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Just-in-Time Education for Intensive Care Nurses

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Just-in-Time Education for Intensive Care Nurses

Abstract

Background: Continuing education is fundamentally necessary to ensure ongoing competency of nurses in the Intensive Care Unit (ICU). There are many effective methods of continuing education, but there is a gap in continuing education for ICU nurses for high-risk low-frequency therapies (HRLFT).

Objectives: The purpose of this project was to determine if the implementation of Just-in-Time Education (JITE) for HRLFT in the Pediatric Intensive Care Unit (PICU) improved nurses' feelings of competence, comfort, and safety when utilizing these interventions.

Methods: JITE checklists for nurses were developed for HRLFT in the PICU. The checklists were reviewed by the staff nurse and charge nurse when a nurse was assigned to a patient with a HRLFT. All nurses in the PICU received an email explaining the project and a pre-survey regarding their feelings of competence and comfort in regards to HRLFT before implementation of JITE checklists. Three months later the nurses received a post-survey addressing the same questions and questions regarding the effectiveness of JITE.

Results: Compared with baseline results, the post intervention survey showed nurses felt more comfortable and competent caring for patients receiving HRLFT. Nurses reported being more comfortable asking for education reinforcement and valued the one-on-one review time with the charge nurse. Eighty five percent of the nurses felt JITE should be continued and 15 percent were neutral.

Conclusions: The results of this study show that utilization of JITE provides a cost and time efficient method to ensure minimal competence for HRLFT in the ICU.

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Just-in-Time Education for Intensive Care Nurses

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Master's in Advanced Practice Nursing

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Conclusions: The results of this study show that utilization of JITE provides a cost and time efficient method to ensure minimal competence for HRLFT in the ICU.

Introduction

Nurses that work in the intensive care unit (ICU) care for many patients with complex medical issues that require high-tech interventions. Continuing education is very important to ensure that ICU nurses are able to provide safe, competent care for all patients. There are many effective methods of continuing education, including simulation, online modules, lectures, and demonstrations. However, there is a gap in continuing education for ICU nurses for high-risk, low-frequency interventions. The implementation of just in time education tools will help fill this gap and ensure that nurses can provide competent care for their patients and empower them as nurses.

Background

Nurses who work in ICUs care for very ill patients with diverse types of diagnoses and high care needs. In the ICU, nurses work in interdisciplinary teams in high-technology hospitals caring for seriously ill patients with rapidly changing conditions (Ballangrud, Hall-Lord, Persenius, & Hedelin, 2014). Nursing school provides nurses with the basic information and skills they need to perform patient care, but with the growing complexity of patients and technology, they may not be prepared to work in the ICU. Due to this lack of knowledge related to ICU level skills, most ICUs have extensive orientation processes with the goal of producing a clinically competent nurse (Cavanaugh & Huse, 2004). However, after the orientation process is complete, nurses do not know everything they need to know to remain a competent ICU nurse. Therefore, continuing education is fundamentally necessary to ensure that they learn and maintain the specialized skills required to work in their clinical area (Tobin, 2007).

There are no clear-cut guidelines regarding how to provide continuing education to nurses. Many institutions use online-based education systems to provide many nurses with

mandatory on-going education. Lecture and skills seminars are also utilized in both school and hospital-based nursing education. With increasing utilization of technology, simulations have become an expanding avenue for hands on education and debriefing that allows nurses and other health care providers to practice many scenarios without risk to any patients (Cato & Murray, 2010).

With the wide array of different teaching methods, it is important to evaluate the effectiveness of each method to determine what methods are best for providing continuing education to ICU nurses. Of interest is the continuing education and ongoing competency evaluation of ICU nurses on high-risk, low-frequency therapies (HRLFT). These include the following interventions extracorporeal membrane oxygenation (ECMO), continuous renal replacement therapy (CRRT), high frequency oscillatory ventilation (HFOV), and others. Children's Hospital of Philadelphia recently developed Just-In-Time Training for HRLFT (Helman, Lisanti, Adama, & Davis, 2016). In their study, they developed training sheets that charge nurses used to evaluate nurses caring for patients with HRLFT, specifically Berlin Heart and CRRT, at the start of their shift to ensure competence and provide peer feedback in the moment. They found that one year after implementation of the checklists, safety events related to the Berlin Heart decreased by 65% and CRRT decreased 78% (Helman et al., 2016). This decrease in safety events demonstrates how these checklists with peer feedback are beneficial for nursing competence in providing safe care for patients receiving HRLFT. They also received positive responses in feelings of increased comfort and safety when caring for patients undergoing these HRLFT when surveying nurses after one year of implementation (Helman et al., 2016). Based on these findings, the implementation of this type of checklist and peer education may be beneficial in other hospitals and with other modalities of HRLFT.

The purpose of this project was to determine if the implementation of JITE for HRLFT in the PICU improved nursing perceptions of competence, comfort, and safety when caring for patients on these interventions. For the purpose of this study, the HRLFT that were utilized were ECMO, CRRT, and HFOV.

Conceptual Framework

Research shows that continuing education not only prepares nurses to perform better in their roles, but increases their feeling of empowerment, staff retention, and job satisfaction (Cooper, 2009). The idea of empowerment comes from Kanter's Theory of Structural Empowerment, which is often applied to nursing and the hospital systems (Lachinger, 1996). Kanter's theory states that staff feel empowered when their job provides them access to resources, support, supplies, opportunities to learn, relevant job activities, and opportunities for advancement. When staff are empowered they have increased motivation, are achievement oriented, have increased feelings of autonomy, increased job satisfaction, and retention (Lachinger, 1996). Based on this theory, providing quality continuing education to nurses in the ICU will empower them to provide quality care and improve retention rates. This was applied in this study by providing an educational resource tool for nurses to allow them to build on their knowledge and feel empowered to care for more complex patients.

Methods

Sample

This project was conducted in a 12 bed PICU in a children's hospital within a large university medical center. All nurses were bachelor's prepared, except 2 that have associates degrees, with a range of 1 year to 20 years of bedside nursing experience, with 78% working full time. The unit demographics were primarily Caucasian, female nurses. This sample is

representative of the hospital demographics. Nurses still on orientation were excluded from the sample.

Program Design

In this study, JITE checklists for nurses were developed for HRLFT in the PICU to ensure the nurses' competence in caring for a patient undergoing one of these interventions and identify any gaps in knowledge. For the purpose of this study, the HRLFT that were utilized were ECMO, CRRT, and HFOV. The JITE checklists were developed in collaboration with the PICU nurse manager, PICU nurse educator, and PICU assistant nurse managers. The sheets were modeled after a Just-in-Time Training provided to the researcher by the Clinical Nurse Specialist (CNS) at The Children's Hospital of Philadelphia (Helman et al., 2016). The checklists were designed to be reviewed by the staff nurse with the charge nurse or nurse leader when a nurse was assigned to a patient that had one or more HRLFT (Figure 1.). They reviewed the information together prior to starting their shift or the day prior to ensure they remembered the need to know information for caring for a patient with this intervention. This included important information to understand what the intervention was for, key concepts, nursing considerations, and troubleshooting. All charge nurses were given information on the project at a charge nurse meeting prior to implementation to gain their insight and answer any preliminary questions. Additional resources to increase understanding were kept in small folders with more in-depth training information that enhanced the learners understanding of the information and was used for initial training. JITE is designed to be low-cost and not require a large amount of time to ensure nurses are minimally competent on these more complicated and risky interventions seen in the PICU.

Implementation

Following the completion of the initial survey, an email was sent out to all nursing staff regarding how to utilize the checklists, with the three checklists attached for staff review. All the charge nurses in the PICU then received one-on-one training regarding how to use the JITE and reviewed the checklists with the researcher. All nurses were followed up via email and in person at least weekly to ensure that they were utilizing the training tools and answering any follow-up questions. During the initial two weeks of implementation, the JITE checklists were discussed in the unit's twice daily huddles and questions were answered by the primary researcher and nursing leadership as needed.

Once JITE was implemented, the checklists were reviewed at the start of the shift with the bedside nurse and charge nurse on their first time caring for the patient receiving the intervention. During the checklist review, the charge nurse provided additional information as needed to ensure the nurse was competent to care for the patient with an HRLFT. The nurse was then deemed competent to care for that intervention on that patient for the rest of their stay. A new checklist was completed for each new intervention and new patient receiving a previously checked off intervention. All blank checklists and completed checklist for the study period were stored in a binder with the charge nurse resources. The goal was for all nurses to know the answers to every checklist without being prompted and to track the questions that required educational feedback to improve initial training on HRLFT.

Surveys and Analysis

In October 2016, all of the nurses in the PICU received an email explaining the project and stating participation in the survey was voluntary. If they agreed to participate, then they filled out a pre-assessment survey regarding their competence, comfort, and safety regarding

HRLFT. No identifying data was collected, only years of nursing experience. Participants were informed that there were no benefits or penalties in their choices to participate or not participate and only aggregate information would be shared with their employer. This project had minimal risk, because participation may have raised questions of doubt related to the nurses' current level of competence or ability to provide safe patient care. If the nurses chose to fill out the surveys, consent was implied.

In January 2017, all nurses in the PICU received a follow-up email including the post-survey addressing the same questions as the pre-survey in addition to questions regarding how JITE was working. The answers to the two surveys were then compared to determine if there were any changes in nurses' feelings of competency, comfort, and safety related to caring for patients on HRLFT.

Results

During the study period from late October 2016 to January 2017, there were two patients who received ECMO, one who received CRRT, and zero received HFOV. When there were no patients with these interventions the checklists were discussed with the staff nurses at bedside to address questions about the new process. Approximately 70% (n = 29) of the bedside nurses responded to the pre-survey and approximately 50% (n = 20) responded to the post-survey. The years of experience of the nurses that responded to the pre-survey and post-survey were similar, with zero less than 1 year in both, 31% and 20% at 1 to 3 years, 41.4% and 35% at 4 to 7 years, 17.2% and 25% at 8 to 10 years, 0% and 5% at 11 to 13 years, 0% at 14 to 16 years for both, and 10.3% and 15% for greater than 16 years.

Nursing comfort

Nurses in the PICU reported increased comfort levels in caring for patients receiving

HRLFT following the implementation of JITE (Table 1.).

Table 1.		
<i>Comfort Caring for Patients with HRLFT</i>		
	Pre- Survey	Post-Survey
Not at all comfortable	6.9%	0%
Slightly comfortable	3.5%	0%
Somewhat comfortable	17.2%	10%
Moderately comfortable	55.2%	50%
Extremely comfortable	17.2%	40%

Competence in performing safe care

Nurses in the PICU reported increased feelings of competence in providing safe care for patients receiving HRLFT following the implementation of JITE (Table 2.).

Table 2.		
<i>Competence to Perform Safe Care for Patients receiving HRLFT</i>		
	Pre- Survey	Post-Survey
Not at all competent	6.9%	0%
Slightly competent	3.5%	0%
Somewhat competent	10.3%	0%
Moderately competent	58.6%	63.2%
Extremely competent	20.7%	36.8%
Not at all competent	6.9%	0%

Comfort asking for education or reinforcement

Nurses in the PICU reported increased comfort levels in asking for education or reinforcement regarding HRLFT when caring for patients receiving HRLFT following the implementation of JITE (Table 3.).

Table 3.

<i>Comfort Asking for Education or Reinforcement of HRLFT</i>		
	Pre- Survey	Post-Survey
Not at all comfortable	0%	0%
Slightly comfortable	6.9%	0%
Somewhat comfortable	10.3%	0%
Moderately comfortable	17.3%	10.5%
Extremely comfortable	65.5%	89.5%

Nurses evaluation of JITE

In response to question 5 of the post-survey regarding one-on-one time with the charge nurse reviewing the JITE improved their care, 80% of the nurses agreed or strongly agreed and 20% were neutral. In response to question 6 of the post-survey regarding improvement in nursing care since implementation of JITE, 65% of nurses agreed or strongly agreed, and 35% were neutral. In response to the final question, do you feel JITE should be continued, 85% of nurses responded yes, and 15% were neutral.

Discussion

The results showed an overall increase in nurses' feelings of comfort, competency, and safety caring for patients receiving HRLFT after the implementation of JITE. The nurses post-survey responses regarding the additional support and educational resource of the JITE showed that they felt there was value in JITE. Overall, JITE seems to be a more effective way to ensure ongoing nursing competency on HRLFT than relying on biannual skills days and online education. Providing this type of on-going review with immediate feedback ensured nurses provided more competent care and empowered them as nurses. This was supported by Kanter's Theory of Structural Empowerment that states increasing access to resources and support should increase job satisfaction and retention (Lachinger, 1996). These findings, in combination with the decrease in safety events which can be found in a similar study by Helman et al. (2016),

showed that JITE has positive effects on the care of patients receiving HRLFT.

Nursing staff in the PICU provided comments in the post-survey that showed they found the JITE useful. Multiple nurses commented the JITE “was a very helpful review before taking care of a complex patient/piece of equipment.” They also liked that it was “quick and accessible.” There were suggestions to add JITE sheets for other interventions, such as external ventricular drains (EVD). Since this was a new practice started with just three interventions, it is important to incorporate this feedback and expand the JITE to EVDs next. The unit will continue to expand the JITE to more interventions as requested by staff or with an obvious need.

As expected, there were multiple challenges as with any change in practice. The most prevalent challenge was the timing of the checklist review. There were two main shift changes on this unit where both the bedside nurses and charge nurses were giving report to one another. With both reports often ending at different times it was difficult to incorporate the JITE checklists into the normal work flow. There has been discussion about having the checklists incorporated into the bedside nurse-to-nurse handoff with the charge nurse checking in to ensure it was done and answer any additional questions. Alternatively, the role of reviewing the JITE could be done by the unit CNS who would be one of the best people to provide feedback; however, they are often not present on all shifts. The unit will continue to work on finding the best way to implement the JITE into their daily workflow.

An additional challenge came with the approach of the JITE and nurses feeling like they were being quizzed. There were a few comments regarding the approach used when going over the JITE: “I think the approach to ascertaining the knowledge is just as important as the education itself when dealing with experienced RNs,” and “as long as the charge nurse approaches the checklist as a conversation rather than a quiz, I think it can be quite beneficial for

staff and patients.” This was addressed by the researcher throughout the study, stating that the JITE was a review and a discussion, not the charge nurse testing the bedside nurse. This can be a sensitive matter as some of the charge nurses were reviewing the JITE with another charge nurse or a nurse more senior than themselves, which has the potential to make both parties uncomfortable if not done in a non-judgmental manner. Also, there were some nurses that both worked in the PICU and as nurse ECMO perfusionists who were more competent in ECMO than other nurses who did not have this role. So, it was decided if they were caring for these patients as the bedside nurse, they would not need to review the checklist, but would be asked if they had any questions or concerns at the start of the shift.

The main limitation of this pilot study was the low number of HRLFT that were utilized during the short study period. This study took part in one PICU over only an approximately three-month period. To get more information, it would be beneficial to incorporate additional ICUs and continue over a longer time frame.

Conclusion

The utilization of JITE provides a cost- and time-efficient method to ensure minimal competence for HRLFT in the ICU. JITE allows nurses to review the key points necessary for caring for a patient receiving HRLFT and provide peer feedback in the moment. In the future, it would be beneficial to continue the study longitudinally and determine how to overcome the challenges of implementing JITE into the daily workflow in the PICU. This educational tool can be adopted by other areas in the hospital and expanded to incorporate other low-frequency interventions the require competency in the ICU setting to ensure the delivery of safe nursing care.

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Figure 1.

ECMO Just-in-Time Competency Checklist

Check box if RN demonstrates competence on 1st attempt. Check 2nd box if RN demonstrates competence after just-in-time feedback.

- Is this patient on VV or VA ECMO? What is the difference? (VA- supports heart and lungs using 2 cannulas 1 arterial 1 venous. VV- supports lungs only, patients heart does the pumping, 1 or 2 venous cannulas used.)
- How do you reposition on patient on ECMO? (should be turned every 2 if tolerated, may use wedge pillow for slight tilts, always tell perfusionist before moving)
- Who should be at bedside when moving the patient position? (perfusionist should be present for any type of movement, and another ECMO trained nurse/charge)
- What are important considerations regarding the Heparin drip? (Checking ACTs: off infant circuit or patient if adult circuit, Q1 neuro checks, assessing for bleeding, titrate per protocol)
- What should you have at the bedside in case of an emergency? (Blood cooler, volume, clamps, be aware of emergency vent settings.)
- What do you do in emergency crash off of ECMO? (clamp both sides of circuit, get help, sedate/paralyze, institute emergency vent settings, give volume, fix problem)
- What setting controls your PCO₂? (sweep: increasing the sweep decreases the PCO₂)
- What settings control you PO₂? (FiO₂ on the oxygenator vs vent)
- What is chugging? (The venous line "dances" d/t cannula being sucked up against the wall of the R atrium or blood vessel, causing decreased flows on the pump, d/t low volume status or poor cannula placement, may need to give volume.)
- Who can change the ECMO cannula dressing? (PICU Charge RN every 48 hours)

In addition to this checklist, quick resources include: the ECMO education in mypath for more information, ECMO cannula dressing change procedural checklist, ECMO perfusionist.

Just-In-Time Education For Intensive Care nURSES

Rosemary Soriano BSN, RN, CCRN

Introduction

- Just-in-time training for high-risk low-volume therapies: An approach to ensure patient safety
Helman, S., Usantl, A. J., Adams, A., Davis, K. F. (2016)
- Use of simulation training in the intensive care unit
Cato, D. L., Murray, M. (2010)
- Oral care education in the prevention of ventilator-associated pneumonia: Quality patient outcomes in the intensive care unit.
Zurmecky, J. (2013)

Purpose

- The purpose of this project was to determine if the implementation of Just-in-time education (JITE) for High Risk Low Frequency Therapies (HRLFT) in the Pediatric Intensive Care Unit (PICU) improved nursing perceptions of competence, comfort, and safety when caring for patients on these interventions.

Methodology- Sample

- All nurses working in the PICU, who had completed orientation were eligible to participate.
- Approximately 70% (n = 29) of the bedside nurses responded to the pre-survey
- Approximately 50% (n = 20) responded to the post-survey.

Methodology- Data Collection

- Online based pre & post surveys were emailed to all nurses in the PICU.
- Survey questions regarding their competence, comfort, and safety in regards to HRLFT
- The answers to the two surveys were then compared in addition to comments.

Methodology- Program Design

- JITE checklists for nurses were developed for ECMO, CRRT, and HFOV. This included important information to understand what the intervention was for, key concepts, nursing considerations, and troubleshooting.
- All PICU nurses received an email regarding how to utilize the checklists, with the three checklists attached for staff review.
- All the charge nurses in the PICU then received one-on-one training regarding how to use the JITE.

Table 1. Description of Research Examining Continuing Education for ICU Nurses

Author/ Date	Purpose	Design	Sample	Data Collection Method	Design Limitations	Findings
Hebbar, Cunningham, McCracken, Kamat, Fortenberry. 2015	To determine if implementation of bedside simulation-based training of central vascular line dressing change by nurses will improve compliance with central vascular line maintenance bundle procedure.	Quantitative, Quasi-experimental. Pre-test, post-test and chart review.	RNs employed in a 30 bed PICU at a children's hospital in Atlanta in Dec 2010 to Dec 2011. RNs could work there full-time, part-time, pm, or ICU float. There was no demographic or nursing experience difference between groups.	Researchers observed RNs performing CVL dressing change and evaluated them on a CVL bundle checklist. Chart review system already in place to monitor for CVL infections was used to obtain data regarding number of CVL infections in the PICU throughout and following the study period.	Small sample size and lack of blinding to groups. Coinciding interventions to reduce the risk of CVL infections may skew data. Limited generalizability because data collected from one ICU at one point in time.	Significantly higher mean CVL bundle checklist score in the intervention group versus the control group (15.8 ± 1.1 vs 13.2 ± 2.1 ; $p < 0.0001$). Significant increase in CVL bundle checklist in the intervention group pre and post intervention (10.9 ± 2.2 to 15.8 ± 1.1 ; $p < 0.0001$). Infection rates significantly decreased during the study from 1.9 ± 2.2 to 0.6 ± 1.6 per 1000/CVL days ($p = 0.034$).

Author/ Date	Purpose	Design	Sample	Data Collection Method	Design Limitations	Findings
Przybyl, Androwich, Evans. 2015	To determine if the addition of high-fidelity continuous renal replacement therapy (CRRT) simulation to current education enhances knowledge, skills, and attitudes of adult ICU nurses who perform CRRT.	Quasi-experimenta 1. Pre-test, post-test design	93 Nurse with at least 1 year experience caring for adult patients on CRRT in the ICU, in multiple ICUs in a medical center in Arizona.	Nurses took a pre and post-survey 3 months after completion of simulation. They evaluated the nurses comfort level with troubleshooting CRRT and feelings regarding the type of education received previously and in the post-survey feelings about simulation education.	Small sample size taken from one hospital. A new questionnaire made by the researchers was used. They did review with nephrology and other CRRT educators to ensure that the questionnaire was valid, however prior use in a study would increase validity and reliability. The results are not presented in a clear cut manner with statements of significance.	This paper did not state if any of the findings were statistically significant, but stated percentages of change per question. There was a 5% increase in correct responses to question 3. There was a 6% increase in correct responses to question 4. There was a 27% increase on question 5. All 3 of these questions were in regards to troubleshooting the CRRT. Overall a 10% increase in rating on current skills, a 15% increase in rating in nursing self-report of troubleshooting. And post-simulation nursing satisfaction was rated a 8 out of 10 on the Likert scale. Additionally the researchers found that the number of CRRT machines sent to get repairs decreased from 26 pre-intervention to 13 post-intervention, equaling significant cost savings for the hospital.

Author/ Date	Purpose	Design	Sample	Data Collection Method	Design Limitations	Findings
Reinaker, Frock. 2015	To compare percentage of sedation scores at goal before and after ICU sedation practice education by a pharmacist.	Quasi-experimental. Pre-test, post-test and chart review.	62 ICU patients in a level I trauma center in Pennsylvania. Excluded patients: <18 years old, intubated < 24 hours, on neuromuscular blockade, with ICP monitor, where care was withdrawn, and with alcohol dependence. All nurses in the ICU received mandatory education by the pharmacist.	Data was collected by retrospective chart review of the included patient. Data collected included Ramsey scores, age, gender, weight, previous benzodiazepine use, type of pt (trauma vs surgical) and injury severity. Number of self extubations, and reintubations, ventilator days, length of stay in the ICU and hospital, number of boluses, and number of continuous infusions, and adherence to sedation protocol were all collected from charts.	The elimination of many types of patients that may have needed more sedation has potential to skew results. Limited generalizability because data collected from one ICU with a small sample size. This could also limit ability to reach significant findings. Retrospective chart review for data collection limits information obtained to what was adequately documented.	The primary outcome of Ramsay scores at goal had no significant difference from the pre- to post-education group. The secondary outcome of percentages of Ramsey scores of 1 did not differ significantly between groups. There was no significant difference in number of ventilator days, ICU days, or hospital days between groups. There was a trend toward reduction of ventilator days and days in the ICU, which may reach statistical significance soon if the trajectory continues. There was a significant increase in protocol adherence post intervention.

Author/ Date	Purpose	Design	Sample	Data Collection Method	Design Limitations	Findings
Guilhermino, Inder, Sundin, Kuzmiuk. 2014	To determine if continuing education on mechanical ventilation in a large tertiary hospital in Australia meets the educational needs of novice and experienced nurses in the ICU. As well as to obtain nurses' perceptions of the education and recommendation for future education.	Qualitative survey	RNs employed in the ICU at a large tertiary hospital in Australia in May 2011. Hospital has 550 beds, ICU has 22 beds. The ICU specializes in trauma and provides care to pediatrics, adults, and cardiothoracic cases. RNs with less than a 3 year degree were excluded. 160 nurses received the survey, 83 returned including some partially complete.	Survey: Designed by researchers three open-ended questions preceded by a question asking participants to rate the importance of five forms of education	Small sample size with a 52% survey return rate. Limited generalizability because data collected from one ICU at one point in time.	The following themes were found: 1. Advanced knowledge-some nurses perceived that the education offered was introductory and based on their experience level not needed. 2. In-service education- some stated that in-services were another way they obtained this kind of education. 3. Practical structured education-many felt that there was not enough practical or frequent enough ongoing education. 4. Interactive bedside teaching-many felt that interactive bedside learning would be beneficial. 5. Practicing safe care- other recommendations involved other content that would supplement their understanding, such as pathophysiology.

Author/ Date	Purpose	Design	Sample	Data Collection Method	Design Limitations	Findings
Gundrosen, Solliard, Aadahl. 2014	To determine the feasibility of using in situ simulation model to explore and assess team competence in the ICU.	Quasi-experimental, simulation video-tape analysis	54 of 72 volunteer nurses with a minimum of 2 years of experience completed the study. Recruited from an ICU at a university hospital in Norway between Jan and Sept. 2008. Sample was divided into 2 groups that received either lecture based presentation or participated in a scenario at the med center.	Both groups were video-taped performing in situ simulation scenarios. The scenarios were evaluated by 2 raters who were blinded to the education technique. They evaluated the groups for team work with 5 associated elements, and situation awareness with 3 associated elements. Both categories were ranked on a 4 point likert scale from poor to good.	Small sample size. One of the researchers was not blinded due to the fact that they provided instructions; this may have biased the outcomes. Due to how busy the unit was during the study time some tests were not conducted or deferred for later.	No statistically significant difference in learning outcomes between the 2 groups. Less than 50% of all the 18 teams prepared for intubation and fluid administration before the patient arrived, 16% did not increase oxygen when saturations dropped. Only 33% monitored respiratory rate and only 44% initiated antibiotics during the scenario.

Author/ Date	Purpose	Design	Sample	Data Collection Method	Design Limitations	Findings
Kane, Pye, Jones. 2011	Determine the effectiveness of simulation training in increasing nurses in the PCICU's comfort and knowledge of resuscitation, confidence and comfort in performing resuscitation skills.	Quasi-experimental, survey	Nurses in the PCICU at Arkansas Children's Hospital who participated in yearly mandatory simulation activity offered once per month. 65 completed pre and post simulation surveys. 50 completed 1 year follow-up.	Nurses completed Likert-scale based survey prior to simulation, post-simulation, and one year post-simulation	There is a moderate sample size and some nurses were lost at 1 year follow up. The results are not presented in a clear meaningful way to be easily utilized. Limited generalizability because data collected from one ICU at one point in time.	statistical significance pre- and post-training for comfort with knowledge of resuscitation skills (df = 8, n = 64) = 40.86, p = .000, confidence in performance of resuscitation skills (df = 10, n = 64) = 57.42, p = .000, and comfort with performance of resuscitation skills (df = 8, n = 64) = 79.005, p = .000

Author/ Date	Purpose	Design	Sample	Data Collection Method	Design Limitations	Findings
Zhang & Hsu 2013	To determine the effectiveness of a continuing education program on nurses' knowledge of interpretation of electrocardiograms (ECGs).	Quasi-experimental 1. Pre-test, post-test design	52 Nurses from the Emergency department (44.2%), Cardiology (23%), and ICU (32.7%) of a large teaching hospital in China. Ages 21- 50 years, RNs with diplomas, Associates degrees, or Bachelor's degrees in nursing.	The participants took a pre-test just prior to the class. They took a post-test 2 weeks after the class, 4 months after the class, and 5 months after the class/ 1 month after receiving handbook. The researchers designed their own test	Limited generalizability because data collected from one ICU at one point in time. Data collected in China.	There was a significant difference in scores from the pre-test to the first post-test ($Z = -5.38$, $p < 0.01$). No significant difference between the first and second post-test ($Z = -.64$, $p > 0.05$). There was a significant difference between post-test 2 and 3 ($Z = -5.695$, $p < 0.001$). There was a significant difference between the pre-test and final post-test ($Z = -6.1$, $p < 0.01$).

Author/ Date	Purpose	Design	Sample	Data Collection Method	Design Limitations	Findings
Zurmehly 2013	To evaluate the effectiveness of a nursing quality education program on oral care to decrease the incidence of ventilator-associated pneumonia (VAP).	Quasi-experimental. Pre-test, post-test and chart review.	44 Nurses from a 12 bed ICU, which had a VAP incidence higher than the national average. Exclusion included: <3 months experience in ICU, transferring in or out of the unit. Patients included who were in the ICU on a ventilator for >24 hour, did not already have the diagnosis of VAP, not transferred from another unit already intubated.	Nurses took a pre-test and a post-test to evaluate their learning. Chart reviews of patients intubated for >24 hours were reviewed 3 months prior to the education and 3 months after the education looking for documentation of frequency of oral care and assessment of pneumonia. VAP was considered when patient had a new persistent infiltrate on x-ray in combination with 3 of the following: fever, leukocytosis, leukopenia, purulent tracheal aspiration, positive cultures.	Nurses knew they were being studied, so they may have tried to improve their oral care, skewing the effect of the intervention. Limited generalizability because data collected from one ICU at one point in time.	There was a significant difference between the mean RN pre-test (8.45± 0.97) to the post-test (9.84±0.37), (p<0.05). The frequency of oral care via chart review significantly increased (p=0.001). Oral care documented every 2 hours inc 21.02%, every 4 hours inc 52.22%, > every 4 hours dec 24.18%, and not documented at all dec 49.06% post intervention. There was no significant difference in type, acuity, number of ventilator days, or age of patients pre and post intervention. There was a significant difference in VAP rates pre vs post intervention (p <0.003). The pre VAP rate was 4.8 patients per 1000 ventilator patient days, the post VAP rate was 1.8 per 1000 ventilator patient days, a dec of 62.5%.

Author/ Date	Purpose	Design	Sample	Data Collection Method	Design Limitations	Findings
East & Jacoby 2005	To determine the effectiveness of an education module on nursing staff compliance to central line care policy in the pediatric cardiovascular intensive care unit (CVICU).	Quasi-experimental pre-test and post-test design, with observation of compliance	All nurses working in a 12 bed pediatric CVICU, including float RNs were offered, 20 nurses (66%) consented to participate. Patients included were all congenital heart surgery patients admitted for post-op care or cardiology patients admitted for medical treatment, all of which had central vascular lines (CVL).	Pre-test and post-test related to central line care. Evaluated for compliance to central line care policy via observation by the researchers and 2 other observers, proficient in the policy and scored yes or no before and after education. An IV audit tool of 47 patients was conducted over a 1-2 month period pre and post education.	Small sample size. Nurses were not observed very many times to ensure consistent compliance to line care policy. If the nurses know which people are observing them performing line care they may act differently than when not being watched. The study only covered a short time period, would like to see more than 2 months' worth of data post-intervention.	There was a significant difference between mean pre- test $Df= 19$ ($p<0.001$, 95% CI). There were improvements in compliance post-education, with significant increase in the presence of interlink injection site (inc from 9/47 to 31/47, $p<0.0001$), and dressing per policy (inc from 23/38 to 37/38, $p<0.0001$), and overall passing score (inc from 23/47 to 35/47, $p=0.0357$). There was also a notable inc in biopatch use but to low of occurrence to be significant (inc from 0/8 to 8/8, $p=0.0625$). There were also so significant differences that were decreases in compliance regarding IV and tubing labeling, which was not stressed in this education module.

Author/ Date	Purpose	Design	Sample	Data Collection Method	Design Limitations	Findings
Wynd 2002	To evaluate the effectiveness of a critical care nursing course for enhancing knowledge of current critical care nurses and nurses interested in moving to critical care areas.	Quasi-experimental, pre-test and post-test with a control group	57 nurses. Experimental group: experienced critical care RNs or interested in moving to the ICU at a community hospital in the Midwest. Control group: RNs from a medical-surgical unit at the same hospital. 40 women, 17 men. Average age of 41.06 years, mean years of RN experience of 13.41. 12 RNs in the control reported previous ICU experience, 7 RNs in the experimental group were current ICU RNs. There were no significant differences in demographics between the 2 groups.	Basic Knowledge Assessment Tool (BKAT-4) was taken prior to course, after completion of course, and 6 month follow-up.	This educational method is very time consuming requiring 8 hours a week for 8 weeks Limited generalizability because data collected from one ICU.	The mean BKAT-4 scores were significantly higher post-education vs pre education in the experimental group ($F=11.05$, $p=.000$) and at 6 months ($F=20.10$, $p=.000$). There was no change in the BKAT-4 scores in the control group from pre-test (mean score 65.33) to post-test (mean score 66.40) and 6 month follow up (mean score 64.53). There was a significant difference in post-test scores in experimental (mean 81.22) vs control group (mean 66.4) a difference of 14.82. There was no significant difference in level of education (diploma, ASN, BSN) on scores. Years of ICU experience was positively correlated with higher BKAT-4 scores pre-test ($r=0.266$, $p<.05$) and post-test ($r=0.293$, $p<.05$). All 7 ICU RNs passed their critical care certifications post-education.

Author/ Date	Purpose	Design	Sample	Data Collection Method	Design Limitations	Findings
Sciarra 2011	To determine the education needs of ICU nurses regarding evidence-based practice and implement an education strategy to meet those needs.	Quasi-experimental, pre-test and post-test	33 nurses from an ICU in a hospital in Northeastern United States.	68 question survey via surveymonkey.com.	Limited generalizability because data collected from one ICU.	The initial survey found that nurses saw their barriers to evidence-based practice as: lack of skills in critiquing or synthesizing research, difficulty understanding research articles, a lack of search skills, and a lack of understanding regarding databases. Post-education survey showed that nurses had a significantly better understanding of how to search and utilize research. In addition the nurses had more positive attitudes toward evidence-based practice and were actively applying what they had learned to current practice.

Author/ Date	Purpose	Design	Sample	Data Collection Method	Design Limitations	Findings
Ballangrud, et al. 2014	To describe ICU nurses' perceptions of simulation-based team training for improving patient safety.	Qualitative descriptive design, interviews	18 RNS working in 7 different ICUs in one hospital trust in Norway. Sampling was done in a way that allowed for variation in gender, age, area of ICU focus, education level, years of practice as an RN, years as an ICU nurse, scenario roles, and simulation experience on different team groups.	Interview, started with the question: "Can you please describe how you perceive simulation-based team training with regard to building patient safety in intensive care?" Followed up by clarifying questions. Interviews lasted 26-47 minutes.	Participants who agreed to participate may have already had a more positive view of simulation and that is why they volunteered, potentially skewing data.	<p>One main category, generated from 3 generic findings with 6 sub-categories. The main category was that training in simulation increases awareness of clinical practice and emphasizes the importance of teamwork.</p> <p>The generic findings with sub-categories include:</p> <ol style="list-style-type: none"> 1. Realistic training contributes to safe care, subcategories include: not putting the patient at risk, transferable to clinical practice 2. Reflection and openness motivates learning, subcategories include: focusing on one's own and others' competence, debriefing facilitates improvement. 3. The importance of finding common understanding of team performance, subcategories include: responsibility in roles and use of human resources, importance of clear communication.

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Appendix A

**Just-In Time Education for Pediatric Intensive Care Nurses
Pre-Survey**

Rosemary Soriano BSN, RN, CCRN
St. John Fisher College Master's in Nursing Project



Introduction: This project is being conducted as part of a requirement for my master's in nursing degree at St. John Fisher College. The purpose of the project is to determine if the implementation of Just-In-Time Education (JITE) or rapid pace education for high risk, low frequency therapies (HRLFT) in the Pediatric Intensive Care Unit (PICU) improves the PICU nurses perception of their competence and empowers their ability to utilize these interventions.

Distribution of the survey was approved by Sue Bezek, RN, MS, Associate Director of Pediatrics on March 28, 2016 and Mary G. Carey PhD, RN, Associate Director of the Clinical Nursing Research Center on final approval date pending. Completion of this survey is voluntary and non-participation will in no way affect your current or future employment at Strong Memorial Hospital.

This pre-survey should take fewer than 5 minutes to complete. You may stop the survey at any time should you decide you longer wish to participate. By completing the survey you are providing your consent.

Date _____

1. How many years have you been a registered nurse?
 - a. Less than 1 year
 - b. 1 to 3 years
 - c. 4 to 7 years
 - d. 8 to 10 years
 - e. 11 to 13 years
 - f. 14 to 16 years
 - g. > 16 years

- 2. I feel comfortable caring for patients receiving high risk, low frequency therapies (HRLFT)
 - 1. Not at all comfortable
 - 2. Slightly comfortable
 - 3. Somewhat comfortable
 - 4. Moderately comfortable
 - 5. Extremely comfortable



Just-In-Time Education Pre- Survey; RN staff
Rosemary Soriano, BSN, RN, CCRN
Location: PICU @ Golisano Children's Hospital
Survey Date(s): start & end dates
Survey Type: Electronic via Qualtrics

- 3. I feel the care I provide for my patients receiving HRLFT is
 - 1. Not at all safe
 - 2. Slightly safe
 - 3. Somewhat safe
 - 4. Moderately safe
 - 5. Extremely safe

- 4. I feel comfortable asking for education or reinforcement of HRLFT at the start of my shift if I am assigned a patient receiving HRLFT
 - 1. Not at all comfortable
 - 2. Slightly comfortable
 - 3. Somewhat comfortable
 - 4. Moderately comfortable
 - 5. Extremely comfortable

- 5. I feel there are enough resources available to assist me in caring for patients receiving HRLFT
 - a. Neutral, no opinion
 - b. Yes
 - c. No

6. Comments

Thank you for your participation.

if you should have any questions or concerns regarding this survey, please contact Rosemary Soriano BSN, RN, CCRN rds00179@sjfc.edu or St. John Fisher College IRB at irb@sjfc.edu



Appendix B

**Just-In Time Education for Pediatric Intensive Care Nurses
Post Survey**

Rosemary Soriano BSN, RN, CCRN
St. John Fisher College Master's in Nursing Project



Introduction: This project is being conducted as part of a requirement for my master's in nursing degree at St. John Fisher College. The purpose of the project is to determine if the implementation of Just-In-Time Education (JITE) or rapid pace education high risk, low frequency therapies (HRLFT) in the Pediatric Intensive Care Unit (PICU) improves the PICU nurses perception of their competence and empowers their ability to utilize these interventions.

Distribution of the survey was approved by Sue Bezek, RN, MS, Associate Director of Pediatrics on March, 28, 2016 and Mary G. Carey PhD, RN, Associate Director of the Clinical Nursing Research Center on final approval date. Completion of this survey is voluntary and non-participation will in no way affect your current or future employment at Strong Memorial Hospital.

This post survey should take fewer than 5 minutes to complete. You may stop the survey at any time should you decide you longer wish to participate. By completing the survey you are providing your consent.

Date _____

1. How many years have you been a registered nurse?
 - a. Less than 1 year
 - b. 1 to 3 years
 - c. 4 to 7 years
 - d. 8 to 10 years
 - e. 11 to 13 years
 - f. 14 to 16 years
 - g. > 16 years

2. I feel comfortable caring for patients receiving high risk, low frequency therapies (HRLFT)
 1. Not at all comfortable
 2. Slightly comfortable
 3. Somewhat comfortable
 4. Moderately comfortable
 5. Extremely comfortable



Just-In-Time Education Post Survey; RN staff
 Rosemary Soriano, BSN, RN, CCRN
 Location: PICU @ Golisano Children's Hospital
 Survey Date(s): start & end dates
 Survey Type: Electronic via Qualtrics

3. I feel the care I provide for my patients receiving HRLFT is
 1. Not at all safe
 2. Slightly safe
 3. Somewhat safe
 4. Moderately safe
 5. Extremely safe

4. I feel comfortable asking for education or reinforcement of HRLFT at the start of my shift if I am assigned a patient receiving HRLFT
 - 1 Not at all comfortable
 - 2.Slightly comfortable
 - 3 Somewhat comfortable
 - 4.Moderatly comfortable
 - 5.Extremely comfortable.

5. The one-on-one time with the charge nurse spent reviewing the JITE safety checklist improved the care I provided for my patients receiving HRLFT
 1. Strongly disagree
 2. Disagree
 3. Neutral; neither disagree nor agree
 4. Agree
 5. Strongly Agree.

6. There has been an improvement in the nursing care I provided to my patients with HRLFT since JITE was implemented
 1. Strongly disagree
 2. Disagree
 3. Neutral; neither disagree nor agree

- 4. Agree
- 5. Strongly agree

- 7. Do you feel JITE should be continued?
 - a. Neutral, no opinion
 - b. No
 - c. Yes



- 8. Please provide any comments regarding JITE for HRLFT

Thank you for your participation.

If you should have any questions or concerns regarding this survey, please contact Rosemary Soriano BSN, RN, CCRN rds00179@sjfc.edu or St. John Fisher College IRB at irb@sjfc.edu