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(Kaddoura, 2010). This type of simulation incorporates a computerized full-body mannequin that can be programmed to provide realistic physiologic responses to a practitioner’s actions. The mannequins have realistic heart, lung, and bowel sounds, reactive pupils, and full-body pulses that respond to physiologic events. The mannequins are used to simulate hemodynamic monitoring, needle decompressions, chest tube insertions, and can be made to exhibit realistic bleeding capabilities. The mannequins are able to demonstrate a wide variety of clinical conditions and respond to practitioners’ corresponding interventions. Because of those capabilities, the mannequins are a useful tool for hospital educators to teach and to aid in the evaluation of competencies (Decker et al., 2008).

Hospital-based nursing educators are routinely faced with teaching new and experienced nurses in addition to determining clinical competency. Nursing competency involves the acquisition of relevant knowledge, the development of psychomotor skills, and the ability to apply the knowledge and skills in a given context (Decker et al., 2008). Nurse educators have discovered that the traditional methods of evaluating competency (e.g., pre- and post-tests, verbal question-and-answer sessions, return demonstrations) do not always meet their needs to accurately determine competencies. Those methods of competency evaluation allow nurses to show every skill step on paper or in a controlled setting rather than demonstrate the critical responsibilities of practice and an understanding of nursing science in a situation that replicates reality more closely (Allen et al., 2008). Requests for abandoning these traditional approaches have been influenced by the complex healthcare environment, changes in technology, and pressing patient safety issues (Byrne, 2005).

Hospital-based nursing educators are turning to high-fidelity human patient simulation as a solution (Decker, Utterback, Thomas, Mitchell, & Sportsman, 2011). A major role of nursing educators is to facilitate learning and evaluation of skills and competencies and the development of clinical judgment (i.e., the marriage of knowledge and clinical practice) (Lasater, 2011).

The Ohio State University Wexner Medical Center (OSUWMC) in Columbus has been using simulation as an educational tool and a method to evaluate nursing competencies since 2006. To date, educators have completed 14 unit-based or division-based projects that have used simulation as one of the teaching and evaluation methods. About 1,000 nurses have completed simulation-based education events or competency evaluations. Despite the use of simulation with RNs, it had never been used with APPs at OSUWMC.

The education needs of practitioners continue after graduation and throughout clinical practice (Benner, Sutphen, Leonard, & Day, 2009; del Bueno, 2005). At the authors’ cancer hospital, nursing standards require a voluntary education needs assessment of all levels of staff every two years. This written self-assessment contains a combination of multiple-choice, oncology-focused topics, as well as some questions that require fill-in-the-blank answers. As a component of the full assessment, last completed in 2011, the APP Educational Needs Assessment was completed by 70 of 132 APPs, representing a 53% response rate at that time. The results clearly indicated a need for more education interventions.

### FIGURE 1. Clinical Judgment Model


- **Context**
  - Background
  - Relationship

- **Interpreting**
  - Expectations
  - Initial Grasp
  - Restoring Patterns
  - Analytic
  - Intuitive
  - Narrative

- **Responding**
  - Action
  - Outcomes

- **Reflecting**
  - Reflection on action and clinical learning
  - Reflection in action

### FIGURE 2. Examples of Priority Interventions for Advanced Practice Professional Education Assessment for Sepsis and Respiratory Failure Simulation

- Immediate patient assessment after receiving report
- Vital signs with critical analysis of results
- Early recognition of respiratory distress
- Appropriate notification of RN/charge nurse with assessment of respiratory distress
- Appropriate notification of RN/charge nurse with assessment of sepsis
- Appropriate notification of attending physician/fellow with assessment of respiratory distress and sepsis
- Give appropriate orders based on patient condition with critical analysis of results:
  - Respiratory distress
    - Arterial blood gas
    - Oxygen
    - Bronchodilator
  - Sepsis
    - Bolus IV fluids
    - Urinalysis with culture and sensitivity
    - Lactate level
    - Broaden antibiotic coverage
    - Central venous pressure
- Responds appropriately to nursing questions regarding guidance in the situation
- Requests or implements the sepsis resuscitation bundles
- Appropriately obtains and follows the febrile neutropenia protocol
- Proficient understanding and ordering of the various oxygen modalities

```plaintext
- **Outcomes**
  - Vital signs with critical analysis of results
  - Early recognition of respiratory distress
  - Appropriate notification of RN/charge nurse with assessment of respiratory distress
  - Appropriate notification of RN/charge nurse with assessment of sepsis
  - Appropriate notification of attending physician/fellow with assessment of respiratory distress and sepsis
  - Give appropriate orders based on patient condition with critical analysis of results:
    - Respiratory distress
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      - Bronchodilator
    - Sepsis
      - Bolus IV fluids
      - Urinalysis with culture and sensitivity
      - Lactate level
      - Broaden antibiotic coverage
      - Central venous pressure
  - Responds appropriately to nursing questions regarding guidance in the situation
  - Requests or implements the sepsis resuscitation bundles
  - Appropriately obtains and follows the febrile neutropenia protocol
  - Proficient understanding and ordering of the various oxygen modalities
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designed to better prepare healthcare practitioners to respond in emergency or rapidly declining clinical situations in the oncology population. The top six most highly rated topics were (a) acute and critical oncology care, (b) caring for the unstable patient with cancer, (c) symptom management, (d) diagnostic tests and interpretation, (e) pain management, and (f) palliative care. Those topics were identified despite that 52% (n = 69) of the respondents had been in their advanced practice role for more than five years, and 51% (n = 68) had more than five years of experience in oncology. After a detailed review of the full education needs assessment results, the advanced practice educator, a Master’s prepared APP educator, determined that the needs called for an education assessment and intervention with the use of simulation.

The purpose of the current evidence-based practice pilot project was to determine a best method for assessing APP performance in oncology-specific circumstances. The secondary objective was to determine if simulation would provide a robust assessment and education intervention for this group.

Theoretical Framework

The theoretical framework for this project was based on the Clinical Judgment Model (Tanner, 2006) (see Figure 1). This theory supports the use and development of clinical judgment through experiential learning and explores the ways in which care providers understand patient issues, attend to salient information, and respond with the deliberate, conscious interventions of the proficient or expert practitioner (Lasater, 2007, 2011; Tanner, 2006).

Methods and Analysis

A test group of 14 APPs, which was about 10% of the APP workforce at the time of implementation, completed the full oncology APP failure-to-rescue simulation initiative. The initiative, designed to correlate with the model shown previously, included the following: completion of an online competency self-assessment, completion of the Basic Knowledge Assessment Tool (BKAT)-8S, and attendance at a four-hour simulation and classroom experience. The BKAT-8S has been used in research since 1979 and has been accepted as a standard for measuring basic knowledge in critical care. The program and content were developed by the OSUWMC simulation program manager and the Ohio State University Comprehensive Cancer Center—Arthur G. James Cancer Hospital and Richard J. Solove Research Institute advanced practice educator and acute care nurse educator. The program structure included a didactic portion that reviewed core elements of typical failure-to-rescue situations and case scenario “dissections” that showed trends in care, priorities of care, and responses to actions and orders. This portion of the experience focused on the APP’s role in care of the declining patient with cancer. The instructor reviewed common critical clinical events for patients with cancer and key intervention strategies. Emphasis was placed on the ability to assess for subtle changes in condition to be able to intervene early and avoid escalating the patient crisis.

Clinical scenarios for the simulations were developed from a review of previous patients who had presented with what were later deemed to be difficult-to-manage crisis oncology clinical situations. The review included specific patient charts, early response team data, code-blue data, and event reports. The simulation included one patient scenario focused on a sepsis and respiratory failure patient and one scenario focused on a postoperative patient following a pneumonectomy who also was experiencing pain. The specific patient scenarios were chosen because those types of cases were seen more frequently in the data reviewed and because each case had a clear but divergent focus; one case was more medically focused, and the other was more surgically focused. Competency checklists with about 30 specific priority interventions for each scenario were anticipated by an expert panel. The expert panel consisted of eight staff members, including educators, APPs, nursing directors, and physicians. To monitor for the anticipated interventions during simulation, APP competency checklists were developed for each scenario (see Figures 2 and 3).

To assess and evaluate APP performance during these simulations, oncology clinical nurse specialists were incorporated in the sessions to act in other vital team member roles, including RNs, a charge nurse, patient care associates (i.e., nursing assistant), a respiratory therapist, an anesthesiologist, and family members. A basic script was created for each scenario, which was used as a guide for all participants to allow for the clinical situation to evolve as planned. Figure 4 shows an excerpted example of this script for the patient with sepsis and respiratory failure. All APP participants completed both simulation scenarios (see Figure 5). Each scenario was followed by a debriefing session, which included comments by the participants evaluating their own responses and the educators conducting
Background
The patient is being admitted to inpatient service from an outpatient clinic. The primary nurse and the charge nurse are already in the patient room. The APP will receive a report from a nurse practitioner in the clinic. The report should be hurried, but if the APP asks questions, they should be answered, if possible.

Report
“We have a 60-year-old male with newly diagnosed acute myelogenous leukemia. He was discharged last week after induction with daunorubicin, cytarabine, and etoposide. He visited the clinic today with complaints of an intermittent fever for two days. His fever was 100.5°F in the clinic. During induction, he experienced a severe exacerbation of COPD and started a prednisone ‘burst and taper.’ He is still on 10 mg per day. He continues to have some nausea, vomiting, and mucositis, but no diarrhea. Line and peripheral blood cultures have been drawn and sent. Patient still has a cough, and clinicians are not sure if it’s COPD, so they did a multiplex swab and a chest x-ray, but they have not been read out yet. Patient also has a history of hypertension. He has not taken any medications today because of nausea. He is on sliding-scale insulin with steroids, but he was never previously diabetic. Cefepime is hanging now. Looks stable.”

If the APP asks:
- Keep vein open; normal saline into double-lumen catheter in the right internal jugular
- Beats per minute, 108; respiratory rate, 28; blood pressure, 104/70
- Temperature of 101.5°F last night at home
- Pulse oximeter was 94% on room air.
- Uses albuterol as needed, but none today
- Lungs are decreased bilateral bases.
- White blood cell—500; absolute neutrophil count—20%; hemoglobin—8.2; platelets—75,000
- Chemistries and liver function tests were clear, but creatine was at 1.2, up from baseline of 0.8 previously.

Mannequin
Sinus tachycardia with ST segment elevation at 108 beats per minute, blood pressure of 104/70, and respiratory rate of 28, with 100.5°F and oxygen saturation at 93%. As the APP is assessing the patient, his rhythm becomes more unstable with the addition of premature ventricular contractions.

The blood pressure should begin to decrease with a slow drop to hang around 76/36, and the oxygen saturation should decrease to hang around 85%, with signs of cyanosis and mental confusion.

Mannequin Voice
Mr. B [continuous complaining, anxious, mildly confused]: “My chest hurts. I can’t catch my breath. It hurts to breathe. I just don’t feel good.”

Mr. B should be complaining and confused constantly enough that it should be obvious when he stops talking and becomes unresponsive.

APP—advanced practice professional; COPD—chronic obstructive pulmonary disease

FIGURE 4. Excerpted Script for APP Sepsis/Respiratory Failure Patient

the simulation. The responses that evolved from the simulator patient were based on the interventions that were enacted and, therefore, could not always be anticipated.

Findings
The test group of APPs (N = 14) had an average of 7.8 years in their advanced practice roles. Eleven of the APPs were CNPs, and three were PAs. Of the CNPs in the test group, seven had their advanced certification as family nurse practitioners, and seven were certified as acute care nurse practitioners. None were certified in oncology, which is fairly common among APPs. All of the providers worked exclusively in the inpatient setting because that was the focus of the pilot trial. Eight participants had previous critical care experience. All members of the test group were asked to complete a competency self-assessment prior to their simulation in the care of the failing patient with cancer by answering two questions on a five-point Likert-type scale, with 1 being “needs improvement,” 5 being “competent,” and 5 being “adept.” One of the questions asked nurses to rate current competency in terms of knowledge base when caring for a failing patient, and the average rating for this question was 4. Another question asked participants to rate current critical thinking skills when caring for a failing patient with cancer, and the average score was 3.71. Those ratings show that the APPs felt more than competent in caring for a failing patient in terms of general knowledge base and critical thinking skills, with critical thinking ranking slightly lower.

The next step in this initiative was to complete the BKAT-8S®. The BKAT-8S® has been used for more than 30 years in the assessment of basic critical care knowledge of nurses and has become accepted as a standard for measuring basic knowledge in critical care nursing. Items on the BKAT-8S® contain multiple choice and fill-in-the-blank questions that measure the recall of basic critical care information and the application of basic knowledge in critical care situations. After an orientation or education to critical care, the expected average score is 84%–87%. All of the APP participants scored at or above the level of a critical care RN with one year of experience on this test, with an average score of 92%.

During the actual simulation activity, 27 of the 30 anticipated interventions were enacted by all practitioners. Interventions that were anticipated but not enacted by all participants included central venous pressure monitoring, the ordering of a lactate level when the first key signs of sepsis were identified, and notifying or calling the responsible physician to the room in a timely manner. Those missing core interventions were discussed and emphasized during the subsequent debriefing and education session. Five additional crucial interventions, which had not been anticipated, were ordered with some regularity by the practitioners. Of the participants, six ordered stat med nebulizers, six ordered troponin level, six ordered trendelenberg, seven ordered an anesthesia consultation for probable intubation, and eight ordered an ST elevated myocardial infarction (STEMI) alert. In reviewing those unexpected interventions postsimulation, the educators felt that troponin level was not anticipated because the clinical scenario progressed in a different manner than anticipated (i.e., chest pain with related assessment and intervention). In addition, the process of STEMI alert had just been initiated throughout the institution prior to the simulation experience. No significant difference was found in performance by any measure used prior to or during the simulation experience between family nurse practitioners versus acute care nurse practitioners, or between CNPs versus PAs.

In general, the participant evaluation of the simulation experience was unwaveringly positive. One participant said, “This is an excellent way to provide real-world scenarios in a practice
environment,” and another said, “Great way to simulate my responses to patient issues that need to be caught and addressed quickly.” Another participant praised the program by saying, “Informative. Educational. Should be required of all advanced practice professionals and house staff!”

Discussion

Performance assessment by use of simulation can have positive and negative effects on the participants. The authors’ education sessions proved to have positive outcomes related to early recognition and management of a deteriorating patient, team communication, and identification of additional education needs. The participants noted that after the simulation activity, future education needs seemed much clearer to them than when they were queried on a written self-assessment alone. Participants provided expected as well as unexpected interventions, to the case scenarios. Team-based learning augmented with simulation provides the opportunity to expand on the expected outcomes to capture alternate pathways of care. In the sessions from the current study, the authors discovered unexpected interventions and responses as a result of the scenarios progressing down a different diagnosis pathway. Educators need to be prepared to recognize unanticipated variances, quickly decide if they are appropriate for the expected outcomes of the session, and redirect as needed.

The success of the education strategy has stimulated the initiation of a full-team oncology failure-to-rescue simulation, as well as other innovative simulation experiences at the authors’ hospital. This new type of simulation session broadened the participant base to include bedside nurses and advanced practice nurses, as well as other disciplines. The full team included two RNs, a charge nurse, a disease-specific CNP, a patient care associate, a respiratory therapist, and an attending physician, all of whom usually work together on the care of a specific patient population. The case scenario for this simulation was revised to be typical of the care usually provided by the group. Using findings from the previous sessions for the APPs, the key elements for the simulation activity focused on assessment and recognition, interventions, and communication. The addition of the attending physician as a participant in the sessions stimulated a different level of performance by the CNP, who sought approval for intervention orders prior to initiating them independently. A limitation of the current study is the lack of measurement of confidence pre- and postsimulation, which could be helpful in measuring impact.

Participant performance and feedback from the APP failure-to-rescue simulation sessions influenced structure and content changes to other oncology courses offered by the nursing education department, including the expert symptom management course and oncologic emergencies course. A course on the fundamentals in acute and critical care oncology is under development at the authors’ hospital. Patients with cancer are unique in that they are receiving care for cancer, in addition to dealing with preexisting health issues. Healthcare providers are challenged daily with determining whether the patient is presenting in a typical fashion for his or her oncology diagnosis and treatment or if he or she is heading down a path to something more unexpected.

Implications for Nursing

Simulation was shown to be an effective modality in the training of oncology APPs. A target goal of any teaching modality is to measure the effectiveness on participant learning and the impact at the patient level. Current practice demands have changed the model of care in oncology, and preparation of APPs should include individual and team-based learning programs that use simulation. The use of simulation to improve knowledge, skill acquisition, and teamwork and to standardize care is at the forefront of improved patient outcomes and safety initiatives and will continue to be integrated into education programs targeted to oncology healthcare providers at all levels.

A multidimensional education program that incorporates team-based learning can provide specific experiences for the learner, improving retention of knowledge, competence, skill acquisition, and patient outcomes. An important question that educators should ask is, “Does the addition of simulation to this program enhance participant outcome?” Despite the realism of the mannequins, patients with cancer often have atypical presentations for common emergencies, such as sepsis and respiratory failure when compared to the non-oncology patient. Respiratory distress may be difficult to simulate because of mechanical limitations in simulating the work of breathing (i.e., use of accessory muscles, nasal flaring, and facial expressions). Therefore, clinical case presentation review still needs to be incorporated into learning for all levels of oncology healthcare providers.

Conclusions

The use of simulation in hospital-based education programs is limited. Although modern mannequins are easy to use, significant expertise and cost are required to implement simulation effectively in education programs. Other challenges for educators include balancing participant interest in simulation with potential learning outcomes, as well as the time required for the educator to develop, implement, and evaluate outcomes of this type of training.
The future of oncology education and use of simulation as a teaching modality at the authors’ hospital includes several innovative initiatives, such as the purchase of a midlevel simulator, the development of a year-long oncology advanced practice nurse fellowship, the revision of previous oncology courses to include simulation, and the continued use of the high-fidelity simulation center for multidisciplinary team training and performance assessment. Continued support from the medical and nursing leadership teams is vital for team training to include practitioners of all levels. Evaluating the effectiveness of such learning is key to the success of any program.

Implications for Practice

- Invest in simulation as one option for clinical education of staff.
- Provide advanced practice professionals with education interventions designed to enhance skills for managing failing patients.
- Allow teams of oncology healthcare providers in all roles to use simulation for realistic clinical learning and evaluation.

References


