Evidence-Based Critical Care Education for Oncology Nurses

By

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ABSTRACT

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Introduction: Advances in the medical care for oncology patients has heightened the complexity of this patient population leading to an increased need for lifesaving, critical care. Oncology nurses provide specialized nursing care; however, when patients require lifesaving care, they are transferred to critical care units. The project oncology unit opened high acuity beds to prevent the need to transfer these patients. The purpose of this scholarly project was to evaluate oncology nurses' mastery of basic and oncology-specific critical care knowledge following an evidence-based supplemental training course.

Methods: This quality-improvement project used Basic Knowledge Assessment Tool (BKAT) results to evaluate oncology nurses' critical care knowledge after an initial 3-month education course. Supplemental training content was developed using the score deficiencies noted. Content on oncology-specific critical care was also developed. BKAT and Oncology Knowledge Survey scores were evaluated pre-and post-supplemental training and Wilcoxon signed rank tests were used to detect significant changes.

Results: Seventeen nurses completed the 8-hour supplemental training. Mean total BKAT scores significantly improved from 65.7 pre-initial course to 73.7 post-supplemental training (p=0.002). Mean total Oncology Knowledge Survey scores

increased from 75.3% to 80.9%, which was a statistically significant improvement

(p=0.039).

Conclusion: Critical care training is imperative for oncology nurses preparing to care for

high acuity oncology patients. Having adequate knowledge of general and oncology-

specific critical care is important to prevent adverse events among this complex patient

population and to improve overall outcomes.

Dedication

To my friends and family who have accompanied me through this journey of obtaining my Doctorate in Nursing Practice. I also dedicate this to the nurses at the practice site for always being willing to learn and provide the best care to our patients.

ACKNOWLEDGEMENTS

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Chapter 1: Introduction

1.1 Background

Critical care has become one of the most developed specialties in nursing (Dudzinski & Januzzi, 2017). Nurses who work in critical care (also known as intensive care) are highly skilled and utilize specialized knowledge to provide lifesaving care to complex patients (American Association of Critical Care nurses, [AACN], 2019, Lakanmaa et al., 2013). Due to an aging population and advances in healthcare technology, a high level of patient complexity has become increasingly common in critical care settings (Dudzinski & Januzzi, 2017). As the complexity of patients who are admitted to the intensive care unit (ICU) increases, it is imperative that nurses possess strong knowledge and critical thinking skills (Madhuvu et al, 2018). Many institutions across the United States and internationally have developed evidence-based programs to train nurses in critical care, often utilizing the Basic Knowledge Assessment Tool (BKAT) to evaluate nurses' mastery of fundamental and crucial critical care knowledge.

While the education related to the critical care specialty has been widely studied, there is a lack of research regarding preparing nurses to specifically care for oncology critical care patients. Oncology is a specialty in nursing practice that entails providing care to patients with cancer. Oncology patients are highly complex and during the course of treatment can often decompensate requiring a higher level of care, such as the ICU (Hull & O'Rourke, 2006). Most of the development of critical care education has focused on basic critical care knowledge such as cardiac emergencies, sepsis, respiratory emergencies and other life-threatening situations. While it is essential critical care nurses possess this basic knowledge, oncology-specific critical care knowledge is also essential

to safely care for this population. Yet, there is a lack of published research studies or evidence-based projects focused on education specifically for oncology critical care nurses.

1.2 Significance

The need for highly trained critical care nurses is imperative due to the complexity of patients who are requiring ICU level care (AACN, 2019; Hull & O'Rourke, 2006). In order to ensure that nurses who will be providing this level of care are adequately prepared, they must receive well-planned, systematic, evidenced-based education that is focused on the basic knowledge needed to provide safe and effective critical care (AACN, 2019, Wynd, 2002). To evaluate the effectiveness of critical care education, the BKAT has been proven to be a reliable measurement tool and it is often utilized in practice by nurse educators and advanced practice nurses who provide education on critical care nursing. Furthermore, the BKAT has also been shown to be effective in guiding the orientation and education process for critical care nurses (Toth, 2006). In addition to receiving basic or general critical care education, nurses who work in specialized ICUs require additional education relevant to caring for their specific patient population (such as cardiac patients, trauma patients, etc.).

The project facility, an 847-bed medical center in Charlotte, NC, opened high-acuity, critical care beds for oncology patients on a Bone Marrow Transplant Unit in 2019. Oncology patients requiring ICU level care will now receive care on this unit, which previously did not admit patients requiring critical care. This required that the oncology certified nurses on this unit be capable and well trained to safely care for

critically ill patients. Having oncology nurses who are trained in critical care is important to improve outcomes for these complex patients.

1.3 Problem Statement

As the complexity of oncology patients increases, the need for critical care trained oncology nurses is imperative. The Bone Marrow Transplant/Oncology Unit at the project facility planned to open high acuity critical care beds in 2019. The units' oncology nurses were trained in oncology nursing care but were not previously trained in critical care. It was vital that these nurses received basic critical care education as well as a targeted component related specifically to caring for critically ill oncology patients.

1.4 Purpose

The purpose of this DNP scholarly project was to evaluate the basic critical care knowledge (using the BKAT) of oncology certified nurses upon completion of a general critical care course, and to use the BKAT results to create and evaluate targeted supplemental basic critical care training designed to enhance nurses' knowledge. Additionally, oncology-specific education was created, and nurses' knowledge of oncology-specific critical care was evaluated pre- and post-supplemental training.

1.5 Clinical Question

In oncology nurses who have completed an evidence-based critical care course and BKAT assessment tool, does the addition of supplemental training improve the mastery of basic and oncology-specific critical care knowledge?

1.6 Project Objectives

The objectives of this DNP scholarly project were to:

1. Assess oncology nurses' basic knowledge post-completion of a 3-month general critical care course using the BKAT.

2. Use the BKAT results to create and implement an 8-hour supplemental training to improve mastery of basic critical care knowledge and evaluate for knowledge gains by repeating the BKAT post-supplemental training.

3. Create evidence-based education specific to caring for critically ill oncology patients and evaluate the effect of this training on nurses' oncology-specific critical care knowledge by administering critical care oncology-specific knowledge items pre- and post-supplemental training.

Chapter 2: Literature Review and Theoretical Framework

This literature review was conducted using the search engines CINAHL, PubMed and Cochrane Review. Key words that were used for this literature search included *Critical Care, Intensive Care, Nurse, Education, Critical Care Education, Oncology Nurse, Oncology Education* and *Basic Knowledge Assessment Tool*. Inclusion criteria were articles that were peer reviewed, less than 10 years old, and focused on education for critical care and oncology nurses. The search yielded few articles related to oncology critical care education; therefore, articles of relevance that were older than 10 years old were retained.

2.1 Outcomes of Basic Critical Care Education

Preparing nurses to care for critically ill patients is an intricate process; therefore, nursing education should be developed based on evidence that has resulted from studies of prior educational courses (Wynd, 2002). There are many published studies showing the importance of education for critical care nurses. One example is a recent study by Madhuvu et al. (2018), in which researchers evaluated the outcomes of nurses who completed a critical care education course. Researchers found that upon completion of a 6-month intensive critical care course that encompassed a didactic and clinical component, nurse satisfaction and retention were increased over a 2-year time span. It was also found that the care provided by nurses who were trained in critical care improved patient outcomes, including reduced infection rates and length of stay

(Madhuvu et al., 2018). These findings align with other studies that have also focused on education for critical care nurses.

In 2010, the Institute of Medicine (IOM) formally released a statement that supported the future of nursing (Adams, Chisari, McAuley, & Ives-Erickson, 2015). The IOM stated that all institutions should invest in developing formal educational programs to help new graduate, novice nurses to effectively transition to practice. Transition-to-practice programs can help to increase nursing job satisfaction and engagement, as well as improve patient satisfaction (Adams et al., 2015). Based on the IOM recommendations, Adams et al. (2015) evaluated a critical care education course in a large medical center in Massachusetts. The course was implemented at a time when the center was experiencing a need to open a new ICU to allow for more ICU beds. Allowing the stakeholders (nurses) to be actively engaged throughout the period of the critical care course, and to provide structured feedback greatly improved the success of this course. Results showed an increase in patient and nurse satisfaction. Further, staff engagement and cohesion were also improved upon completion of the education course (Adams et al., 2015).

In addition to evaluating the effect of education on such measures as satisfaction and engagement, it is also essential to evaluate nurses' knowledge post-education. To evaluate the effect of education on nurses' critical care knowledge, the BKAT is frequently used. The BKAT was developed in 1984 by Jean Toth and was designed to test the basic entry level knowledge required by practicing critical care nurses upon completion of orientation or an education course. The BKAT is comprised of 80-100 questions (number of questions varies based on the BKAT version) testing knowledge for

various physiologic systems (cardiology, pulmonary, endocrine, etc.) (Toth, 2006). In multiple studies, the Cronbach alpha reliability of the BKAT has been established at greater than 0.90 (Toth, 2006). In addition to using the BKAT to measure basic or general knowledge, the BKAT has been tailored to also assess multiple specialty areas: Adult Emergency, Pediatric Intensive Care, Telemetry/Progressive Care and Neonatal Intensive Care. To date, there has not been a version created to evaluate oncology-specific knowledge.

Studies utilizing the BKAT as a measurement tool have administered it as an evaluation tool post-completion of a critical care course. In a study to evaluate the effect of critical care education for 57 nurses, the BKAT was administered immediately post-completion of an education course and then again at 6 months (Wynd, 2002). The course was 16-weeks long and was divided into two eight-week sessions (didactic and clinical based). The didactic sessions covered basic critical care information to include anatomy and physiology, pathophysiology, generalized monitoring systems and also included an intensive cardiac section. Wynd (2002) found that scores on the BKAT were comparatively similar to other studies pre-critical care course (mean= 70.00, range 37-91) and that scores significantly improved immediately post-critical care course (mean= 81.22, range 51-97, p=0.0001). The BKAT was re-administered 6-months post-completion of the course and the mean score (80.48) was similar to the score immediately post-education, but the range of scores was noted to be higher (57-97). Wynd (2002) further analyzed the results and found that the majority of participants scored higher on the pre-course assessment for the cardiovascular and invasive monitoring sections, and

these scores remained high with little improvement compared to other sections of the BKAT (such as pulmonary, endocrine, neurology, etc.).

There is additional support for using the BKAT to assess the effectiveness of critical care education for nurses. In a study by Price (1993), the BKAT was administered pre-and post-completion of a critical care course for 38 nurses. Findings showed that the mean scores for the post-education BKAT were significantly higher (pre-mean: 64.37, post-mean: 77.21). In this study, there was a more significant improvement in all subject areas assessed by the BKAT (Price, 1993). Lakanmaa et al. (2013) and Aari et al. (2004) also found that BKAT scores were significantly improved post-completion of a critical care course. The Lakanmaa et al. (2013) study was unique in that a self-survey of basic competence was also given to participants pre- and post-education course. Evaluation of the results of the self-assessment compared to the BKAT scores showed there were no significant associations between the self-assessment and BKAT results. Aari et al. (2004) also found that, in addition to improvement in post-education BKAT scores, there was an increase in autonomy among nurses while transitioning to practice.

2.2 Formats for Basic Critical Care Education

Extensive research has been performed on evaluating effective teaching modalities for critical care education. A randomized controlled trial (RCT) performed by Jansson et al. (2016) evaluated the use of high-fidelity simulation using a computerized full-body manikin. Jansson et al. (2016) conducted the RTC in a 22-bed adult mixed medical-surgical ICU over a 30-day period. The researchers evaluated the essential nursing interventions required to prevent Ventilator Associated Pneumonia and nurses' adherence to these interventions. Education was provided using a high-fidelity simulation

manikin. Upon completion of the RCT it was noted that participants in the intervention group had an increase in scores for the interventions required to prevent Ventilator Associated Pneumonia (Jansson et al., 2016), demonstrating the effectiveness of using simulation to allow nurses to practice essential skills.

Literature reviews have compared the different education modalities for beginner and novice nurses in the critical care field. Innes and Calleja (2018) performed a literature review evaluating the transition support for beginner and novice nurses who transition into the critical care setting. The researchers reviewed the required knowledge and how nurses acquire that knowledge as they transition. It was noted that structured programs promoted skill and knowledge retainment and in turn improved nursing satisfaction, confidence and skill (Innes & Calleja, 2018). Specifically, in the critical care setting it was noted that simulation-based training was beneficial in improving assessment, decision making and evaluating the clinical changes that frequently occur in the critical care setting (Innes & Calleja, 2018; Berger, Kuszajewski, Borghese & Muckler, 2018).

2.3 Lack of Oncology-Specific Critical Care Education

The literature search revealed no research on critical care education specifically for oncology certified nurses. Given the specialized patient population and the quickly changing acuity of oncology patients, there is a need to provide education to nurses who will care for critically ill oncology patients. The studies in this literature review support the need to provide basic critical care education to oncology nurses and to assess knowledge level using the BKAT. Studies also support the need for repeated training to enhance nurses' critical care knowledge. Although there is a lack of research on oncology

critical care education, other specialized formats of the BKAT indicate that there is also a need to provide education specific to caring for this patient population.

2.4 Theoretical Framework

Patricia Benner was a pioneer in nursing theory and developed the *From Novice to Expert* theory*,* which describes the advancement of nurses throughout their career (Benner, 2001). Benner developed this theory based on the Dreyfus model of skill acquisition, which was initially used in the aviation field (Altmann, 2007). The Dreyfus model describes that a learner will transition through five levels of proficiency: novice, advanced beginner, competent, proficient, and expert. Benner utilized this model to describe how nurses progress or advance in their professional development (Davis & Maisano, 2016). In the novice stage, nurses have not had any clinical experience in their area of specialty. Thus, even if nurses have experience in other healthcare settings, they become a novice when providing care to a new patient population. At the novice stage, nurses focus on simple, basic objective skills to complete the task at hand. As the novice nurse becomes more experienced, he or she will be able to use past experiences to make judgements in certain clinical situations they have been exposed to previously (Benner, 2001).

Benner's *From Novice to Expert* theory explains the importance of providing and evaluating critical care education for oncology certified nurses who are novices in regard to caring for critically ill patients. Based on Benner's theory, the nurses who will transition to providing care to critically ill oncology patients are now back in the novice stage. Thus, to help the nurses in this project progress to the next stage, a critical care course was developed by expert critical care nurses in order to advance their mastery of

knowledge of basic critical care content material. As the oncology nurses complete the critical care course and then receive targeted supplemental training to address areas of weakness and provide information on oncology-specific critical care, they will begin to transition to advance beginner, competent, proficient and expert stages. As they gain further experience working with this specialty population, they will then continue to further their development. Assisting these nurses to advance through Benner's stages is vital to ensure they have the knowledge required to provide safe and effective patient care.

Chapter 3: Methods

3.1 Design

This Doctor of Nursing Practice (DNP) scholarly project was a quality-improvement project. The project used BKAT results to evaluate oncology nurses' critical care knowledge after a basic critical care education course. The post-education BKAT results were used to create and implement supplemental training to improve identified knowledge deficiencies, with effectiveness measured by re-administering the BKAT post-supplemental training. Oncology-specific critical care education was also created and changes in knowledge measured pre-and post-supplemental training.

3.2 Setting

The setting of this project was an 847-bed medical center in Charlotte, North Carolina. Specifically, the project occurred on a 30-bed oncology/bone marrow transplant unit. This unit opened 8 new high-acuity beds in 2019 to be able to provide critical care to oncology patients directly on the unit, rather than transferring them to general ICUs. Preventing oncology patient transfer is important to ensure they receive care from oncology certified nurses who are knowledgeable about the patients' unique and complicated disease processes. The patients admitted to this unit have been diagnosed with a hematologic malignancy, are receiving chemotherapy, or are undergoing a bone marrow transplant.

3.3 Sample

A convenience sample of oncology nurses who participated in a 3-month basic critical care education course were recruited to participate. The criteria for nurses to have been selected by leadership for the basic critical care training were: nurses must work on the 30-bed oncology/bone marrow transplant unit, be interested in pursuing critical care training, and have at least one year of nursing experience. Therefore, this was also the inclusion criteria for this project focused on providing 8 hours of supplemental training. Exclusion criteria were nurses not employed on the project unit, as well as nurses who were not selected to participate in the initial basic critical care training cohorts. The critical care education was provided to nurses in 3 different cohorts. The first cohort of 11 oncology nurses received their initial education January to March 2019. The second cohort of 7 oncology nurses received their initial education from May to July 2019. The last cohort of 6 oncology nurses received their initial education August to October 2019. The oncology nurses from all three of these cohorts were invited to participate in this project that began in September 2019. Each cohort participated in this project's supplemental training individually (thus training was provided at three different points in time). Participation in the supplemental training and this project's data collection was voluntary.

3.4 Intervention

The project intervention was the 8 hours of supplemental training that followed the 3-month basic critical care education course. Content of the supplemental training was designed in August and September 2019 after the first two cohorts completed the BKAT following their initial basic critical care course. Deficiencies noted in the BKAT

subject areas were identified by assessment of cohort scores and the supplemental training was developed to address these noted deficiencies. In addition, the supplemental training intervention provided new content on caring for patients with oncological disease process and crises that require ICU-level care. Specifically, the oncology content addressed tumor lysis syndrome, management of the acute leukemia patient, disseminated intravascular coagulation, differentiation syndrome, neutropenic fever, CAR T cell infusion and oncologic emergencies.

The supplemental training intervention for the first two cohorts occurred in two 4-hour sessions. The third cohort's training intervention was combined into one 8-hour training session due to scheduling conflicts. The training time was built into the nurses' regular pay hours and time for the training was largely shaped by the requirement not to exceed regular pay hours due to budget constraints. The supplemental training intervention consisted of various instructional modalities to meet learning objectives specific to each topic. A didactic component was used for each topic to review concepts of basic critical care (concepts in need of further review identified with BKAT scores) and oncology-specific critical care nursing. Didactic learning consisted of PowerPoint presentations designed by the DNP project lead. In addition, the participants applied their knowledge through use of journal article discussions pertaining to oncology emergencies, case studies, and Advanced Cardiac Life Support (ACLS) simulations. Respiratory therapists were also recruited to conduct a class on mechanical ventilation, non-invasive ventilator options, and arterial blood gas interpretation.

3.5 Measurement Tools

Prior to starting the supplemental training intervention, participants completed a 10-item demographic and general information survey created by the DNP project lead (see Appendix A). This survey had two sections. The first section consisted of 5-items to obtain demographic information about participants' age, gender, nursing degree, years of nursing experience in general and years of oncology nursing experience. The second section consisted of 5-Likert scale questions to evaluate preferred learning methods (3 questions), comfort in caring for ICU patients and comfort in caring for high acuity oncology patients. Post-supplemental training, participants were asked to indicate the amount of supplemental training sessions they attended, as well as their comfort in caring for ICU patients and comfort in caring for high acuity oncology patients. Questions also assessed the nurses' satisfaction of the learning methods and their overall satisfaction using a 5-point Likert scale (1=least satisfied to 5= most satisfied). Participants were asked if they would recommend this training to other nurses and to write in suggestions for improving the training and to share anything else they wanted.

To measure the participants' basic critical care knowledge, the BKAT was used. The BKAT is a reliable tool that has been utilized by many institutions to assess the basic knowledge of nurses who are entering into critical care nursing practice. In repeated studies, reliability tests have shown Cronbach's alpha at 0.90 (Toth, 2006). Experts in the critical care nursing practice field were instrumental in development of the BKAT-9r to ensure it is valid (Toth, 2006). The BKAT-9r consists of 81-100 multiple choice and fill-in-the-blank questions (length varies depending on specific subject matter) that were developed based on a review of literature on critical care nursing practice (Toth, 2006). It consists of questions that test the knowledge of entry level critical care nurses as it relates

to all body systems (cardiac, respiratory, renal, etc.). Each item is scored and the total score is reported as a percentage. The scores are further broken down into each subject area and given a percentage. The average total score for nurses' post-orientation is reported at 82-84% (Toth, 2006).

At the project site, the BKAT-9r is used pre and post-critical care nursing education and consists of 85 items to test basic critical care knowledge. It was administered by nurse educators prior to the start of the project unit's basic critical care course and was re-administered upon completion of the 3-month course to allow for comparisons. The BKAT-9r scores immediately following the 3-month basic critical care course were used in this project to identify areas of deficiency to shape the design of the supplemental training. The BKAT-9r was re-administered immediately after the completion of the supplemental training intervention to evaluate for changes in basic critical care knowledge from pre to post-supplemental training. The BKAT-9r is not included as an appendix per stipulations accompanying the permission to use the tool.

To measure participants' oncology-specific critical care nursing knowledge, a 20-item Oncology Knowledge Survey created by the DNP project lead was administered. The Oncology Knowledge Survey items (see Appendix B) were created to measure knowledge about oncology critical care nursing. They were developed to measure the essential oncology knowledge that was taught in the supplemental training. Knowledge about each of the topics addressed in the supplemental training (tumor lysis syndrome, management of the acute leukemia patient, disseminated intravascular coagulation, differentiation syndrome, neutropenic fever, CAR T cell infusion, oncologic emergencies) was measured using multiple choice questions. The Oncology Knowledge

Survey items were reviewed by content experts in high acuity oncology and experts in test-item writing. The Oncology Knowledge Survey was administered immediately prior to the start of the supplemental training intervention and repeated when the intervention was complete to assess for changes in participants' oncology-specific critical care nursing knowledge.

3.6 Data Collection

Appendix C for diagram of project and data collection. The BKAT scores immediately post-basic critical care education course were obtained from the facility's nurse educators and used to design the general critical care content of the supplemental training. Oncology specific content was also designed by the DNP project lead. After the intervention content was complete, with basic and oncology-specific critical care content, participant recruitment began. Participation was voluntary but highly encouraged by unit leadership who provided hourly pay to each participant to enhance participation. All nurses who completed the initial critical care education course were invited to participate by the DNP project lead and nurse educators via a face to face meeting.

At the start of the supplemental training, the DNP project lead reviewed the project information and answered any questions. Participants then completed the demographic and general information survey and the 20-question Oncology Knowledge Survey. The supplemental training intervention then occurred, with participants completing 8 hours of supplemental training. Upon completion of the supplemental training, the participants completed the BKAT and Oncology Knowledge Survey, as well as the 8 post-supplemental training questions (comfort, satisfaction). All surveys were completed via paper and pencil format.

3.7 Data Analysis

Pre- and post-supplemental training data was transferred from paper to StataCorp 2017 v. 15 by a statistician. All data was analyzed using StataCorp 2017 v. 15. First, responses to the demographic and general information survey, as well as the post-supplemental training questions (comfort, satisfaction) were assessed using descriptive statistics (means, frequencies). Changes in comfort from pre-to post-supplemental training were analyzed using chi-square analysis. Written in questions were analyzed by dividing comments into common themes that were discovered.

 Descriptive statistics were also used to evaluate the data collected from the BKAT (mean, standard deviation, median, range) and Oncology Knowledge Survey (frequencies, mean, standard deviation). To evaluate for statistically significant changes in BKAT (pre-to post-initial course, post-initial course to post-supplemental training, and pre-initial course to post-supplemental training) and Oncology Knowledge Survey (pre-to post-supplemental training) scores, Wilcoxon signed rank tests were used. Significance level was set at $p<0.05$.

3.8 Ethical Considerations

The project facility reviewed this project and deemed it exempt from Institutional Review Board (IRB) review because it is a quality improvement project. IRB approval was obtained from the project lead's university prior to start of the project. (see Appendix D and E). To help ensure the confidentiality of participants, no personal or identifying information (such as name or employee ID number) was collected on any of the surveys. Instead, participants were assigned a number by the nursing educator that administered

the basic critical care course and they placed on each survey so that responses could be tracked over time. Survey scores were reported as aggregate percentages; no individual scores were reported. All hard copies of surveys were stored in a locked file cabinet in the project lead's office and then will be shredded 3-years after completion of the project. When transferred to StataCorp, data was stored electronically on a secure, password-protected drive accessed only by the project lead. These measures to protect confidentiality were explained to all participants at the start of the project. Completion of the voluntary surveys conveyed consent; participants were not required to sign informed consent forms for this quality improvement project.

Chapter 4: Data Results

4.1 Sample Information and Demographics

The project took place over four months. There were three separate cohorts of nurses that participated in the project for a total number of 24 nurses who participated. However only 17 nurses (70.8% completion rate) completed all of the supplemental training to comprise the project sample.

Participants completed a survey prior to the supplemental training to assess the demographics of the sample. The survey collected the following information: gender, age, years of total nursing experience, years of oncology nursing experience and highest nursing degree obtained. Characteristics of the 17 study participants are presented in Table 1. Almost all participants were 40 years of age and under (95%) and 100% of participants were female. About two-thirds of the participants had 1-3 years of general nursing experience (70%) and the majority (82%) had 1-3 years of oncology nursing experience. Over half of the participants had obtained a bachelor's degree in nursing (58%), with the remainder having an associate degree in nursing.

Table 1: Demographic survey data (N=17).

	Number	Percentage
Gender		
Female	17	100%
Male	0	0%
Age in years		
23-26	8	47%
27-30	3	18%
31-35	3	18%
36-40	2	12%
>41	1	5%
Total experience as a nurse in years		
1-3	12	72%
4-6	3	18%
7-10	1	5%
>11	1	5%
Total experience as an oncology nurse in years		
1-3	14	82%
4-6	2	12%
7-10	1	6%
>11	0	0%
Highest nursing degree obtained		
Diploma	0	0%
Associates	7	41%
Bachelor	10	59%
Master's	0	0%

Participants were then asked to rank their preferred learning methods using a Likert scale as shown in Table 2. Mean scores indicated that simulation training (Mean 4.2) was the most preferred learning method, followed by case studies (Mean 3.6) and then journal clubs (Mean 2.6).

Table 2: Preferred learning method on pre-supplemental survey (N=17).

	Number	Percentage
Journal Club		
Strongly Agree (5)	0	0%
Agree (4)	4	24%
Not Sure/Neutral (3)	5	29%
Disagree (2)	6	35%
Strongly Disagree (1)	2	12%
Mean		2.6
Simulation Training		
Strongly Agree (5)	8	47%
Agree (4)	7	41%
Not Sure/Neutral (3)	0	0%
Disagree (2)	2	12%
Strongly Disagree (1)	0	0%
Mean		4.2
Case Study		
Strongly Agree (5)	2	12%
Agree (4)	11	65%
Not Sure/Neutral (3)	1	5%
Disagree (2)	2	12%
Strongly Disagree (1)	1	5%
Mean		3.6

4.2 BKAT General Critical Care Knowledge Data

Scores on the BKAT were obtained at three time points: prior to the initial critical

care training, post-initial critical care training (prior to the project's supplemental

training), and post-supplemental training. BKAT scores were described using descriptive

statistics and total BKAT mean score changes were evaluated for significance using the

Wilcoxon signed rank test due to the non-parametric nature of the data. There were 16

participants who completed the BKAT at all three time points, one participant did not

complete the post-supplemental training BKAT. Table 3 shows the results of descriptive

analyses of the BKAT scores at all three time points. Scores on the total BKAT improved from a mean of 65.7 to 71.6 to 73.7. Scores for each subject area were also assessed (with pre-and post-initial course scores used to identify the content of the post-supplemental training). BKAT subject area scores increased at all three time points, except for scores for renal and endocrine subject areas.

Table 3: Descriptive statistics for all survey scores (n=16).

Survey	Count	Mean	SD	Median	IQR	Min - Max
BKAT Pre-Course	16	65.7	5.7	65.5	60.0-72.0	58.0-73.0
BKAT Post-Course	16	71.6	11.9	75.0	66.5-78.5	40.0-88.0
BKAT Post-Supplemental Training	16	73.7	6.7	71.0	69.0-78.0	64.0-86.0
CV PRE	16	55.2	9.9	51.5	46-63	45-74
CV POST	16	68.8	11.1	68.0	61.5-77	44-84
CV POST SUPPLEMENTAL	16	70.5	10.7	66.5	65-75.5	55-92
RESP PRE	16	63.3	15.2	63.0	55-72	27-90
RESP POST	16	74.4	16.2	72.0	63-85.5	45-100
RESP POST SUPPLEMENTAL	16	74.8	12.6	72.0	67.5-85.5	45-90
NEURO PRE	16	67.7	20.3	68.5	56-87	25-100
NEURO POST	16	72.4	20.1	75.0	62-87	37-100
NEUOR POST SUPPLEMENTAL	16	76.3	15.8	75.0	68.5-87	37-100
ENDO PRE	15	65.2	13.4	66.0	55-77	44-88
ENDO POST	16	67.3	20.4	71.5	49.5-88	22-88
ENDO POST SUPPLEMENTAL	16	64.6	16.5	66.0	55-77	33-88
RENAL PRE	15	77.7	14.2	71.0	71-85	57-100
RENAL POST	16	74.3	22.6	78.0	64-85	10-100
RENAL POST SUPPLEMENTAL	16	81.7	12.3	85.0	71-85	57-100
GI PRE	16	68.8	29.6	75.0	75-75	0-100

GI POST	16	79.7	20.9	75.0	62.5-100	50-100
GI POST SUPPLEMENTAL	16	90.6	12.5	100	75-100	75-100
IV PRE	16	56.9	22.6	66.0	50-66	0-83
IV POST	16	65.1	12.8	66.0	66-66	33-83
IV POST SUPPLEMENTAL	16	70.3	15.7	66.0	66-74.5	33-100
CARE PRE	16	87.5	28.9	100	100-100	0-100
CARE POST	16	96.9	12.5	100	100-100	50-100
CARE POST SUPPLEMENTAL	16	96.9	12.5	100	100-100	50-100

Although there was an increase in total mean BKAT scores, there was no statistically significant difference in the pre- and post-initial course BKAT scores (p=0.094). Similarly, total mean BKAT scores improved from post-initial course to post-supplemental training, but this was not a statistically significant change (p=0.534). The mean total BKAT scores pre-initial course were also compared to the post-supplemental training scores and this revealed a statistically significant improvement in scores (p=0.002), with the mean scores increasing from 65.7 to 73.7. Table 4 presents mean total BKAT scores at each time point, along with the results from the Wilcoxon signed rank tests.

Table 4: Analysis of changes in mean total BKAT scores (n=16).

Survey	BKAT Pre-Initial Course	BKAT Post-Initial Course	p value
Total BKAT Score % mean (SD) [a]	65.7 (5.7)	71.6 (11.9)	.094
	BKAT Post-Initial Course	BKAT Post-Supplemental	
Total BKAT Score % mean (SD) [a]	71.6 (11.9)	73.7 (6.7)	.534
	BKAT Pre-Initial Course	BKAT Post-Supplemental	
Total BKAT Score % mean (SD) [a]	65.7	73.7	.002*

Abbreviation: SD, standard deviation
* indicates statistical significance at p <0.05
[a] indicates Wilcoxon sign-rank test performed, due to non-parametric nature of the data. Values reported as mean (SD). See Table 3 for median, IQR, min-max for more detail

4.3 Oncology Knowledge Survey Data

An Oncology Knowledge Survey was administered pre- and post-supplemental training and 17 participants completed these surveys. Table 5 shows the number and percentage of participants who answered each item correctly. The table demonstrates that there were four items on the oncology knowledge survey that the majority of the participants did not answer correctly. Mean total scores on the oncology knowledge survey were compared using a Wilcoxon signed rank test. The mean total scores increased from 75.3% (SD 8.3) to 80.9% (SD 10.2), which was a statistically significant improvement (p=0.039).

Table 5. Oncology knowledge item results (N=17).

	Pre-Supplemental		Post-Supplemental	
Item Number	Correctly Answered Number	Correctly Answered Percentage	Correctly Answered Number	Correctly Answered Percentage
1	16	95%	17	100%
2	16	95%	17	100 %
3	12	71%	11	65%
4	15	89%	17	100%
5	16	95%	17	100%
6	17	100%	17	100%
7	1	6%	2	12%
8	10	59%	12	71%
9	7	42%	10	59%
10	4	24%	7	42%
11	16	95%	16	95%
12	16	95%	17	100%
13	17	100%	17	100%
14	13	77%	15	89%
15	10	59%	10	59%
16	15	89%	17	100%
17	9	53%	8	48%
18	17	100%	17	100%
19	14	83%	12	71%
20	17	100%	17	100%

4.4 Comfort Level Assessment

Comfort level in caring for critically ill patients and high acuity oncology patients was also measured pre- and post-supplemental training. There were 17 participants who completed these items pre-supplemental training, and 14 participants completed them post-supplemental training. Data was analyzed using a chi-square analysis. As described in Table 6, comfort levels in caring for critically ill and high acuity oncology decreased

from pre-to post-supplemental training, but this was not a statistically significant

difference (p= 0.304, p=0.113).

Table 6: Comfort with critical illness and high acuity oncology patients.

Survey	Pre (*n* = 17)	Post (*n* = 14)	*p* value
Comfort in caring for critically ill patients			
n (%)			
Very comfortable	0	0	--
Mostly comfortable	2 (11.8)	1 (7.1)	.665
Somewhat comfortable	12 (70.6)	7 (50.0)	.242
Minimally comfortable	3 (17.7)	6 (42.9)	.124
Not comfortable	0	0	--
Mean	2.94	2.64	.304
Comfort in caring for high acuity oncology patients			.113
n (%)			
Very comfortable	0	0	--
Mostly comfortable	0	1 (7.1)	.263
Somewhat comfortable	12 (70.6)	5 (35.7)	.052
Minimally comfortable	4 (23.5)	8 (57.1)	.056
Not comfortable	1 (5.9)	0	.356
Mean	2.65	2.50	.113

Abbreviation: n, Number
* indicates statistical significance at p <0.05

4.5 Satisfaction

After completing the post-supplemental training, participants were asked to rate

their satisfaction with each learning method and their overall satisfaction of the

intervention using a Likert scale, ranging from1= least satisfied to 5= most satisfied.

Fourteen participants completed this survey and Table 7 shows the data. There was a high

level of satisfaction for the overall intervention (Mean 4.7). Scores were highest for

lecture (Mean 4.7) and lowest for journal club (Mean 4.1). Open-ended questions also

asked participants for suggestions to improve the intervention and for general comments regarding the education provided. There were 10 comments were received, and comments were sorted to identify common themes. Participants suggested ways to improve the intervention for future cohorts and suggested to utilize more simulation activities and provide more education sessions overall. General comments indicated participants were satisfied with the course, they enjoyed when real life examples were presented to enrich their understanding, and they felt secure while learning and did not feel like "they were put on the spot."

Table 7: Post-supplemental training satisfaction for learning methods (1, least, 5 most) (n=14).

	(1)	(2)	(3)	(4)	(5)	Mean
Method						
Case Study	0	0	2	5	7	4.3
Simulation	0	1	2	1	10	4.4
Journal Article	0	0	6	5	4	4.1
Lecture	0	0	0	4	10	4.7
Overall	0	0	0	3	11	4.7

Chapter 5: Discussion

5.1 Discussion of Results and Implications for Practice

Preparing nurses to care for critically ill patients is vital for patient safety and positive outcomes; therefore, nursing education should be developed based on evidence that has resulted from studies of prior educational courses (AACN, 2019; Wynd, 2002). When opening high acuity beds on the project's oncology unit, careful attention to the education nurses needed was deemed essential. A primary goal was to improve nurses' knowledge of general critical care and to build their knowledge specific to the care of critically ill oncology patients.

General critical care knowledge was measured using the BKAT. The BKAT has been widely used for assessing the entry level knowledge of critical care nurses pre-and post-education. In one study that had a similar design as the current project, there was no statistically significant difference in BKAT scores; however, there was an improvement in the self-assessment autonomy scores for transitioning to practice (Aari et. al., 2004). Whereas, Lakanmaa et. al. (2013) found that BKAT scores were significantly improved post-completion of a critical care course. In this current project, nurses took the BKAT before and after their initial general critical care course, and then took the BKAT again post-supplemental training. Findings showed scores increased at all time points; however, there was no statistically significant improvement from pre-to post-initial course or from post-initial course to post-supplemental training. There was a statistically significant increase in the total mean BKAT scores from the pre-initial course to the post-

supplemental training. Mean total BKAT scores increased from 65.7 to 73.7 (p=0.002) to show that the nurses' knowledge of general critical care significantly improved after having received both the initial course and supplemental training. This highlights the effectiveness of critical care education for oncology nurses, as well as the need for repeated education. Further, the data from the first two time points were used to identify areas of focus for the supplemental training, which may have helped to further improve BKAT scores in subject areas with noted deficiencies.

Although there are BKAT versions specific to other critical care specialty areas (such as pediatrics, progressive care, emergency medicine), there is currently no version of the BKAT to evaluate knowledge for the care of critically ill oncology patients. This project was important because as the complexity of oncology patients increases, the need for critical care trained oncology nurses is imperative. Patients who develop a malignancy, specifically a hematologic malignancy, often require complex supportive care (Martina, Ghadimi, & Incekol, 2016) further supporting the need for this project. There is a lack of research studies or evidenced-based projects regarding critical care training for nurses who care for oncology patients. Many oncology patients experience life-threatening illnesses related to their cancer and its treatment and having specialty nurses that are trained in both oncology care and critical care can lessen adverse events and improve patient outcomes. Therefore, oncology knowledge questions were developed for this project and administered pre- and post-supplemental training. There was a statistically significant improvement in the mean oncology knowledge scores (p=0.039), which demonstrates improved knowledge about oncology emergencies that the nurse participants will observe with this patient population. Further analysis of the breakdown

of correctly answered items demonstrated that four of the items were answered incorrectly by the majority of the participating nurses. This signifies that future efforts need to improve the oncology emergency education to assure the nurses' attainment of knowledge on the topic. Additionally, these four questions need to be reviewed and likely revised prior to administering the survey to future cohorts. However, significant improvements in overall scores signifies that the project was effective in improving nurses' knowledge about caring for critically ill oncology patients. Having highly trained, specialized nurses in oncology and critical care is important to help improve overall outcomes for this patient population and reduce overall healthcare spending.

The nurses' comfort level in caring for critically ill and high acuity oncology patients did not improve from pre- to post-supplemental training. This may have been due to the supplemental training heightening their realization of the high acuity of these patients who have multiple complex problems. In other words, the supplemental training may have helped participants better realize the extent of nursing care required for critically ill oncology patients. As nurses gain more experience in caring for critically ill oncology patients, their comfort level should improve with time. Many of the nurses who completed the intervention expressed interest in repeat education sessions with longer class times to review or learn new concepts on patient care they are providing. Ongoing education and repeated evaluation of nurses' comfort is warranted.

Having specialty nurses complete a critical care course has been shown to increase nurses' satisfaction and retention (Madhuvu et. al., 2018). In the current project, participants expressed a high level of satisfaction for the overall training and the learning methods used. The use of simulation has been shown to greatly increase nursing

confidence, thereby increasing nursing satisfaction with caring for critically ill patients (Boling & Hardin-Pierce, 2016). Nurses' comments indicated a desire for more simulation learning, which may further increase satisfaction and may also improve comfort as they gain experiential practice.

It has been shown that having specialty nurses complete a critical care course can lead to a decrease in adverse events relating to patient care, as well as a decrease in infection rates and length of hospital stay (Madhuvu et. al., 2018). Although this was not a stated objective of this current project, cost and patient outcome data is tracked by the project unit. Since the opening of the high acuity oncology beds at the project site (April 2019 to February 2020), there have been 134 admissions to the high acuity beds and this represents a $767,232 cost avoidance in admissions to the critical care units. It is significant to note that there have been no reported complications such as Central Line Associated Blood Stream Infections, Catheter Associated Urinary Tract Infections, Infection-related Ventilator Associated Complications or Pressure Injuries (stage 2 or higher) for patients who were admitted to the high acuity beds on the oncology unit. As these are considered measures of the quality of nursing care (Flaatten, 2016), this indicates that the critically ill patients on the oncology project unit have been receiving high-quality care from the nurses who participated in this project. Finally, the patients admitted to the high acuity beds on the oncology unit have not experienced any sentinel or significant negative events related to patient care, chemotherapy administration or medication errors; further demonstrating the high-quality of care being provided. Therefore, facilities with a large number of oncology patients requiring critical care should consider adding high acuity beds to their oncology units and ensuring oncology

nurses receive similar education and training to ensure they are able to provide safe, effective nursing care.

There were numerous challenges in completing this project. The biggest challenge was the allotment of time to have the nurses complete the supplemental training intervention. Also, it was difficult to find time where the nurses would not be pulled from staffing for an extended period of time. The first two cohorts were divided into two different 4-hour sessions to prevent going over scheduled allotted hours. The third cohort was compressed into one 8-hour training day due to other mandatory training that needed to occur. The sample size was also limited due to the number of nurses who met inclusion criteria and staffing needs for the unit. To overcome these challenges, nursing leadership worked to divide the nurses into three different cohorts and arrange schedules to allow for maximum participation. It is evident that nursing leadership and buy-in are pivotal to offering ongoing education for nurses.

5.2 Limitations

There were limitations to this project. First, the sample size was small and this may have contributed to the lack of statistical significance for the BKAT results for time points 1 to 2 and for time points 2 to 3. However, there was a statistically significant improvement in total mean BKAT scores from time point 1 to time point 3. Due to the difficulty in scheduling that resulted from conflicts with other mandatory training the nurses had to complete, only 17 nurses completed all required post-supplemental training for this project. In addition, the sample size was not diverse (100% of participants were female) and all worked on the same oncology unit. Future projects should seek to obtain a larger and more diverse sample of nurses. Next, the years of nursing experience of the

participants was low with majority of them having 1-3 years of total nursing and oncology nursing experience and the results may differ among more experienced nurses. Another limitation is that 3 different cohorts participated, with the third group receiving the supplemental training in one day. Group differences were not compared due to the small sample size. Additionally, although participation was voluntary, unit leadership encouraged it, and this may have influenced survey responses.

This project also did not evaluate for sustained knowledge levels such as 6 or 12 months following the supplemental training and this should be addressed in future projects to ensure nurses have the knowledge they need to provide safe care and to identify how often continued education is needed. Lastly, the oncology knowledge survey questions were designed by the project lead and 4 items on the survey were problematic. Revision of the items and reliability testing is important.

5.3 Future Projects and Research

Future projects should repeat this project on a larger and more diverse sample. To improve generalizability, research including multiple units or multiple hospitals is warranted. In regard to the methodology, future projects should consider re-administering the BKAT and oncology knowledge questions 6-months to 1-year post completion of supplemental training to assess if nurses retained the knowledge and whether there was further improvement due to experience gained with performance of critical care in clinical practice. There is also a need for further development of reliable and valid oncology knowledge questions, as there is no oncology-specific version of the BKAT. An oncology-specific BKAT would help to ensure these specialized nurses have the knowledge necessary for safe care. The nurse participants reported a desire for more

education, yet scheduling issues were a barrier. Therefore, future projects may consider development of online training modules to provide ongoing education to overcome scheduling barriers. Finally, future projects should evaluate the cost effectiveness of having specialized high acuity beds, as well as the cost savings and patient outcomes that result from training specialized nurses to care for critically ill patients. Data on cost savings and improved patient outcomes would help to increase support for the expense associated with providing continuing education to nurses.

5.4 Conclusion

Scores on the BKAT showed a statically significant improvement in the oncology nurses' general critical care knowledge. There was also clinical significance as demonstrated by positive results of clinical nursing quality indicators and absence of sentinel events and errors. Oncology knowledge scores also significantly improved. This was an important finding because oncology patients who are critically ill have unique nursing care needs. By having critical care trained oncology nurses with adequate knowledge of general and oncology critical care, the care of these acutely ill oncology patients with complex problems can be improved.

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Appendix A: Demographic and General Information Survey and Post Supplemental

Training Questions

Please write in or circle the response that best describes you:

1. What is your gender?

2. What is your age in years?

3. How many years of total nursing experience do you have?

4. How many years of oncology nursing experience do you have?

5. Circle the highest nursing degree you have obtained:

Diploma degree

Associates degree

Bachelor's degree

Master's degree

Circle the response that best describes your learning preferences and comfort level:

1. Learning by partaking in journal club is adequate for my retainment of subject knowledge

    Strongly agree   Agree   Not sure/Neutral   Disagree   Strongly disagree

2. Learning by partaking in simulation training is adequate for my retainment of subject knowledge

    Strongly agree   Agree   Not sure/Neutral   Disagree   Strongly disagree

3. Learning by partaking in reviewing a case study is adequate for my retainment of subject knowledge

Strongly agree   Agree   Not sure/Neutral   Disagree   Strongly disagree

4. I would rate my comfort level for caring for critically ill patients as:

Very comfortable   Mostly comfortable   Somewhat comfortable Minimally comfortable Not comfortable at all

5. I would rate my comfort level for in caring for high acuity oncology patients as:

Very comfortable   Mostly comfortable   Somewhat comfortable Minimally comfortable Not comfortable at all

Post-supplemental training questions:

1. How many supplemental training sessions did you attend over the past 6 weeks?

2. I would rate my comfort level for caring for critically ill patients as:

Very comfortable   Mostly comfortable   Somewhat comfortable Minimally comfortable Not comfortable at all

3. I would rate my comfort level for in caring for high acuity oncology patients as:

Very comfortable   Mostly comfortable   Somewhat comfortable Minimally comfortable Not comfortable at all

Appendix B: Oncology Knowledge Survey

1. CYou are caring for a patient with newly diagnosed Diffuse Large B Cell Lymphoma who has a high tumor burden. Upon review of the admission labs you have concern for possible tumor lysis syndrome. Which lab values would validate your concern?
   a. WBC: 50K, Hgb: 8.0, PLT: 55K
   b. Blood Glucose: 218
   c. Phosphorus: 7.8, LDH: 1500, Uric Acid: 16
   d. INR: 1.4, PTT: 45.6 sec, Fibrinogen: 250

2. In a patient you are caring for who has been diagnosed with Tumor Lysis Syndrome which complication would you expect the patient to have?
   a. Acute Anemia
   b. Thrombocytopenia
   c. Acute Kidney Injury
   d. Hemorrhagic Cystitis

3. In a patient that you are caring for you note an elevated Uric Acid (14), knowing that the patient is developing signs of Acute Kidney Injury (Cr 2.3). You would expect the provider to prescribe which medication?
   a. Zometa
   b. Insulin
   c. Rasburicase
   d. Allopurinol

4. R-CHOP has been initiated on your patient with newly diagnosed Diffuse Large B Cell Lymphoma, what medication would you expect your patient to be administered for prophylaxis TLS prevention?
   a. Acyclovir
   b. Heparin
   c. Allopurinol
   d. Zometa

5. You are caring for a newly diagnosed Acute Promyelocytic Leukemia (APL) patient. You are evaluating the laboratory values and noted a coagulopathy:
   - Fibrinogen 100
   - aPTT 59 sec, PT 20 sec
   - PLT: 16K
   - INR 2.0

   Noting these laboratory values, you know the patient is developing:

   a. Tumor Lysis Syndrome
   b. Disseminated Intravascular Coagulation
   c. Pulmonary Hemorrhage
   d. Cardiomyopathy

6. Noting the patient has developed DIC and the above lab vaules what assessment findings would you expect to see?
   a. Distended abdomen, hypoactive bowel sound
   b. Petechiae, mucosal bleeding and scattered ecchymosis

    c.   Expiratory wheezing
    d.   Confusion

You are caring for a patient who was diagnosed with APL. They are undergoing Induction therapy with ATRA(D14) and Arsenic (D12). You go into the patient's room to perform your afternoon assessment and notice that the patient is demonstrating signs of respiratory distress. You call the provider and a stat CXR is ordered:
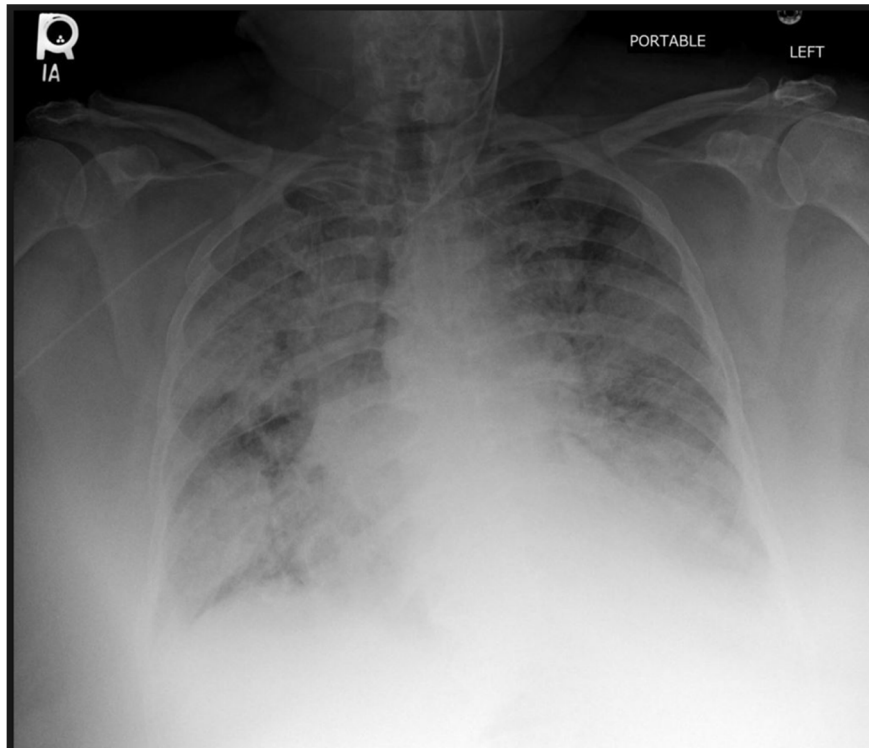
7. Based off the above image what is your first concern? (Choose the best 2 answers)
    a.   Congestive Heart Failure
    b.   Pulmonary Edema
    c.   Pulmonary Hemorrhage
    d.   All of the above

8. The provider orders additional test to include CBC, Coagulation panel and CMP. The CBC returns and you note the WBC has trended up to 30K and Hgb is 9.2 and PLTs are 35K. The coagulation panel is WNL. What is your concern now?
    a.   Pulmonary Hemorrhage
    b.   Differentiation Syndrome
    c.   Pneumonia
    d.   Acute Kidney Injury

9. What would be the first treatment intervention you would expect to be ordered by the provider?
    a.   Broad spectrum antibiotics
    b.   High Dose Steroids
    c.   Emergent dialysis
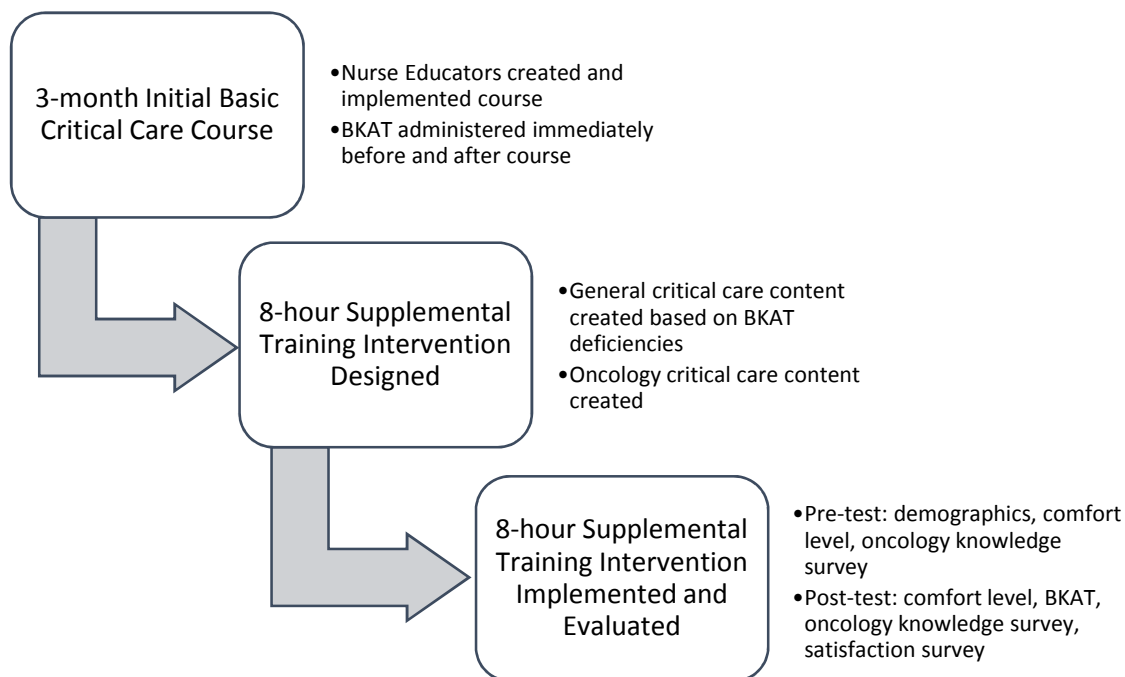
    d. Bronchodilators

10. What is the other priority intervention you would expect from the provider to care for this patient?
    a. Suspending ATRA
    b. Transitioning the patient to comfort care measures
    c. Hemodialysis
    d. Continue to monitor for further respiratory decline

You are caring for a patient who was admitted for "flu like symptoms", on initial laboratory results patient was noted to have a leukocytosis of 240K, Hgb of 5.0, PLTs 35k. The differential on the CBC showed 70% circulating blasts. The provider also requests a peripheral smear. The peripheral smear demonstrates Acute Myeloid Leukemia.

11. On evaluation of the patient you note the patient to be confused and tachypneic. You call the provider and report the assessment findings. You noticed that the provider is ordering Hydrea. What would your next expected intervention be for this patient?
    a. Rapid PRBC transfusion
    b. Emergent dialysis
    c. Leukapheresis
    d. Continue to monitor

12. What complications could occur in the above patient?
    a. Multisystem organ failure
    b. Tumor Lysis Syndrome
    c. Stroke
    d. All of the above

13. After 1 treatment of leukapheresis the WBC count has been reduced to 100K. You notice that the provider has ordered a unit of PRBC. Patient's initial symptoms have improved and Hgb is 6.0. Being an experienced Oncology nurse, you question the order because you know:
    a. PRBC transfusion can increase the risk of leukostasis causing further multi-system damage
    b. Its ok to give the blood because the Hgb is below the transfusion parameter of 8.0.
    c. You know to pre-medicate with Acetaminophen and Benadryl as hematology patients have a higher risk of transfusion reaction

14. Neutropenic Fever is an oncology emergency?
    a. True
    b. False

15. Commonly patients are diagnosed with GNR bacteremia because of?
    a. Patients are unable to provide care for their invasive lines
    b. In the neutropenic state of patients, they commonly have GI bacteria translocation to the blood stream
    c. The longer a patient is neutropenic the more prone they are to resistant bacteria

16. You are caring for a patient who received the Yescarta CAR T cell infusion and is day 8. The patient develops a fever and hypotension. You call the provider immediately because you know the patient could be developing:
    a. ARDS
    b. Dehydration
    c. Cytokine Release Syndrome
17. You are caring for a newly diagnosed Multiple Myeloma patient. On initial laboratory results you notice the patient has developed an acute kidney injury, the Kappa light chains are elevated, hypercalcemia and now with a new oxygen requirement. While the patient is being prepared for Hemodialysis what would you as the nurse expect the provider to give acutely?
    a. Rasburicase
    b. Normal Saline bolus
    c. Zometa
    d. Insulin
18. You are caring for a patient with newly diagnosed NHL (Non-Hodgkin's Lymphoma) with a known large spinal tumor. The patient calls out to the nurse's station complaining of increased back pain with decrease in sensation movement to their bilateral lower extremities. You are immediately concerned for:
    a. Acute Stroke
    b. Spinal Cord Compression Syndrome
    c. Multiple Sclerosis exacerbation
19. Your patient has been diagnosed with an Acute Pulmonary Embolism; you know that this commonly occurs because of what disease process:
    a. Acute Malignancy
    b. Immobility
    c. Patient has Factor V Liden deficiency
    d. All of the above
20. A patient is admitted with acute renal failure, hypercalcemia, acute back pain from pathologic compression fracture and acute anemia. A bone marrow biopsy is obtained, and you know that the patient likely has Multiple Myeloma because
    a. Only patients with multiple Myeloma present with Acute Renal Failure
    b. Patient meets the CRAB criteria
    c. Only patients with acute pain are diagnosed with Multiple Myeloma

Appendix C: Diagram of Project and Data Collection

3-month Initial Basic Critical Care Course
- Nurse Educators created and implemented course
- BKAT administered immediately before and after course

8-hour Supplemental Training Intervention Designed
- General critical care content created based on BKAT deficiencies
- Oncology critical care content created

8-hour Supplemental Training Intervention Implemented and Evaluated
- Pre-test: demographics, comfort level, oncology knowledge survey
- Post-test: comfort level, BKAT, oncology knowledge survey, satisfaction survey

Appendix D: IRB Approval UNCC

Jennifer Leake <jleake1@uncc.edu>

IRB Notice - 19-0240
2 messages

IRB <uncc-irb@uncc.edu>   Mon, Jul 22, 2019 at 8:38 AM
To: jleake1@uncc.edu, kpower15@uncc.edu
Cc: uncc-irbis@uncc.edu

To: Jennifer Leake
School of Nursing

From: Office of Research Compliance

Date: 7/22/2019
RE: Determination that Research or Research-Like Activity does not require IRB Approval
Study #: 19-0240

Study Title: Evidence-Based Critical Care Education for Oncology Nurses

This submission was reviewed by the Office of Research Compliance, which has determined that this submission does not constitute human subjects research as defined under federal regulations [45 CFR 46.102 (e or l) and 21 CFR 56.102(c)(e)(l)] and does not require IRB approval.

Study Description:

This quality-improvement DNP scholarly project will use Basic Knowledge Assessment Tool (BKAT) results to evaluate oncology nurses' critical care knowledge after a basic critical care education course. The post-education BKAT results will be used to create and implement supplemental training designed to improve identified knowledge deficiencies, with effectiveness measured using the BKAT post-supplemental training. Oncology-specific critical care education will also be created and implemented, with changes in knowledge measured pre and post-supplemental training.

Please be aware that approval may still be required from other relevant authorities or "gatekeepers" (e.g., school principals, facility directors, custodians of records), even though IRB approval is not required.

If your study protocol changes in such a way that this determination will no longer apply, you should contact the above IRB before making the changes.

Appendix E: IRB Approval- Project Site

<table>
<tr>
<td colspan="2" align="center">CAROLINAS HEALTHCARE SYSTEM
Institutional Review Board / Patient Privacy Board

IRB Review & Determination of QI vs. Research Projects</td>
<td>**RECEIVED**
MAY 21 2019
CHS IRB</td>
</tr>
</table>

Submission Date: 5/16/2019	IRB Tracking #: (To be supplied by the IRB)
Project Lead: Jennifer Leake	Dept.: Levine Cancer Institute
Phone: 434-962-7776	E-mail: Jennifer.Leake@atriumhealth.org

Project Title: Evidence-Based Critical Care Education for Oncology Nurses

Is the project supported by funding?

☐ Yes – Federal or Foundational funding, please provide copy of grant proposal with this form

☐ Yes – Industry sponsored

☐ Yes – CHS internal funding

☒ No

Purpose of the project: *Provide a 2-3 sentence description*
The purpose of this quality improvement project is to use results from the BKAT to assess critical care knowledge of oncology nurses on 4T after completing the formal critical care course. Based on the results, supplemental education will be provided. Following the supplemental education, the BKAT will be administered again to determine the effectiveness of the supplemental education to nurses as well as the usefulness of the BKAT in targeting learning deficiencies.

Briefly describe project details, including how patients and/or providers will be involved:
The BKAT is a valid and reliable tool used to assess the basic knowledge of nurses entering into critical care nursing practice. The BKAT will be administered to nurses prior to Critical Care Education and post education. Pre- and Post-scores on the BKAT will be used to create supplemental training targeted at deficiencies identified from the BKAT. After completing the supplemental education, the BKAT will be administered to nurses a third time to determine the effectiveness of the supplemental education to improve the competency of nurses in critical care.

*Adapted from the Stanford University Research Compliance Office Determination of Human Subject Research screening form

QI vs. Research Screening Form
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3.25.15

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IRB Review & Determination of QI vs. Research Projects

Is this project Quality Improvement (QI)?		
Quality Improvement includes activities that have purposes limited to: (a) implementing a practice to improve the quality of patient care, <u>and</u> (b) collecting patient or provider data regarding the implementation of the practice for clinical, practical, or administrative purposes. Improvement projects are limited to a setting of care and do not seek to make universal changes to evidence-based care. See CHS Policy http://documents.carolinas.org/Research/QI_vs_Research_Definition.pdf.		
	Yes	**No**
Do you consider this project to meet the definition of QI as noted above?	☒	☐
Is the activity primarily designed to:		
1. Improve clinical care at CHS?	☒	☐
2. Apply to patients or populations beyond your specific study population?	☐	☒

Is this project Research?		
Research is "a systematic investigation, including research development, testing and evaluation that is designed to develop or contribute to generalizable knowledge". [45CFR46.102 and 45 CFR 164.501] See CHS Policy http://documents.carolinas.org/Research/QI_vs_Research_Definition.pdf.	**Yes**	**No**
Do you consider this project to meet the definition of research as noted above?	☐	☒
Does the project involve a systematic investigation that may include a hypothesis, testing and evaluation?	☐	☒
Is the activity primarily designed to:		
1. Develop new knowledge?	☐	☒
2. Apply to patients of populations beyond your specific study population?	☐	☒

Activity Involves Human Subjects?		
Does your project involve:	Yes	No

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Interventions or interactions with patients, including manipulation of a person, or a person's environment through surveys, interviews, tests or observations? **If yes, attach the document.**	☐	☒

Does your project involve:	Yes	No
Obtaining identifiable private information **about living people?**	☒	☐
If this project uses existing data, please answer the following:		
What is the source of the data (i.e., from whom/where): Nurse responses to the BKAT		
Are the data publicly available?	☐	☒
Can the individual associated with the data be identified?	☒	☐
Are the data de-identified? If yes, who did (or will) de-identify the data? Project Lead will de-identify data	☒	☐
Were the data collected specifically for this project?	☒	☐
Were the data collected as part of clinical care?	☐	☒

Clinical Investigation?	Yes	No
Does your project include testing the safety and efficacy of a drug or device in a human subject, including analysis or comparison of outcome data about a drug or device?	☐	☒
Does your project include a non-FDA-approved assay or In Vitro Diagnostic device?	☐	☒
Will any data resulting from this activity be submitted to the FDA?	☐	☒

Other Considerations	Yes	No
Does your project involve a vulnerable population, e.g. children, impaired adults with special consent issues, CHS employees? The data will be collected from Atrium Health Nurses, but the intent is to improve their competency and educational deficiencies in knowledge related to critically ill patients. See: http://documents.carolinas.org/Research/OCTR%20Research%20SOPs.pdf	☒	☐
Are there plans to publish information gained from this project?	☒	☐

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Will patients be consented for entry into this project?	☐	☒

What are the potential risks to participants? There are no identifiable risks to participants.

Improvement in knowledge of nurses and improved quality of care for patients

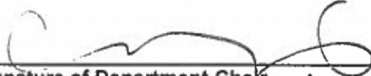**CERTIFICATION OF PROJECT LEAD:**
I certify that the information provided in this IRB Review of QI and Research Projects screening form is complete and accurate. The above titled project has been/will be conducted in full compliance with the HHS/FDA Regulations and IRB requirements/policies governing human subject research. IRB review is required for projects meeting the criteria of, "Research" as noted above.

_____   5/17/2019
Signature of Project Lead (only)   Date
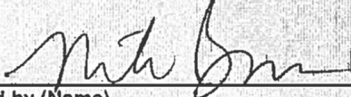
CERTIFICATION OF DEPARTMENT CHAIR (If a resident or student)
I certify that I have read the attached IRB Review of QI and Research Projects screening form and the project has been reviewed.

_____   5/20/2019
Signature of Department Chair   Camille Petraitis   Date

IRB Use Only

The IRB has determined this project is: ☐ Research   ☒ Quality Improvement

_____   5-31-19
Completed by (Name)   Date

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