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The Use of Simulation for Pediatric Oncology Nursing Safety Principles: Ensuring Competent Practice Through the Use of a Mnemonic, Chemotherapy Road Maps and Case-Based Learning

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Background and Significance

Caring for patients with cancer is becoming more common in acute and critical-care settings. According to the [American Cancer Society \(2010\)](#), cancer is the second leading cause of death in the nation. In any setting, nurses can encounter patients experiencing cancer care anywhere along the cancer care continuum. This includes recent diagnosis, induction chemotherapy, maintenance therapy, recovery, remission, or relapse and hospice care. Nurses need to be ready to respond to the unique needs of the cancer patient, whether the care is focused on adult or pediatric patients.

Baccalaureate or associate degree nursing education does not typically thoroughly cover the intricacies of the safe oncology nursing care required for adults or children. This means that when students graduate and begin their professional careers, their knowledge on the care of a patient with cancer may be limited, and the limited exposure and education may lead them to steer away of oncology nursing. Educational offerings and competency evaluation are needed for both student nurses and practicing nurses and must encompass at least the three phases of chemotherapy: pre, intra, and post safe and error-free chemotherapy administration, as well as introduction to symptom assessment and management, central line care, and patient education. All of these components are required to reduce the possibility of complications or errors associated with treatment. Basic

principles of cancer nursing care and chemotherapy administration skills should be introduced before graduation.

The purpose of this article was to share a process where practicing nurses and student nurses engaged in a learning experience concerning the safe process of chemotherapy administration and care of the cancer patient. A high-fidelity simulation was developed by oncology-experienced faculty as a means to educate student nurses and nurses on safe oncology care. The focus of the project was on a realistic pediatric oncology patient, but the scenario could be adjusted to be used in teaching many of the foundational principles of adult oncology care.

Project Goal

To provide an educational seminar followed by a high-fidelity simulation scenario to learn, practice and apply the essential safety components of treatment during the care of a child with cancer, including chemotherapy administration, central line care, and symptom management.

Learning Objectives

1. Demonstrate how simulation technology can support learning and practicing oncology-related skills to ensure safe patient assessments and administration of chemotherapy, as well as cancer symptom management.
2. Analyze the merit of using two actual cancer patient simulation scenarios (young adult with lymphoma and

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young child with leukemia) to learn and practice the care of the cancer patient with cultural considerations.

3. Discuss the components of essential simulation debriefing when a simulation participant has encountered a patient with a new diagnosis of cancer receiving his or her first chemotherapy multidrug treatment. Components include patient teaching, prechemotherapy consent, prechemotherapy laboratories and assessments, intrachemotherapy assessments, and postchemotherapy assessments and teaching.

Simulation has proven to be an effective clinical adjunct to hands-on patient care (Jefferies, 2007). When clinical educational experiences are difficult to find for the majority of pediatric nursing students, simulation is an excellent choice to provide high-risk and low-frequency patient experiences in a safe learning environment where participants can receive feedback and guidance. High-fidelity nursing simulation is championed as an environment where students can practice on lifelike mannequins without the risk of harming a live patient, the underlying focus being patient safety (Engelmann, 2009; Gore, Hunt, & Raines, 2008). High-fidelity nursing simulation refers to the use of high-technology lifelike mannequins in a simulated clinical environment to teach nursing students the art and science of nursing or to teach working nurses improved practices, new nursing techniques, or the use of new technology (Feingold, Calaluce, & Kalen, 2003).

Case-based and problem-based strategies provide a student-centered learning approach that enables a real-life situation (Murphy, Hartigan, Walshe, Flynn, & O'Brien, 2010). The emphasis of problem-based learning is on teamwork, problem solving, and error reduction. The move from content-driven nursing education to learning-centered, hands-on approaches where participants can apply and practice what they have learned enhances the educational outcomes. One of the main overarching goals of problem- or case-based learning is to have an educational experience where students can use previous knowledge, problem solving, teamwork, and critical thinking to engage in complex situations.

This pilot project offered bachelor of science in nursing (BSN) students at a private Catholic heritage school in northern California the opportunity to learn about the diagnosis, nursing care, medical treatment, symptom management, and educational needs of two cancer patient scenarios: an 8-month-old girl with newly diagnosed acute lymphocytic leukemia (ALL) and the same child at 14 months of age presenting with fevers and neutropenia (rule-out sepsis) during a period of myelosuppression between cycles of chemotherapy. The simulation experience was in lieu of a clinical day, and all students enrolled in the pediatric nursing theory class rotated through the simulation experience on one of their assigned clinical days. Principles of case-based learning were used to enhance the educational experience. The case studies were from the nursing faculty

Box 1. Teaching Learning Presimulation Session

1. Review of cancer nursing responsibilities, need for medication administration safety and an overview of the specialty of pediatric oncology in general
2. Review of mission and vision of the Association of Pediatric Oncology/Hematology Nursing: quick Web site review
3. Basic principles of the physiology of cancer, tumor growth and spread, and staging of cancer histologies
4. Review of two case studies
 - a. Infant with new diagnosis of ALL requiring immediate placement of a central line and the initiation of chemotherapy treatments
 - b. The same infant 6 months later who presented to the emergency department with rule-out sepsis, fevers, neutropenia, and stomatitis (mucositis)
5. Introduction to the principles of chemotherapy treatment: drug classifications and the meaning of induction, consolidation, maintenance therapy phases, as well as a review of pediatric cancer treatment "road maps" used to determine the course of treatment for a child with high (infant) ALL
6. Maintaining patient and staff safety; using a mnemonic for pre-, intra-, and postchemotherapy administration: Mnemonic was CHEMO SAFE SOUND.

member's recent clinical experience so the realism of the simulation was enhanced by the authenticity of the scenarios.

The educational program procedures encompassed an orientation to the simulation center, the manikins and equipment, and the planned learning objectives for the session. Students arrived with a minimal knowledge about the impending pediatric oncology simulation experience. They were handed a packet upon arrival with an article that covers the basics of pediatric oncology cancer care, "Pediatric cancer; A comprehensive review. Part 1: Biology, epidemiology, common tumours, principles of treatment and late effects" by Macdonald, (2010); a list of learning objectives for the day; a PowerPoint slide handout that covered the principles of cancer nursing; a pre- and posttest; and an evaluation form to assess their satisfaction with the learning experience. A 1-hour seminar took place prior to the simulation experience to review the packet with the six educational components. See Box 1 for a summary of the components of the presimulation teaching/learning session. A mnemonic was developed by this author to improve the simulation participants' organization and recall process. See Box 2 for an abbreviated copy of the mnemonic.

After the mnemonic was presented, the students progressed to the simulation laboratory, and report was given from a standardized actor who played the part of the offgoing shift nurse. The student was given report that covered the status of the child, the need for chemotherapy treatment

Box 2. Pediatric Oncology Simulation Mnemonic

Prechemotherapy

C: Consent procedures complete for treatment? Cancer treatment protocol road map secured from national pediatric oncology treatment organization and reviewed

H: Health assessment including vital signs, urine pH and specific gravity, CBC, electrolytes, pain assessment, and overall developmental status of child

E: Evaluation of parent's/guardian's understanding of impending treatment plan including assessment of need for language interpreter

M: Securing the presence and engagement of child's mother and/or father or primary caregiver/guardian to provide emotional support, distraction, and play as tolerated

O: Overview of treatment road map including specific prechemotherapy requirements such as adequate absolute neutrophil count, minimal platelet count, adequate urine specific gravity, urine pH, and any other pretreatment diagnostics such as audiogram, cardiac echo, chest x-ray, and further laboratory studies to provide a safe patient status before drug administration.

Intrachemotherapy

S: Safe administration: double-blind, two-nurse check of body surface area calculation, correct medication dosing, route, and timing against the protocol road map treatment plan. Ensure a prechemotherapy call to oncologist to ensure safe treatment go-ahead

A: Assessments of intravenous central line site and adequate blood return to prevent extravasation of a vesicant drug

F: Provision of intravenous fluids to keep child well hydrated and maintain large-volume urine output

E: Assessment of electrolytes if chemotherapy drug is electrolyte wasting (potassium, sodium, and magnesium).

Postchemotherapy

S: Symptoms needing attending to such as nausea, fatigue, fear, and anxiety

O: Observation for adverse effects of chemotherapy drugs (i.e., allergic reactions)

U: Adequacy of urine output as evidence of excreting the chemotherapy appropriately

N: Need for nursing care/further education during the postchemotherapy period such as home care needs for central line care, follow-up pediatric oncology clinic visits during myelosuppressive (postchemotherapy nadir with neutropenia, anemia, and thrombocytopenia)

D: Drugs needed for symptom management such as nausea and mouth care, also need for posttreatment chemoprotective drugs such as leucovorin rescue or doses of mesna to protect the bladder from hemorrhagic cystitis.

Box 3. Case Study: Infant with New Diagnosis of ALL

A 10-month-old infant girl demonstrated 3 weeks' history of fevers, fussiness, poor oral intake, and irritability. She was seen in a public health clinic and treated for a urinary tract infection and bilateral otitis media. After two courses of antibiotics, her mother brought her to an acute care pediatric emergency room with continued fevers and weight loss. An assessment of her laboratory values demonstrated the possible diagnosis of leukemia.

The mother is a single parent of three children. She speaks Cantonese only. She works full time and lives with her mother who provides the childcare during the day. The family has no means of transportation other than the city bus system. They live in a small one-bedroom apartment quite a distance from hospital.

Upon initial assessment in the emergency room, the child's laboratory studies indicated the following: complete blood count (CBC) with manual differentiation demonstrating a white blood count of 82,000. Microscopic evaluation demonstrated early indication of ALL.

The child was immediately admitted to the acute care pediatric unit and scheduled for a single lumen central line placement and chemotherapy induction.

Family at bedside needing teaching and support

The Children's Oncology Group road map was delivered to the floor by the primary pediatric oncologist, and chemotherapy was to start after the central line was placed. Consent was obtained by the use of a Cantonese interpreter during the first family conference.

during the upcoming shift, and the social history of the child's family structure and educational needs. See [Box 3](#) for a presentation of the oral report given to the students prior to the simulation. The students, in groups of three, progressed into the simulation laboratory room and proceeded to conduct their initial assessments and nursing care of the newly diagnosed infant with ALL. The child required a sterile central line dressing change and pretreatment blood and urine laboratory assays. The students were expected to establish rapport and communicate with the mother while providing emotional support for the child and family. After the initial assessment, the students progressed to the steps of the mnemonic. The first simulation took approximately 30–45 minutes. Each group was debriefed and then prepared for the second simulation where the same child with ALL returns to the pediatric hospital unit with rule-out sepsis, mucositis, and severe neutropenia. Again, the students were given report and then expected to demonstrate a physical examination, review of orders, and initiation of neutropenic precautions and rapid antibiotic therapy.

The final phase of the simulation was to practice using a chemotherapy spill kit. A simulated pool of red-colored chemotherapy representing doxorubicin was placed on the floor near the child's crib, and the simulation participants followed the instructions on the spill kit package to contain, clean up, and dispose of the chemotherapy spill. Students were expected to don protective gear and perform the duties of a significant toxic substance spill cleanup protocol while maintaining a safe environment for the child, family, and health care team.

An evaluation of the postpediatric oncology simulation was conducted to assess the student's perceived knowledge gain, reported confidence, overall satisfaction with the simulation, and self-evaluation of skill performance. Group rating scores demonstrated a high level of satisfaction and perceived skills acquisition. Comments included, "This simulation should be offered to all BSN students" and "This was a great way of learning the basics of chemotherapy safety and reviewing the principles of medication safety."

Future projects should include an evidence-based research investigation to determine the most effective means to teach the basics of oncology nursing care across

the life span. An investigation into the effectiveness of the mnemonic in retaining safe chemotherapy administration should also be conducted.

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