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# Bedside Nurses' Perceptions of Intensive Care Unit Telemedicine in a Rural Setting

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Bedside Nurses' Perceptions of Intensive Care Unit Telemedicine  
in a Rural Setting

by

Susan Parker

A thesis submitted to the faculty of  
Gardner-Webb University Hunt School of Nursing  
in partial fulfillment of the requirements  
for the Master of Science in Nursing Degree

Boiling Springs, NC

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## Abstract

Healthcare is a rapidly changing and continuously advancing field. Currently, virtual care technology (e-ICU) is moving into many rural healthcare facilities in an effort to improve patient care outcomes and bridge physician and nursing shortages. The purpose of this Masters of Science thesis is to determine the impact that electronic telemedicine has on the quality of nursing care at the bedside. The study done by Mullen-Fortino et al. (2012) in an urban academic center was replicated to compare the bedside nurses' perception of ICU telemedicine in a rural hospital setting. Thirty-eight rural ICU nurses working with ICU telemedicine responded to the study questionnaire. Overall results showed that ICU nurses in a rural care center and urban academic care center had the same positive opinions of the e-ICU, and felt that telemedicine is beneficial to patient care, positive outcomes, and improved satisfaction. Efforts to improve collaboration and communication between bedside and e-ICU staff will improve care. The results of this research can help with expanding telemedicine programs into other rural hospitals by assisting in the management of communication between bedside and e-ICU staff.

*Keywords:* intensivist, e-ICU, technology, critical care, patients

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## CHAPTER I

### Introduction

In a small rural hospital, a frail patient was nearing the end of life. The battle had been long. Earlier in the day the family had chosen to act in what they felt was in the best interest of their loved one, and comfort became the goal of care. As the day turned into night, a new shift, including a virtual care team, took over the patient's care. Comfort meant something different to the new virtual care team. After reviewing labs, x-rays, and charts of a dying patient, nurses and physicians hundreds of miles away decided to order chest tubes, intubation, and a series of other heroic measures, feeling that the patient was simply too young to die. In another situation at this same rural hospital, a new patient was decompensating. A complete critical care assessment was needed but no critical care intensivist was in the facility. Because of the newly integrated electronic Intensive Care Unit (e-ICU), the patient was able to have access to a virtual care intensivist. Labs were ordered, neurological and physical assessments were complete with the assistance of bedside staff, and diagnosis was made. The patient was able to receive life saving measures and positive outcomes were obtained. These are examples of technology influencing positive as well as negative impacts on the quality of care delivered at the bedside.

“Technology is not new to nursing because we have always used tools and equipment as part of our practice, but the way(s) we and they act upon contexts of care has never been more important to consider” (Barnard, 2015, p. 10). When used correctly and responsibly, technology can be not only helpful to the medical community but it can aide in patient healing and positive outcomes. By the same standard when not used

correctly, the patient can be at an increased risk for adverse reactions and negative outcomes.

This research will focus on the advancing technology of the e-ICU and the impact that it brings to the quality of care at the bedside.

### **Significance**

The face of healthcare is changing. From advancing technology and shortages of healthcare workers, to calls for healthcare reform, everything is changing. The changing healthcare climate also influences modifications in nursing practice. Perhaps one of the biggest variations to the nursing profession is the increasing use of advanced technologies.

There was a time when a personal physician followed a patient throughout their life. Now, insurance companies mandate who an individual can choose as their primary physician (HealthCare.gov, 2016), and too often when a person is admitted into the hospital for a healthcare crisis, the care provided is from a stranger, and not from a personal physician. When patients are admitted with a critical illness, an intensivist typically provides care.

Intensivists are physicians who specialize in the care and treatment of patients in Intensive Care Units (ICUs). The Health Resources and Services Administration (HRSA) was asked by congress to “examine the adequacy of the critical care workforce in response to concerns that the number of pulmonary and critical care physicians would not be able to meet the needs of the aging baby boomer population” (Association of American Medical Colleges, 2012, p.13). The HRSA findings suggested that the “demand for intensivist will continue to exceed available supply through the year 2020 if

current supply and demand trends continue” (Association of American Medical Colleges, 2012, p. 13). With the predicted shortage of intensivists also comes a predicted shortage of registered nurses (RN). A shortage of RNs is projected to spread across the country between 2009 and 2030 (American Association of Colleges of Nursing, 2014, para. 3).

There is a need for nurses to know patients as human persons not objects of care (Parker & Smith, 2010). Since critically ill patients are at higher risk for adverse events or errors in their care (Orlovsky, 2005), patients in critical care units should receive very close bedside monitoring. With pending predicted shortages and so many demands on physician and nurse time, this can often be challenging.

Alarmed by the impending shortages and potential for adverse health outcomes in 1998, employers met to discuss strategies to best influence the quality and affordability of healthcare (Leapfrog Group, 2016). Their report suggested that changes be made in the delivery of critical care medicine. Specific recommendations included the presence of an intensivist in the ICU who could intervene in a patient care crisis within five minutes. The report suggested that these intensivists be present at least eight out of every 24 hours (Manthous, 2004).

With the need for hospitals to act on the recommendations from the HRSA and the Leapfrog Group, the e-ICU was born (Breslow, 2005). e-ICU telemedicine is defined as “the continuous off-site monitoring of ICU patients and the interaction between the bedside nurse and the telemedicine staff via audio and visual equipment” (Mullen-Fortino et al., 2012). The e-ICU technology combines software, video feeds, and real-time patient information. This technology allows for 24 hour monitoring by critical care certified registered nurses (CCRN) and an intensivist via the computer system. e-ICU technology

was originally developed and sold by Baltimore's Visicu Incorporated (Breslow, 2005). The technology allows hospitals in rural areas or with few resources access to intensivist and CCRN care. With the e-ICU, “a single physician and nurse can support bedside caregivers for more than 100 patients at once” (Mullaney, 2006, para. 3).

With the integration of e-ICU technologies, patients will have individual access to a critical care team 24 hours per day, allowing for more specific patient centered care. Patient centered care is a core competency recognized by the Institute of Medicine (2010). With this goal also comes the task of patient satisfaction and positive patient experiences (Finkelman, 2012). According to Sodani and Sharma (2011), “Satisfaction has been defined as a consumer’s emotional feelings about a specific consumption experience” (p. 404). Clients of the e-ICU technology have reported concerns about being cared for by computers (Kerlin & Halpern, 2013). Previous research indicates that the “patient’s desire for emotional connection, reassurance, and a healing touch from their caregivers is well documented and longstanding” (Bailey, 2011, p. 183). Hill (2013) states, “A committed relationship between the nurse and the patient are essential to patient care outcomes and building trust” (para. 4). The growing importance of patient satisfaction scores is recognized. These scores have a significant impact on insurance or federal reimbursement rates (Centers for Medicare and Medicaid Service, 2016).

### **Purpose**

Dr. Rozzano Locsin theorized, “technologies are continuously used to know persons as whole and complete and in the moment” (Locsin, 2005b, p. 8). Remotely located nurses and physicians, periodically involved in a patient’s care, should use technology to know the person in the moment and to provide what is most needed. The

purpose of this research is to determine the impact of advancing technology, specifically the e-ICU, on the quality of nursing care at the bedside.

### **Theoretical Framework**

Locsin's model *Technological Competency as Caring in Nursing* (2005b), acknowledges that wholeness of a person is a focus of nursing. This process "involves a continuous collection of data in order to understand the person as whole and complete in the moment through the competent use of technologies of nursing" (Locsin, 2005b, p. 130).

Locsin made the assumption that technology is used to know persons fully in the moment (Locsin, 2005b), and consistent with that assumption this researcher thinks that the purpose of healthcare technology, specifically the e-ICU should enhance and improve upon nursing care. This researcher agrees that the purpose of this technology is to allow nurses to see a broader picture of the patient and diagnosis associated with the patient. Additionally, Locsin assumed that persons are whole or complete in the moment and that knowing persons is a practice process that allows for continuous appreciation of the person moment to moment (Locsin, 2005b).

The Locsin model recognizes three spheres that interface with each other; dimensions of technological value in the theory; technological competency as caring in nursing; and the process of nursing (Locsin, 2005b). Locsin believes that caring, which is central to the philosophy of nursing, need not be lost in becoming technologically proficient (Locsin, 2005b). Locsin defined the process of nursing as: (1) *knowing*, the process in which persons are appreciated as participants in their care rather than objects of care, (2) *designing*, both the nurse and a patient planning a rewarding and mutual care

process, (3) *participation in appreciation*, the practice of conjoined activities that are crucial to knowing persons, and (4) *verifying knowledge*, a continuous circular process that demonstrates the ever-changing, dynamic nature of knowing in nursing (Locsin, 2005b).

Caring, while traditionally perceived in ways such as holding the patient's hand, takes on new meaning in the Locsin model which believes that using technology proficiently to help a patient is an act of caring. Knowledge gained from the use of technology can help to support the patient in their health care endeavors. Technology allows nurses to enter the world of the patient in ways that broaden knowledge of the patient. Therefore, competent use of technology enhances nursing (Locsin, 2005b). This is important to understand as, many times, the use of technology and caring is perceived as mutually exclusive. To prevent patients from being objectified through the use of technology, or nurses getting lost in the tasks of technology use, a broader frame of mind must be used. Technology encountered in the workplace must be viewed as a tool to know patients as human beings in the moment, and not just another task to be completed (Locsin, 2005b). Locsin's theory gives an invaluable perspective on how nurses can relate to the ever-increasing technology in their work. It is important for nursing to define what technology means to the profession and how it will be used by the profession. (Figure 1)



Figure 1: Loocsin Model for Knowing Persons (Loocsin, 2005a)

## Summary

Currently, virtual care technology is moving into many rural healthcare facilities. This is a direct effort to combat the physician and nursing shortage that this country is currently facing. Eventually, the goal of the e-ICU or virtual critical care will be for one intensivist and one CCRN to monitor up to 120 patients via satellite computer (Carolinas Healthcare System, 2016).

The purpose of this Masters of Science thesis is to determine the impact that electronic telemedicine has on the quality of nursing care at the bedside in the critical care unit. Technology and nursing should be in alignment to ensure positive outcomes, patient safety, and patient satisfaction. Nurses must commit to being at the forefront of technology and innovation, and remain dedicated to personal bedside monitoring of the person, not the technology.

## CHAPTER II

### Literature Review

The use of advanced technology has proven to be a valuable tool in healthcare. With shortages of RNs and intensivists, the e-ICU may be the answer to a mounting problem. This chapter will offer an overview of the literature regarding the use of the e-ICU. The literature will be analyzed and critiqued related to advancing technology in healthcare and how it influences the quality of healthcare delivered at the bedside and its impacts on patient satisfaction.

A web-based search was performed at the University's library; EBSCO and CINAHL Plus databases were searched. Some current literature was also selected using web-based searches via Google. The following key words and search terms were used: advancing health care technology, e-ICU, telemedicine, healthcare quality, bedside nursing care, critical care nursing care, intensivist, healthcare shortages, critical care technology, and patient satisfaction. All resources used were peer-reviewed journals, textbooks, and articles or reports from reputable stand-alone websites. The e-ICU, healthcare quality, patient satisfaction, and advanced technology were the focus areas. The search was conducted to determine current gaps in knowledge regarding the fairly new technology of the e-ICU and how it relates to quality of care at the bedside, as well as patient and nurse satisfaction in critical care units. The collected literature was sorted into two main categories: theoretical literature defined as concept analyses models, theories, and conceptual frameworks, as well as non-empirical literature written by content experts, and empirical literature defined as primary research studies (Grove, Burns, & Gray, 2013).

## Theoretical Literature

With the current and future problem of predicted staffing shortages among intensivists and RNs, it is clear that changes will be needed. *Crossing the Quality Chasm*, a follow-up to the 2001 IOM report, calls for needed changes to be made in the way that healthcare is delivered (*The IOM Health Care Quality Initiative*, 2013). “The basic message was that outcomes will improve only when new systems of care are introduced” (Breslow, 2005, p. 2). With this information at hand, the e-ICU was born. The e-ICU is a “systematic reorganization of ICU care focused on improving patient safety and operating efficiency” (Breslow, 2005, p. 2). With this technology, the current and predicted staffing shortages are bridged as ICUs in multiple facilities and are linked to a command center staffed with intensivists and CCRNs. Patient rooms are equipped with high-resolution cameras and monitors along with two-way audio systems. This equipment allows for telecommunications with precision fine enough to do critical care assessments, interpret radiological tests and provide critical care monitoring. Breslow concluded, “the e-ICU can provide meaningful increases in operating efficiency and quality if they can be integrated effectively” (Breslow, 2005, p. 5).

With the calls for needed changes in healthcare from the IOM, and the implementation of telemedicine, Manthous (2004) looked at the evidence behind the leapfrog guidelines that were the fuel for the birth and implementation of the e-ICU. Manthous suggested that the “Leapfrog standards for critical care are based either on weak or no scientific evidence...rather most of the guidelines are grounded in common sense and rational exploration of the data” (2004, p. 188). The author listed each of the four leapfrog guidelines and 10 leapfrog criteria and analyzed them for evidence. They

were listed as:

#### Leapfrog Guidelines

- 1) Intensive care units (ICUs) should be staffed by board-certified intensivist, to coordinate and manage care of patients.
- 2) Intensivists should staff ICUs during daytime hours, a minimum of eight hours, seven days per week.
- 3) Intensivists should respond to more than 95% of calls for assistance within five minutes.
- 4) The intensivist, a “fundamentals of critical care”- certified physician or “physician extender” (also described in some Leapfrog documents as “effectors”), should arrive at the bedside within five minutes in 95% of cases. (p.191)

#### Leapfrog Criteria for Telemedicine

- 1) An on-site intensivist collaborates with a remote (tele-) intensivist, sharing all pertinent information.
- 2) A tele-intensivist is available for all hours when the on-site intensivist is not available.
- 3) The tele-intensivist has immediate access to patient data.
- 4) Data links are available >98% of the time and are secure, to maintain patient confidentiality.
- 5) Tele-intensivist are able to visualize the patient through clear audiovisual transmissions.
- 6) Written standards of remote care include that the tele-intensivist is critical care board certified, licensed to practice in the state of on-site care, is credentialed in

the on-site location, and remains under the hospital's quality assurance purview; that explicit policies are available to guide roles and responsibilities; and that staff members are educated as to these roles and responsibilities.

- 7) Tele-intensivist review patients at a frequency that is appropriate for their acuity of illness.
- 8) Tele-intensivist can respond to and provide complete assessment of problems within five minute of any request for assistance.
- 9) There are written rules to guide the effective communication of the tele-intensivist and on-site personnel.
- 10) Tele-intensivist provide written documentation of their assessment and suggested interventions. (p. 192)

Manthous concluded that while the leapfrog standards were not sufficiently grounded in evidence, the outcomes of critical care patients were better when care was managed by the intensivist and critical care staff. While many questions have been left unanswered, Manthous stated that as a result of Leapfrogs efforts, "physicians, hospital administrators, and policy makers should consider the evolution of evidence-based, cost-effective critical care in the 'new health system for the 21<sup>st</sup> century'" (2004, p. 192).

More hospitals are now favoring 24-hour attending physician coverage in their intensive care units (ICUs), with some even opting for remote tele-monitoring. Kerlin and Halpern (2013) determined that 24-hour intensivist staffing was a benefit to patients. After analyzing multiple research studies and looking at known trends in healthcare, the authors felt that there was tension between the training needs of inexperienced providers

and patient safety. They determined that since the early period of critical illness was the time to improve outcomes, there are benefits to having 24-hour intensivist care at the bedside. The authors believed that this type of intensivist care can offer a critically ill patient constant surveillance and appropriate assessment and treatment, and showed clear potential in improving patient care outcomes (Kerlin & Halpern, 2013). The authors also believed that direct benefits to patients included better integration of care and improved patient outcomes but concluded that the current and predicted supply of intensivists were not suitable to maintain twenty-four-hour intensivist care in critical care units (Kerlin & Halpern, 2013).

In 2011, Dr. James E. Bailey saw a need to look at technology and its effects on healthcare. Bailey considered two different cases, one of a patient needing specialty care as an outpatient and another of a patient in a foreign country needing emergency medical care. Bailey found that while the first patient received competent and thorough care, the doctors were so engaged in the use of the technology, that the purpose of the technology became less clear. It was determined in this example that the purpose for which the technology is used, often determines the benefit. In the second case, the technology supported the case and was not at the forefront of care. It enabled the virtual physician to deliver the needed care while being thousands of miles from the patient's home. Bailey concluded that although some studies suggested that telemedicine can adversely affect doctor-patient communication, "most studies found neutral or positive effects on patient satisfaction" (Bailey, 2011, p. 2).

Electronic telemedicine brings a world of potential to rural areas. With this potential comes a new type of patient known as the e-patient. Gee et al. (2012) defined

the e-patient as someone “equipped, enabled, empowered, and engaged in their own health care” (p. e10). Gee et al. (2012) explored the e-patient phenomenon and determined that e-patients actively participate in their own care by using technology to equalize the knowledge between themselves and their healthcare care providers. This type of participation allows the e-patient to assume higher levels of responsibility for their own health and wellness. The authors’ purpose was to “understand the emerging e-patient phenomenon and explore its ramifications for nursing science and clinical practice” (p. e10). For a framework, the authors applied the use of data, information, wisdom, and knowledge (DIWK). The authors concluded that the “e-patient phenomenon has grown rapidly since the advent of the internet”, and that this growth has affected the “balance of health information between the clinicians and the patients” (Gee et al., 2012, p. e15). The author also concluded, “further study on both the safety and quality of the e-patient is needed” (Gee et al., 2012, p. e15).

Miller (2003) questioned the effects of telemedicine on the doctor-patient communication. His technical concerns were with communication technologies and the clinical processes enabled by those technologies. Specifically, Miller looked at depersonalization of the doctor-patient relationship. He took into account participation, enhancements and impediments, and sensory and non-verbal limitations. Miller questioned how telemedicine influenced outcomes when communication was altered between the caregiver and the patient, recognizing that separation between the provider and the patient removes the ability to touch. Miller was concerned that this may adversely affect the emotional bond between the patient and healthcare provider since physical examination brings a sense of comfort, relaxation, self-assertion, and pleasure to the

patient (Miller, 2003). The author concluded that the results were not clear and that more investigative studies into the relationship between telemedicine, medical encounters, and health outcomes would be beneficial to all parties (Miller, 2003).

In 2010, Miller theorized that telemedicine affected the physician/patient consultation. Miller had concerns that “by affecting consultation behavior, telemedicine may impact trust, which can facilitate patient disclosure and cooperation. It may also influence the extent of patient and physician participation during medical encounters” (Miller, 2010, p. 1). In research on the impact of telemedicine on the patient-provider relationship, Miller introduced a “conceptual model to guide communication research in telemedicine” (2010, p. 10). The conceptual framework “posits that patient, provider, and contextual characteristics influence the nature and content of provider-patient communication, all of which, in turn, affects various health outcomes” (p. 2). Miller (2010) proposed that the reason for this might be that technical aspects of telemedicine impacts the “provider-patient communication through depersonalization of the provider-patient relationship, participatory enhancements and impediments, and sensory and non-verbal limitations” (p. 2). The author concluded with a call for “more in depth qualitative investigations in addition to the application of interaction analysis instruments to electronically mediated communications” (Miller, 2010, p. 42).

There are many rapid changes taking place in healthcare; most as a call to improve the healthcare system. With so many changes, it is important to look at its effects on nursing. Barnard (2015) looked at technology as a phenomenon and theorized that “the end effect of technological progress is ambivalence... technology is both good and bad and will be used in ways to bring about expected and unexpected outcomes”

(Barnard, 2015, p. 9). Barnard (2015) looked at the needed nursing technique as a new world, determining that nursing should be organized as a part of the technological process. The technique needed was the “creation of economic, human, and political systems that bring us increasingly in line with technology” (Barnard, 2015, p. 11). Barnard also looked at neutrality and care practices and determined that technology is “*not* neutral to care and sometimes overshadows consideration of cultural, spiritual, emotional, physical, and psychological needs (Barnard, 2015, p. 12). Barnard determined that “each person has a right to quality nursing care and nurses have the right to be able to practice nursing that is authentic” (Barnard, 2015, p. 15). The author concluded that technology in clinical practice can improve care but felt that more research may be needed to “address technology and nursing from perspectives that examine effects of technology” and to ask, “a range of philosophical questions associated with power, human experience, and discipline development” (Barnard, 2015, p. 18).

The obligation that a nurse has to care for the patient should be unaltered by technology. Hill (2013) used Rozzano Locsin’s 2005 middle range theory on Technological Competency as Caring in Nursing to assist with making this point. Hill (2013) determined that the priority must always remain with the patient, stating that “devotional, committed relationships between nurse and client are essential to increased patient care outcomes and building trust” (Hill, 2013, p. 2).

### **Empirical Literature**

In 2006, *Bloomberg.com* reported that e-ICU technology was first sold to Sentara Healthcare at a cost an initial cost of 1.6 million dollars (as cited in Mullaney, 2006). The Sentara system reported that the technology paid for itself in a six-month timeframe,

stating that the majority of the “savings came from a dramatic plunge in complications such as hospital-acquired pneumonia and bloodstream infections” (Mullaney, 2006, p. 2). Mannion stated that e-ICU implementations were “enormously expensive, and third-party payers almost never cover the costs of care provided by workers at a remote site” (2009, p. 1). Mannion (2009) suggested that the primary reason for e-ICU use was:

that it allows more constant monitoring of critically ill patients, especially in hospitals that don't have enough Intensivists or ICU nurses, and even when units have critical care experts on hand, proponents say, the inherent redundancy is both welcome and reduces morbidity and mortality. (para. 2)

Mannion (2009) used an interview style study to explore why some units have adopted telemedicine while others still have not. The researcher found “widespread belief among hospitals that have adopted ICU telemedicine that it has improved quality and safety, even though the facility representatives interviewed could provide no data to support the notion” (para 5). Mannion (2009) concluded that these processes warrant as much study as drugs or devices and called for a comprehensive, nationwide evaluation, possibly in clinical trials” (para. 5). While a weakness in this study may be lack of facility data, it is important to note the suggestion that the e-ICU allowed for constant monitoring of the critically ill patients. This finding has increased importance in rural areas where there is often a lack of intensivist and CCRN staff.

How patients feel about telemedicine is important when looking at the impact that the technology has on the quality of care. A study by Harrison, MacFarlane, Murray, and Wallace (2006), explored patient perceptions of teleconsultations. Using semi-structured interviews, the researchers completed a qualitative study with a sample of 28 participants.

The authors examined teleconferenced consultations between the general physician and needed specialists. The researchers paid special attention to the patient experience, looking at patient-doctor interaction and patient care. Patients in the study were randomly assigned to see a specialist via teleconferencing or traditional face-to-face care (Harrison et al., 2006). Seven different specialist fields were investigated. The sampling strategy was based on gender, location, and referral specialty. Twenty-eight interviews were conducted looking at convenience, cost, and punctuality. Harrison et al. (2006) found that patients were appreciative of the convenience, felt that problems with cost was eliminated, and liked having their general physician available for their consultations. Overall, the authors of this study felt that patients were highly accepting of telemedicine. However, Harrison et al. (2006) also found grounds for dissatisfaction. It was noted that patients were not comfortable with the clinical aspect of tele-care, with some preferring that physical exams were conducted directly by the specialist. In conclusion, the authors felt that the study provided new insights into patient satisfaction and dissatisfaction with telemedicine. They felt that “while patients generally welcome the increased convenience and punctuality, they do not want these aspects to take precedence over the quality of clinical care. Patients showed a wide variety of views, and this heterogeneity must be recognized when developing new services” (Harrison et al., 2006, p. 89). While this study may not look specifically at critical care, it strongly supports the importance of the patient’s opinions about how their healthcare is shaped.

In another study of patient perceptions, Sodani and Sharma (2011) surveyed 280 patients to describe their perceptions about services at public health facilities. The majority of participants were from rural areas. Public health facilities were divided into a

grid and a sample was taken from each area. In total 24 public health facilities were used. A structured, closed-ended questionnaire was developed and used. Two-hundred-eighty patients were included in the study. Of those patients investigated, 90% felt that overcrowding was a problem, but respondents liked the tested facilities, telemedicine services offered, and felt the care provided was confidential. With this information, the authors suggested that reducing the patient load by offsetting services to other facilities might improve patient satisfaction (Sodani & Sharma, 2011).

With confirmed studies showing current and predicted physician and nursing shortages (American Association of Colleges of Nursing, 2014; Association of American Medical Colleges, 2012), there is a demonstrated need for the e-ICU. This technology should not only assist bedside staff in caring for critically ill patients, but should also be used as a means to potentially improve staff satisfaction.

It is important that the nurse's perception of the e-ICU be considered. A study by Mullen-Fortino et al. (2012) looked at the bedside nurse's perception of ICU telemedicine. Mullen-Fortino et al. (2012) studied 179 ICU nurses working in three different critical care units located in two university-affiliated academic hospital centers equipped with e-ICU technology. Nurses were asked to respond to an online survey concerned with their perception of ICU telemedicine. The survey questionnaire focused on four specific domains: functionality, patients' outcomes, privacy, and culture. Usage trends and a general opinion were also areas of focus. The survey tool used for this study was based on a preliminary qualitative study by the same author that included questions regarding electronic documentation. Based on feedback from the preliminary study, Mullen-Fortino removed those questions allowing the current survey tool to consist of a

mix of “positively and negatively worded questions and language” (Mullen-Fortino et al., 2012, p. 27), containing 19 questions using “Likert-type responses and an open-ended, general opinion area” (Mullen-Fortino et al., 2012, p. 27). While currently unnamed, the survey developed by Mullen-Fortino et al. (2012) establishes content validity. Reliability continues to be determined as the survey gains popularity among researchers and therefore is not currently available.

Of the 179 survey invitations extended, 93 nurses responded giving the study a response rate of 52 %. Nurse’s opinions in the functionality portion of the questionnaire indicated regular incorporation of e-ICU suggestions into their patient’s care. None of the surveyed nurses felt that they were less likely to communicate with the in house physician because of the e-ICU and only a minimal percentage felt that the e-ICU interrupted their daily workflow. When looking at the patient and family outcomes section of the questionnaire, the research showed that participants believed that the e-ICU had positive effects on patient outcomes. Nurses had strong opinions that the e-ICU generally increased the patient’s chance of survival, but opinion was not as strong that telemedicine actually prevented medical errors or improved family satisfaction. Researchers also found that 40% of the ICU nurses responding felt that the e-ICU was equally as good with or without the e-ICU in place. Nurses had some concerns about privacy; 11% felt that the e-ICU was intrusive, 27% felt that it decreased patient privacy, and 13% felt that they were being spied on. The majority of nurses (87%) agreed that it was important to be alerted before the e-ICU entered their patients’ room. When looking at organizational climate, 79% of nurses felt it important to be familiar with the telemedicine staff. Open-ended comments in the 2012 study were both positive and

negative and contained specific suggestions for improving the interactions between bedside and telemedicine staff (Mullen-Fortino et al., 2012).

Overall nurses supported the use of the e-ICU technology and the immediate availability of expert staff. The authors felt that study findings could offer assistance in making improvements to existing and future e-ICU care and in promoting more effective relationships and communication patterns between bedside and telemedicine staff. Concerns with the technology were minimal, consisting of issues with privacy and intrusions into the daily workflow. Mullen-Fortino et al. (2012) had concerns about the limitations of the study suggesting that the low response rate left the possibility of response bias open and suggested that results may not be generalizable over smaller areas implying that research into smaller rural areas could be useful Mullen-Fortino et al. (2012).

### **Conclusion**

The electronic e-ICU consists of advanced software capable of treating patients via video conferencing with the ability to listen to breathe sounds and check pupillary responses (Carolinas Healthcare System, 2016). While some feel that this does not allow for personalized care, many hospital metrics report a decrease in the length of stay and adverse outcomes resulting from e-ICU assisted patient care. Many rural healthcare facilities have now incorporated the e-ICU as part of their care models (Mullaney, 2006). While the Harrison et al. (2006) study suggested that patients often felt a sense of distance with telemedicine, other studies have suggested that having a doctor or nurse ‘in a box’ does not always appeal to the patient in need of a personal touch (as cited in Vandekieft, 2001). Most studies show that the e-ICU improves quality and safety and

these same studies show decreases in mortality rates, length of stays and point to high levels of patient satisfaction with telemedicine (Bailey, 2011; Mannion, 2009; Miller, 2003, 2010).

Critically ill patients in ICUs are at risk for an increase in adverse events. Keeping clients satisfied is also crucial to reimbursements from insurance companies (Orlovsky, 2005). Quality is emphasized as “the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge” (Crossing the quality chasm: *The IOM Health Care Quality Initiative*, 2013, para. 3). As a direct effort to combat the shortage of healthcare professionals, virtual care technology is quickly moving into healthcare facilities across the nation. With quality targets on healthcare, there is a need to evaluate that quality in e-ICU care areas.

A quick analysis of the research used for this work will show approximately 32 sources. Of these sources, only about nine were related to the specifics of nursing. Of those nine sources, only one (Barnard, 2015) looked at the needed nursing technique for current advancing healthcare technology, believing that “technique is the creation of a kind of thinking that is necessary for contemporary healthcare technology to develop and be applied in an efficient and rational manner” (Barnard, 2015 p. 8). This lack of knowledge shows a clear gap in the field of telehealth nursing. The purpose of this study will be to help bridge that gap.

Nursing is the art of caring. Finding a balance between increasing and advancing technology and providing patient centered quality care is crucial. This study will consider how telehealth, specifically the e-ICU, affects the quality of nursing care at the bedside.

The research question for this study is, *what is the bedside nurses' perception of Intensive Care Unit (ICU) telemedicine in the rural healthcare setting?*

## **CHAPTER III**

### **Methodology**

The goal of this research was to analyze the impact that advanced technology brings to the quality of nursing care, specifically in the ICU. Of particular interest was the nurses' perception of the effect of e-ICU technology on the quality of patient care at the bedside, patient outcomes, and patient satisfaction. The intention of this researcher was to replicate a study by Mullen-Fortino et al. (2012). Communication with Margaret Mullen-Fortino indicated the need for surveying ICU nurses in smaller, rural community hospitals.

### **Research Question**

The research question for this study was; *what is the bedside nurses' perception of Intensive Care Unit (ICU) telemedicine in the rural healthcare setting?*

### **Study Design**

This study used a quantitative descriptive design. The researcher replicated, in a rural setting, a study by Mullen-Fortino et al. (2012).

### **Setting and Sample**

The study was conducted on an 18 bed medical-surgical ICU located in a rural area of North Carolina. The ICU was in a 245-bed level three trauma center, with an average daily census of 130 patients, and an average ICU daily census of 14. The hospital has Joint Commission accreditation for chest pain, stroke, and joint replacement.

ICU is equipped with two-way video monitoring e-ICU technology in each of its 18 rooms. The unit is monitored via the e-ICU 24 hours per day. The ICU has an in-house intensivist from 7am until 5 pm, seven days per week. At 5pm, the virtual

intensivist is available via the e-ICU. The target population for this study was all Registered Nurses currently employed within or assigned to provide care in the 18 bed medical-surgical ICU of interest (N=55).

### **Instrumentation**

A survey developed by Mullen-Fortino et al. (2012) was used. The researcher was granted permission to use the survey. The survey tool used for this study was based on a preliminary qualitative study by the same author. Based on feedback from the preliminary study, Mullen-Fortino et al. (2012) the current survey tool consists of a mix of “positively and negatively worded questions and language” (Mullen-Fortino et al., 2012, p. 27), containing 19 Likert-type questions and an area for open-ended, general opinion. The questionnaire was organized into five specific domains; Functionality, Patient and Family Outcomes, Privacy, Organizational Climate, and Patterns of Use. According to Mullen-Fortino et al. (2012) the survey has content validity. Reliability continues to be determined as the authors collect data from researchers using the instrument.

### **Design for Data Collection**

A participant flyer was designed and posted throughout the ICU two weeks before the study began, and announcements about the research were made to each shift in the daily ‘*shift starters*’ information. A cover letter, instruction page, and a survey were placed in an envelope in each RN employee mailbox. The cover letter explained the study, time frame for answering the survey, the voluntary nature of the study, and confidentiality concerns. Each survey packet included an instruction page giving detailed instructions on how to complete and place the completed survey in a locked collection

box placed in the break room of the ICU. Completion of the survey implied voluntary consent. RNs not wishing to participate were invited to place their uncompleted surveys in the collection box.

The survey was anonymous, with no identifiers or demographics. The collection period planned was two weeks. Completed surveys were collected from the locked box by the researcher three times per week.

### **Protection of Human Subjects**

Prior to starting the study, approval was obtained from the ICU director, the bb University's Institutional Review Board (IRB), the facility's IRB, and the facility's Nursing Scientific Advisory Committee (NSAC). Each anonymous survey included a cover letter stating the purpose of the research, instructions for completion, and statement of confidentiality. Both the cover letter and the instruction sheet contained a statement of voluntary participation. Completion of the survey implied consent. A locked box was provided for submission of the questionnaires. There was no risk to the research participants. All surveys were kept in a locked drawer in a locked office and in a password protected computer.

### **Data Analysis**

The surveys were removed from the lock box and analyzed by the researcher. Survey responses were calculated from a Likert-scale with responses ranging from 1 (strongly disagree) to 5 (strongly agree). Responses were then grouped into two categories: 1 and 2 (strongly disagree and disagree) and 4 and 5 (strongly agree and agree). Descriptive statistics were used to analyze data.

Open-ended responses were reviewed and key themes identified. Findings were analyzed by theme with illustrative quotes. Statistical and demographic data, used to describe the ICU unit of interest, were collected from the QM department.

## **CHAPTER IV**

### **Results**

The purpose of this study was to determine the bedside nurses' perception of Intensive Care Unit (ICU) telemedicine in the rural healthcare setting. After obtaining permission from the ICU director, the University's IRB, Facility's IRB and the facility's NSAC committee, the Mullen-Fortino et al. (2012) study was reproduced. This chapter will present the analysis of nurse's responses to the Mullen-Fortino et al. (2012) questionnaire.

### **Setting and Sample**

In 2015, this rural ICU had 1,233 total admissions and maintained full staffing levels of 55 RNs. As of June 1, 2016, the total number of ICU admissions was 627, on track for exceeding 2015 admissions (D. Funchess, personal communication, June 22, 2016). All Registered Nurses currently employed within or assigned to provide care in the 18 bed medical-surgical ICU of interest (N=55), received questionnaire invitations. Data was collected over two weeks. Thirty-eight RN's responded to the questionnaire, for a 69% response rate that included RNs from weekday and weekend staff and both day and night shifts.

The ICU is equipped with two-way video monitoring e-ICU technology in each of its 18 rooms. The unit was monitored via the e-ICU twenty-four hours per day. The ICU has an in-house intensivist from 7am until 5 pm, seven days per week. At 5pm, the virtual intensivist is available via the e-ICU.

## Findings

Completed questionnaires were collected by the researcher and tallied.

Percentages were determined for each of the 19 questions on the questionnaire and general themes were pulled from the open-ended response section of the questionnaire.

The presentation of the five subscales below combine Strongly disagree and disagree responses, as well as *strongly agree* and *agree* responses, as in the original Mullen-Fortino et al. (2012) study.

### Functionality

The first three questions in the functionality domain, found that the majority of participating RNs did in fact agree that they regularly incorporated interventions suggested by the e-ICU staff into their patient's care. A greater number of RNs disagreed that the presence of the e-ICU made them less likely to communicate with the on-site physician, and more RNs agreed that the e-ICU interrupted their daily workflow. (See Table 1)

Table 1

*Analysis of Functionality Portion of Mullen-Fortino et al. (2012) Questionnaire*

Functionality	Disagree	Neither	Agree
I regularly incorporate interventions suggested by the e-ICU staff into my patients care	7.89%	28.95%	63.16%
The presence of the e-ICU makes me less likely to communicate with the on-site physician	44.74%	28.95%	26.31%
The e-ICU interrupts my daily work flow	31.58%	26.32%	42.10%

### **Patient and Family Outcomes**

Results of the data analysis of questions 4-8, found that RNs felt confident that the interventions received from the e-ICU were best for their patient. RNs disagreed that having the e-ICU prevented medical errors and felt strongly that having the e-ICU increased the patient's chance of survival. RNs agreed that having the e-ICU improved family satisfaction, but felt strongly that the quality of their ICU was equally good with or without the e-ICU in place. (See Table 2)

Table 2

*Analysis of Patient and Family Outcomes Portion of Mullen-Fortino et al. (2012)*

*Questionnaire*

Patient and Family Outcomes	Disagree	Neither	Agree
When I consult the e-ICU physician, I am confident that the interventions are best for the patient	18.42%	31.58%	50.00%
Having the e-ICU prevents medical errors	31.57%	47.37%	21.05%
Having the e-ICU increases the patient's chance of survival	13.16%	36.84%	50.00%
Having the e-ICU improves family satisfaction	13.16%	44.74%	42.10%
The quality of our ICU care is equally good with or without a e-ICU unit in place	10.52%	23.68%	65.79%

**Privacy**

Results of the data analysis for questions 9-13 found that RNs felt that the e-ICU was intrusive. Participants disagreed that having the e-ICU decreases patient privacy but the majority of RNs who participated agreed that it was important for e-ICU staff to alert them to their presence whenever they entered the room. RNs mostly disagreed that they felt like they were being “spied upon” when working in their patient’s rooms and stated that they were comfortable communicating with the e-ICU staff. (See Table 3)

Table 3

*Analysis of Privacy Portion of Mullen-Fortino et al. (2012) Questionnaire*

Privacy	Disagree	Neither	Agree
I find the e-ICU intrusive	28.95%	28.95%	42.10%
Having the e-ICU decreases patient privacy	36.84%	28.95%	34.21%
It is important the e-ICU staff alert me to their presence whenever they enter the room	2.63%	5.26%	92.10%
I feel like I am being “spied upon” when working in my patient’s room	47.37%	26.32%	26.31%
I am comfortable communicating with the e-ICU staff	0.00%	21.05%	78.95%

### **Organizational Climate**

Results of the data analysis for questions 14-17 found that most RNs who participated agreed that the e-ICU physician sometimes leaves them unaware of communication with the on- site physician. RNs felt that it was important that they were familiar with the e-ICU, and participants mostly agreed that they were more likely to communicate with the e-ICU if they personally knew the physician. The majority of RNs who participated felt that overall they were satisfied with the service that e-ICU provided. (See Table 4).

Table 4

*Analysis of Organizational Climate Portion of Mullen-Fortino et al. (2012) Questionnaire*

Organizational Climate	Disagree	Neither	Agree
The e-ICU physician sometimes leaves me unaware of communication he or she has with the on-site physician	23.68%	23.68%	52.63%
It is important that I am familiar with the e-ICU physician	10.53%	28.95%	60.53%
I am more likely to communicate with the e-ICU if I personally know the physician	18.42%	34.21%	47.37%
Overall, I am satisfied with the service that the e-ICU provides	2.63%	28.95%	68.42%

### **Patterns of Use**

Results of questions 18 and 19 found that in the past six months, nearly 87% of RNs stated that they were contacted by the e-ICU 5 or more times while 45.5% of RNs stated that they had contacted the e-ICU 5 or more times in the past six months. (See Table 5).

Table 5

*Analysis of Patterns of Use Portion of Mullen-Fortino et al. (2012) Questionnaire*

Patterns of Use	Disagree	Neither	Agree
e-ICU to nurse contact in the past 6 months	0.00%	13.16%	86.84%
Nurse to e-ICU contact in the past 6 months	5.26%	28.95%	65.79%

**General Opinion**

About one-half of the nurses responding to the questionnaire (47.36%) made comments in the general opinion section. Comments were categorized into three themes: positive, negative and suggestions for improvement. The statements were noted as follows:

**Positive Comments**

- “It has been helpful”
- “I enjoy having it and its fast in getting orders I need.”
- “E-ICU is an excellent tool. Patient care advances and problems are resolved quicker. As a result, increases survival rate, and possibly LOS.”
- “Helpful”
- “Better care, quicker!”
- “Helps calling lab values at night”
- “e-ICU is better utilized in the evening hours and should be used more then. They are a good safety net.”

- “The nurses of e-ICU that I love are great at gently offering suggestions without pestering or interventions for other things. Mutual respect, and me not feeling threatened by suggestions helps me accept their help more.”

#### Suggestion for Improvement Comments

- “I feel the e-ICU is mostly helpful at night when they’re no Intensivists in the hospital. Sometimes, the nurses are of no help. It would be nice if we could directly speak with a physician, rather than RN to RN to MD, when things of importance can get lost in translation.”
- “I feel like the E-ICU is probably more helpful for night-shifters nurses.”
- “I like extra support at night, but at times I find it difficult to deal with E-ICU RN’s when the talk down to me, a seasoned RN.”
- “Helpful, but intrusive at times.”
- “The e-ICU are very helpful when there are not as many doctors available (night time). They thoroughly check the patients’ charts, labs & vital signs (too much sometimes). However, they are not necessary to provide excellent patient care. During true emergencies, the ICU cares for the patient and makes the difference.”

#### Negative Comments

- “Sometimes e-ICU is intrusive and overpower bedside physicians. Communication could be better. E-ICU dayshift is nonexistent. 3pm MDs change orders without communication to RNs”.
- “Sometimes it is difficult to communicate with the E-ICU nurses because they are not familiar to your patient. Some nurses will not report things to a physician

because they do not feel it is pertinent information. Overall, I enjoy having a 2<sup>nd</sup> opinion and doctor at my fingertips.”

- “I have found that some e-ICU nurses like to tell the bedside nurse how to practice. The e-ICU nurses can be very inconsistent in their practice. Some nurse camera in multiple times a day, others not at all.”
- “Intrusive”
- “e-ICU is helpful as a supplement to our care. Sometimes they are intrusive, they review your admission orders before you can see them or change them so you have conflicting orders.”

## CHAPTER V

### Discussion

The purpose of this research was to replicate an urban academic study (Mullen-Fortino et al., 2012) and add to nursing knowledge the bedside nurses' perception of ICU telemedicine in a rural setting. As in the case of the Mullen-Fortino et al. (2012) study, the researcher felt that there is general nursing support for the e-ICU technology and that these study findings could offer assistance in making improvements to existing and future e-ICU care.

### Interpretation of Findings

#### Demographics

The participants for this research consisted of 38 RNs, comprising 69.1% of the 55 employed nurses (n=55) in the rural ICU of interest. The 38 respondents worked a mix of both day (7a-7p) and night (7p-7a) shifts. The RNs invited to participate in this research range in age from 24 years to 61 years. Of the 55 nurses invited, 9 hold CCRN certification, 25 have Associate degrees, 27 have Bachelor of Science degrees, and three have Masters of Science degrees. RN experience for this unit ranges from two years to 39 years.

#### Perceptions of Nurses

**Functionality.** It is not surprising that the majority of RNs regularly incorporate e-ICU suggestions into their care. In this rural area, the e-ICU suggestions may often be the only physician support available to the nursing staff. It is the opinion of the researcher that the 29% of nurses who answered "neither" on the first question of the survey, are most probably day shift nurses who have in-house intensivist availability for final

decisions about what is incorporated into the patient's care. The percentage of nurses who answered "neither" to question two is the same (29%), leading the researcher to believe that these nurses were probably dayshift nurses who have easy access to the in-house intensivist. By the same standard, the researcher believes that the 26% of nurses that felt that the e-ICU made them less likely to communicate with the on-site physician were most probably night shift nurses who did not have easy access to in-house intensivist.

**Patient and family outcomes.** Only half of the RN participants felt confident that the interventions received from the e-ICU were best for their patient, which correlates with the same 50% ratio of nurses that agreed that the e-ICU increased their patient's chances of survival. These numbers may be linked to nurses who have had successful interactions versus those who have not. The researcher felt that the 32% and 37% of nurses who chose neither just simply did not have an opinion either way. This feeling was supported by the 66% of participants who felt that the quality of the ICU was equally as good with or without the e-ICU in place.

**Privacy.** An overwhelming number of RN's felt it important to be alerted whenever the e-ICU staff entered the patient room, and the majority of nurses stated that they felt comfortable when communicating with the e-ICU staff. These perceptions support the idea that if the e-ICU staff are truly alerting bedside staff to their entrance, communication is increased and relationships are being formed between the two groups of caregivers.

**Organizational climate.** Bedside RNs felt that it was important to be "kept in the loop" of communications between the e-ICU MD and the on-site MD, and that, it was important to know the e-ICU physician. This perception may represent being from and

working in a small town culture. Nurses in rural areas know the physicians they work with and these same nurses may feel more comfortable knowing the e-ICU staff.

**Summary.** Nurses responding to this study and practicing in a rural area equipped with the e-ICU generally support the technology, and generally incorporate the suggestions from the e-ICU into their patient's care. Bedside nurses generally have confidence that the e-ICU physician interventions are best for their patient's and that having access to the e-ICU increases family satisfaction and increases their patient's chance of survival. Participating RNs did not believe that having the e-ICU decreased or prevented medical errors, and found that overall the e-ICU was viewed as intrusive and had strong feelings that they should be notified whenever the e-ICU staff entered the patient's room. The participating RNs did not feel that the e-ICU decreased patient privacy, and strongly agreed that they were comfortable communicating with the e-ICU staff. Many nurses indicated that the e-ICU physician sometimes left staff unaware of communication with the on-site physicians, and strongly felt that it was important to be familiar with the e-ICU physician. The contact with telemedicine staff was as anticipated. The researcher was not surprised by the high patterns of use at this rural facility. The e-ICU implemented in this hospital, contacts nursing multiple times daily for rounds or updates to the medical record, and the bedside staff contact the e-ICU for new admissions and changes in their patient's care.

#### **Comparison to Mullen-Fortino et al (2012) study**

Both the rural and urban academic studies were compared by the researcher. Findings indicated similarities between rural bedside nurses' perception of ICU telemedicine and the perception of ICU nurses in the urban academic setting. Specific

areas of disagreement between the two studies were:

- “The e-ICU interrupts my daily work flow” with 42% of the rural facility agreeing with this statement and only 9% of the academic facility agreeing.
- “Having the e-ICU prevents medical errors”. In the rural facility 32% of participants disagreed with this statement and 47% answered “Neither”. Reasons for the large percentage of participants who answered ‘neither’ may include the capacity in which the e-ICU is used in each facility, and may also include personal experiences with the e-ICU or the number of medical errors that the individual nurse has been involved with. There was also a large percentage of “neither” answers (36%) in the academic facilities showing that while these two studies differed in this area the neutral responses may generate from the same opinions.
- “I find the e-ICU intrusive”. These two differences, rural area agreement of 42%, and urban center agreement of 11%, showed the most disagreement between the two studies. The rationale for the difference may be tied to the patterns of usage.
- “Patterns of use”. In the academic center, the e-ICU to nurse contact is minimal when compared to the rural center. This may be because of the number of on-site physicians and resources available at each facility. This pattern is most likely representative of the strong difference opinions of e-ICU intrusiveness when comparing the two studies.

In all other questions, the trends remained the same between the two studies with the highest percentage of nurses agreeing or disagreeing to the same statements. This finding leaves this researcher with the opinion that the general and overall perception

of the e-ICU is the same for the rural nurse as for the urban academic nurse.

### **Relationship to Locsin theory**

While the survey questions in this particular study did not address patient wholeness specifically, the e-ICU does allow for increased observation of patients. This increased observation allows the nurse to know more about that patient in the moment and be alerted more efficiently to changes in that patient's condition. The positive general opinions and perceptions of bedside nurses regarding the e-ICU show that there can be a peaceful coexistence between technology and caring.

### **Limitations**

There are high percentages of "neither" or neutral responses throughout the questionnaire for both studies. It is unclear in some of these responses if participants felt these statements simply did not apply to them or if they just did not have an opinion either way. Other limitations included a small sample size. Of the 55 employed nurses, working within the ICU only 38 (69.7%) responded to the questionnaire. It is possible that the nurses' perceptions may have been reflective of a single negative experience or that nurses may have completed the questionnaires together sharing opinions.

### **Implication for Practice**

For the success of future e-ICU integrations, effective communication will be essential. The results of this research can help with expanding telemedicine programs into other rural hospitals by assisting in the management of communication between bedside and e-ICU staff. The suggestions made in the general opinion section of this research can be used to improve working relationships between bedside and telemedicine staff so that suggestions are better received and implemented on both sides with the goal of obtaining

improved patient outcomes. It would also be helpful to implement this research toward standardizing e-ICU programs to play an active part in the prevention of medical errors.

### **Future Research**

As this research dealt mainly with the bedside nurses' perception of ICU telemedicine, further research could determine if electronic telemedicine actually can assist with the prevention of medical errors. It would also be helpful to determine how intrusive the e-ICU is to the bedside nurses' daily workflow and the number of interruptions that the e-ICU brings to the nursing workday versus the number of positive outcomes received by the patient. Furthermore, researching technology use, which reveals the person in their wholeness, would contribute to nursing knowledge of improving quality of care in critical care settings.

### **Conclusion**

Research in both rural and urban hospital settings has suggested that the e-ICU is a benefit to patients and that it improves patient and family satisfaction. This improvement in satisfaction may have positive effects on patient satisfaction scores. Findings from both studies suggested that the majority of RNs believe that patient outcomes are improved with e-ICU use.

Locsin's model, *Technological Competency as Caring in Nursing* (2005b), acknowledges that wholeness of a person is a focus of nursing. This process "involves a continuous collection of data in order to understand the person as whole and complete in the moment through the competent use of technologies of nursing" (Locsin, 2005b, p. 130). The researcher found that rural nurses believe that the e-ICU assists with the continuous collection of data needed to know persons as whole and complete in the

moment. Better methods are needed to measure caregiver satisfaction with the use of technology to assess wholeness over individual systems.

Technology continues to play an important role in healthcare delivery.

Telemedicine will most likely continue to grow as technology advances, caregiver shortages continue, and vulnerable populations access needed healthcare. Nurses in all clinical settings will offer skillful caring in technological environments and promote wholeness of persons, particularly as influenced by technologies in nursing practice.

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