

ORIGINAL RESEARCH

Assuring RN competency in central line catheter care

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ABSTRACT

The culture of healthcare is evolving and patients are expecting high quality, effective care from competent practitioners. This brings to light the challenge of maintaining and assuring competency in healthcare providers. The goal of this project was to identify the most effective, cost-conscious method for improving nurses' competency in central line care. Competency-based education using low-fidelity simulation was found to improve competency in nursing practice, leading to safer care, less hospital-acquired infections, and cost savings for the patient and the healthcare organization. This article highlights the importance of maintaining competency to improve patient outcomes and includes recommendations for use of low-fidelity simulation in central line care.

Key Words: Catheter-related bloodstream infections prevention and control, Ambulatory setting, Central venous, Competency assessment, Low-fidelity simulation, Nursing practice

1. INTRODUCTION

Competency in nursing practice is essential when providing safe, quality care to patients and families. The National Council of State Boards of Nursing^[1] defines competency as the "application of knowledge and the interpersonal, decision-making, and psychomotor skills expected for the nurse's practice role, within the context of public health, welfare and safety." It involves a combination of knowledge, skills and attitudes^[2] that reflect current practice^[3] and together meet expected levels of performance.^[4] Competency has been identified as a standard of professional nursing^[3] and is at the core of nursing practice.^[5] As part of the commitment to provide safe and effective care to patients and families, it is an expectation that nursing professionals will remain current and competent.^[3] Ensuring competency is not only the responsibility of nurses but also the nursing profession, professional organizations, employers, and credentialing and regulatory agencies.^[4] In order to maintain competency, it is

important to adequately assess and evaluate the knowledge, skills and attitudes required in current practice.

Assessment and maintenance of competency in the nursing profession has been addressed by local, state, and national organizations but it remains one of the most significant topics in nursing education today. The Joint Commission^[6] requires health care organizations to assess for competency at the time of hire and periodically throughout employment, especially with updates in technology or practice changes. Despite these recommendations, nurses may not be evaluated on a regular basis to ensure competency. The focus of the assessment is often the same year after year and topics do not change despite the fluid nature of nursing practice. In addition, competency assessment does not always address the nurse's ability to think critically when applying knowledge to patient care.^[7] This results in nurses unknowingly providing care or completing tasks incorrectly which may lead to negative patient outcomes. Periodic evaluations of

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best practice should be performed; simply participating in continuing education is not enough to ensure competence.^[8]

Maintaining competency is a challenge in the current health care environment as patient acuity levels are rising, budgets are tightening, and nurses are encouraged to spend more time at the bedside. Changes in health care require organizations to focus on minimizing waste and improving workflows. There is an even bigger push to keep nurses at the bedside and have nursing professionals perform to the maximum of their ability. This decreases the time and support for other activities such as quality improvement, evidence-based practice projects, and education. Minimizing time spent on other activities can have detrimental effects on health care outcomes. Central-line associated blood stream infections (CLABSI) are one of the main causes of health care-associated infections but are easily prevented when evidence-based practices are implemented.^[6] The Joint Commission recommends only allowing competent nurses to care for central lines. Therefore, nurses must demonstrate initial competency in the maintenance of central lines as well as complete periodic assessments to ensure evidence-based practice is being performed.^[6] Something as simple as missing one step greatly increases the risk for negative patient outcomes. While no evidence exists defining the maximum length of time a person can maintain competency, it is recommended that assessments are done periodically to ensure competence.^[6] Accepting education as an important piece of maintaining competency is one way to ensure nurses provide safe and effective care.

Background

Over 3 million central venous catheters are used each year in the United States to provide short- and long-term vascular access for blood, fluid, medication, and nutrition administration as well as laboratory and hemodynamic monitoring.^[6] Central venous catheters are placed by trained professionals in the arm, neck or chest and can be tunneled or non-tunneled depending on the use and length of time the catheter is needed. Non-tunneled catheters are only used in the hospital setting for short-term therapy. Implanted ports, peripherally inserted central catheters (PICCs), and tunneled catheters are used for long-term therapy and are common in the outpatient setting. While necessary, central venous catheters are invasive devices that may place patients at higher risk for negative outcomes.

Central venous catheters are the number one cause of health care-associated bloodstream infections and the third leading cause of health care-associated infections.^[6] It is estimated that over 330,000 CLABSI occur each year with 75% of the infections occurring in settings outside of the intensive

care unit^[6] where central lines are often used for long-term therapy. The average cost of a CLABSI is \$16,550 as it requires diagnosis and treatment and may require a prolonged hospital stay.^[6] This can amount to over a billion dollars in additional health care costs and does not even begin to take into account the physical and emotional turmoil experienced by patients and families. Additional action needs to be taken to decrease the number of CLABSI events and improve the care provided to patients.

Many organizations have called for a reduction in CLABSI rates by implementing evidence-based guidelines to provide safe and effective patient care. It has been shown that up to 70% of central line-associated bloodstream infections can be prevented when evidence-based practice is consistently used.^[6] While education and training may be available, routine CLABSI prevention education is not provided to all health care practitioners. Experienced staff may care for patients with central lines on a daily basis but do not know all of the steps involved in preventing a central line-associated bloodstream infection. Simply skipping one step of the evidence-based procedures may place the patient at a much higher risk of acquiring a central line-associated bloodstream infection. Therefore, it is essential that health care professionals understand the importance of using proper techniques to prevent central line-associated bloodstream infections^[6] and are competent in central line care. Current education requirements are not effective in ensuring competency in central line care.

There are many ways to measure competency in the health care setting but few address the knowledge, skills and attitudes that are required to maintain competency. Simulation education is used all over the world to teach many different types of nursing skills^[9] but has recently been noted as an option for maintaining competency.^[10] It allows for repetitive and realistic training in a safe environment. Learners are able to practice clinical judgement and decision making without risking patient safety. In addition, simulation provides immediate feedback that helps increase self-confidence and advance critical thinking skills.^[11] It allows learners to connect what is learned in the classroom to actual practice.^[10] Simulation can vary in fidelity or how realistic the environment and simulator are to the learner.^[9] High-fidelity simulation is more interactive and offers a higher level of realism^[12] but comes with added costs. Low-fidelity simulation is more basic but still offers a realistic learning environment at a much lower price. Another benefit to low-fidelity simulation is that it allows learners to focus on a few critical steps and not get caught up in the complexity of a patient situation.^[13] Low-fidelity simulators work best for task-based education such as learning basic nursing skills or practicing the steps

of complex cares.^[12] They are also beneficial in assessing competency as they allow the learner to demonstrate the knowledge, skills and attitudes in a realistic environment.^[14] Therefore, low-fidelity simulation may be beneficial when assessing competency in central line care.

The goal of this project was to determine if competency-based education and low-fidelity simulation enhance staff registered nurses' knowledge, skills and attitudes related to central line care. The Quality and Safety Education for Nurses (QSEN) knowledge, skills, and attitudes (KSAs) format from the QSEN Institute was used to define the KSAs for central line care for this competency. Competency-based education allows educators to provide clear learning expectations, view demonstration of proficiency, and evaluate competency on an ongoing basis.^[15] Simulation in education enables students to apply theory to patient care and practice skills repeatedly in a safe environment. While several education strategies exist to help improve knowledge and understanding in the clinical setting, few address the knowledge, skills and attitudes required for competency. This article highlights the importance of maintaining competency to provide evidence-based care to all patients.

2. IMPLEMENTATION PLANNING

A competency-based education and simulation format was used to measure staff registered nurses' knowledge, skills, and attitudes related to central line care. According to the Joint Commission,^[6] using didactic and hands-on training can help give staff the knowledge and ability to provide competent care. This program included both modalities to support all learners in maintaining competency. A knowledge assessment was completed before and after providing the competency-based education. These sessions were then followed by skills demonstrations in a low-fidelity simulation environment. Measurement data was collected by using competency assessment tools, a written test, and via surveys from the participants.

This project was conducted using participants who were employed at a rural, critical access hospital. Participants were staff registered nurses who had at least three years of nursing experience. Other than years of nursing experience, there were no exclusions for participants. Recruitment was conducted via flyers and emails which were sent to all nurses who provide outpatient infusion services and were thus required to maintain competency in central line care. Participation was completely voluntary and participants were given the opportunity to remove themselves from the project at any time. There were no dual or authority relationships between the nurse educators and the potential participants. Nine participants volunteered to take part in this project and

all nine completed the competency-based education and simulation. IRB approval was obtained from the University and the healthcare organization.

Participants were asked to sign an informed consent document that outlined the purpose of the project, goals, participation requirements, and the risks and benefits involved with participation. The educators did not identify any risks to participants and determined the benefits of participation would include the acquisition of knowledge and skills related to central line care. An explanation that participation was voluntary with no penalties if they chose to withdraw from the project was also included. Contact information for the project leads was provided with the informed consent document. Participants were required to sign the informed consent document before participating in the project.

2.1 Data collection instruments

A survey format using a four-point Likert scale was chosen to collect quantitative data regarding knowledge and attitudes related to the care of central lines. The survey and scale allowed participants to choose one option that best reflected their self-assessed confidence level related to the care of central lines. The Likert scale also provided clear objective statements for the staff educators to use in measuring nurses' skills during demonstrations. An even numbered scale was chosen to provide adequate response options yet reduce the number of neutral responses. The Likert scale utilized was: 1 for no confidence, 2 for mostly not confident, 3 for mostly confident and 4 for confident. The knowledge and attitudes survey was used immediately prior to and following the education intervention to assess participants confidence in performing central line care. The following are examples of statements that were included in the survey:

- (1) I always follow strict sterile technique when performing central line dressing changes.
- (2) I know that I always use the right solution to flush a central line.
- (3) I know how to differentiate between a valved and a non-valved central line.

Additionally, participants were asked to complete a 15-question written test following the education session. The tests utilized matching, true/false, and short-answer test item formats to assess knowledge in central line care. The variety of item formats within the test provided students with multiple ways to demonstrate competence.^[16] Skills competency was assessed using a KSA-based competency document that defined the required competencies for central line care and provided the educators with a means to objectively document the participant's performance (see Table 1).

Table 1. Knowledge, skills, and attitudes competency for accessing a picc line or implanted port (excerpt)

Knowledge	Skills	Attitudes	Method of Evaluation	Evaluator Assessment				Date & Initials
				1	2	3	4	
<i>This section applies to behaviors when accessing all central lines</i>								
	Assesses catheter (port) site for signs/symptoms of infection prior to accessing the catheter		SIM					
	Aspirates for blood return as a component of assessing catheter function prior to administration of medications or fluids		SIM					
	Implements trouble-shooting interventions if unable to obtain blood return		SIM					
Differentiates between a valved catheter and a non-valved catheter			TEST				Test Question #2	
		Embraces culture of safety practices	SUR					

Equipment

For the competency-based education, a computer with speakers and an LCD projector were used to display the PowerPoint presentation and videos. Equipment used in the simulation education sessions included two low-fidelity manikin arms and two low-fidelity manikin chests. The low-fidelity manikin arms had PICC lines in place that allowed for assessment of blood draws using simulated blood. Implanted ports were placed in the low-fidelity manikin chests for demonstration of port access and dressing changes. Central line care supplies were provided including central line dressing kits, flush syringes, port access kits, empty syringes, alcohol and chlorhexidine swabs, access caps, chlorhexidine patches, alcohol-based hand gel dispensers, and personal protective equipment such as gloves and masks.

2.2 Intervention

This project took place over a three-month timeframe in the Upper Midwestern United States. The initial teaching sessions were held in November, 2014 and the follow-up testing sessions were held in late February, 2015. The central line education session was designed to be completed within a 60-minute time frame to accommodate ambulatory nurses'

workflow. The short time frame allowed the education to be provided during a lunch hour or immediately following a shift. This was important as the competency-based education and simulation was not required at the organization. If a full hour was not available, the program could be split into two, 30-minute sessions; one session for education and the other for hands-on simulations and written assessments.

The educators used three objectives as a guideline to develop the education session. The first objective was to describe and demonstrate central line care and maintenance and apply principles of sterile technique where required. The second was to explain the difference in care for each type of central line. Lastly, the educators wanted staff registered nurses to embrace a culture of safety practices for prevention of CLABSI.

A PowerPoint presentation was developed to review evidence-based principles of central line care based on current evidence from the Joint Commission and the Centers for Disease Control.^[6, 17] In addition, the presentation included a review of sterile technique, explanation of the common valved and non-valved catheters used in the outpatient population, pathogenesis of central-line associated bloodstream

infections, and proper flushing techniques and solutions for each catheter type. Two brief videos were included within the PowerPoint to demonstrate a proper central-line dressing change using a chlorhexidine gel dressing and appropriate use of the Port Access Kit.

Participants were placed in groups of two to four for the competency-based education and simulation sessions to enhance learning and encourage discussion. The education sessions took place in a classroom setting at the critical access hospital. The classroom setting was ideal for reducing distractions as it required staff to leave the unit. A pre-education survey using a Likert scale from one to four was completed by each participant immediately before the start of the education session. This survey provided baseline data for the registered nurses' knowledge and attitudes related to central line care. Competency-based education via the PowerPoint presentation and videos of central line skills followed the pre-education survey. Participants then performed hands-on demonstrations of the defined competencies using low-fidelity simulation manikins in two different simulation scenarios. The first scenario utilized the low-fidelity manikin chest to demonstrate proper access of an implanted port. The second scenario involved completing a central line blood draw followed by a central line dressing change on the low-fidelity manikin arm. At the end of the education session, participants took a written test to assess post-competency-based education and simulation knowledge followed by the post-education survey. The post-education survey provided information on the nurses' confidence in providing central line care.

2.3 Methods of evaluation

Participants were evaluated during the competency-based education and simulation and reassessed three months later. Evaluation during the education sessions included the pre- and post-education surveys, the written test, and the skills demonstration using low-fidelity simulators. The three month evaluation included a skills demonstration, written test, and survey. Skills sessions were completed individually in order to remove variability related to the confounding factors of concurrent evaluation and interaction of the participants. The three month post-education evaluation provided an assessment of nurses' long-term knowledge, skills, and attitudes following the competency-based education and simulation.

3. RESULT AND DISCUSSION

Current practice of competency assessment is completed annually and often focuses on the same skills year after year. Nurses spend a short amount of time signing off on compe-

tencies for various skills but do not always receive education regarding best practice. This method of skills assessment and training does not adequately measure competency as it may not identify whether the nurse can complete all of the steps necessary to perform a skill safely and effectively. Prevention of CLABSI is only effective when all evidence-based procedural steps are completed correctly. Simply skipping one step when caring for a central line greatly increases the patient's risk for a CLABSI. Nurses should be able to identify the reasoning behind each step and demonstrate accurate performance of each skill required in the practice. This type of competency assessment and training requires more time than is allowed in most annual review skills training sessions. A common concern identified during recruitment of participants was the amount of time that nurses would be pulled away from staffing to participate in the competency assessment and evaluation of central line care. Department managers were aware of the need for their staff to be provided with more in-depth review of central line care but could not allow them to be removed from staffing for the hour of education. This project took a different approach to competency assessment by utilizing the knowledge, skills, and attitudes format to frame the education and subsequent assessments.

3.1 Findings

Participation was voluntary and nine nurses agreed to participate in this project. All nine nurses were female, white, and had three or more years of experience working with central lines. They ranged in age from 28 to 57 with the average age being 43.5 years old. In terms of education, four nurses were Associate Degree graduates, four were Bachelor's-prepared nurses, and one nurse was from a Diploma program. The average length of time as a Registered Nurse was 18 years and participants ranged from 5 to 33 years of experience.

All participants reported higher confidence levels from the pre-intervention survey to the post-intervention survey during the competency-based education and simulation session. Increases in self-assessed confidence ranged from 15% to 72% with a mean increase of 36% (SD = 20.41). More importantly, however, all participants continued to report increased confidence levels three months following the education session. During the three-month follow-up sessions, participants reported continued confidence improvements which ranged from a 7% increase in confidence to a 71% increase over their initial education session scores (M = 23%, SD = 28.17). In addition, three of the participants (33%) reported feeling 100% confident in their central line skills during their three-month follow-up. Of those three participants, written test scores also improved an average of 5% or one full point. In a similar study comparing the effectiveness

of high-fidelity versus low-fidelity simulation methods, participants also perceived the simulation experience increased their problem-solving ability.^[11]

Another improvement that demonstrated the value of frequent competency assessment was the overall improvement in core central line knowledge as assessed via the written test. Average test scores improved from 82% correct following the initial education session to 87% correct at the time of the three-month follow-up sessions. Only one student's test score was lower at the repeat session. Skill competency assessment did not show the same level of improvement as the confidence and written competency assessments. Skill demonstrations of line access and blood draws showed an average decrease in confidence of 17% (SD = 14.98) at the three-month follow-up sessions. Six of the nine nurses demonstrated no more than 50% of their skills at a confident level, with an additional 15% or more of their skills (M = 21.4%) at a mostly confident level. Only two of the nurses demonstrated 70% or more of their skills at the confident level. In terms of the potential for causing a CLABSI, these numbers are not reassuring. As described above, simply skipping one step in the care of central lines can greatly increase the risk for a CLABSI.

3.2 Limitations

Since this project was implemented at a rural, critical access hospital and only included outpatient nurses that care for patients with central lines, the number of participants was small (n = 9). In addition, participants were voluntary and a majority of the nurses who participated were experienced and committed to continuing education. Therefore, the results may not be generalizable as participants may not be an accurate representation of all outpatient nurses. Another limitation in this project was the evaluation tool used to assess the skills related to central line care. The large number of knowledge, skills and attitudes required to assess competency made it difficult for one educator to evaluate two nurses at the same time. It would be beneficial to have a more concise evaluation tool that is still rigorous but focuses on a few key steps in the competency and not every step involved. This project evaluated nurses' competency at three different times throughout the competency-based education and simulation: pre-education, post-education and at three months. Based on the findings of this project, competency assessment may be needed every three to six months for ambulatory staff nurses who are expected to access central lines but are not given the opportunity to perform the skill often enough to remain confident. Assessment at only three months may not adequately reflect the change in nurses' knowledge, skills and attitudes after receiving central line education. Additional follow-up

of participants at six months and one year may be an area for further investigation to help define the length of time a person can maintain competency.

3.3 Factors affecting validity

Participants may not have performed at their absolute best or taken the simulation exercises seriously knowing it was a pilot project without any repercussions for performance. Therefore, validity of these results cannot be assured. Another factor affecting the validity of the results was the complexity of the skills assessment tool. At all sessions, there was only one educator present to both monitor the simulation area and assess the skills of the participants. In addition, there was some difficulty using the assessment documents due to the length and number of knowledge, skills and attitudes included. Knowing that most ambulatory care departments only have one educator, our recommendation would be to format the tool to focus on the core competencies required to provide safe and effective central line care.

4. CONCLUSION

The health care environment is ever changing, evolving, and improving. Now more than ever, patients and families are expecting high quality care by competent practitioners. In addition, health care organizations are being held accountable for negative patient outcomes such as central line-associated bloodstream infections. In order to provide safe and effective care, nurses need to embrace the culture of providing best care through implementation of evidence-based practice at the bedside. It has been shown that nurses who work in health care organizations that have written policies and active formal training programs are more likely to embrace evidence-based practices to improve CLABSI rates.^[18] Health care today requires nurses who commit to being lifelong learners, not stagnant practitioners.

Competency should be assessed regularly and be built around current evidence. In addition, the focus of competency assessments should change based on new evidence and the needs of patients, nurses, and health care organizations. Nursing needs to avoid conducting annual competency assessments that address the same topics year after year. Embracing a culture of competency is essential to providing safe and effective care to patients and families.

There are many ways to evaluate competency in the health care setting. This project measured competency using the QSEN knowledge, skills and attitudes format which serves as a guide for nursing education with a focus on quality and safety.^[5] The competency-based education program and skill demonstrations using low-fidelity simulation were found to

be effective for improving central line care knowledge, skills, and attitudes. It was also demonstrated that skills related to central line care may decrease in as little as three months if the nurse does not perform the skills regularly.

Our recommendation for competency evaluation is to develop a regular assessment plan that addresses knowledge, skills and attitudes and includes some form of low-fidelity simulation. It is essential to evaluate not only the understanding of the competencies but also the actual demonstration of cares as these can vary greatly from practitioner to practitioner.

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CONFLICTS OF INTEREST DISCLOSURE

The authors declare that there is no conflict of interest statement.

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