

A Second Set of Eyes: An Introduction to Tele-ICU

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Welcome to a new column for *Critical Care Nurse: Tele-ICU Enhancements*. As a journal, *Critical Care Nurse* is recognized for providing readers with the latest innovations and evidence base for patient and family care. In keeping with *Critical Care Nurse's* high standards, this department will present peer-reviewed articles exploring the influences of this new delivery model, the tele-ICU. The various facets of the tele-ICU model will be examined, including program development, staffing models, patient outcomes, integration issues, provision of clinical care using technology, and other areas of interest. Current controversies and the latest research will be highlighted to provide readers with a balanced perspective on the impact of tele-ICU on patient and family care. The intent of this introductory article is to provide a baseline understanding of the tele-ICU model; future articles will further focus the picture.

Suggestions or ideas for future articles are invited and can be sent to *Critical Care Nurse* at ccn@aacn.org with Tele-ICU Enhancements in the subject line.

PRIME POINTS

- The purpose of the tele-ICU is not to replace bedside clinicians or bedside care, but to provide improved safety and to enhance outcomes through standardization.
- The tele-ICU is a “second set of eyes” that provides additional clinical surveillance and support.
- Some eRNs are attracted to the tele-ICU to mitigate the significant physical and emotional demands of full-time bedside care. Others want to provide patient care in a new setting and enjoy being on the cutting edge of change.

Multiple Names, One Concept

Telemedicine, defined as “the use of medical information exchanged from one site to another via electronic communications to improve patients’ health status” is not a novel approach to patient care.¹ It has been more than 25 years since

CE Continuing Education

This article has been designated for CE credit. A closed-book, multiple-choice examination follows this article, which tests your knowledge of the following objectives:

1. Identify how tele-ICUs can provide the continuation of patient care
2. Define the requirements for a tele-ICU nurse
3. Discuss strategies to enhance the ICU/tele-ICU relationship

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Grundy et al² first described the use of intermittent remote telemedicine consultation to improve the delivery of health services to 395 patients in an intensive care unit (ICU) at a 100-bed hospital. Although the project demonstrated that television consultation had a “greater clinical and educational impact” than telephone consultation, Grundy et al concluded that further research was necessary to optimize use of the technology. Historically, other models of ICU tele-consultation have also demonstrated clinical benefits; a reduction in length of stay for infants of very low birth weight in neonatal ICUs,³ improved management and transfer of trauma patients,⁴ and improved consultations for pediatric critical care inpatients.⁵

In the year 2000, Sentara Health-care, in partnership with VISICU, Inc (a Baltimore-based health care solutions company), implemented the first continuous, multisite telemedicine program. At 1 year after implementation, Sentara reported a reduction in hospital mortality of 27% when compared with the preceding year.⁶ According to today's estimates, approximately 45 to 50 tele-ICU programs are supporting care in several hundred ICUs nationwide. The US market has 1 dominant vendor for tele-ICU systems, Philips-VISICU (Baltimore, Maryland), and 2 additional vendors, Cerner (Kansas City, Missouri) and iMDSoft (Needham, Massachusetts).

The terms "tele-ICU," "virtual ICU," "remote ICU," and "eICU" all refer to the same care concept; a centralized or remotely based critical care team is networked with the bedside ICU team and patient via state-of-the-art audiovisual communication and computer systems. The tele-ICU team can provide surveillance and support for a large number of ICU patients in disparate geographical locations for multiple hospitals.

Why the Tele-ICU?

The ICU environment continuously assails clinicians with distractions, alarms, and interruptions that produce alarm fatigue and the potential for increased error rates. While addressing the needs of 1 patient, a busy nurse or physician may be

unaware of a second patient's change in status that requires immediate attention. The tele-ICU is that "second set of eyes" that provides additional clinical surveillance and support. By collaborating with the bedside team, the tele-ICU can support care without distraction and deliver timely interventions when minutes may make the difference. The purpose of the system is not to replace bedside clinicians or bedside care, but to provide improved safety through redundancy and enhance outcomes through standardization.

Facing the Supply Issues

There is no doubt that we are living in challenging times that promise to become increasing complex. The health care system will experience a surge in demand for services as more than 70 million "baby boomers," many with chronic health conditions, continue to age.^{7,8} The volume and severity of cases treated in ICUs will increase dramatically with the aging population. To meet this expanding demand, hospitals will be required to increase the critical care capacity at great cost and simultaneously increase the volume of staff. Unfortunately, this surge will collide with the significant shortage of critical care nurses and physicians.

The lack of human resources could adversely affect patients' outcomes. Suboptimal staffing of ICU nurses has been linked to medication

errors,⁹ increased risk of pneumonia and reintubation,¹⁰ and increased lengths of stay with higher complication rates.¹¹ Physician staffing is also a concern; data¹²⁻¹⁴ strongly suggest that the best clinical outcomes occur when ICUs are managed by intensivists, specialists in critical care with advanced certification, who are directly involved with patient care. In its 2000 baseline analysis, the Leapfrog Group, an association of Fortune 500 companies, concluded that by having full-time intensivist staffing in metropolitan areas, 53 850 lives could be saved annually.¹⁵ However, given the current and projected shortage of intensivists, few hospitals are able to meet this mandate. Today fewer than 15% of ICUs are able to provide intensivist care; it is unlikely that future resources will be adequate to meet the population surge.¹⁶ The Leapfrog Group, recognizing the challenge in meeting this directive, has acknowledged that the tele-ICU may play an important role in attaining this quality objective.^{17,18}

How It Works: The Technology

The designation "tele-ICU" implies the presence of telemedicine technology in the delivery of care to ICU patients. The technology platform includes various vendor-specific components of hardware and software and affects both the tele-ICU and bedside teams. The tele-ICU team requires the same access as the bedside team to data elements related to patient care (eg, vital signs, results of laboratory tests, radiologic images, orders, and notes) to assess patients' status accurately and identify actual

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and/or potential issues related to patient care. By using sophisticated alert systems, subtle changes in a patient's condition are assessed for the purposes of early intervention and prevention of a crisis for the patient. High-resolution zoom cameras, microphones, and speakers are mounted in each ICU patient's room (Figure 1), providing the tele-ICU 1-way or 2-way video/ audio assessment capability and bedside communication. The VISICU vendor also provides an in-room button (Figure 2) that the bedside team can activate when requesting tele-ICU support. The complex technology (Table 1)^{19,20} is designed to support and enhance the care process while improving efficiency and effectiveness.

How It Works: The Tele-ICU Staff

Although the technology is relatively consistent from one tele-ICU system to another, program staffing models vary according to the needs of the hospitals within the system and the availability of resources. The "typical" tele-ICU operates 24 hours a day, 7 days a week and is staffed with critical care nurses and support staff with the intensivist on site 15 to 20 hours a day.²¹ In some programs, the intensivist works only the off-shift hours when on-site physicians have signed out to the on-call system. Replacement of tele-ICU registered nurses (eRNs) by midlevels such as nurse practitioners or physician assistants is another option for the model (Shawn Cody, VISICU operations director, oral communication, monthly teleconference, August 2007). The mean ratio is about 60 to 125 patients to 1 tele-intensivist, 30 to 40 patients to 1 eRN, and 50 to



Figure 1 High-resolution cameras with zoom and pan ability are mounted in each room in the intensive care unit, enabling the tele-ICU staff to assess patients and/or communicate directly with the bedside team.

125 patients to 1 clerical assistant.²² Currently no data suggest a particular model as the most effective way of achieving the best outcomes. As the collective tele-ICU experience increases, patterns may emerge that enable us to indentify more specifically the efficacy of staffing models and processes.

The Tele-ICU Physician

Tele-ICU physicians (ePhysicians) are board-certified/board-eligible intensivists, privileged and credentialed in each participating hospital, who provide oversight and intervention as appropriate for patient safety or as requested by the attending physician. A few programs employ a full-time ePhysician, but most programs have physician rotation schedules. When a program has more than 125 patients, the need for additional ePhysicians may need to be revisited.²² Challenged by the shortage of intensivists, some programs provide additional coverage with specialists such as cardiologists



Figure 2 VISICU eLERT button allows staff in the intensive care unit to request the on-camera presence of the tele-ICU team. Both 1-way and 2-way audio/video communications are available for tele-ICU use.

or with hospitalists under the guidance of the ePhysician (a VISICU operations director, oral communication, monthly teleconference, August 2007). Staffing needs are driven by the availability of on-site intensivists, the organization's use of house staff, hospital resource utilization, and program goals.

When the ePhysician arrives, the eRN or physician from the previous shift provides an overview of patient issues and concerns. Acute needs are prioritized and addressed

Table 1 Technical components of the tele-ICU^a

Technical components may vary depending on the choice of vendor.

Bedside waveforms: An interface from the intensive care unit's (ICU's) central monitor enables the off-site team to view the data on the bedside monitor, including real-time waveforms. Although the tele-ICU may view bedside alarms, tele-ICU staff are unable to reset or change any bedside alarm parameters.

Alert systems: Tele-ICU software (vendor dependent) provides the use of automated surveillance tools to assist the remote team in the identification and prompt response to changes in a patient's condition. These alerts use sophisticated rules engines to evaluate bedside monitor, laboratory, medication, and charted data, which are entered into the software's clinical information system to flag situations that may require intervention. Some vendor systems allow customization of alerts for the individual patient.

Audio/video equipment: The audio/video equipment provides the eyes and ears for the tele-ICU team. Each patient's room is installed with a high-quality camera and speaker system that is used for assessment and problem solving by the tele-ICU team or for in-room consultation when initiated by the ICU team. The camera is real-time video only, and no images or conversations are recorded. The camera resolution is excellent, allowing the tele-ICU team to assess patients' skin color, breathing patterns, or pupils while zoom capabilities allow direct visualization of labels on bags of intravenous fluid or ventilator settings. Two-way video conferencing from the patient's room is now available from all vendors but may not be implemented in all tele-ICU programs.

Clinical information: In order to assess a patient's status, the remote care team requires access to all relevant patient information including laboratory results, medication lists, progress notes, and bedside flow sheet documentation. Information from the hospital's clinical information system may be interfaced through a standard HL7 interface or can be directly entered into the tele-ICU software system.

Networks: All of the ICU beds that comprise the remote care program are linked together through both local and wide-area networks. Data are encrypted for security purposes and transmission is secure between transmission sites.

^a Based on data from Breslow¹⁹ and Miller and Fifer.²⁰

before the initiation of routine “virtual” rounds. During rounds, each patient's status is evaluated with the aid of vital signs, results of laboratory tests, progress notes, radiology reports, and other patient data. The acuity level of the patient determines the frequency of rounds, but most patients are reassessed every 1 to 4 hours according to acuity or as needs emerge. As patient care conditions are identified, changes to the plan of care are discussed directly with the bedside team. As needed, the ePhysician enters orders into the system software, or if available, directly into the hospital's order entry system. The ePhysicians provide a variety of services, which may include performing multidisciplinary rounds via the camera, discussing weaning options with respiratory therapists, identifying potential patients for transfer, or entering the orders for bundle compliance. Software alerts provide a visual cue that allows the

physician to respond proactively to emerging problems.

The tele-ICU's medical director is accountable for the medical care provided by the tele-ICU, but providing patient care is only 1 aspect of the tele-ICU work. Teamwork, essential to a culture of safety, is crucial to the success of the tele-ICU program. The tele-ICU environment encourages and supports excellence in ongoing collaboration between the tele-ICU team and the ICU. The tele-ICU's medical director must demonstrate strong leadership skills in order to build and strengthen the working relationships if the transformation of care is to be accomplished.²³

The Tele-ICU's RN

The tele-ICU's RN (eRN) often monitors the ICU patients 24 hours a day, 7 days a week. Many tele-ICU centers have highly experienced staff with 15 years or more of bedside experience in critical care. Some eRN's are attracted to the tele-ICU

to mitigate the significant physical and emotional demands of full-time bedside care. Others are drawn to the challenge of providing patient care in a new setting and enjoy being on the cutting edge of change. Although programs vary, Table 2 highlights the baseline requirements for an eRN position. Excellence in communication is the most essential skill required for the eRN position. Computer and workflow skills can be obtained through orientation and experience, but poor communication and customer service skills are counterproductive and deleterious to the goals of the program.

As with the ePhysician staffing, the eRN models vary among programs. Some tele-ICUs may employ only dedicated eRN's, whereas others contain a combination of dedicated and “shared” positions. The staff with shared positions have a secondary position in the tele-ICU and a primary position in the ICU; dedicated eRN's work only in the

Table 2 Requirements for a tele-ICU nurse^a

Although requirements may vary slightly from system to system, the following requirements are consistent throughout many of the tele-ICU sites

5 years of recent adult critical care experience (experience may include but is not limited to the following intensive care units: trauma, neurology/neurosurgical, mixed medical-surgical, cardiac, cardiac surgery)

CCRN or CCRN-E certification preferred/required

Basic Life Support/Advanced Cardiac Life Support certification required/preferred

Bachelor of science degree in nursing required/preferred

Demonstrated leadership skills, including outstanding communication skills

^a Based on direct communication during the VISICU 2007 User Conference's Operations Director Meeting; November 2007; Baltimore, MD.

tele-ICU. Each model has pros and cons. Shared positions have the potential to enhance collaboration and acceptance of the tele-ICU program in the “home” ICU and provides for continued clinical competence for the eRN. However, shared positions can also increase the requirements for attendance at staff and committee meetings, competency demonstration, and performance evaluations. Because shared staff may report to 2 or more managers and units, the scheduling of vacation, shift rotation, and weekend and sick time coverage is more complex as staff respond to the needs of both work locations. Significant ongoing communication must occur between the director of the tele-ICU and the directors/managers of the ICU to secure staffing for both units.

Shared positions may also be more challenging for staff who are less professionally mature. Critical care nurses often attain status and identity from their role in the ICU; they are required to have the ICU knowledge and skills to function in a new role but are not in the ICU. There is a transition not only to a new location and team, but to a new role with considerable ambiguity

remaining in its definition. The desire for their tele-ICU contributions to be valued and recognized by their ICU counterparts is part of finding the new identity. For some, conflict with ICU peers or confusion about loyalty issues becomes overwhelming and the RN will decide to leave 1 of the 2 positions. For others, however, this combination role provides significant satisfaction and balance, which may actually extend the nurse’s critical care career.²⁴

In programs with only dedicated positions, eRNs work full time in the tele-ICU. This simplifies scheduling, evaluation, and identity issues and contributes to team stability and staff satisfaction.²⁵ However, ICU staff often voice concerns about the eRN’s ability to maintain clinical competence when not providing care at the bedside (Elaine Comeau, CNE, VISICU, oral communication, VISICU 2008 User Conference, November 2008).

To enhance the role of team, eRNs should participate in the candidate interview, selection, and orientation process. The transition from bedside nurse to eRN is neither intuitive nor easy. Even for experienced critical care nurses, the idea of “providing care” for 30

ICU patients is overwhelming and feels “unsafe.” A new definition of providing care must be developed and accepted for tele-ICU staff to be satisfied. Orientation should focus not only on managing the tele-ICU software and technology, but on strategies to enhance the tele-ICU identity. Tele-ICU competency standards have been determined via consensus among many tele-ICU programs, but they still must be validated through the research process.

The variance found in tele-ICU programs due to vendor selection or program goals may produce subtle differences in work flows, but similarities in patient assessment and virtual rounding exist. Table 3^{21,22,26} highlights the various components of virtual rounds. RN rounds, like the ePhysician counterparts, are prioritized on the basis of patient acuity and occur every 1 to 4 hours. During the rounding process, the eRN also responds to requests for assistance from the ICU team. Requested assistance may include but is not limited to the following: paging necessary personnel, verifying high-risk medications, reporting results of laboratory tests, or nursing consultation on patient care issues. The eRN is also evaluating alert notifications that can be dismissed after review or reset as the clinical condition warrants.²⁶ During the hours in which the tele-intensivist is not on site, the eRNs must be able to direct requests for tele-physician consultation to the appropriate resource as determined by the individual program’s policies.

Other Staff in the Tele-ICU

Other members of the tele-ICU team often include support staff,

Table 3 Tele-ICU “virtual” rounds^a

Routine tele-ICU rounds are performed by both the ePhysician and eRN with frequency determined by the patient's acuity. The patient's record and the following data are examined for any new trends or changes indicating a potential change in the patient's status.

- Vital sign trends during the past 1-4 hours
- Current waveforms; note any alarms or changes in waveform configuration
- New laboratory results; confirm interventions for laboratory values with the intensive care unit (ICU) team as appropriate
- Nursing flowsheet documentation, including assessments and interventions
- Physician's daily notes
- Care plan updates
- Radiographs or other diagnostic tests not reported since the last rounds
- Respiratory therapy flow sheet data

Camera/video rounds also typically occur:

- Within 30 minutes of a new admission for a tele-ICU assessment
- During assessments at the beginning of the shift
- At the request of the ICU team
- With identified changes in the patient's condition

^a Based on data from Myers and Reed,²¹ Ries,²² and Breslow et al.²⁶

who are instrumental in data entry, phone management, and quality monitoring. Support staff may have a variety of backgrounds, including previous experience as a unit secretary, nursing assistant, or as a nursing student seeking part-time employment. As with the eRN staff, the commitment to excellence in customer service is vital to the success of the role. Support personnel must be competent in the management of various computer software systems and demonstrate accuracy in data entry as the data may be used to support clinical decision making.

A key component of the success of the tele-ICU program is the partnership between the clinical staff and the system's information services department. Platform, network, interface development, connectivity, and desktop management are all components within the information services department that must be attuned to the technology needs and goals of the program. Program growth and maintenance can occur only with the understanding and support of the team from the information services

department. The ability of the clinical staff to articulate their needs to the information services team in a way that promotes shared understanding takes time and energy but is vital to the success of technology integration. Each tele-ICU program requires a clear simple-to-use structure for problem reporting that clarifies the roles and responsibilities of the individual hospital's information services team, and the tele-ICU's information services team. It is vital for ICU and tele-ICU staff to understand to whom and how to report technical issues so that clinical time remains focused on patient care.

As new and creative uses of the technology emerge, new positions such as pharmacists, clinical nurse specialists, case managers, and quality analysts are being added to the tele-ICU teams. The expertise of each of these roles can be leveraged to develop system standards of care or provide consultations that can improve both patient and system outcomes. Examples of standardization may include sedation and

delirium management, prevention and treatment of pressure ulcers, and identification and measurement of quality indicators.

How It Works: The Environment

Visitors to the tele-ICU are often surprised by the environment. They envision a hectic environment with hundreds of electrocardiography tracings and as many camera images on display, with alarms sounding compounded by the usual ringing of the phones. Many anticipate a realization of Orwell's famous novel, *1984*, with constant camera surveillance, a loss of ICU control, and increasing encroachment on the rights of the attending physician.

The reality of the tele-ICU environment is often different than imagined. A site visit by the ICU team can be paramount in the acceptance of the remote team and program. Whether the tele-ICU is located within a hospital facility, or in a business park, they are similar in function. The typical workstation houses 5 to 7 computer screens for data display (Figure 3). Although, many assume the tele-ICU is “watching” with the cameras “on” all the time, only 1 camera at each workstation can be activated at a time; so if the tele-ICU has 4 workstations, only 4 patients can be viewed at once. Having the immediate access to patients' data, including real-time vital signs and waveforms, allows patients' changes to be evaluated without always activating the in-room camera. However, if the tele-ICU is extremely busy, the tele-ICU staff may camera in and out of several patient rooms in a short time to meet multiple demands.

The waveform interface allows access to all patients' waveforms, but often only the patients in the most unstable condition are continuously monitored. Other waveforms become visible with a single click of the mouse. The tele-RN or tele-physician can focus on each patient without the various disruptions that can plague bedside care.

Ergonomic Impact of the Environment

Placing ICU nurses and physicians at computer workstations to work for up to 12 hours when they are used to a very physically demanding pace provides its own ergonomic challenges. Computer monitors may require adjustment to accommodate the various vision needs of the users. Many tele-ICUs have electronic work tables that adjust the height of the desk from 26 inches (66 cm) high to 46 inches (117 cm) high, enabling staff to work in either a sitting or standing position. When building or initiating a tele-ICU program, consultation with an ergonomic specialist is a valuable and cost-effective strategy to prevent repetitive work injuries. Tele-ICU staff are encouraged to take frequent breaks from the computer screens to reduce eye strain, and many tele-ICU centers boast a variety of exercise equipment to discourage the risks of a sedentary position.

Technology Is the Easy Part!

The concept of allowing a remote team to join the bedside patient care team in providing care can be either reassuring or threatening, depending on the culture of the ICU and the transparency of the program's goals. An organization's ability to realize

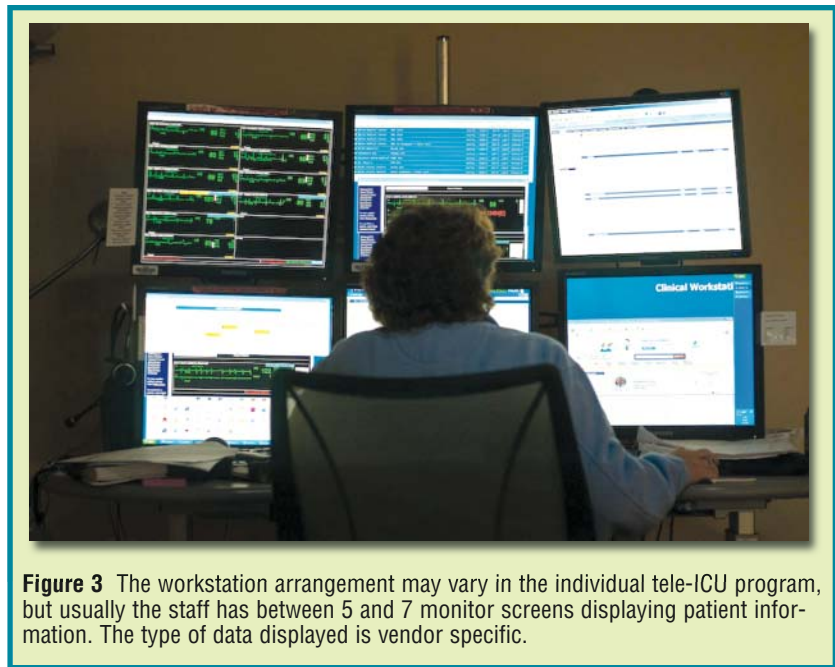


Figure 3 The workstation arrangement may vary in the individual tele-ICU program, but usually the staff has between 5 and 7 monitor screens displaying patient information. The type of data displayed is vendor specific.

improved clinical outcomes from investment in the tele-ICU program, however, depends largely on the acceptance of the bedside team.

Success starts with visionary leadership and direction at the organization level. Zapotochny-Rufo²⁵ describes the importance of organizational vision for virtual ICU utilization:

Careful consideration of the desired direction of the virtual ICU is critical because this technology impacts organizational acceptance, clinical transformation of bedside practices, and overall program performance.

Pexton, coauthor of *Improving Healthcare Quality and Cost With Six Sigma*, points out in her article, "Overcoming Organizational Barriers to Change in Healthcare"²⁷ that there is "often an inverse correlation between expectations and end results." Pexton further identifies the most common barriers to

successful change initiatives and strongly encourages the development of a management plan to address each potential barrier.

Each of the barriers as noted by Pexton may be present as a system implements a tele-ICU program. Competing organizational priorities may make effective communication and leadership support more difficult and time consuming. Myers,²¹ Ries,²² Zapotochny-Rufo,²⁵ and Sapirstein et al²⁸ emphasize the importance of both organizational leadership support and local nursing and physician champions to achieve program integration and acceptance. Sapirstein et al further emphasize that tremendous organization and cultural changes are required and must appear if clinical transformation is to be accomplished with tele-ICU implementation. The roles of the tele-ICU nursing and medical directors are also key factors in this transformation. Behaviors such as acceptance, patience, support, reassurance, and good

judgment must be modeled by the tele-ICU leadership²² and recognized and rewarded in integration efforts.

Tele-ICU programs use a variety of strategies to build the communication skills and collaborative environment for integration success (Table 4). A focus on the AACN's standards for a healthy work environment becomes a powerful foundation upon which to build the tele-ICU/ICU relationship and desired behaviors.²⁹ Sharing outcome metrics such as length of stay, mortality rates, and compliance with best practice measures with both the ICU and tele-ICU staffs provides an additional opportunity to support the common goal of improved patient care.

Outcomes

Given the current economic constraints, hospital executives and clinical leaders are requesting tele-ICU data demonstrating improved outcomes and return on investment. An analysis of severity-adjusted data from 185 464 patients from 2006 to 2007 in 156 hospital ICUs supported by the VISICU eICU programs shows actual hospital mortality rates of 9.6% versus the national average of 13.6%. These data were collected in a mix of rural, community, urban, and academic centers. The 29% reduction in mortality for this sample translates into an additional 7233 saved lives.³⁰

Aggregate and individual system outcomes are also being reported in a variety of professional publications and conference venues (Table 5).^{26,31-35} Currently, success is predicated on meeting the individual program goals such as a decrease in hospital mortality, reduction in ICU length of stay, or improved compliance

Table 4 Strategies to enhance the relationships between the remote staff and the staff in the intensive care unit (ICU)^a

- Shared tele-ICU/ICU staff meetings/retreats
- Visits to the remote site
- Formal staff liaison positions (may include ICU visits, e-mail contact, phone contact)
- Partnership committee: allows staff from the tele-ICU and staff from the ICU to meet and identify potential problems and solutions
- Orientation programs that allow tele-ICU staff to visit the various ICUs, and ICU staff to spend orientation time in the remote site
- Newsletters
- Shared continuing education opportunities; shared renewable competencies
- Shared holiday events
- Recognition programs that reward excellence in tele-ICU/ICU behaviors
- Regular ICU and tele-ICU leadership meetings
- Research projects related to tele-ICU participation

^a Based on direct communication with the VISICU eICU-ICU Care Team Integration Team, May 2009.

Table 5 Examples of tele-ICU outcome data^a

Mortality data

- Sentara, Virginia: 27% reduction in hospital mortality at the end of 1 year
- Maine Medical Center, Portland, Maine: demonstrated a 20% hospital mortality in the 32-bed mixed medical-surgical intensive care unit (ICU) in a 7-quarter comparison of before and after eICU implementation.
- Memorial Hermann Health System, Texas: observed mortality reductions in all 5 monitored ICUs at the same time that case mix index increased
- Avera Health System, South Dakota: 29% reduction in severity-adjusted mortality despite increased case mix index

Best practice improvements

- Sutter-Sac, California: Screening of all ICU patients on admission for sepsis; identified higher incidence of severe sepsis than previously reported; compliance with 6-hour and 24-hour protocols demonstrated saving of 56 lives in a 30-month period at 1 facility
- Advocate Health, Chicago, Illinois: Screening and order support from the eICU improved compliance with the ventilator-associated pneumonia (VAP) bundle within 3 months to 99%; VAP throughout the Advocate System has decreased from 101 in 2004 to 14 in 2007.
- Inova Healthcare, Virginia: Comanagement of the ventilator patient by the remote team in 95% of patients provided a 25% reduction in ventilator days; in ICUs allowing comanagement in <20% of patients, the number of ventilator days did not change.

Financial performance

- Avera Health System, South Dakota: More than 160 patients have been able to stay in their hometown hospital with support from Avera Tele-ICU CARE; air transport costs saved: \$1 000 000
- Maine Medical Center, Maine: During the 33 months after implementation of tele-ICU, turnover of registered nurses decreased by 56% at a cost savings of \$1 090 909 per year
- Resurrection Health Care, Illinois: 7% reduction in blood transfusions in 6 months = \$11 200 in savings; 38% decrease in ICU length of stay in 6 months = approximately \$3 000 000 in savings
- Via Christi Health System, Kansas: Tele-ICU/ICU partnership to prevent air embolism; teaching intervention allowed avoidance of an estimated \$240 000 in nonreimbursable patient care costs under the new Centers for Medicare and Medicaid Services never event rule.

^a Based on data from Breslow et al.²⁶ Van der Kloot et al.³¹ Zawada et al.³² Rincon et al.³³ Ikeda et al.³⁴ and Raitz-Cowboy et al.³⁵ Also based on information obtained from a presentation by Michael Ries, MD, MBA, during the VISICU annual medical director meeting; June 2007; Chicago, Illinois; and information in the Tele-ICU Program Success Stories about Avera Health System, MaineHealth VitalNetwork, Resurrection Health Care, and Via Christi Health System. VISICU version 2008.2.2.

with best practice recommendations. However, other specific markers of success may include return on investment data or other clinical outcomes specific to the use of the tele-ICU program.

Interest in the use of telemedicine for improvement in the care of acutely or critically ill patients continues to expand. Mobile units capable of providing data to the tele-ICU team outside of the traditional ICU setting are being used by rapid response teams, or in emergency departments, postanesthesia care units, critical access facilities, and long-term acute care hospitals.

Summary

Tele-ICU, eICU, virtual ICU, or remote ICU centers are affecting ICU patient care and clinicians in 28 states, more than 40 health care systems, and more than 200 hospitals.¹⁹ The concept of a remote ICU team providing care remains foreign to some, whereas others remain skeptical of the cost-to-benefit ratio. However, with the expansion of the various programs and the publication of clinical and fiscal outcomes, tele-ICUs are becoming more mainstream and transforming clinical care. Controversies and challenges will continue as the tele-ICU programs grapple with reimbursement issues, cultural resistance, and interoperability of information technologies.



To learn more about new delivery models in the intensive care unit, read "Changing the Work Environment in Intensive Care Units to Achieve Patient-Focused Care: The Time Has Come" in the *American Journal of Critical Care*, 2006; 15: 541 - 548. Available at www.ajconline.org.

The tele-ICU concept expands the care team to include a "second set of eyes," not to control or intrude, but to support and enhance current care. It is imperative to critically ill patients and their families that ICU and tele-ICU teams continue to share experiences, collaborate to find solutions, build respect and understanding of the role of the tele-ICU, and learn how together the teams can improve patient care. **CCN**



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Financial Disclosures

None reported.

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CE Test Test ID C1043: A Second Set of Eyes: An Introduction to Tele-ICU

Learning objectives: 1. Identify how tele-ICUs can provide the continuation of patient care 2. Define the requirements for a tele-ICU nurse 3. Discuss strategies to enhance the ICU (intensive care unit)/tele-ICU relationship

1. One year after implementation of tele-ICU at Sentra Healthcare, the mortality rate decreased by what percentage?

- a. 15% c. 27%
- b. 22% d. 37%

2. Which of the following is one of the primary purposes of tele-ICU?

- a. Offset the projected nursing shortage, thus increasing safety and satisfaction
- b. Provide improved safety through redundancy and enhance outcomes through standardizations
- c. Provide improved productivity by reducing alarm fatigue
- d. Decrease the percentage of sentinel events through close monitoring of patient care

3. Which of the following is not an identified result of suboptimal staffing in ICUs?

- a. Increased readmissions to the hospital
- b. Medication errors
- c. Increased risk of pneumonia and reintubation
- d. Increased length of stay with higher complication rates

4. Despite the Leapfrog Group's conclusion that having full-time intensivists in metropolitan areas could save 53850 lives annually, what percentage of ICUs are able to provide intensivist care?

- a. 5% c. 50%
- b. 15% d. 75%

5. Which of the following tele-ICU staffing mean ratios is accurate?

- a. 60 to 125 patients to 1 tele-intensivist, 50 to 125 patients to 1 tele-ICU registered nurse (eRN)
- b. 50 to 100 patients to 1 tele-intensivist, 20 to 75 patients to 1 eRN
- c. 30 to 40 patients to 1 tele-intensivist, 30 to 40 patients to 1 clerical assistant
- d. 60 to 125 patients to 1 tele-intensivist, 30 to 40 patients to 1 eRN

6. Which of the following can enhance the role of the eRN on the tele-ICU team?

- a. Providing shared positions between tele-ICU and the in-house ICU
- b. Participating in joint selection of mid-level practitioners
- c. Participating in the candidate interview, selection, and orientation
- d. Participating in the selection of computer technology software

7. Which of the following should orientation of the eRN not focus on?

- a. Management of the tele-ICU technology
- b. Competency of the tele-ICU software
- c. Strategies to enhance the tele-ICU identity
- d. Methods for decreasing patient alarms

8. Which of the following is not included in the eRN's responsibilities during rounds?

- a. Paging necessary personnel
- b. Verifying high-risk medications
- c. Reporting results of laboratory tests
- d. Providing differential diagnosis and treatments to patients

9. Which of the following is a key component to the success of the tele-ICU program?

- a. Level of technology and equipment used to provide real time data
- b. Partnership between the clinical staff and the information services department
- c. Partnership between the clinical staff and the administrative staff
- d. The expertise of clinical staff with the platform, network interface development, and connectivity

10. Which of the following is the most important factor to realize improved clinical outcomes from a tele-ICU program in an organization?

- a. The amount of vendor technology purchased by the organization
- b. The acceptance of the program by the bedside team
- c. The tele-ICU team's ability to respond to alarms
- d. The use of the audio/visual capabilities of the system

11. Which of the following is not a strategy used to build a collaborative environment between the tele-ICU and the ICU?

- a. Share outcome metrics such as length of stay and mortality rates
- b. Hold joint staff meetings and/or educational offerings with tele-ICU and ICU staff
- c. Encourage ICU staff to visit the tele-ICU center
- d. Develop separate goals for the improvement of patient care for the ICU and tele-ICU

12. Which of the following best identifies the national hospital mortality rates for hospitals supported by a tele-ICU?

- a. 9.6% vs 13.6% c. 5.9% vs 13.6%
- b. 8.5% vs 20% d. 9.6% vs 8.0%

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