Using Simulation to Assess Chemotherapy Competency

Paula M. Muehlbauer, RN, MSN, AOCNS®, Mary Beth Parr, MSN, RN, CNS, and Allison K. Perkins, MSN, RN, ACNS-BC

Simulation with lifelike mannequins is used in schools of nursing and hospital-based education as a method of teaching clinical content, enhancing clinical skills, applying theory to practice, and validating competency. It provides a safe learning environment to enhance nurses’ clinical judgment and critical thinking skills in an increasingly complex care environment. Simulation can be used in the practice setting with experienced nurses to teach or reinforce complex information and allow the learner to practice without devastating consequences. Medical-surgical units in some institutions have dedicated beds for patients with cancer but may not be a full oncology unit. Evaluating chemotherapy and biotherapy competency is difficult when extensive time periods exist between chemotherapy administrations. One method for assessing annual chemotherapy competency is to use simulation.

Cancer is a disease affecting people across the age continuum and is the second most common cause of death in the United States. Current statistics estimate that 1,660,290 people will be diagnosed with cancer and 580,350 people will die of cancer in 2013 (National Cancer Institute, 2013). Cancer causes one in four deaths, second only to heart disease. About 67% of those diagnosed with cancer will live five years (American Cancer Society, 2012). As baby boomers age, these percentages likely will continue to increase. Oncology care is being delivered across a variety of settings. Generalist medical-surgical nurses may care for patients admitted with cancer as either a primary or secondary diagnosis. The patient may be admitted for cancer treatment, side effects of cancer and cancer therapy, or for a non–cancer-related condition (Smith & Lichtveld, 2007).

A steady flow of patients with cancer requiring IV chemotherapy does not always occur in a medical-surgical unit; therefore, maintaining competency for a high-risk, low-volume patient population becomes an issue. This gap between administration of chemotherapy may cause nurses to feel incompetent or unsafe in administering, monitoring, and caring for this specialized population. They must be well versed in side-effect management and use the best evidence to manage and educate patients and families regarding symptoms. This article describes the use of simulation to evaluate nurse competency for chemotherapy administration.

Simulation in Education

Human patient simulation (HPS) is used in learning exercises that closely mimic real life in nursing and medical education and hospital practice. Simulation integrates adult learning theory into an interactive educational session (Kuhrik, Kuhrik, Rimkus, Tecu, & Woodhouse, 2008; Nehring & Lashey, 2009; Su & Juestel, 2010). Simulation, including virtual reality and low- and high-fidelity mannequins, was introduced into nursing education in the 1970s, with noted increase in use in the past 10 years (Nehring & Lashey, 2009). A systematic review of the literature from 2000–2010 found that simulation can be used to create a learning environment to support development of knowledge, skills, and attitudes. However, Norman (2012) noted that a lack of literature related to conveyance of these outcomes to the clinical setting. The International Nursing Association for Clinical Simulation and Learning (INACSL) developed the Nursing Skills and Clinical Judgment Model that incorporates specific concepts into simulation, including participant ability to use psychomotor skills, problem solving, use of clinical reasoning, and, at the
highest level, use of clinical judgment (INACSL, 2011a). During the simulation, learners are asked to demonstrate skills and knowledge as the session unfolds. Frequently, several competencies can be addressed within one phase of the simulation.

Simulation has a wide range of applications, from laboratory stations with body parts to high-fidelity simulators that breathe and blink. INACSL defined fidelity as believability or the degree to which the experience approaches reality (INACSL, 2011a). Nursing education uses a variety of simulation techniques to teach skills (Nehring & Lashley, 2009; Su & Juestel, 2010). In hospital-based practice, simulation can be used to measure competency, provide education on complicated topics, reinforce skills, and assess clinical judgment. Whenever nurses practice on anything other than a human patient, it could be counted as simulation. Low-fidelity simulation includes static full-size mannequins, task trainers such as IV arms, and body parts with wounds for dressing changes (Cook et al., 2011). Cardiopulmonary resuscitation (CPR) training has made use of low-fidelity simulation for years with the Resusci Anne model for annual or semiannual CPR certification. Low-fidelity simulators and body parts are relatively inexpensive, ranging from a few hundred dollars to a few thousand dollars for static mannequins. One use for low-fidelity simulation would be to teach the tasks of chemotherapy administration such as calculations, chemotherapy physician order review, checking for blood return, and IV pump programming. This can be accomplished by using IV arms and IV pumps set up at a competency station.

Another form of simulation uses a standardized patient (SP). INACSL (2011a) defined SP as a person who is trained to consistently portray a patient or other individual. The SP should be given a script to follow based on the outcomes of the simulation and preparation is needed regarding expectations for the simulation (Churchouse & McCafferty, 2011; Nehring & Lashley, 2009). The participant in the simulation could use an SP to educate a family member and to answer questions related to treatment side effects and home-care issues. When the participant has to talk to a real person, they will be called on to demonstrate critical thinking and clinical judgment. An SP costs about $20 per hour (Peggy Wallace, personal communication, June 26, 2012). Additional locales for finding SPs are community theater troupes, but, again, a cost may be associated with the actors. Another option is to use volunteers or coworkers, but preparation still needs to be done regarding the expected outcomes so that the person playing the SP does not stray from the script.

High-fidelity simulators have been incorporated into education and practice since the early 2000s (Cook et al., 2011; Nehring & Lashley, 2009). A high-fidelity mannequin is a realistic simulated patient with interactive features, including eye blinks, a pulse, blood pressure, and secretions such as tears or sweat. The simulation environment with a high-fidelity mannequin may be more lifelike and reflective of an actual event. For example, placing the mannequin in a hospital room with hospital equipment helps the participant engage and suspend disbelief. A person playing the voice of the patient can stay out of sight and talk to the participants using a microphone.

Participating with an academic institution may be an avenue for cost containment. High-fidelity human patient simulators cost anywhere from $45,000–$250,000 (Richard Kuschinsky, personal communication, June 28, 2012). Hospital nursing departments can help to defray this cost by partnering with local nursing or medical schools that already have high-fidelity simulators and laboratories (Bowman et al., 2011; Kuhrik et al., 2008).

The form of simulation used varies depending on several factors. Low-fidelity simulators and task trainers are relatively inexpensive. Participants can practice repeatedly until the skill is perfected. Use of SPs helps with realism because they can play the role of the family member or patient. Use of a high-fidelity simulator moves the scenario to the next step because the simulator responds to participant interventions, such as talking to the participants, showing changes in vital signs, and/or reacting to life-threatening events (e.g., septic shock).

The simulation experience encompasses preparation, a prebrief session, the actual simulation, and debriefing. The prebrief session includes a review of the scenario with the expectation that participants have prepared for the simulation. During the prebrief, participants are asked to outline priorities of care to be performed and discuss any preparation questions. The debrief session post-simulation is as important as the simulation. Reflective learning takes place during debrief where participants are asked to review the scenario and compare the priorities set during the prebrief. The participants reflect on their practice, including what went well and what they would do differently (INACSL, 2011b).

Simulation in Oncology Nursing Practice

Simulation has been used in a variety of ways in oncology nursing practice. However, the literature is limited on use of simulation as it directly relates to oncology nursing. White et al. (2010) used high-fidelity simulation and SPs to study the effectiveness of two different checklists (original and revised versions) prior to administering chemotherapy. They replicated the clinical environment by setting the laboratory scene as it would be on a patient care unit and found that the revised checklist assisted nurses in detecting more errors prior to administration.

Oncologic emergencies can be replicated in simulation while providing a safe environment for learning and keeping a real patient from harm. Sepsis may occur in an immunosuppressed population, such as recipients of a bone marrow transplantation (BMT). Kuhrik et al. (2008) developed a high-fidelity simulation as a pilot project for a patient more than 10 days after an autologous BMT presenting with signs of sepsis. The group programmed the simulator to respond to interventions the participants used, whether they were correct or not. Incorrect interventions caused a decline in patient status, whereas correct interventions improved patient condition. Following the pilot program, Kuhrik et al. (2008) used simulation to train staff caring for patients undergoing BMT who become critically ill.

Simulation exercises for chemotherapy administration and symptom management have been used in pediatric and adult oncology settings (Crannell, 2012; Linnard-Palmer, 2012). The methods varied somewhat in each setting, but the goals of safe chemotherapy administration and spill management were similar. Both studies showed that participants had increased confidence overall in all aspects of chemotherapy administration.

Case Example: The Simulation Scenario

Veterans Affairs San Diego Healthcare System (VASDHS) started using simulation to assess chemotherapy competency because...
of the lack of a consistent inpatient oncology population on the dedicated medical-surgical unit. Going several months without administering or caring for a patient on chemotherapy is not unusual for medical-surgical nurses. The clinical nurse specialist (CNS) on the unit kept a log to track how often medical-surgical nurses were administering chemotherapy on her unit. She found that, on average, 2–3 months passed between administration of IV chemotherapy for day shift nurses and 4–6 months passed between administration of IV chemotherapy for night shift nurses (Allison Perkins, personal communication, December 10, 2011).

Introduction of simulation into chemotherapy training was a result of collaboration between San Diego State University School of Nursing and the VASDHS as part of the VA Nursing Academy (VANA). VANA was established in 2007 and included 15 VA and baccalaureate schools of nursing partnerships nationwide. The purpose of these partnerships is to provide clinical nursing faculty, augment clinical faculty development, increase nursing student enrollment, increase recruitment and retention of VA nurses, and encourage educational innovations (Bowman et al., 2011). Faculty from the VASDHS received instruction on evidence-based educational concepts in developing a simulation scenario, the basics of how to run the simulator, and the methods for prebrief and debrief. This education was essential to creating an institution-specific chemotherapy simulation.

All nurses who administer chemotherapy are required to attend the two-day Oncology Nursing Society (ONS) chemotherapy/biotherapy course. They are then sent to the chemotherapy infusion center for hands-on practicum. Competency is assessed

![FIGURE 1. Chemotherapy and Biotherapy Competency Chart](image_url)
annually using high-fidelity simulation. Various forms of simulation, including SPs, anatomical models, and high-fidelity, have been used in other settings for competency validation. The scenario must be realistic, developed by experienced simulation educators, and the evaluation needs to be performed by content experts (Decker, Utterback, Thomas, Mitchell, & Sportsman, 2011). The VASDHS uses various forms of simulation, including high-fidelity, for annual competency evaluation for medical-surgical, emergency department, and critical care nurses, as well as in the new graduate nurse residency program.

A collaboration of experts, including a unit-based CNS, oncology CNS/VANA faculty educator, oncology nurse practitioner, oncology case manager, oncology pharmacist, nurses from the chemotherapy infusion center, and a simulation education expert was essential for developing the appropriate scenario. A common chemotherapy regimen administered on the medical-surgical unit was chosen because of the high-risk, low-volume nature of the patients with cancer and their treatment. The oncology advanced practice nurses determined the most suitable side effects to give the patient as well as expectations for proper symptom management, including patient and family education. Participants were rated against a checklist and the VASDHS chemotherapy competency (see Figure 1). The simulation follows ONS guidelines for chemotherapy and biotherapy administration as well as the American Society of Clinical Oncology (ASCO) and ONS (2013) standards for safe administration of IV chemotherapy.

The simulation was based conceptually on those used in schools of nursing. Participants were sent a set of questions and the first part of the simulation ahead of time to prepare. The rationale for this preparation was based on similar expectations of nursing students. A study conducted by Gates, Parr, and Hughen (2012) showed that student nurses retain the information learned in the simulation better with prior preparation when tested on it later. The preparatory questions were geared toward the expected outcomes of the simulation, and the outcomes of the simulation were based on Appendices 5 and 6 from Polovich, Whitford, and Olsen (2009). A copy of the simulation and preparatory questions can be obtained by scanning the QR code on the bottom right of this page or typing the provided URL into a Web browser.

The iStan high-fidelity mannequin was used for this simulation. The simulation educator programmed the computer so that the key physiologic features for each state of the scenario were consistent and flowed according to each action of the nurse. In addition to other high-fidelity simulator features, this one also can have rigors. The rigors were simulated by opening the convulsion application because the convulsions look more like rigors. Nurses had to ask for the patient’s temperature, but other vital signs showed on a monitor once temperatures were taken. The person playing the voice of the patient talked to the nurses as if in a clinical situation. The nurses would have to tell the patient when they needed to concentrate, such as when they were setting the IV pump. The patient would ask about the drugs, and it was expected that he or she would be told what could happen. Medication side effects were reviewed during the prebrief session, but the nurses were required to apply the same knowledge during the simulation when asked by the patient. The faculty refrained from interrupting during the simulation.

Debriefing was conducted after the simulation to discuss what went well and what the participants would do differently. Observations of areas for improvement in the clinical setting were reviewed. Faculty encouraged the nurses to self-identify areas for additional development not only with chemotherapy administration but in their overall oncology practice. Not all participants passed the first simulation because they did not meet all elements of the competency. Reasons for failure included lack of preparation for the day, failure to correctly identify major toxicities (particularly when asked by the patient), inability to apply theory to practicum, and major safety flaws identified by the faculty during the administration portion.

**Nursing-Sensitive Outcomes Using Simulation for Competency**

Various nurse-sensitive outcomes may be met when all standard components of simulation are included, such as preparation, prebrief, the simulation, and debrief. Nurses are required to anticipate when the absolute neutrophil count will nadir, and teach preventative measures, self-administration of filgrastim, and instructions for when to call the healthcare team. The intent is to decrease the rate of post-chemotherapy infection. During this simulation, the participants were expected to be able to calculate an absolute neutrophil count and provide appropriate patient education.

Side-effect management is crucial because this affects patient quality of life. Nurses are essential in teaching and reinforcing symptom management, including cancer-related fatigue, nausea and vomiting, anorexia, constipation, and delayed side effects such as cardiotoxicity and peripheral neuropathy. Resources for this information include the ONS Putting Evidence Into Practice (PEP) resources; participants were expected to study the PEP resources when preparing for the simulation.

**Discussion**

Advantages of using simulation to assess competency include (a) standard common chemotherapy regimen, (b) consistency with rating competency, (c) safe environment for participants, and (d) nurses scheduled to come to the simulation with their time protected. The simulation was scheduled for a full eight-hour day. Half the nurses came to the morning session and then took over the patient assignment for the afternoon participants, and vice versa. Disadvantages are that it could be costly depending on the type of simulator used and not being done in real time, so some participants may have trouble suspending disbelief. The scenario was altered between the first and second year to keep it fresh for the participants and to reflect the most current standard chemotherapy regimen being used.

**Exploration on the Go**

View the patient simulation document detailed in this article as well as preparatory questions related to the simulation. To access, open a barcode scanner on your smartphone, take a photo of the code, and your phone will link automatically. Or, visit http://www.ons.org/MuehlbauerAppendixA.
Implications for Practice

- Maintaining chemotherapy competency is challenging on a medical-surgical unit when long gaps in time exist between chemotherapy administrations.
- Simulation provides a consistent scenario and safe setting to assess chemotherapy competency.
- Using simulation to assess competency can be done via multiple types of simulators.

Future Directions

Updated evidence for symptom management and administration will be incorporated as it becomes available. The simulation will be altered annually so that nurses do not rely on prior simulations alone and review current evidence and practice related to the scenario. Other modifications will include changing to one-on-one competency evaluation versus groups of three at a time, and possibly doing a quiz based on preparatory work to evaluate individual understanding of the scenario, treatment, and side effects. During the prebrief session, one or two individuals may dominate, allowing others to get by without fully understanding key concepts of the therapy. The quiz would alert the facilitator to additional educational needs of individuals.

Conclusion

Keeping nurse competency in chemotherapy administration on a medical-surgical unit that has a varying oncology population is challenging. Simulation provides a consistent method for assessing chemotherapy competency in a safe environment where nurses are willing to identify what they do well and where they need additional improvement. This activity is dynamic, requiring changes in the simulation scenario to avoid nurses knowing what to expect. Partnering with a local school of nursing may help defray costs and provide simulation education to nurse educators without experience.

The authors gratefully acknowledge Michael Gates, PhD, RN, and Carole Hair, PhD, for their review of this manuscript.

References


Receive Continuing Nursing Education Credits

Receive free continuing nursing education credit* for reading this article and taking a brief quiz online. To access the test for this and other articles, visit http://evaluationcenter.ons.org/Login.aspx. After entering your Oncology Nursing Society profile username and password, select CNE Tests and Evals from the left-hand menu. Scroll down to Clinical Journal of Oncology Nursing and choose the test(s) you would like to take.

* The Oncology Nursing Society is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center’s COA.
Synopsis
This simulated clinical experience presents the learner with an opportunity to provide care for an older adult patient who is receiving chemotherapy in the inpatient setting. This simulation will cover the following areas: (a) safe handling and administration of chemotherapy and biotherapy, (b) calculation of absolute neutrophil count (ANC), (c) patient education regarding side effects, potential complications, and preventive measures, (d) symptom management, and (e) proper documentation of chemotherapy infusion and patient and family education.

Learning Outcomes and Questions
- Performs an accurate basic physical assessment, including review of pertinent laboratory findings prior to administering chemotherapy, and presence or absence of informed consent.
- Correlates individual’s pathophysiology with the purpose of drug administration.
- Integrates history information and cycle of treatment with assessment findings and potential side effects of therapy.
- Calculates ANC.
- Discusses nursing management of side effects, risks, and potential complications of specific agents.
- Communicates changes in a patient’s status to the appropriate healthcare team member.
- Documents that patient teaching is completed.
- Demonstrates safe handling, administration, and disposal of chemotherapy agents.
- Completes chemotherapy/biotherapy worksheet in the electronic healthcare record.
- Documents medication and administration per Veterans Administration nursing department guidelines.
- Verbalizes correct management of a chemotherapy spill.
- Uses therapeutic communication techniques to assist the patient in managing side effects and symptoms during administration and after hospital discharge.
- Provides patient and family with appropriate resources to assist with diagnosis and coping.

Equipment Needed
- Personal protective equipment
- A chemotherapy spill kit
- Chux
- 4-inch x 4-inch gauze pads
- A chemotherapy waste bucket
- Chemotherapy orders provided from an oncology pharmacist, and medications for premedication and side-effect management
- Chemotherapy labels for rituximab, etoposide, vincristine, doxorubicin and cyclophosphamide (R-EPOCH)
- Bags of normal saline
- Red food coloring for doxorubicin, etoposide, and vincristine combination
- IV set up and an Alaris® pump

Note. Have nurses explain rationale for premedications to patients and family members.

Patient History
E.M. is a 68-year-old man recently diagnosed with non-Hodgkin lymphoma. He is a Vietnam War veteran and was exposed to Agent Orange during his time there. He is being admitted for his first cycle of R-EPOCH. The schedule for R-EPOCH is one cycle every 21 days. E.M. will be admitted for each cycle of therapy. He is classified as stage IV(B) and has no significant comorbidities. E.M.’s vital signs include a heart rate (HR) of 72 bpm, blood pressure (BP) of 124/74, respiratory rate (RR) of 16, a 98.6°F temperature (T), and 100% oxygen saturation (O₂ Sat) on room air.

Exercises to Be Completed

State 1 Pretreatment
- Calculate body surface area (BSA) assessment.
- Complete chemotherapy worksheet for the entire regimen.
- Are doses appropriate for this patient?
- Considering E.M.’s treatment, what laboratory results and tests would you need to monitor closely?
- State drug properties (vesicant, irritant) for each agent.
- Describe potential side effects to the patient and family and when to notify the RN.
- What personnel protective equipment is needed for each agent?
- What emergency equipment is necessary?
- State supportive care indicated for administration each agent based on its side-effect profile.

Chemotherapy Administration
- Demonstrate independent double-check process.
- Verbalize proper documentation of administration of these agents.
- You go into the patient’s room to administer IV chemotherapy/biotherapy and there is no blood return from central line. What is your next step?
- The central line now has a good blood return. What premedications will you administer and why?
- Describe infusion of rituximab and the side effects to monitor.

Faculty note. Has the patient asked: “What are you doing? What is this drug? Am I going to get sick? Is this that ‘pork-chop’ drug combo the doc told me about?” Be prepared to explain the potential side effects of rituximab to the patient.

Faculty note. Rituximab is increased by 50 mg per hour every 30 minutes to a total rate of infusion of 400 mg per hour or until the patient experiences side effects. This drug and the calculations are in guardrails on the Alaris pump, so the nurse needs to use guardrails.

Faculty note. After the nurse starts rituximab at 50 mg per hour for 30 minutes (level 1 for first dose of rituximab), change vital signs to: HR = 80 bpm, BP = 110/60, T = 98.6°F; RR = 16, and O₂ Sat = 98%.

Faculty note. Instruct the nurse to increase the rituximab dose to the next level (100 mg per hour over 30 minutes).

Complication 1
E.M.’s dose of rituximab has been increased to 100 mg per hour over 30 minutes. He tells you “my stomach kind of hurts” and “I am feeling cold. Can I have another blanket please?”

Faculty note. Open seizure scenario to imitate rigors. After this has been completed, change E.M.’s vital signs to: BP = 88/58, RR = 24, T = 101.5°F; O₂ Sat = 93%.

What do you suspect is happening with E.M.? Demonstrate your first action. Demonstrate your next actions.

Obtain provider orders and carry out.

E.M.’s side effects have resolved after carrying out the provider’s orders and the rituximab rate of infusion has been ordered to stay at 100 mg per hour.

(Continued on the next page)
**Chemotherapy Simulation Exercise Preparatory Questions**

1. Describe the basic pathophysiology of the disease and rationale for treatment chosen for E.M.
   a. What are 8 symptoms?
   b. What makes a patient with non-Hodgkin lymphoma eligible to receive rituximab? (Note. It is one criterion.)

2. Prior to administering chemotherapy, what would the nurse need to do to ensure safety in administration? (Reference to a checklist is helpful in answering this question.)
   a. What personal protective equipment (PPE) does the nurse need to wear?
   b. Explain the entire procedure for administering chemotherapy.
   c. What would the nurse do if there is no signed consent form to receive chemotherapy?
   d. Name a resource the nurse could use to verify correct dosages of chemotherapy agents.
   e. Describe the documentation the nurse would complete once chemotherapy has been administered.
   f. A drop of chemotherapy has spilled onto the nurse’s arm. Explain the proper procedure to address this incident.
   g. What should the nurse do if chemotherapy splashes into his eye?
   h. Explain how the nurse would manage a suspected extravasation.

3. The patient has a high tumor burden and is at risk for developing tumor lysis syndrome (TLS).
   a. What is TLS?
   b. If E.M. develops TLS, what would his laboratory work show and why?
   c. What other assessments would you do?

4. List two treatment goals in the management of TLS.
5. How will the interdisciplinary team manage this patient?

6. Describe the major side effects of an initial infusion of rituximab and how you would manage the side effects if experienced.

7. Describe the premedications and the rationale for them.

8. What are the risk factors for E.M. developing neutropenic sepsis and how would you manage the side effects if experienced.

9. What should you teach E.M. to monitor and report in preparation for receiving chemotherapy?

10. When would you expect to see the ANC nadir? (Note. Be prepared to calculate an ANC.)

11. What are the risk factors for E.M. developing neutropenic sepsis and is he at an increased risk of developing neutropenic sepsis?

12. What should you teach E.M. to monitor and report in preparation for discharge following his first cycle of chemotherapy regarding neutropenia?

13. Describe evidence-based preventative measures to minimize risk of neutropenic sepsis complications.

14. Discuss immediate interdisciplinary actions to be taken when neutropenic sepsis is suspected.

15. What is the emetogenic potential of this chemotherapy regimen?

16. What is the emetogenic potential of this chemotherapy regimen?

17. How would you manage complications of administering doxorubicin, vincristine, and etoposide and length of infusions.

18. Provide patient discharge instructions to include neutropenia precautions, medication side effects, and when to call the healthcare provider.


20. What are B symptoms?

21. How would you manage a suspected extravasation.

22. What should the nurse do if chemotherapy splashes into his eye?

23. Describe signs and symptoms of neutropenic sepsis.

24. Discuss immediate interdisciplinary actions to be taken when neutropenic sepsis is suspected.

25. What is the emetogenic potential of this chemotherapy regimen?

26. Describe appropriate measures to manage nausea and vomiting.

27. Demonstrate proper administration of cyclophosphamide.


29. Demonstrate proper documentation in electronic medical record for cyclophosphamide including patient education.

30. Explain best evidence for managing fatigue and make some suggestions to E.M.

31. Provide patient education on side-effect management from all chemotherapies and prednisone.

32. Administer appropriate premedications, regularly scheduled medications such as prednisone, and any hydration if ordered and explain rationale.

33. Describe to E.M. and his family potential complications of administering doxorubicin, vincristine, and etoposide and length of infusions.

34. Describe how often you check for a blood return.

35. Describe appropriate actions if you suspect an extravasation.

36. Provide patient and family with patient education on side-effect management from all chemotherapies and prednisone.

**State 2**
The rituximab has completed infusing and it is time to administer the other chemotherapies (the combination of doxorubicin, vincristine, and etoposide). Oral prednisone also is administered.

- **Faculty note.** E.M. asks “Can I go home tomorrow? How long will this infusion take? My buddies are coming over to watch the ball game on my big flat screen this weekend. That is our tradition.”
  - Administer appropriate premedications, regularly scheduled medications such as prednisone, and any hydration if ordered and explain rationale.
  - Describe to E.M. and his family potential complications of administering doxorubicin, vincristine, and etoposide and length of infusions.
  - Describe how often you check for a blood return.
  - Describe appropriate actions if you suspect an extravasation.
  - Provide patient and family with patient education on side-effect management from all chemotherapies and prednisone.

**Complication 2**
E.M. starts to complain of nausea despite premedication. Demonstrate additional management of nausea (pharmacologic and nonpharmacologic).

- **Faculty note.** Have mannequin groan to imitate retching. Voice of faculty asks for a “bucket to puke in. Not sure I can hold this.”
- **Faculty note.** Change vital signs to reflect increases in BP and HR with retching. After the participant states that he or she has administered additional antiemetics, change vital signs back to HR = 80 bpm, BP = 110/60, T = 98.6°F; RR = 16, and O₂ Sat = 98%.

**State 3**
Combination of etoposide, vincristine, and doxorubicin has completed infusing. Cyclophosphamide is ready to be administered. Vital signs are now HR = 80 bpm, BP = 110/60, T = 98.6°F; RR = 16, O₂ Sat = 98%.

- **Faculty note.** E.M. asks, “How long is this going to take? When can I go home? That other bunch of drugs exhausted me. I am so tired. Can I have a ‘pep’ pill or something to give me some energy? My buddies are coming over next week to watch the game and I want to be awake for them and have some fun.”
- Demonstrate proper administration of cyclophosphamide.
- Describe to patient potential side effects of cyclophosphamide.
- Demonstrate proper documentation in electronic medical record for cyclophosphamide including patient education.
- Explain best evidence for managing fatigue and make some suggestions to E.M.
- Provide patient discharge instructions to include neutropenia precautions, medication side effects, and when to call the healthcare provider.
- Instruct E.M. on self-administration of filgrastim.

**State 4 (All Participants)**
E.M. had been discharged home 12 days prior. The hematology/oncology team has readmitted him because his temperature rose to 101.8°F. Pan-cultures are sent and blood work is obtained, including a complete blood count with differential. Antibiotics and IV fluids are ordered. All of these activities were done in the emergency department (ED).

Calculate E.M.’s ANC based on laboratory values from admission to the ED.