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The Impact of TeleCritical Care on Length of Stay in a Critical Care Setting

Mallory Oberts
University of St. Augustine for Health Sciences

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Mallory Oberts, MSN, RN

School of Nursing, University of St. Augustine for Health Sciences

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Doctor of Nursing Practice Program and is Approved by:

Sheri Jacobson, PhD, RN

Spencer Cho, DNP, RN

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University of St. Augustine for Health Sciences
DNP Scholarly Project
Signature Form

Student Last Name:	**First Name:**	**Middle Initial:**
Oberts	Mallory	D.A.

E-mail:
M.oberts@usa.edu

Title of DNP Project:

The Impact of TeleCritical Care on Length of Stay in a Critical Care Setting

My signature confirms I have reviewed and approved this final written DNP Scholarly Project.
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Type Name in Blue Box Below	Signature	Date
DNP Project Primary Faculty: Sheri Jacobson PhD, RN	Sheri Jacobson PhD RN	4/5/2024
DNP Project Preceptor: Spencer Cho DNP, RN	SPENCER CHO Digitally signed by SPENCER CHO Date: 2024.04.05 09:18:25 -07'00'	4/5/2024
DNP Project Preceptor:		

Abstract

Practice Problem: At a major metropolitan VA hospital, there was a lack of adherence by the nursing staff to the TeleCritical Care program for adult patients in the critical care setting.

PICOT: The PICOT question guiding this project was: In adult patients admitted to critical care (P), does the implementation of TeleCritical Care (I) compared to standard critical care without telemedicine (C) decrease length of stay (O) within 8 weeks (T)?

Evidence: The literature review identified improved quality of care delivery, decreased length of stay, and reduced mortality rates as key benefits of implementing TeleCritical Care in critical care settings.

Intervention: The intervention involved providing knowledge and training to support nurses in utilizing TeleCritical Care, a system linking bedside nurses to a remote team for consultation, monitoring, and intervention recommendations. Nurses were trained on initiating TeleCritical Care for all new ICU/PCU admissions and using it for procedures like verifying skin breakdown on admission. The ADKAR change model guided awareness building, fostering desire, providing knowledge/training, and ensuring ability through tools like checklists, and reinforcement.

Outcome: The anticipated outcome of decreased length of stay was not statistically significant, although there was a 23% increase in nursing utilization of TeleCritical Care during the 8-week implementation period.

Conclusion: While the project did not demonstrate a decrease in length of stay, the increased utilization of TeleCritical Care by nurses indicates progress toward integrating

this evidence-based practice into the critical care setting to improve the quality of patient care.

The Impact of TeleCritical Care on Length of Stay in a Critical Care Setting

TeleCritical Care refers to the application of telemedicine technologies and distant monitoring systems to provide critical care services and assistance to patients in critical care settings. It is comprised of concurrent videoconferencing, electronic health record integration, and continuous remote monitoring of enrolled patients' vital signs and medical information. TeleCritical Care has grown significantly across the critical care arena, reaching more patients with these advancing technologies, and expanding different modalities (Volpe, 2022). Rapid expansion across the Veterans Health Administration (VA) organizations is being pressed by national VA leaders (Wilson, 2022). Unfortunately, even with the infrastructure in place to support TeleCritical Care, many nurses have not fully embraced this program to support the highest quality of care it can offer.

Significance of the Practice Problem

The practice problem involved the lack of adherence by the nursing staff in the utilization of the TeleCritical Care program for adult patients in the critical care setting at a major metropolitan VA hospital. TeleCritical Care infrastructure is available to both inpatient critical care units; the Intensive Care Unit (ICU) and the Progressive Care Unit (PCU). Both units are situated in the same department on the fifth floor, west wing. There are 36 beds in total with 18 of them designated as ICU and the remainder 18 as PCU. The infrastructure includes videoconferencing abilities in each patient room, TeleCritical Care staff access to Electronic Medical Record (EMR), and TeleCritical

Care. According to Wilson (2022), the TeleCritical Care program is promoted nationally by the VA Central Office (VACO). The participating hospital has become a hub, meaning it is equipped with state-of-the-art computer monitors that utilize specialized software to display patient charts and real-time vital signs and waveforms that are operated by critical care nurses and physicians. However, unlike other sites all over the country, the participating hospital is only using its services for Surgical ICU (SICU) patients, by the SICU physician team.

Due to the complexity and fast-paced nature of critical care, staff workload, and resource constraints, maintaining consistency with evidence-based care delivery and standardization of protocols and guidelines in the critical care setting can be difficult. Especially, with the loss of experienced nurses across critical care nationally due to the COVID-19 pandemic and other factors, organizations are seeing an increasingly concerning knowledge gap (Volpe, 2022). TeleCritical care has been identified as a tool to help mentor onsite nurses and support the development of newer nurses' critical thinking and process adherence. TeleCritical Care supports both experienced and novice critical care nurses in countless procedures including skin checks for pressure injury on admission, evaluating medication drip titrations and compatibilities, assessing for early decompensation in patients, documenting activities of nurses during code situations or rapidly decompensating patients, and much more.

Patient decompensation requires early identification and intervention. Unfortunately, medical, cardiac, and surgical providers are not always available to come urgently to the bedside due to rounding, conferences, and lack of 24-hour coverage.

According to Bircher et al. (2019), delays in emergency treatment are associated with lower survival rates by as much as five percent. TeleCritical Care provides a timely intervention and early identification of patients showing signs of deterioration. This proactive monitoring prevents adverse events, lower mortality, and reduces the length of stay (Lilly et al., 2014). According to Spaulding and Oshfeldt (2014), the majority of cardiac arrests occur after several hours of progressive deterioration, and the quality of resuscitative processes contributes to poor critical care outcomes.

Increased length of stay (LOS) has a negative impact on the organization and patient outcomes. According to the Agency for Healthcare Research and Quality (n.d.), the average cost of one day in the hospital is $6,326. Priore and Beauvais (2022), explain that a reduction in LOS of even half a day not only saves the organization money but also emphasizes the quality of care provided. Increased LOS can also increase the risk of hospital-acquired infection and negatively impact the patient's ability to return to normal activities and baseline quality of life. Data suggests that the sooner patients are safely discharged, the sooner they return to normal (Sarpong et al., 2022).

PICOT Question

For this project, the PICOT Question was: In adult patients admitted to critical care (P), does the implementation of TeleCritical Care (I) compared to standard critical care without telemedicine (C) decrease the length of stay (O) within 8 weeks (T)?

Population

At a VA hospital, the patient population was Veterans who served in the Military, Navy, or Air forces (U.S. Department of Veterans Affairs, n.d.). In order to serve, an

individual must be eighteen years or older. For this project, the intervention took place in a critical care unit that treats both the Intensive Care Unit (ICU) and Progressive Care Unit (PCU) or step-down level of care patients. The unit operates at a 36-bed maximum capacity.

Intervention

The intervention involved the implementation of TeleCritical Care as a practice and decision-support tool for critical care patients. TeleCritical Care is an audio and visually connected system that links the bedside nurse to a remote team. This team has access to medical records, decision-support resources, and best practices. The TeleCritical Care team has jurisdiction to recommend interventions when there are delays in the clinician's reactions or when there is a drift from evidence-based guidelines. According to Subramanian et. al. (2020), TeleCritical care is a recognized mechanism to influence critical care expertise in any critical care environment. It is a tool used to support nurses in countless procedures ranging from being a second set of eyes on wound assessments to assisting in documenting actions in an emergency response. The initiation of TeleCritical care by the nurses can be done at any time but is recommended at the time of admission.

The Doctor of Nursing Practice Project Manager (DNP PM) led a team of invested individuals in providing education and support on the process and benefits of using TeleCritical Care to support nursing practice. The team provided the critical care nurses with a checklist to help guide their process of initiating TeleCritical Care during admission to the ICU and PCU. The project team audited documentation to uncover

outliers that are not initiating TeleCritical Care for their patients. They then reinforced education at daily huddles and during just-in-time training. The DNP PM collected data on LOS from the participating facilities' data team.

Comparison

The comparison was standard critical care practices that include multidisciplinary rounding, rapid response calls for deteriorating patients, and other standard practices and procedures for critical patients. Response time for a clinician to be available varies depending on the time of day and location of the clinician. Additionally, when comparing expert versus novice nurses and their ability to identify cues of decompensation and clinical decision-making, novice nurses demonstrate slower attentiveness to impending problems (Brenner et al., 2009)

Outcome

The anticipated outcome was a decrease in critical care length of stay. Data was pulled from the VCCS report and PowerBI dashboards created by the facility's data team on ICU days and were pulled each week. Continuous communication between stakeholders and the DNP PM helped facilitate adherence, promote a sense of comfort, and reinforce the benefits of utilizing the program. The anticipated outcome of decreased length of stay was not statistically significant, although there was a 23% increase in nursing utilization of TeleCritical Care.

Timing

TeleCritical Care was encouraged on all newly admitted ICU or PCU critical care level patients over 8 weeks.

Evidence-Based Practice Framework & Change Theory

The Johns Hopkins Evidence-Based Practice (JHEBP) model was a systematic approach used to integrate the best available evidence into healthcare decision-making processes (John Hopkins Medicine, 2022). The JHNEBP framework involves a three-step process called Practice, Evidence, and Translation (PET). According to Melnyk and Fineout-Overholt (2018), working through this process enhances the learning necessary to provide an understanding of the evidence that impacts practice.

When it came to the development and application of TeleCritical Care, the JHEBP framework provided a structured approach by framing the clinical question including the desired outcomes of reducing the length of stay in critical care at the participating hospital. Next, the evidence included locating and filtering evidence through a literature search and creating an evidence table on TeleCritical care implementation and outcomes through practice change. This step gathered relevant and reliable information about the benefits, risks, and best practices of implementing TeleCritical Care. The final stage was taking that evidence and transforming it into the implementation of TeleCritical Care and evaluating the outcomes.

ADKAR Change Theory

The participating hospital utilized the awareness, desire, knowledge, ability, and reinforcement (ADKAR) theory as their change theory for implementation processes. ADKAR was an appropriate change theory for TeleCritical Care because it recognized

the importance of addressing individual needs and concerns during the implementation process. With hesitancies among the medical team that appeared to be affecting the nurses' openness to using this tool, addressing each service's apprehensions better encouraged buy-in to this change. Telemedicine adoption in a critical care setting represented a significant change in workflow and technology used for all critical care providers. The ADKAR model provided leaders with a structured approach to ensure that individuals were aware of the need for change, motivated to embrace it, equipped with the necessary knowledge and skills, and supported throughout the process (Balluck et al., 2020).

A- For this project, awareness was accomplished by bringing attention to the benefits of TeleCritical Care for patient care outcomes.

D- The DNPPM built a desire to implement TeleCritical Care by addressing any concerns and explaining how it aligned with the mission.

K- Training was provided before implementation to ensure the nurses knew how to use TeleCritical Care effectively.

A- The DNPPM offered ongoing support and coaching as the nurses became familiar with TeleCritical Care.

R- After outcomes were shared and celebrated, continued communication of the benefits of TeleCritical Care will be reinforced periodically.

By using the ADKAR model, TeleCritical Care implementation was guided effectively. The model emphasized the importance of well-defined and consistent communication to create awareness, addressed potential resistance and concerns through building desire, and provided the necessary knowledge and training for nurses

to follow a process to use TeleCritical Care technologies. This model also highlighted the need for ongoing reinforcement and support to sustain the change and promote long-term adoption.

Evidence Search Strategy

A detailed search was conducted using the Cumulative Index to Nursing and Allied Health (CINAHL), Medline, OVID, ScienceDirect, DOAJ, and EBSCO. Keywords in the search process included telehealth intensive care unit, critical care remote monitoring, eICU, ICU telemedicine, ICU telehealth, tele-ICU, and teleCritical Care. The Boolean expression of (“TeleICU”, “telehealth intensive care unit”, “critical care remote monitoring”, “eICU”, “ICU telemedicine”, “ICU telehealth”, “tele-ICU”, “teleCritical Care”) AND (“Nurse”, “Inpatients”, “hospitalization”, “hospitalized patients”) NOT (“Delirium”, “Neonatal”) were used. The search was limited to articles in English from January 2017 through the present date. Results were limited to peer-reviewed only. Further examinations into the details of the studies followed to exclude any articles that did not align with the focus of the intervention of TeleCritical Care. Articles, where implementation did not involve nursing, were not included. Additionally, all case reports and editorials were removed as some of these reports were noted to be of studies already included in the search results. Topics such as machine learning algorithm evaluations and application in an educational setting were also excluded because the studies were not focused specifically on the intervention of TeleCritical Care. After applying all the above inclusion and exclusion criteria, 12 articles were identified as having evidence to support the intervention of TeleCritical Care.

Evidence Search Results

The online article search resulted in 25 articles total, five from CINAHL, six from Medline, one from OVID, three from ScienceDirect, five from DOAJ, and six from EBSCO. These results were reduced to a final 12 articles. Exclusions included limitations to any discipline not to include nursing. Several articles focused on Respiratory Therapy or solely on Advance Practice Providers. Provided the focus of this project was on the intervention of nurses using TeleCritical Care, nursing should be included in the literature search results. A critical screening of articles excluding any that the subject was testing a tool or intervention in combination with TeleCritical Care was completed. Additionally, all case reports and editorials were removed as many of these reports were noted to be of studies already included in the search results. Topics including machine learning algorithm evaluations and application in an educational setting were excluded because the studies were not focused specifically on the intervention of TeleCritical Care. After applying all the above inclusion and exclusion criteria the remaining 12 articles were identified as having evidence to support the intervention of TeleCritical Care.

These remaining articles were reviewed to determine evidence level and quality score by using the Johns Hopkins EBP Model level and quality guide (John Hopkins Medicine, 2022). A combination of four were of high quality, five were of good quality, and three were of low quality. Of the 12 articles reviewed, three were systematic reviews, eight were descriptive or comparative and used secondary data, one was quasi-experimental and zero were randomized control trials (Appendix A) and (Appendix B). According to Lee and Kerlin (2019), due to the nature of TeleICU and its complex organizational intervention a large experimental study would be difficult to

capture its complexities and contextualize its effectiveness. The level of quality and clinically significant evidence support the application of this practice change in the critical care environment.

Themes with Practice Recommendations

After a thorough and rigorous review, the literature produced three major themes: Improved quality of care delivered, shortened length of stay, and decreased mortality rates.

Improved Quality of Care Delivery

A trend identified in the literature was the improvement in the quality of care delivered with the use of TeleCritical Care. TeleCritical Care provides an immediate response to emergencies and access to specialized expertise. This specialized expertise provides standardized processes and psychological support to the bedside nurse (Arneson et al., 2020; Hoonakker et al., 2017). It allows for remote clinicians with access to up-to-date guidelines, protocols, and decision support tools, ensuring consistent and standardized care within the critical care environment (Becker et al., 2019; Hassan, 2018; Mohammadi et al., 2019; Rocha de Macedo et al., 2021). It promotes interprofessional communication among the remote and bedside clinicians, improving collaboration, transferring of knowledge, and dissemination of the latest research findings (Arneson et al., 2020; Hoonakker et al., 2017). Improved quality of care was the most significant trend throughout nearly all the articles reviewed.

Collaborative Approach

Through a collaborative approach to improving the quality of care, data collection and interpretation, and early detection of deteriorating patients, and shortened LOS (Becker et al., 2020; Bircher et al., 2019; Hassan, 2018; Rocha de Macedo et al., 2021; Watanabe et al., 2023). The collaborative approach ensures that important care decisions are made promptly and backed by evidence. This approach minimizes delays in care coordination and treatments. Additionally, TeleCritical Care enhances communication among clinicians for a more efficient sharing of knowledge and a streamlined approach to care delivery (Arneson et al., 2020; Hoonakker et al., 2017). The intensivists have real-time access to patient data improving their ability to make timely decisions and communicate best practices (Rocha de Macedo et al., 2021).

Decreased Mortality Rates

With the standardization of care and adherence to best practices, TeleCritical care has been shown to decrease mortality rates (Becker et al., 2019; Becker et al., 2020; Hassan, 2018; Robie et al., 2022; Rocha de Macedo et al., 2021; Watanabe et al., 2023). Through early detection and intervention, clinicians are found to more efficiently able to identify signs of deterioration and make the appropriate recommendations for intervention that decreases development of life-threatening decompensation (Becker et al., 2020). Continuous data monitoring and analysis allows clinicians to identify best practices and early interventions, ultimately reducing mortality rates (Becker et al., 2019; Rocha de Macedo et al., 2021).

Decreased Length of Stay

By streamlining processes and shortening intervention time an outcome identified throughout the literature was a decrease in LOS (Becker et al., 2020; Bircher et al., 2019; Hassan, 2018; Rocha de Macedo et al., 2021; Watanabe et al., 2023). TeleCritical Care is found to decrease nonproductive hours during hospitalization, decreasing the amount of time required for critical care interventions (Arneson et al., 2020; Hoonakker et al., 2017). Having support from TeleCritical Care practitioners helps to prevent or minimize complications that increase critical care LOS (Becker et al., 2020; Watanabe et al., 2023).

Strength of Body of Evidence

Most of the studies reviewed met level III for being studies that were descriptive or used secondary data. Only one was a study with an independent variable but did not have a randomized control of those variables. There were three systematic reviews. The overall quality of the articles produced recommendations that are reasonably consistent and supported by some references to scientific data. Overall, the JHNEBP supports the implementation of TeleCritical Care to improve quality of care in the critical care environment.

Practice Recommendations

In summary, the literature answers the PICOT question by determining the implementation of TeleCritical Care is an appropriate tool used to decrease LOS. According to Robie et al. (2022), even with the associated costs of implementation, the value of support from Tele Critical Care is significantly worth the investment. Based on themes drawn from the literature, TeleCritical Care leads to an improvement in quality

care that indicates an improvement in mortality rates and LOS. Overall, TeleCritical Care plays a critical role in lowering mortality rates by enhancing patient outcomes in the ICU setting and improving the quality of care through continuous monitoring, expert consultation, standardized care, quick access to specialized care, and data-driven quality improvement (Becker et al., 2019; Hassan, 2018; Mohammadi et al., 2019; Rocha de Macedo et al., 2021).

As a result of the literature review, the following practice recommendations were incorporated into this evidence-based practice project by using TeleCritical Care to support nurses with critical care processes. The bedside nurses used TeleCritical Care nurses as a resource when they were unsure of critical care processes and as a second verifier for procedures like verifying lack of skin breakdown. The literature recommends including TeleCritical Care in the nurses' standard workflow. This was accomplished by having the nurses initiate TeleCritical Care on admission or transfer to any bed in ICU or PCU by contacting the TeleCritical Care nurse to obtain consent immediately following admitting the patient into the bedside monitor.

Setting, Stakeholders, and Systems Change

The setting for this project is a 36-bed ICU/PCU mixed critical care unit within a large diversified tertiary hospital system. The combined unit sees on average 2000 patients per year including cardiology, medical, and surgical patients. Specialties within the department are cardiac surgery, traumatic brain injury, heart failure, acute severe renal failure, multi-organ failure, and much more. The organization’s core values are to care for its population with integrity, commitment, advocacy, respect, and excellence

(U.S. Department of Veterans Affairs, 2021). The organization strives towards its goals of upholding these core values by using innovative and impactful initiatives, including the implementation of TeleCritical Care.

The staffing mix to care for these patients includes a physician, the presence a of medical and surgical team, and specialty provider consults. Two Nurse Managers (NM) and three Assistant Nurse Managers (ANM) oversee the department's operations. There are over 100 Registered Nurses needed to fully staff this combined unit and less than ten Nursing Assistants (NA) who also work as Restorative Health Technicians (RHT) servicing the rehabilitative needs of surgical patients. The focus of this project is solely on the utilization of TeleCritical Care by the RNs.

There is a mix of new graduates and 25+ year experienced nurses. The turnover rate was greater than 60% in the last fiscal year and is projected to be the same this fiscal year. This contributed to the identification of the organizational need for additional critical care support for the new and inexperienced nurses within this critical care environment. A discussion with the service chiefs of both acute care and critical care after attending a protected peer review committee meeting, developed an agreement that utilization of TeleCritical Care could have produced better outcomes for patient cases reviewed. During the protected peer review process a systems breakdown was identified as an opportunity for improvement. The lack of nursing utilization could have improved process identification, documentation of critical events, and supportive critical care decision-making for several patients.

Before implementation, only the Surgical Intensive Care Unit (SICU) physicians were regularly using TeleCritical care for their patient rounds. They used this tool to speak with the TeleCritical Care Physician to place orders, document, and assist with streamlining processes. Several stakeholders including the Critical Care Leadership, peer review committee members, and experienced critical care nurses have all determined a need for this supportive tool for nursing service.

A strengths, weakness, opportunity, and threats (SWOT) analysis was completed in order to determine the organization's readiness for implementing this change (Appendix C). Key strengths included the local and national level of support for this implementation. There were several health systems throughout the nation that were already using this tool and have had notable successes with the implementation (Wilson, 2022). Other strengths included enhanced and improved access to specialized care through expert guidance, more timely interventions, and improved collaboration and decision support. These strengths led to decreased LOS in critical care areas (Becker et al., 2020). The primary weakness was resistance to change and hesitancy in nursing acceptance of this new technology. The greatest threats were nursing turnover and medical team resistance.

This implementation created a direct impact on patient outcomes and experiences at a micro level. By enabling continuous monitoring, remote nurse consultations, and timely interventions during emergencies, TeleCritical Care improves individual patient care, enhances patient safety, and reduces LOS. Patients received specialized care and expertise regardless of their nurses’ experience. At a meso level,

TeleCritical Care implementation significantly impacts the organization's operations, workflows, and resource allocation. It may require changes in staffing models, infrastructure, and communication systems. It can also enhance collaboration and coordination among healthcare providers, leading to more streamlined and coordinated care delivery. Outcomes support sustainability in the utilization of TeleCritical Care due to stakeholders' improved satisfaction and comfort with evidence-based critical care processes guided by TeleCritical Care nurses. Additionally, the NM will continue to enforce this practice as a standard for all admitted critical care patients. At the Macro level, TeleCritical Care impacts the organization by transforming the delivery of critical care through the reduction of the need for costly patient transfers to community facilities when specialty care and pathways are necessary to ensure positive patient outcomes.

Implementation Plan with Timeline and Budget

The primary goal of this project was to improve the quality of care delivered in the ICU and PCU. Nurses used TeleCritical Care to help guide practice and improve patient outcomes. There were several objectives for this project including:

1. TeleCritical Care will be used by the nurses on fifty percent of the critical care patients admitted to ICU or PCU within 8 weeks.
2. TeleCritical Care will be used by the nurses on 95% of decompensating patients within 8 weeks.
3. The TeleCritical Care nurses will document all treatments and outcomes in the TeleCritical Care note for one hundred percent of patients who participated in TeleCritical Care during the 8-week implementation.

4. A result of a 10% reduction in length of stay with those patients that participate in TeleCritical Care

These objectives were accomplished by setting clear and measurable goals at the onset of the implementation of the DNP project, it was hoped that the critical care departments would successfully implement and utilize the TeleCritical Care program, resulting in an improvement in quality care defined by a decrease in critical care length of stay for critically ill patients.

The ADKAR change management framework was used to direct the introduction of TeleCritical Care for nursing in the critical care environment. The ADKAR model placed an emphasis on the individual aspects of change and worked to make sure that everyone in the organization was ready and willing to accept the change (Angtyan, 2019). The ADKAR change management model helped guide this implementation by addressing individual aspects of change and ensuring that stakeholders were prepared and willing to embrace the change to use TeleCritical Care more effectively.

Awareness

Stakeholders, primarily the bedside critical care nurses, were made aware that there was a need to better care for patients by using TeleCritical Care. They were made aware of the benefits it could bring to patient care and LOS outcomes. The TeleCritical Care program's goals and objectives were explained, emphasizing how it would improve the delivery of critical care, patient monitoring, and access to remote expertise.

Desire

The DNPPM built enthusiasm and desire for the TeleCritical Care implementation by describing how it supported the goal of optimizing the quality of care delivered. Bedside staff participated in decision-making throughout the project. The DNPPM addressed any issues or resistance they had.

Knowledge

The DNP PM provided training on the benefits of the TeleCritical Care program and changes to practice. Training materials were disseminated during training sessions before and during implementation and incorporated into the critical care nurse's orientation. A PowerPoint presentation was disseminated to each nurse through Elsevier Clinical Skills where reports were pulled to determine compliance. Content used for education (Appendix E). Focused training was applied to those who had questions or lacked understanding of the process for using TeleCritical Care. Collaboration with the department managers ensured that staff were given one hour to complete training outside of their patient care hours.

Ability

The DNPPM ensured that the nurses had the knowledge and tools, i.e., functioning green buttons, cameras, and pamphlets to give to patients and families. The nurses were given a checklist to follow with the new admission process including initiation of TeleCritical Care by pressing the green button and introducing the patient/family to the TeleCritical Care nurse so they could obtain consent and explain what TeleCritical Care was. The next step on the checklist was providing the patient/family with the TeleCritical Care brochure. See Appendix H for the checklist.

Additionally, provided ongoing coaching and support as they got accustomed to TeleCritical Care operations. The DNPPM and team offered technical assistance and resources for troubleshooting to handle any issues that arose during the implementation phase.

Reinforcement

Finally, once the nurses were using TeleCritical Care as part of their standard nursing process, the DNPPM recognized and highlighted the positive outcomes and accomplishments, reinforcing the importance of using TeleCritical Care regularly. Providing continuous feedback reinforced the value this change had on the organization.

The current TeleCritical Care Standard Operating Procedure (SOP) reflected the SICU team using TeleCritical Care for surgical patients and only vaguely mentioned bedside nursing using the intervention. Education regarding the SOP was directed towards nursing being able to use TeleCritical Care with all patients admitted to ICU and PCU regardless of whether the patient was under the surgical service or not. There were no limitations for nursing with medical patients although the physicians chose not to utilize TeleCritical Care for their patients.

Stakeholders were briefed on the timeline and given opportunities to contribute to the completion of training materials and rollout. A briefing on pre-implementation data related to LOS for both PCU and ICU was provided. This data was collected from clinical dashboards on Veterans Health Administration Support Service Center Capital Assets (VSSC).

The implementation of this project was completed in 8 weeks (Appendix D). The DNP Project Manager (DNPPM) ensured the organization's critical care standards of practice were maintained throughout the project. The DNPPM communicated regularly with stakeholders to ensure efficiency in the project's implementation. The DNPPM did regular chart audits to see if nurses complied with initiating TeleCritical Care on admission and provided any feedback and just-in-time training if necessary. These chart audits included a review of the newly admitted patients in ICU and PCU and verification that the TeleCritical Care nurse was initiated by completion of the TeleCritical Care note (Appendix F). Necessary qualities for the DNPPM to be successful included being a good communicator, being organized and efficient with time, and being able to collaborate well with those on a multidisciplinary team.

TeleCritical Care requires a robust technological infrastructure, including reliable internet connectivity, secure data transmission, connectivity equipment, and compatibility with existing healthcare programs and documentation platforms. Because TeleCritical Care was already being used by the SICU providers, the costs of implementation for this project were much lower in comparison to a site that implemented the whole program without this infrastructure already in place. The primary budget (Table 1) was for staff education and training in addition to a few short meetings with the project team members before implementation.

PET Framework

The PET framework was used to guide this project. The first phase, practice, guided in defining the problem, creating a project team, identifying the need for this

project, and identifying stakeholders. The next phase, evidence, involved searching for and appraising the evidence to develop practice recommendations. The last phase, translation, is disseminating the findings.

Evaluation

All ICU and PCU nurses were encouraged to participate in this project. Only those who floated to ICU or PCU from other critical care areas were excluded from the project as they did not receive the pre-implementation training. The main data collection for this project was critical care LOS with the utilization of TeleCritical Care compared to pre-implementation LOS for 8 weeks. Additionally, a checklist (Appendix H) was used by the ICU and PCU leadership to audit nursing adherence to the TeleCritical Care initiation process. Initiation included an introduction to the program and completing four eyes skin checks. Four eyes skin checks were part of the organization's Hospital Acquired Pressure Injury prevention bundle, requiring two nurses to inspect bony prominences upon admission to the unit to identify any skin breakdown.

Other outcome variables as a result of the implementation of TeleCritical Care included improvement in patient outcomes with a continuation of low mortality and readmission rates, improved patient satisfaction, improved communication and collaboration among teams, and improved quality of care as noted in Appendix G. Additionally, adherence to admission protocol with TeleCritical care included, integration of TeleCritical Care in routine care delivery, availability of TeleCritical Care resources and support, and utilization of TeleCritical Care for skin checks were internal measures used to evaluate the efficiency and effectiveness of the TeleCritical Care

implementation. Balancing measures or unintended outcomes of TeleCritical Care included technology-related failures and a shutdown for updates, TeleCritical Care Staff inconsistencies in practice, hospital overcrowding and emergency room diversion, and patient/family non-consent and refusal to participate in TeleCritical Care.

There were no cost savings from reduced Length of Stay as the LOS went up from pre-implementation. A large portion of the admissions to ICU and PCU were overflow from acute care which required a reduced need for increasing acuity for specialized care. The integration of TeleCritical Care into critical care standards of practice, ongoing support from VACO for funding allocation, increased training for TeleCritical Care imbedded Nursing Service Orientation (NSO), and stakeholder engagement for long-term support of TeleCritical Care were all positive clinical impacts to ensure sustainability and determine the clinical significance of utilization of TeleCritical Care.

LOS data (Appendix F) was collected for the 8 weeks before and after the initial implementation of nurses using TeleCritical Care to support daily practices and during decompensating patient events to show a comparison. Data was retrieved from VSSC reports by a data extraction specialist employed at the organization. Then a manual review of TeleCritical Care nursing notes was performed by the DNPPM. The DNPPM worked with Clinical Informatics to pull LOS data on these reports. The data does not contain any patient identifiers.

Before starting the project, approval was sought from the participating facility's IRB and the Evidence-Based Practice Project Review Council (EPRC) at the University

of St. Augustine School of Health Sciences to ensure the safety of human participants. Participants in this evidence-based practice project faced very little risk. Risks included the possibility of providers and nurses feeling anxious while utilizing the new procedure or feeling anxious because of a perceived lack of knowledge. Authentication was required to access the specific electronic files and datasets, protecting information privacy, and ensuring Health Insurance Portability and Accountability Act (HIPAA) compliance. The data collection did not include a patient's protected health information (Appendix F). Data protection was ensured as the data were housed in the participating hospital's main protected network. The network required individuals with a personal employee identification card and associated personal PIN to access data. Only a password-protected computer at the hospital had access to these files.

Results

LOS data was submitted in Intellectus Statistics software with assistance from expert consultation to conduct a statistical analysis. Intellectus is a software designed to support non-statisticians with the ability to interpret data they have collected for their projects (Intellectus Statistics, 2019). The data was evaluated and shared in Appendix F. The data was statistically evaluated using a t-test to determine the difference between pre- vs. post-LOS in both PCU and ICU and a two-tailed Mann-Whitney test was conducted to examine whether there were significant differences in LOS between the pre and post-categories.

Table 1

Two-Tailed Independent Samples t-Test for LOS by Time

	Pre			Post					
Variable	*M*	*SD*	*n*	*M*	*SD*	*n*	*t*	*p*	*d*
LOS	3.17	3.47	75	4.10	5.90	69	-1.16	.247	0.19

Note. N = 144. Degrees of Freedom for the *t*-statistic = 142. *d* represents Cohen's *d.*

The Mann-Whitney test yielded a non-significant p-value, indicating no statistically significant difference in LOS between the pre- and post-categories. The Shapiro-Wilk test showed significant deviations from normality in both categories, meaning it did not result in the normal bell-shaped curve of a normal distribution. This deviation from normal distribution indicated that the assumptions required for the use of parametric tests like the independent samples t-test were violated. Given the non-normal distribution of the data, it was appropriate to use the Mann-Whitney test, a non-parametric alternative, which doesn't require the data to follow a normal distribution. The Mann-Whitney test is well-suited for assessing differences between groups when the data is non-normally distributed.

Table 2

Two-Tailed Mann-Whitney Test for LOS by Time

	Pre		Post				
Variable	Mean Rank	*n*	Mean Rank	*n*	*U*	*z*	*p*
LOS	69.18	75	76.11	69	2,338.50	-1.01	.310

The statistical report showed there was no discernible change in LOS between the pre-and post-implementation periods, indicating that overall, the analysis indicates that the introduction of TeleCritical Care did not have a major effect on the Length of Stay in the ICU and PCU. Additionally, TeleCritical Care notes documentation data (Appendix F) was collected to identify compliance and utilization of the TeleCritical Care program. The DNPPM monitored the acceptance of this change by auditing documentation weekly in the TeleCritical Care note for both PCU and ICU patients.

Impact

This project aimed to address the practice problem of lack of adherence by nursing staff to the TeleCritical Care program. Despite the absence of statistical significance and an unintended result of increased LOS, there was a significant increase in the utilization of TeleCritical Care by 23%. This improvement in usage indicates a shift in nursing practice toward acceptance of the TeleCritical Care program. By actively using this tool, it is intended for nursing staff to become more comfortable with TeleCritical Care, particularly in critical situations, thus enhancing the quality of their nursing practice as critical care nurses. Also, the previous stigma towards TeleCritical Care is dissipating due to the increased usage, this cultivates a culture of acceptance and trust in the program.

Although the project's increased utilization during its implementation phase has shown encouraging results, maintaining adherence to the TeleCritical Care program is desired. Improved education and conversations about TeleCritical Care are now incorporated into new nurse orientations for all ICU and PCU nurses to ensure

sustainability. Before leaving orientation, each nurse is also stationed in the TeleCritical Care room, allowing them to observe and witness the advantages of the program. The goal of these actions is to make TeleCritical Care practices part of ICU and PCU's standard practice.

Ongoing evaluation for the continued adherence to TeleCritical care is desirable for the continuation of the program beyond this implementation. The initiation of TeleCritical Care upon admission is becoming standard practice for all ICU and PCU nurses. The responsibility for measuring success lies with Nurse Managers, Assistant Nurse Managers, and the Education team. They will continue to support the program and conduct audits to ensure proper utilization of TeleCritical Care on admission. The checklist (Appendix H) will used in auditing compliance in the utilization of the TeleCritical Care program.

This project did face several barriers and limitations. Ongoing hospital diversion and overcrowding of critical care units with general medicine patients, who do not require the same level of care and monitoring as ICU and PCU patients, posed significant challenges. Additionally, there was an influx of non-ICU and PCU nurses, who were not trained to initiate TeleCritical Care, which further hindered the project's implementation and likely contributed to the increased LOS during the implementation phase. Another possible contributing factor to the increased LOS may have been short staffing due to overcrowding and hospital diversion. During this implementation, the unfortunate occurrence of increased nurse-to-patient ratios particularly for ICU and PCU were abnormally high.

Other barriers that occurred were TeleCritical Care national outages and updates that paused the program for over 24 hours and discrepancies between TeleCritical Care nurses' willingness to accommodate first-time users and their questions. The outage and updates happened right after the implementation and traction with compliance began. This led to some nurses feeling the system was unreliable. The TeleCritical Care nurses are stationed all over the country and have various levels of experience in the role. Some nurses were more eager than others to explain how TeleCritical Care can be used. This inconsistency was noted to be somewhat discouraging. Overall, the substantial increase in utilization signifies that the barriers and limitations did not significantly affect the desire to utilize the TeleCritical Care program.

Dissemination Plan

A plan was devised to disseminate the EBP project outcome, methods used, and any lessons learned through a PowerPoint slide presentation presented to stakeholders and administrators at the Nursing Leadership Council (NLC) and Quality Executive Council (QEC) virtual meetings. Both NLC and QEC were councils at the participating hospital in place to monitor and promote best practices and improvement in patient care outcomes. NLC membership included the Associate Director of Patient Care Services (ADPCS), two Deputy Nurse Executives (DNE), all Nursing Service Chiefs, all Nurse Managers and Educators, and several front-line Nurses. QEC was chaired by the Medical Center Director (MCD) and attended by Quality Management (QM) Staff and Education Service Chiefs. This project was shared with the local and national leaders in TeleCritical Care via a monthly TeleCritical Care meeting. National leaders included a

Nurse Manager for TeleCritical Care nurses in the Midwest region, TeleCritical Care Pulmonary Attending, local site nurses, and physicians along with those located at other TeleCritical Care sites aligned with VACO.

An oral presentation was given to The University of St. Augustine Health for Health Sciences (USAHS) for peer review and distribution. A manuscript was sent to the American Association of Critical-Care Nurses as they focused on critical care nursing practices. This manuscript and oral poster presentation were also submitted to The Scholarship and Open Access Repository (SOAR) for USAHS as part of the DNP project requirement. To encourage global discoverability, SOAR gathered and disseminated student DNP projects.

Conclusion

This project aimed to improve the quality of care in critical care units by promoting the adoption of TeleCritical Care among nursing staff. The lack of adherence by nursing staff to the TeleCritical Care program has been identified as a practice problem, potentially hindering the full potential of this technology in improving patient outcomes and reducing critical care LOS. The literature emphasizes improved quality of care delivery through standardized processes, quicker access to specialized care, and enhanced collaboration among clinicians. TeleCritical Care has been associated with decreased mortality rates and a reduced length of stay in critical care units. By facilitating early detection and intervention, TeleCritical Care helps prevent complications and adverse events, ultimately leading to better patient outcomes. The

evidence supports the use of TeleCritical Care as a valuable tool to support nursing practice and improve patient care in critical care settings.

By utilizing the JHEBP model and the ADKAR change theory, the implementation plan aims to facilitate a smooth transition and widespread acceptance of this technology. The implementation plan aims to address individual needs, provide necessary education and training, and reinforce the benefits of utilizing TeleCritical Care. With careful planning, collaboration, and continuous evaluation, the successful implementation of TeleCritical Care has the potential to make a significant positive impact on patient care and outcomes in the critical care setting. Ultimately, successful implementation of TeleCritical Care could lead to improved patient outcomes, increased efficiency, and enhanced collaboration among clinicians in critical care settings.

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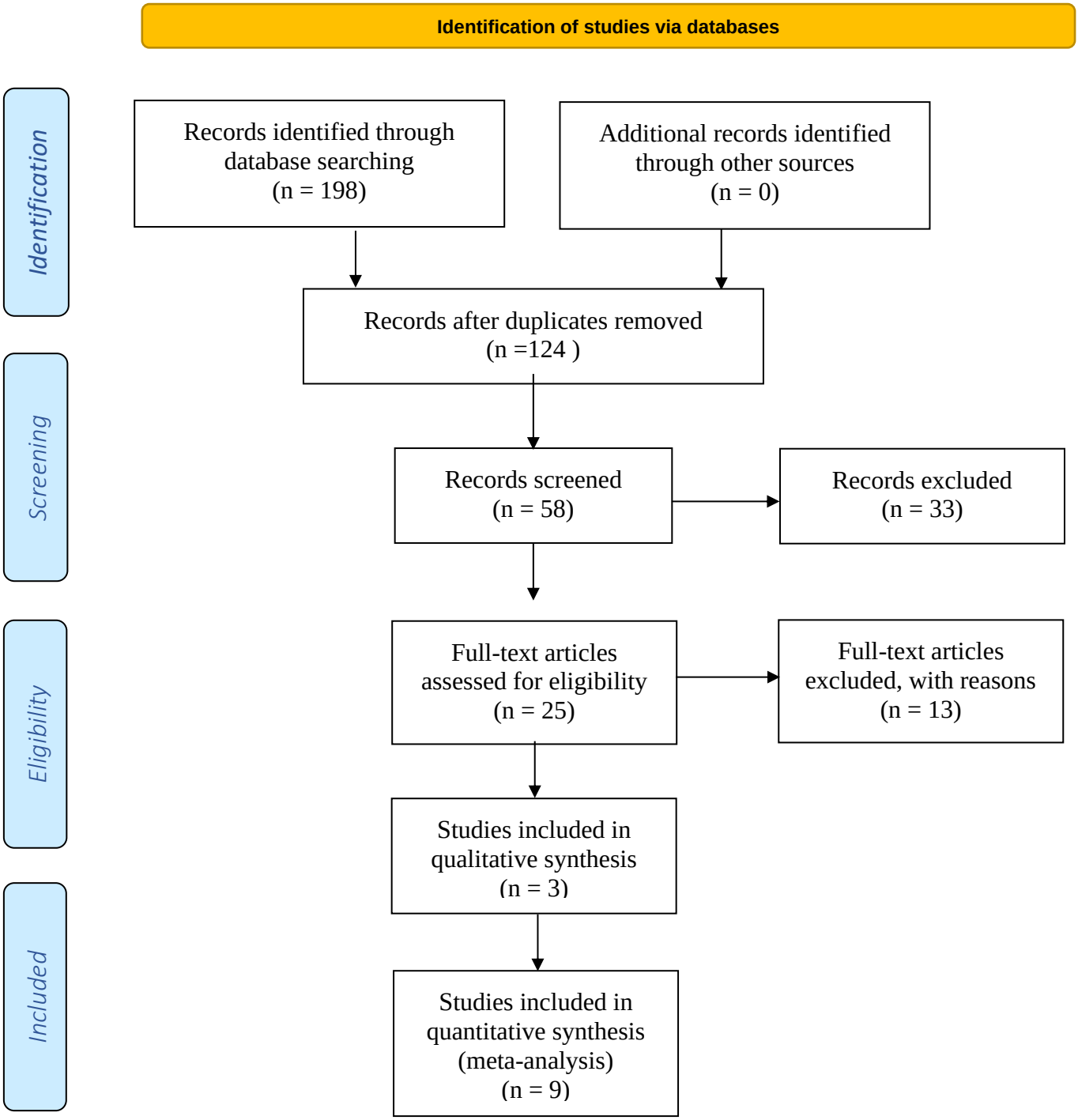
Table 3
Implementation EBP Project Budget

Expenses		Revenue	
Indirect- Included in regular operating costs	est. $	Billing	0
Salary and benefits x 1 hour for training, all Critical Care staff.	$8,400	Supplies/ patient	0
		Grants	0
Supplies – office	$<100		
Estimate Total Expenses	$8,500	Estimate Total Revenue	0
Net Balance			-$8,500

Note: All budget entries are estimates. Expenses are based on means. Revenue estimates do not include potential cost avoidance due to realized outcomes. All costs associated with salary and benefits, patient care supplies, and overhead are fixed indirect expenses not associated with this project. Project costs are nominal for printing and laminating, under $100.

Figure 1
PRISMA Literature Search Strategy Diagram



Note. Adapted from Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLOS Medicine*, *6*(7), e1000097.

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Appendix A

Summary of Primary Research Evidence

Citation	Design, Level Quality Grade	Sample Sample size	Intervention Comparison (Definitions should include any specific research tools used along with reliability & validity)	Theoretical Foundation	Outcome Definition	Usefulness Results Key Findings
Arneson et. al., 2020. Answering the call: Impact of tele-icu nurses during the covid-19 pandemic. *Critical Care Nurse*, *40*(4), 25–31. https://doi.org/10.4037/ccn2020126	Level:III Grade: C	No specific sample size. 300 clinicians had access to the software and 224 telemedicine mobile carts ordered	Implementation of Tele-ICU technology, software, cameras, monitors, microphones, speakers and distribution of handheld tablets to improve communication and visitation. No comparison	No specific theoretical foundation. However, it refers to the American Telemedicine Association's Continuous Care Model and the American Association of Critical-Care Nurses'	Tele-ICU nursing approach described in the article includes reducing exposure risk, minimizing time spent in patient rooms, maintaining a high level of care, improving communication and providing psychological support to bedside nurses	Tele-ICU nursing can be a valuable strategy to support critical care nurses during a crisis like the COVID-19 pandemic. The results highlight the positive impact of tele-ICU nursing in reducing exposure risk and

				consensus statement on tele-ICU nursing practice alignment with the goals and structure of the tele-ICU approach		maintaining quality care
Becker et. al., 2020. Effects of telemedicine icu intervention on care standardization and patient outcomes: An observational study. *Critical Care Explorations*, *2*(7), e0165. https://doi.org/10.1097/cce.0000000000000165	Level:III Grade:A	14,874 ICU admissions postintervention	Implementation of tele-ICU services and the comparison is made between the preintervention period and the postintervention period. Review of a subset of records was done by a second independent abstractor to ensure reliability and concordance. The use of APACHE-IVa methodology for calculating patient acuity and risk-adjusted mortality and LOS adds to the validity of the study.	No Theoretical Foundation used	The primary outcome is the difference in risk-adjusted ICU mortality between the pre and post tele-ICU intervention groups. Secondary outcomes include hospital mortality, ICU LOS, hospital LOS, CVC utilization, and compliance rates with best clinical practice measures.	The results provide evidence that tele-ICU intervention is associated with significantly lower ICU and hospital mortality odds ratios and improved ICU and hospital LOS. The article also presents

						data on best practice adherence, tele-ICU performance metrics, and the impact of a CVC utilization initiative.
Becker et. al., 2019. Optimizing tele-icu operational efficiency through workflow process modeling and restructuring. *Critical Care Explorations*, *1*(12), e0064. https://doi.org/10.1097/cce.0000000000000064	Level:III Grade:B	Baseline sample size of 1,155 patients and the post-intervention phase of 6,232	The intervention of operationalizing changes to the tele-ICU workflow. The pre intervention and post intervention changes in performance measures were compared. Reliability and validity of the study are addressed through the use of a discrete-event simulation model, which is validated by comparing the model outputs to empirically collected tele-ICU data. Tools use were software to create the simulation model and tele-ICU software.	No theoretical Framework identified	The study used a combination of empirical data collection and simulation modeling to evaluate the impact of operational changes on performance measures. IT added to previous studies regarding length of stay, mortality and cost but looking at level of authority of the tele-ICU, protocols for	The aim of the study is to develop an operational model that accurately reflects existing workflows and priorities in the tele-ICU, use simulation modeling to identify workflow changes that optimize operational efficiency,

					best practice adherence, timely use of performance data, leadership, perceived value, and the addition of a logistics center for optimizing ICU bed access and care standardization.	and validate the simulation model through correlation with actual performanc e measures linked to patient outcomes.
Goedken et. al., 2017. Introduction of tele-icu in rural hospitals: Changing organisational culture to harness benefits. *Intensive and Critical Care Nursing*, *40*, 51–56. https://doi.org/10.1016/j.iccn.2016.10.001	Level:III Grade: B	Purposive sample 24 rural staff members from three rural ICUs.	Implementation of a tele-ICU system in the Veterans Health Administration (VHA) to provide remote monitoring and consultation for rural ICUs. The study explores the perceptions and experiences of rural ICU staff regarding the Tele-ICU system. No specific comparison group or intervention for comparison. It focuses on understanding the staff perceptions of Tele-ICU before and after its implementation.	No theoretical framework was identified.	The study aims to contribute to the existing literature by exploring the perceptions of rural ICU staff regarding Tele-ICU.	Highlights the usefulness of Tele-ICU. Shows benefits and challenges of implementin g Tele-ICU
Hoonakker et. al., 2017. Virtual collaboration, satisfaction, and trust between nurses in the tele-	Level:II Grade: B	Purposive sample	The data analysis involved merging the tele-ICU nurses'	No theoretical foundation	Tele-ICUs and monitored ICUs should work to	The results highlight the importance

icu and icus: Results of a multilevel analysis. *Journal of Critical Care*, *37*, 224–229. https://doi.org/10.1016/j.jcrc.2016.10.018		110 tele-ICU nurses across 5 tele-ICUs. 84% response rate. With a goal of 140 nurses.	questionnaires with the questionnaires on tele-ICU characteristics and monitored ICU characteristics. The data were then analyzed using a 2-level hierarchical path model in Mplus. Communication variables (openness, accuracy, and timeliness) were included as mediators to assess their role in mediating the effects of organizational factors and nurse characteristics on trust and satisfaction.	. A model developed and tested by Shortell on t understanding the relationship between organizational factors, communication, and effective patient care	optimize communication so that trust can be established among the nurses.	of insuring relationships are built between nurses and optimized communication so that trust can be established
Mohammadi et. al., 2019. Clinical dashboard in the intensive care unit: Need-assessment and survey about attitudes and acceptance of tele-icu from the viewpoint of nurses and clinicians in the intensive care unit. *Tanaffos*, *18*(2), 142–151. https://pubmed.ncbi.nlm.nih.gov/32440302/	Level:III Grade:A	Voluntary response sample 138 care providers from three groups: nurses and respiratory therapists (98), anesthesiologists (20), and	Survey questionnaire as the primary research tool and included diverse clinical participants. The goal was to to evaluate the knowledge and awareness of care providers about telemedicine and Tele-ICU, (2) to assess the acceptability of a clinical dashboard in the ICU, and (3) to determine the need for future services provided by clinical dashboards. mixed-methods approach for	No theoretical foundation used.	The study evaluated the knowledge and awareness of care providers about Tele-ICU, assess the acceptability of the clinical dashboard in the ICU, and identify the future needs of care providers regarding clinical dashboards.	The study provides the organization with information to support decisions regarding training programs, resource allocation, and the customization of tele-ICU technologie

		anesthesiologist students (20). The sample size was determined through a census approach, where all care providers in the ICUs were invited to participate.	data analysis. The quantitative analysis involved evaluating the percentage of participants based on their characteristics, such as age, gender, work experience, and knowledge about telemedicine, Tele-ICU, and clinical dashboards. The Likert scale responses were categorized into negative/no response, abstentions, and positive, and the differences among the responses were tested using the chi-square test. The qualitative analysis involved extracting and categorizing participants' speeches and comments based on their groups and identifying common topics and areas of comments.			s based on provider preference. It also support the evidence of impact teleICU makes on quality of care.
Rocha de Macedo et. al., 2021. Implementation of tele-icu during the covid-19 pandemic. *Jornal Brasileiro de Pneumologia*, e20200545. https://doi.org/10.36416/1806-3756/e20200545	Level:III Grade:A	Convenience Sampling .454 patients at a total of 20	intervention in this study is the implementation of a Tele-ICU program. There is no mention of a comparison group. However this is only for patients admitted with	No theoretical foundation	Data was collected on outcomes, including age, gender, comorbidities, ICU therapies,	Findings support the use of Tele-ICU for COVID-19 patients and

		hospital across 2 phases over 4 months.	COVID-19. REDCap was used to create a form to collect data. statistical analysis methods used, such as the Shapiro-Wilk test to assess the distribution of continuous variables. It mentions that nonparametric variables were expressed as median and IQR, and categorical variables were expressed as absolute and relative frequency. The R software was used for the analysis		length of ICU stay, LPV settings, duration of LPV, length of hospital stay, ICU mortality, and overall in-hospital mortality	protocols/decision making to treat these patients during a pandemic.
Watanabe et. al., 2023. An evaluation of the impact of the implementation of the tele-icu: A retrospective observational study. *Journal of Intensive Care*, *11*(1). https://doi.org/10.1186/s40560-023-00657-4	Level:III Grade:B	Pre-intervention 893 patients and 2,896 patients post-intervention.	The intervention is the implementation of the Tele-ICU system. The comparison is made between the pre-implementation and post-implementation periods. The study includes pre/post comparisons and interrupted time series analysis. Statistical tests such as t-tests, Mann-Whitney U tests, and chi-squared or Fisher's exact tests are used for data comparison.	No Theoretical Foundation	The study assesses various outcomes, including ICU and hospital mortality, length of stay (LOS), intubations, duration of mechanical ventilation (DOV), and predicted mortality	The results support the impact of the Tele-ICU system on ICU performance and physician workload. Also show the impact of decreased EMR tasks for physicians.
Williams et. al., 2020a. Tele-icus for covid-19: A look at national	Level:III Grade:B	4,288 US short-	The intervention in this study is the provision of	No theoretical	Outcome of the prevalence of	Shares insights on

prevalence and characteristics of hospitals providing teleintensive care. *The Journal of Rural Health*, *37*(1), 133–141. https://doi.org/10.1111/jrh.12524		term, acute care hospitals that responded to the 2018 AHAAS	tele-ICU by hospitals. The comparison is between hospitals that reported providing tele-ICUs and those that did not. Data was reported to AHAAS, HCRIS, HSAF, and AHRF.	foundation found	tele-ICU provision among US hospitals, weighted by the total outpatient visits in a hospital referral region (HRR).	national distributions of tele-ICU distributions and usefulness of tele-ICU

Legend:

Appendix B

Summary of Systematic Reviews (SR)

Citation	**Quality Grade**	**Question**	**Search Strategy**	**Inclusion/ Exclusion Criteria**	**Data Extraction and Analysis**	**Key Findings**	**Usefulness/Recommendation/ Implications**
Hassan, 2018. Tele-icu and patient safety considerations. *Critical Care Nursing Quarterly*, *41*(1), 47–59. https://doi.org/10.1097/cnq.0000000000000185	Level: V Grade: C	What are the differences tele-ICU models, including decentralized and centralized models, highlighting their characteristics, advantages, and disadvantages?	Not explained	Not mentioned	This article provided a review and synthesis of existing literature on tele-ICU models and their impact on patient outcomes. It presents findings from various studies and includes a subgroup analysis of ICU mortality based on the type of tele-ICU system. synthesizes the literature	With improved compliance with best practice guidelines, identification and intervention in acute physiological instability, and overall improvement in critical care delivery. The results support these outcomes, signifying the potential benefits of tele-ICU models in terms of reduced ICU mortality, length of stay, and improved patient safety.	The results are useful for health systems and clinicians in understanding the potential impact of telemedicine technology in critical care

Citation	Quality Grade	Question	Search Strategy	Inclusion/ Exclusion Criteria	Data Extraction and Analysis	Key Findings	Usefulness/Recommendation/ Implications
					on tele-ICU models, comparing decentralized and centralized models. It discusses the advantages and disadvantages of each model, citing relevant studies to support the information presented.		
Michael et. al., 2022. Tele-icu in the unites states: Is a cost-effective model? *International Journal of Healthcare Management*, *15*(4), 306–313.	Level: V Grade: A	Is tele-ICU a cost effective model?	PubMed, EBSCOhost, Google Scholar, Google Search, ProQuest, and JSTOR. The most cited telehealth	The included articles needed to examine healthcare services using	The articles were divided into categories such as original research, review articles, news articles,	They found that the capital investment for tele-ICUs is relatively high for the initial setup, but the return on investment (ROI)	The findings suggest that tele-ICU can yield cost savings, improve patient outcomes, and enhance the quality of care. This is important when

https://doi.org/10.1080/20479700.2022.2040877			journals were searched: Journal of Telemedicine and Telecare, Telemedicine Journal and e-Health, Telemedicine and e-Health, and Telemedicine Journal and professional journals as Critical care Medicine, Chest and others medical journals. Relevant keywords 'telehealth' OR 'telemedicine' OR or 'telecare' OR 'ehealth' OR 'tele-ICU' AND 'length of stay' OR 'LOS' OR 'mortality rates' OR 'financial impact' OR 'cost' OR 'cost savings' OR 'reimbursement' AND 'Hospitals'	information communication technology for tele-ICU, report or describe the evaluation of pilot studies or implementation of tele-ICU services, and be related to the financial management of tele-ICU. The literature search was limited to articles published between 2004 and 2022. The screening process	and books. The articles included in original research were further categorized based on the type of research design used. The researchers conducted a full-text review of the selected articles to extract relevant data and information for analysis.	has been reported to range from 3:1 to 6:1. Tele-ICU has been associated with reduced mortality rates, shorter length of stay, cost savings, improved patient safety and care quality, and decreased ventilator days. The study also reports specific findings from various research studies, indicating the positive impact of tele-ICU implementation on outcomes such as mortality rates, transfer rates, and purchase care costs.	organizations are considering the adoption and implementation of tele-ICU programs, upfront cost will be high but ROI suggest its cost effectiveness in LOS, Mortality, quality, and cost savings.

			AND 'USA' were used to search for peer-reviewed literature	involved independent review and validation by multiple reviewers to ensure agreement on inclusion criteria.			
Vijayaraghavan, B. 2020. Breaking barriers to reach farther: A call for urgent action on tele-icu services. *Indian Journal of Critical Care Medicine*, *24*(6), 393–397. https://doi.org/10.5005/jp-journals-10071-23447	Level: V Grade: C	What is the impact of tele-ICU services on mortality, ICU LOS, compliance with best practices, and timeliness of interventions?	The search strategy was not clearly explained settings	Included studies on different tele-ICU models, patient outcomes, and the implementation of tele-ICU in different healthcare settings. No explanation on the exclusion criteria.	The study discusses the findings of other studies and systematic reviews, sharing pertinent results related to mortality, ICU length of stay, adherence to best practices, and other patient-centered outcomes. The article also acknowledges the limitations	The benefits of tele-ICU are inconsistent among the studies reviewed due to variations in study designs, tele-ICU models, and the heterogeneity of support provided on the ground.	Several studies and systematic reviews identify benefits of tele-ICU in terms of improved adherence to best practices and reduced ICU mortality and length of stay

					of the evidence and the need for more robust studies to definitively answer the question		

Legend:

Appendix C

Strengths, Weakness, Opportunities, and Threats Analysis

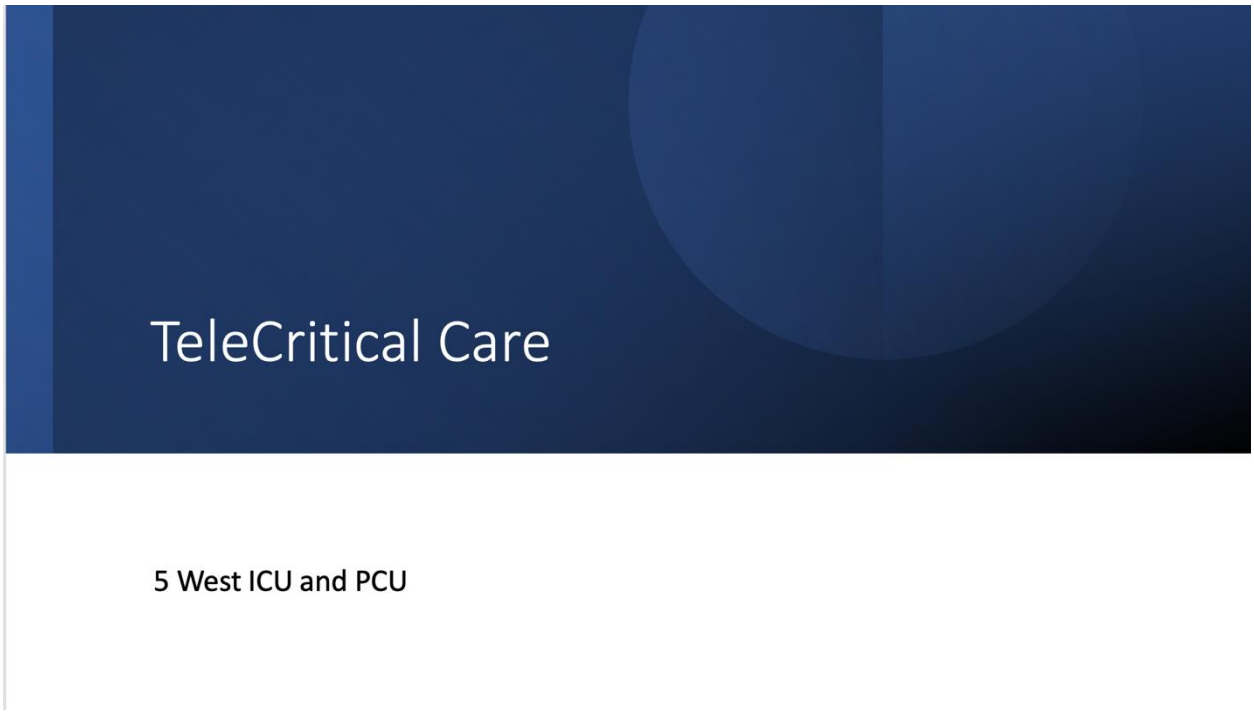
Internal Forces (Project, Nursing)	External Forces (Organization)
Strengths (Internal) • Infrastructure (technology) already in place to support implementation for nursing • National leadership support • Local leadership support • Enhance patient care • Increased access to specialized care • Streamlines processes and protocols • Improve efficiency if care	**Opportunities (External)** • Support from other sites using TeleCritical Care • Decrease hospital length of stay • Decrease mortality rates • Improved collaboration
Weaknesses (Internal) • Absence of standardized process • Lack of training and comfort from the nursing staff • Resistance to change • Technical Challenges	**Threats (External)** • Nursing turnover • Medical team resistance

Appendix D

Project Timeline

	NUR7801-Practicum 1															NUR7802- Practicum 2															NUR7803- Practicum 3														
Activity	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15
Meet with preceptor																																													
Prepare project proposal																																													
EPRC and IRB approval preparation and submission																																													
Create buy-in & awareness																																													
Create training materials																																													
Edit SOP to include nursing, approval																																													
Pre-implementation data collection																																													
Project schedule shared with stakeholders																																													
Education and training for nursing staff																																													
Begin implementation and celebrate beginning of project																																													
Chart audit with feedback																																													
Data collection																																													
Evaluation																																													
Project completion																																													

Appendix E


TeleCritical Care
5 West ICU and PCU


Objectives
TeleCritical Care Mission & Vision
National VA Program
What is TeleCritical Care?
How can TeleCritical Care help the bedside nurse?
TeleCritical Care Process (equipment and team)
FAQ

TeleCritical Care Mission & Vision

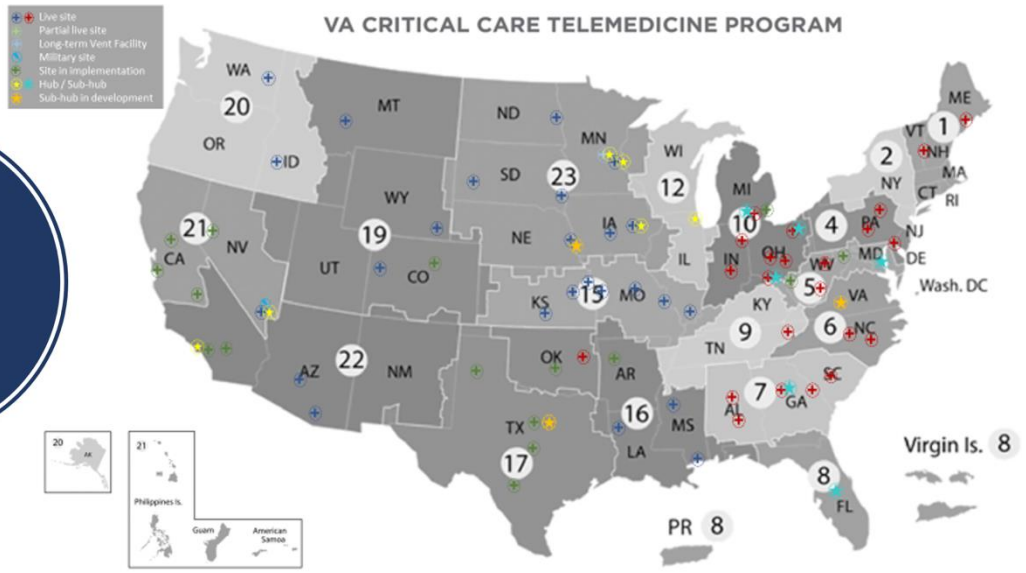
Mission

- Ensure consistent, timely access to state-of-the-art intensive care for all acutely ill Veterans whenever and wherever critical care services are required.

Vision

- To be a patient-centered, multidisciplinary team that combines technology and state of the art critical care with a compassionate and caring approach while working seamlessly with the Veteran's direct care clinical staff to provide the highest quality critical care, research, and education.

National VA Program

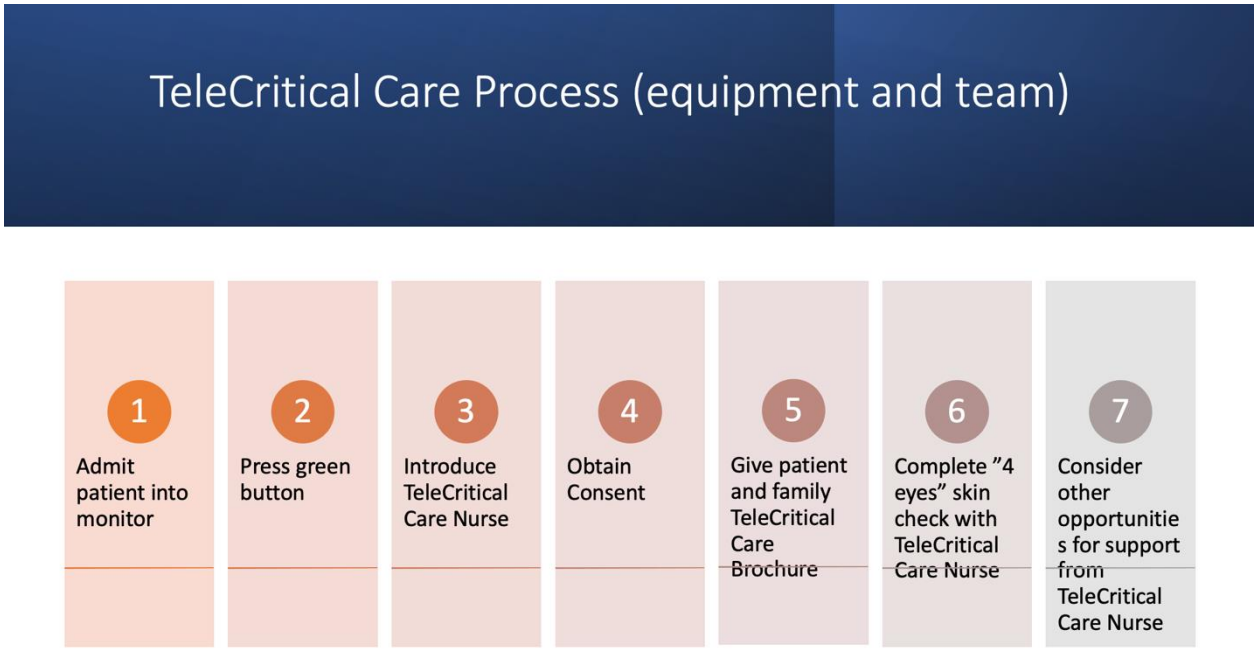


What is TeleCritical Care

- Concurrent videoconferencing, electronic health record integration, and continuous remote monitoring of enrolled patients' vital signs and medical information. It uses real-time electronic communications between healthcare facilities. This allows for the simultaneous monitoring of a patient's health status and the implementation of collaborative care support when needed.
- The TeleCritical Care center and staff are linked to ICU rooms through non-recording cameras, video display, microphone, and speakers that allows collaborative patient assessment and discussions with the bedside staff.
- The TeleCritical Care team is a virtual partner who monitors patients and provides an added layer of support to the clinical bedside staff in the care of patients
- Monitoring hubs are equipped with state-of-the-art computer monitors which utilize specialized software to display patient charts and real-time vital signs and waveforms located in Minneapolis, MN, Cincinnati, OH, and West Los Angeles, CA.

How can TeleCritical Care help the bedside nurse

- Nursing consult: assess patient with bedside RN, talk through gtt titrations, look up gtt compatibilities.
- TeleCritical Care Nurse can access CPRS charting and can review meds, labs or orders as a resource
- Help visually monitor pts for short periods of time if RN needs to step away.
- Help with time keeping and note taking during Code Blue or other emergent situations
- Mentor new critical care RNs with critical care processes and protocols
- Assist with proning: help adhere to best practice while implementing procedures, watching lines or follow proning checklist
- Can be a second RN when doing treatments like skin checks on admission (4 Eyes)
- Can monitor trends in VS to identify early signs of decompensation



FAQ

- Do we have to use this for every patient?
  - Ideally yes.
- What if the patient doesn't consent to TeleCritical Care?
  - Just document in your note that they do not consent and use non-telemedicine critical care processes.
- Are the TeleCritical Care nurses on site?
  - Sometimes, we have a hub at our facility but they rotate who is covering between all three hub locations.
- Are the nurse experienced critical care nurses?
  - Yes, they have a minimum of 5 years in critical care.
- What if MICU does not want us to use TeleCritical Care?
  - Let them know the value nursing receives from the TeleCritical Care nurses and that nursing using it will not affect their medical residents learning opportunities.
- Can I use the nurses to be the second RN when giving blood?
  - No that procedure requires a second RN in person.
- What if I do not have time to chart, can the TeleCritical Care nurse chart for me?
  - The TeleCritical Care nurse does not replace the bedside nurses charting throughout your shift, but they can document in emergencies for you as you are doing them, you will then need to document the rest of your assessment etc.

Appendix F

Data Collection Form

Pre-Implementation Data		
Patient	LOS	TeleCritical Care Note
Pt 1	5	Y
Pt 2	21	y
Pt 3	13	n
Pt 4	0	n
Pt 5	1	y
Pt 6	1	y
Pt 7	1	y
Pt 8	3	y
Pt 9	3	n
Pt 10	0	n
Pt 11	1	y
Pt 12	3	y
Pt 13	7	n
Pt 14	4	n
Pt 15	3	y
Pt 16	1	n
Pt 17	4	n
Pt 18	1	y
Pt 19	5	y
Pt 20	6	n
Pt 21	13	y
Pt 22	10	y
Pt 23	1	y
Pt 24	1	y
Pt 25	8	y
Pt 26	1	y
Pt 27	1	n
Pt 28	2	y
Pt 29	4	n
Pt 30	3	y
Pt 31	15	y
Pt 32	1	y
Pt 33	3	y

Pt 34	5	y
Pt 35	2	y
Pt 36	1	n
Pt 37	3	y
Pt 38	33	n
Pt 39	0	y
Pt 40	0	n
Pt 41	3	n
Pt 42	1	n
Pt 43	1	y
Pt 44	20	n
Pt 45	1	n
Pt 46	3	y
Pt 47	1	y
Pt 48	5	y
Pt 49	3	n
Pt 50	4	y
Pt 51	11	n
Pt 52	2	y
Pt 53	3	n
Pt 54	5	n
Pt 55	9	y
Pt 56	3	n
Pt 57	1	y
Pt 58	7	y
Pt 59	7	n
Pt 60	1	y
Pt 61	1	n
Pt 62	1	y
Pt 63	5	n
Pt 64	1	y
Pt 65	1	n
Pt 66	3	n
Pt 67	1	n
Pt 68	0	y
Pt 69	5	n
Pt 70	2	y
Pt 71	1	n
Pt 72	3	y

Pt 73	4	n
Pt 74	2	y
Pt 75	3	y
Pt 76	4	n
Pt 77	7	y
Pt 78	2	n
Pt 79	0	n
Pt 80	4	y
Pt 81	0	y
Pt 82	7	y
Pt 83	1	y
Pt 84	24	n
Pt 85	3	n
Pt 86	0	n
Pt 87	1	y
Pt 88	4	n
Pt 89	1	y
Pt 90	3	y
Pt 91	4	y
Pt 92	7	n
Pt 93	2	y
Pt 94	1	y
Pt 95	3	y
Pt 96	4	y
Pt 97	4	y
Pt 98	5	n
Pt 99	4	y
Pt 100	1	n
Pt 101	1	y
Pt 102	5	n
Pt 103	3	n
Pt 104	5	n
Pt 105	0	n
Pt 106	5	n
Pt 107	6	n
Pt 108	2	y
Pt 109	1	y
Pt 110	1	y
Pt 111	7	n

Pt 112	1	y
Pt 113	8	n
Pt 114	4	n
Pt 115	1	n
Pt 116	4	n
Pt 117	2	y
Pt 118	1	y
Pt 119	1	y
Pt 120	0	n
Pt 121	8	n
Pt 122	2	y
Pt 123	3	y
Pt 124	3	y
Pt 125	7	n
Pt 126	2	n
Pt 127	1	n
Pt 128	4	y
Pt 129	4	n
Pt 130	0	n
Pt 131	2	n
Pt 132	2	y
Pt 133	4	n
Pt 134	4	n
Pt 135	1	n
Pt 136	3	y
Pt 137	3	y
Pt 138	0	n
Pt 139	2	y
Pt 140	0	n
Pt 141	1	y
Pt 142	3	n
Pt 143	3	n
Pt 144	1	n
Pt 145	0	n
Pt 146	4	n
Pt 147	4	n

Post-Implementation Data		
Patient	LOS	TeleCritical Care
Pt1	1	Y
Pt2	1	Y
Pt3	4	y
Pt4	2	y
Pt5	2	N
Pt6	1	Y
Pt7	1	Y
Pt8	5	N
Pt9	0	Y
Pt10	2	Y
Pt11	8	Y
Pt12	1	Y
Pt13	1	Y
Pt14	2	Y
Pt15	6	Y
Pt16	6	Y
Pt17	1	Y
Pt18	9	Y
Pt19	1	Y
Pt20	4	y
Pt21	4	N
Pt22	2	Y
Pt23	2	Y
Pt24	6	N
Pt25	1	N
Pt26	0	Y
Pt27	0	Y
Pt28	2	N
Pt29	4	Y
Pt30	1	Y
Pt31	2	Y
Pt32	2	Y
Pt33	6	Y
Pt34	2	Y
Pt35	1	Y
Pt36	8	Y
Pt37	7	Y
Pt38	3	Y
Pt39	0	Y
Pt40	4	Y
Pt41	5	Y

Pt42	4	N
Pt43	4	Y
Pt44	3	Y
Pt45	4	Y
Pt46	0	Y
Pt47	11	N
Pt48	2	N
Pt49	4	N
Pt50	2	N
Pt51	7	Y
Pt52	7	Y
Pt53	15	Y
Pt54	1	Y
Pt55	4	Y
Pt56	0	Y
Pt57	6	Y
Pt58	10	N
Pt59	4	N
Pt60	23	N
Pt61	3	N
Pt62	1	N
Pt63	43	N
Pt64	1	Y
Pt65	7	Y
Pt66	2	Y
Pt67	5	Y
Pt68	2	Y
Pt69	1	Y
Pt70	1	Y
Pt71	5	Y
Pt72	1	Y
Pt73	1	Y
Pt74	6	N
Pt75	4	Y
Pt76	13	Y
Pt77	3	Y
Pt78	10	N
Pt79	1	Y
Pt80	0	Y
Pt81	2	Y
Pt82	11	Y
Pt83	3	Y
Pt84	3	Y
Pt85	1	Y

Pt86	4	N
Pt87	4	N
Pt88	2	Y
Pt89	2	N
Pt90	45	Y
Pt91	43	N
Pt92	4	Y
Pt93	9	Y
Pt94	2	N

Appendix F

Table 4

Frequency Table for Nominal Variables- Pre-implementation

Variable	*n*	*%*
TeleCritical_Care_Note_Completed		
Y	75	50.68
n	72	48.65
Missing	1	0.68

Note. Due to rounding errors, percentages may not equal 100%.

Table 5

Summary Statistics Table for Interval and Ratio Variables

Variable	*M*	*SD*	*n*	*SEM*	Min	Max	Skewness	Kurtosis
LOS	3.84	4.62	136	0.40	0.00	33.00	3.38	14.70

Note. '-' indicates the statistic is undefined due to constant data or an insufficient sample size.

Table 6

Frequency Table for Nominal Variables- Post-implementation

Variable	*n*	*%*
TeleCritical_Care_note		
Y	70	74.47
N	24	25.53
Missing	0	0.00

Note

Table 7

Summary Statistics Table for Interval and Ratio Variables

Variable	*M*	*SD*	*n*	*SEM*	Min	Max	Skewness	Kurtosis
LOS	5.17	7.95	93	0.82	0.00	45.00	3.84	15.55

Note. '-' indicates the statistic is undefined due to constant data or an insufficient sample siz

Figure 2

The mean of LOS by levels of Time with 95.00% CI Error Bar

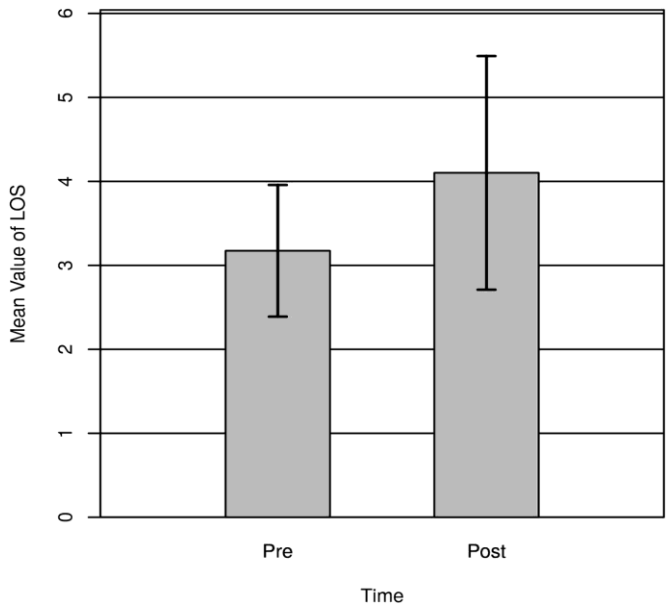
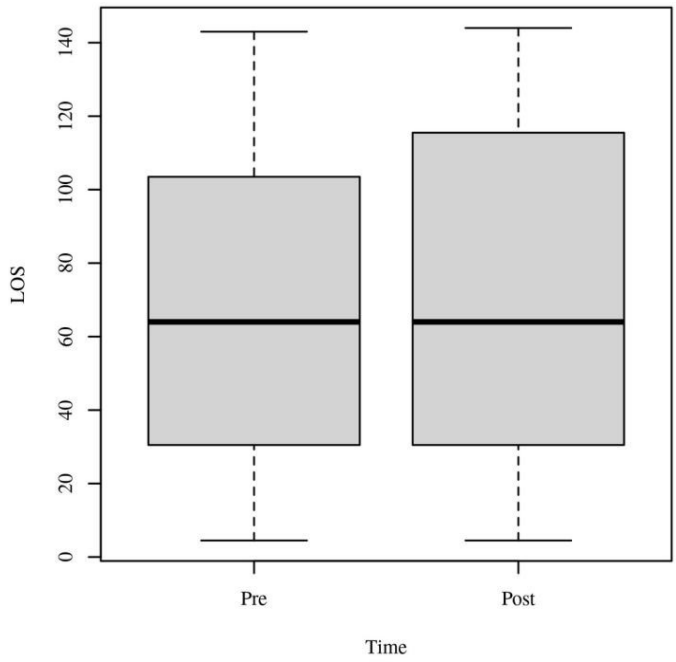


Figure 3

Ranks of LOS by Time



Appendix G

Measure	Variable
Outcome	Decrease in Length of Stay
	Improvement in patient outcomes
	Reduction in mortality rates
	Improved patient satisfaction
	Improved communication and collaboration
	Improved quality of care
Process	Adherence to admission protocol with TeleCritical care included
	Integration of TeleCritical Care in routine care delivery
	Availability of TeleCritical Care resources and support
	Utilization of TeleCritical Care for skin checks
Balancing	Incidence of technology-related failures
	Patient/family non-consent and participation
Financial	Cost savings from reduced Length of Stay
	Reduce need for increasing acuity for specialized care
	Maintenance costs of TeleCritical Care staffing
	Maintenance costs of TeleCritical Care equipment
Sustainability	Integration of TeleCritical Care in critical care standards of practice
	Ongoing support from VACO for funding allocation
	Training for TeleCritical Care in Nursing Service Orientation
	Stakeholder engagement for long-term support of TeleCritical Care

Appendix H

Admission Checklist

Yes	No	Observation
		Admit the patient to the bedside monitor
		Contact the TeleCritical Care Nurse by pressing the Green button on the wall of the patient's room to alert them of a new critical care admission
		Introduce the TeleCritical Care nurse to the patient and/or family
		With the TeleCritical Care nurse, explain what TeleCritical Care is and how it supports critical care nursing practice
		Give the patient and/or family the TeleCritical Care brochure
		Allow the TeleCritical Care nurse to obtain consent and initiate the program
		Verify that patient information is correct and accessible by the TeleCritical Care nurse
		Complete "4 eyes" skin check with the TeleCritical Care nurse to verify admission skin status or stage existing wounds
		Consider other opportunities for support with patient care processes or protocols from the TeleCritical Care nurse (Cardiothoracic pathway, medication verification, drip calculations, vital signs trending)
		Verify that the TeleCritical Care note was completed in CPRS – Documented Consent Obtained – Patient/Family educated (brochure given) – Documented interventions completed with the bedside nurse – Vital Signs documented