solutions for mitigating the effect on caregivers have not been sufficiently explored. In an attempt to further innovate and mitigate these deleterious effects on our staff, Emory proposed, piloted, and established a solution: "Turning Night into Day" (https://clinicaltrials.gov/ct2/show/NCT02895997).

Thus, Emory clinicians that provide remote eICU coverage on the night shift were relocated to the opposite side of the world. From the Antipodes, they would deliver their nighttime care to the patients served at the Emory eICU site, but they would do so from daylight in Australia. (The remote monitoring platform used allows for distance communication and connection with ICUs as far away as 250 miles, so repurposing that platform for ultra-remote coverage 12,000 miles away was technically possible.) A 6-month pilot research study was proposed to explore the effects on clinicians providing the eICU services when they are moved to a different time zone. Could a geographically dispersed clinical team create quality outcomes for patients as well as increase quality of life for those clinicians? The decision was made to focus on an English-speaking country, with a specific initial

focus on a destination familiar to Americans. We were able to leverage a personal connection to establish a relationship with Macquarie University (MU) in Sydney Australia. That university is also home to the Australian Institute of Health Innovation, so it was an ideal location to form a partnership for this forward-looking study. Meetings were scheduled with administrative leadership there to assess the feasibility of this project. There was mutual interest in exploring the project, so the planning phase began.

There were three primary areas of focus for developing this new clinical workflow; how to manage the people, how to manage the legal aspects and how to choose the technical solutions to be used.

## 16.1   Managing the People

Study development and design was a cooperative effort between EHC and MU. The Emory eICU clinicians would be the study subjects and an application for an IRB was completed that focused on studying how the change in location and night/day hours would affect them physically, emotionally and cognitively. Study subjects were chosen on a volunteer basis and would travel to MU for a time of 6–9 weeks while performing specific physiologic tests and wearing a heart rate and activity monitoring device. The subject travelers also completed surveys on quality of life and mood status in addition to performing validated tasks to measure efficiency.

Once the study design was complete the focus turned to providing what the clinicians would need to perform effectively in the new environment. The decision was made to send two clinicians. Sending two Emory clinicians would lend to assuring a shared sense of purpose and understanding of the primary objective for the study and the Emory eICU Center. This laid a foundation for the primary component of building the dispersed teams. Relocating our own clinicians instead of employing services of local Australian clinicians ensured that the possible obstacles of competing goals and objectives by clinicians from different backgrounds and countries would be avoided (Crowley 2005).

The site in Australia was built to echo the site in Atlanta to help increase clinicians' level of comfort working there. Tools to communicate with the team at home in Atlanta in a seamless and timely manner were needed so there would be no delays in patient care. A video conferencing tool was installed in parallel with the patient-centered eICU tool so clinicians could launch a sidebar video call. This sidebar video conferencing system allowed all clinicians to maintain the perception of being physically collocated, yet they were still thousands of miles apart. To further the sense of teamness, a large screen television/monitor was placed in the MU monitoring room that had a live feed of the Australian COR running for the duration of the shift. A reciprocal monitor was also placed in the COR in Atlanta. In all, there were three video channels used by staff: the video channel embedded in the eICU

application facilitating communication between eICU staff and the bedside; the sidebar video link so eICU staff could speak with each other; and the full-room continuous video link providing a sense of "looking into the other room" on the other side of the globe.

## 16.2  Legal Aspects

There were many questions related to liability, insurance, professional credentialing, indemnity and more that had to be answered to arrive at a mutually acceptable contract. Agreements would be governed by Australian law so a contract dispute among the parties would be litigated in Australia. For this reason, EHC chose to hire outside legal counsel in Australia to assist with navigating these questions. Making decisions about how operations function in another country involves being as informed as possible to protect traveling clinicians, Emory Healthcare and the patients treated.

The Australian legal team consulted with the NSW medical and nursing boards to determine what the requirement would be for the clinicians while they worked there. We were informed that Emory's physicians and nurses were not required to apply for registration as health practitioners, apply for licensure or fulfill credentialing requirements in Australia during the six (6) month Project. Even if the Emory employees did not have to register, they were required to comply with relevant codes of conduct for Australian practitioners. They could not provide any type of medical services including consultations to Australian patients at all. All clinicians had to adhere to their scope of practice guidelines and codes of conduct for their place of practice, Atlanta Georgia. Emory clinicians had to comply with EHC employment and HR policies and US laws and regulations. As the Emory employees would not have an Australian employer the Australian minimum conditions, such as pay rates, would not apply during their Australian assignments. However, as they are performing duties in Australia relevant U.S. employment laws would apply, including anti-discrimination, harassment and work health and safety (which in turn covers workplace bullying). Emory had to take reasonable steps to ensure that the Australia workplace is safe for the Emory employees.

They determined that Emory employees could apply for standard visitor's visas electronically online instead of any type of work visa. MU sponsorship was not required because Emory individuals would not be employees or contractors of MU. This was determined because the clinicians would remain Emory employees for the length of their work assignment there and not employed by an Australian entity. They also found that EHC would not need to register with the Australian Securities and Investment Commission as a company doing business in Australia because of the temporary nature of the trial and the fact that it would not be hiring Australian employees. General sales tax would also not be paid because the Emory team would not be generating revenue while there.

To ensure uninterrupted insurance for the clinicians, Emory verified their plan for medical, dental and life insurance had global coverage. There are very different limits and restrictions related to malpractice between the U.S. and Australia, so indemnity had to be granted to the Australian parties involved. The malpractice insurance for all participating clinicians from EHC had to be verified and outlined in the legal contract.

Emory privacy guidelines had to be reviewed with each participating employee before deployment to the Australian site. Any visitors to the Australian site had to complete forms for compliance with HIPPA guidelines around patient confidentiality and privacy. After some preliminary investigation the determination was made that an end to end connection from Emory to the distant site in Australia would be the best solution for ensuring adherence to HIPPA guidelines and ensure security for protected health information (PHI).

## 16.3   Technical Aspects

Emory needed to have a connection back home that was private, secure and reliable. The IT team made the determination that an end to end circuit was the best option to achieve all three. A multiprotocol label switching (MPLS) network was chosen for the circuit type. This type of circuit could be configured to originate in Atlanta at EHC and terminate at MU in Sydney. This circuit is private and does not involve any transfer of information from one site to another. All the patient data remained on the Emory network, eliminating concerns about adherence to HIPPA guidelines or violation of security of patient information. All patient information remained the property of EHC. The telephones placed in the MU site were also internet based on the EHC network. This offered our clinicians in Atlanta and Australia the ability to make the same local calls with the same numbers and dialing protocols thus avoiding confusion.

The circuit is composed of a fiber connection extending from the U.S. to the street outside the MU building the operations room was located in. Once the fiber was installed, the line then had to be connected to the building and up to the COR where it would terminate. There were three vendors that had to be employed for the completion of the build of the fiber line. The line was then connected to a router which was connected to a switch. The switch had network jacks that allowed the computers in the room to connect to the Emory network. All phases of this process had to be managed by the specific vendor and checks had to be made to ensure the access was complete and live. It is essential when developing this type of connection that all vendors are engaged early on, so they can partner and make the process as seamless as possible.

The decision was made that the Emory IT team would purchase and configure the CPUs to be used in Australia. Then the units were shipped to the site at MU. This was another step to ensure patient confidentiality and protection of patient information. Once the computers arrived in Australia, the IT team used remote desktop

access to log into the computers and ensure functionality. This remote access also allowed the Emory IT team to apply updates and needed changes to the computers in Australia. There was no need to train or depend on staff at MU to perform those functions thus adding to the reliability of the systems' performance. The computers were also configured using local Atlanta time in order to avoid any confusion or error in documentation by the Australia based clinicians. Upon arrival, the computers were set up by an outside party with Emory IT checking functionality remotely.

The MU site was a locked room with access granted only to Emory staff and essential IT and emergency MU staff. Once again reinforcing protection of PHI and the clinicians themselves that worked weekends when other employees were not present. The computers remained powered on but clinicians logged off after each shift. This action not only added a layer of PHI protection but leaving them on and accessible allowed changes or trouble shooting by Emory IT to be performed remotely.

The "sidebar" video sessions were performed via a standard commercial video conferencing tool. This tool was loaded on the secondary computer the clinicians use and also had separate speakers to allow the verbal communication needed. When a nurse in Atlanta called the nurse or physician in Australia they had an open instance of the video tool and made a call. This resulted in an indicator popping up on the receiving clinician's monitor and they could then answer the call. Network phones were installed and active, and this was the primary means for our staff to communicate back and forth with the staff in Australia.

A 42-in. monitor was installed on the wall in the COR in Atlanta and in Sydney. This monitor had a mini CPU connected to it, and a live video feed from one side of the earth to the other was established. This feed was the best option for allowing the staff at both sites to have the feel of being collocated. When a nurse in Atlanta had a question or task for the physician to follow up on this live feed allowed them to see what the physician was doing. If the physician was involved in a conversation with another clinician, the nurse in Atlanta could communicate with the nurse in Australia to ensure the question would be answered in a timely manner.

As patient populations change there is a need for healthcare to adapt to provide the care needed to those patients. The Emory eICU represents another option for managing the demands of care delivery for this critically ill population. The expertise and knowledge that might not be available locally to some hospitals can be leveraged through this medium, thus providing patients access to the care they need. The Australia approach affords the clinicians delivering that essential care another option for preserving a quality of life that isn't available while working during night time hours. The audio-visual base of the program affords the ability to put novel workflows in place regardless of the distance between the clinicians and patients. As tele medicine models grow in use, these types of options will increase for clinicians.

We also analyzed qualitative data collected from the clinicians that were study subjects. The model allowed clinicians at the remote site to forge friendships and a level of closeness neither of them expected, and they reported that made the work even more rewarding for them. The clinicians felt more awake and alert while being

in Australia because they were able to maintain regular sleep/wake cycles instead of trying to rest ahead or make up for sleep missed working at night. One of our clinicians wrote "The communication from Australia to stateside seemed to be a non-issue when it came to the workflow of the eICU. Personally, it was a chance of a lifetime. I was able to complete my shifts on the weekends and during the week, my time was mine to do as I wanted. The most significant aspect for me, was the change from working nights to working days. I felt like I had more time. When working nights, you can either sleep when your get home, or stay up all day and change to a day routine. Either way, your feel tired, and exhausted, especially working 3 or 4 12-h shifts in a row. In Australia, I completed my assigned shifts, went home and slept. The next morning, I was able to accomplish whatever I had planned. I was not exhausted and did not lose a day just to make the transition from nights to days". Emory Healthcare leadership fully supports their staff and makes efforts to ensure the clinicians are cared for as well as the patients. This program allowed those clinicians a once in a lifetime experience in another country while having the security of continuous employment and financial stability.

As the next phase of the project, we are launching an Emory eICU installation in Perth, Western Australia. Perth is the largest city antipodal to Atlanta and offers the advantage of being either 12 or 13 h out of phase with Atlanta (depending on whether Atlanta is on daylight or standard time.) Our initial experience in Perth will be reported in 2019.

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