

Does Didactic Teaching Translate into Effective Recall in the Clinical Setting? A Description and Methodology as Part of Peer Review Process

Karen K. Schultz
Douglas Smith

ABSTRACT. This study documents a clinical based peer review process for outcomes of didactic teaching, thereby expanding peer review normally associated with didactic teaching of either lecture or small-group discussion in contained classrooms. An Instruction Design faculty member conducted peer review in didactic instruction and learning objective construction. Randomly selected students were observed in the clinical setting to assess their recall and application of specific learning objectives taught in the didactic lecture. This process provides a model for peer review of didactic teaching with student clinical application and recall in the acute care clinical environment. This methodology ensures effective didactic teaching by observing and recording student behaviors and recall in the clinical setting. It enables students to receive feedback on their progress as learners as well as informing the practice faculty the level of recall and application of knowledge in the clinical setting. doi:10.1300/J060v14n01_04 [Article copies available for a fee from The Haworth Document Delivery Service: 1-800-HAWORTH. E-mail address: <docdelivery@haworthpress.com> Website: <[http://www. HaworthPress.com](http://www.HaworthPress.com)> © 2007 by The Haworth Press, Inc. All rights reserved.]

Karen K. Schultz, Ph.D., MBA, is Associate Professor, Instruction Design (E-mail: kschultz@su.edu) and Douglas Smith, Pharm.D., BCNSP, BCOP, is Associate Professor, Pharmacy Practice (E-mail: dsmit3@su.edu) at Shenandoah University, Bernard J. Dunn School of Pharmacy, 1175 North Sector Court, Winchester, VA 22601.

Journal of Pharmacy Teaching, Vol. 14(1) 2007
Available online at <http://jpt.haworthpress.com>
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doi:10.1300/J060v14n01_04

KEYWORDS. Assessment, didactic teaching, clinical behavior outcomes, peer review

INTRODUCTION

Evaluation, testing, and measurement are integral parts of medical and health care curricula but evaluation as it is practiced today is less than a century old (1). It has evolved through a number of forms and is still evolving. As demands for accountability increase and outcomes assessment is required in our curriculum, it is imperative that each moment be utilized and each evaluation instrument reveals as much information as possible to make our curriculum relevant and our teaching more meaningful. Students need feedback on their progress as learners so they can make changes while the teaching and learning is in progress.

In the process of designing a peer review with the Instruction Design faculty member and co-author, one of the desired outcomes was to determine if teaching was "effective." How does one measure the effectiveness of teaching? The immediate response was to look at the multiple choice test and exam results which would be given some weeks after relevant content was presented in the lecture based format. Upon further discussion, the Instruction Design faculty member, who was conducting the peer review, asked what would be the ideal way to measure "effectiveness" as well as how to document the effectiveness. Ultimately, the outcome of effective didactic teaching of clinical topics should and can be measured by accurate student performance in the clinical setting.

As part of the peer review process, the summative grades of the students are one point in the triangulation process for effectiveness of teaching. The practice faculty member undergoing peer review was most interested in how the points he thought he made in class in the didactic lecture would be recalled and applied by randomly selected students from the class in the clinic setting. Assessments by the bedside would be contrary to the dismal picture painted by those who view assessments of learning that frequently demand only the recall of memorized material or low-level comprehension of concepts.

Peer review has been associated primarily with didactic teaching of either lecture or small-group discussion in contained classrooms. Although the literature is forthcoming on processes and forms for peer review in teaching in classrooms (2-3), the authors found a void in the literature for peer review of didactic teaching by assessing student recall

in the clinic setting. Documenting a clinical based peer review for outcomes of didactic teaching, by the bedside in an acute care setting offers an alternative method of assessing student learning. It also affords a mechanism by which a faculty member can make changes in didactic teaching that directly affect patient care.

Although many factors can influence student clinical performance, a good knowledge base is paramount. The following describes a methodology to test students on pertinent didactic learning objectives as applied to hospitalized patients.

METHODS

In the spring of 2006, seventy-three entry-level PharmD students enrolled at the Bernard J. Dunn School of Pharmacy completed a 5 week didactic study of hematology and oncology topics, as part of their third year curriculum. Shortly afterwards, three students were randomly chosen to participate in our research. Prior to beginning, this project was approved by the Human Subjects Review Board of Shenandoah University. The Instruction Design Faculty member met with each of the students individually to provide an overview of the project and gain their consent. Enough information was provided for the students to make an informed decision, without knowing that the process involved recall testing. We felt that withholding this piece of information was important in providing an accurate assessment of their recall (i.e., to prevent them from studying beforehand). Four weeks after the end of the didactic module, students were scheduled to participate. A one hour block of time, per student, was anticipated to complete data collection.

Two days prior to the first scheduled student, the practice faculty member visited his inpatient oncology unit to select patients for the encounter. Three patients were chosen, based on their disease states and broad range of health issues. Patient #1 had a diagnosis of limited stage small cell lung cancer, patient #2 had metastatic esophageal cancer and patient #3 had metastatic prostate cancer. From these three patients, 34 questions were developed, based on 19 corresponding course objectives. Thirteen miscellaneous questions, based on 4 additional learning objectives, were added to broaden the question base. A total of 47 questions were constructed (Appendix A), testing 23 course-specific learning objectives (Table 1). Although this comprises a small percentage of the total learning objectives taught throughout the 20 lecture hours pro-

TABLE 1. Learning Objectives Evaluated

Question	Objective Statement	Topic of Study
1	Given a patient case, calculate body surface area (BSA).	Dispensing Chemotherapy
2	Given a patient case, calculate absolute neutrophil count (ANC).	Supportive Care - Neutropenic Fever
3	Provide accurate consultation regarding the onset of action and most common adverse effects of megestrol acetate, as used for anorexia.	Supportive Care - Anorexia
4	Rank the prevalence and mortality of lung cancer versus other cancers in the United States.	Solid Tumors - Lung Cancer
5	State the greatest risk factor for the development of lung cancer.	Solid Tumors - Lung Cancer
6	Distinguish between small cell and non-small cell lung cancer in terms of staging and treatment strategy.	Solid Tumors - Lung Cancer
7	State the standard chemotherapy agent which forms the basis for combination chemotherapy regimens used to treat lung cancer.	Solid Tumors - Lung Cancer
8	State the typical circulating life for all three blood cell lines.	Supportive Care - Neutropenia, Thrombocytopenia, Anemia
9	State the usual nadir period following cytotoxic chemotherapy.	Supportive Care - Neutropenic Fever
10	List the signs and symptoms associated with a decrease in each of the three blood cell lines.	Supportive Care - Neutropenia, Thrombocytopenia, Anemia
11	List four common adverse effects of opioids.	Supportive Care - Pain Management
12	Describe an effective plan to prevent opioid constipation.	Supportive Care - Pain Management
13	Provide an appropriate equianalgesic dose of fentanyl transdermal patch for a patient being converted from another opioid.	Supportive Care - Pain Management
14	Evaluate a patient for the appropriateness of parenteral nutrition support.	Supportive Care - Malnutrition
15	Provide an effective treatment and monitoring plan for chemotherapy-associated mucositis.	Supportive Care - Gastrointestinal Toxicity
16	Rank the prevalence and mortality of prostate cancer versus other cancers facing men in the United States.	Solid Tumors - Prostate Cancer
17	Explain the mechanism of action of LHRH agonists and anti-androgens used in treating prostate cancer.	Solid Tumors - Prostate Cancer
18	Discuss the role of chemotherapy in treatment of prostate cancer.	Solid Tumors - Prostate Cancer
19	State the American Cancer Society recommendations for prostate cancer screening for average risk men.	Solid Tumors - Prostate Cancer
20	State the pharmacologic class of capecitabine.	Solid Tumors - Colorectal Cancer
21	State 1 important patient counseling point regarding the administration of capecitabine, and 2 important adverse effects.	Solid Tumors - Colorectal Cancer
22	List the major adverse effects associated with antiestrogens and aromatase inhibitors.	Solid Tumors - Breast Cancer
23	State 1 important counseling point regarding the administration of thalidomide and 4 important adverse effects.	Hematologic Malignancy - Multiple Myeloma

vided by the practice faculty member, it was thought to be a good representation of many key concepts.

The first student was brought to the oncology unit mid-morning and orientation was provided by the practice faculty member. This included an introduction to oncology team members, an overview of the physical layout and patient rooms, as well as an overview of the exercise they were about to undertake. Afterwards, the charts of each of the three chosen patients were reviewed (history and physical examination, medication administration records, progress notes, laboratories, etc.), and the student was introduced to the patients. Then, all patient records were gathered and the student and practice faculty member met in a small meeting room for administration of the verbal examination.

As noted, a total of 47 questions were asked of the student, by the practice faculty member. The student was given adequate time to extract patient data and ponder each question. Questions were divided by patient and asked in sequence (Appendix A). The practice faculty member recorded student responses with handwritten notes. Feedback was provided to the student after each question was answered. A score was then recorded as the percentage of correct responses to the 47 questions. This score was then compared with corresponding didactic course scores.

The process was repeated two days later with the remaining two students. A post-evaluation interview with students and practice faculty member was conducted by the Instruction Design faculty member. Qualitative data from these semi-structured interviews were analyzed utilizing open coding.

EXPECTED OUTCOMES

Traditionally, student grades in lecture courses are determined by their performance on multiple choice tests, short answer questions, and fill in the blank. Although the practice faculty member undergoing peer review in this study reviews student outcomes on tests and quizzes, student recall in the clinical setting was the focus of this study.

From the analysis of student outcomes in the clinic setting, either confirmation of the pedagogy of didactic teaching or possible changes in emphasis, pedagogy, and incorporation of patient and clinical data for future didactic lectures could ensue. This process was purposefully designed to check student recall of didactic course work within 1-2 weeks of the lecture. Rather than gauging student recall on a traditional multiple choice test given up to 4 weeks after the lecture, the course material addressing 19 learning objectives were tested verbally in the clinical setting utilizing real patients and applying the didactic material in a practical, real life setting. The clinical instructor will receive immediate feedback as to student comprehension of the didactic material and whether or not the student was able to apply the material to real patient situations. From this experience, the instructor will be able to evaluate his didactic material and make changes for future lectures.

RESULTS

Student evaluation results in the clinical setting were 49%, 60% and 72%, for students #1, #2 and #3, respectively. Didactic course averages,

based on multiple choice examinations and quizzes, were 80%, 81% and 93%. Overall, clinical evaluation results paralleled the didactic testing of multiple choice questions. There were 17 questions in common between multiple choice (didactic) quizzes and examinations and verbal (clinic) examination. When comparing student performance on these 17 questions, student #1 scored better on multiple choice examinations, student #2 scored exactly the same on each and student #3 actually scored better on the verbal (clinic) examination (Table 2).

The open coding methodology for qualitative semi-structured interviews requires the researcher to form initial categories of information about the participants' learning and teaching experiences (2). Within each category, several properties or subcategories are defined (Appendix B). All 3 students enthusiastically agreed to be part of the clinical study and were eager to have one-on-one time with the practice faculty member in the clinical setting. Students individually self-reported thoroughly enjoying their interactions with the patients, oncology staff, and the faculty member. Each student independently emphasized that the experience of being in the hospital shortly after the lecture enhanced the relevance and application of facts and figures covered in class. It made them "care more" about learning the information since they could see the implications of their decisions and use of lecture information when

TABLE 2. Comparison of Didactic (Multiple Choice) and Clinical Testing

Q#	Student #1		Student #2		Student #3	
	Didactic	Clinic	Didactic	Clinic	Didactic	Clinic
1	C	I	I	C	C	I
2	C	C	C	C	C	C
3	C	I	C	C	C	C
4*	C/C	C/C	C/C	C/C	C	C/C
6	I	I	C	C	C	C
7	C	C	C	C	C	C
9	C	I	C	I	C	C
10	C	C	C	C	C	C
12	I	C	I	C	I	C
13	C	C	C	I	C	C
14	C	C	I	C	C	C
17*	C/I	I/I	C/C	C/I	I/C	C/C
21	C	I	C	C	I	I
22	I	I	C	C	I	I
23	C	I	C	C	C	C
%						
Correct	75	47	82	82	76	82

C = correct; I = incorrect

* two part question

counseling and working with real patients, health care professionals, and the patient's family members. A student stated, "You lock in what you learn. I created a rapport with the patient and I worked into feeling a comfort level and a pathway to the patient. I was able to get the background [of the patient] so I could have a full understanding of the situation."

All 3 students in this study longed for more of this type of experience as well as wishing their classmates could have experienced the clinical setting with patients, other health care professionals, and their faculty member.

Discussion

The concept utilized throughout this study is that of "assessment-for-improvement" model (4). Both the students being observed and tested in the clinical acute care setting and the faculty member undergoing peer review experienced "assessment for improvement." Students were able to apply their recall and understanding of the didactic material to real patients.

For students with no prior exposure to acute care, the experience provided a good introduction to the hospital environment. Other learning activities included patient interaction, chart review, assessment of laboratory values, interaction with other health professionals, and a prelude to the role of the acute care pharmacist.

The practice faculty member saw immediate student behavior and recall of the lecture material rather than having to wait months for students on rotation. This experience provided a unique opportunity to observe the success and recall of his didactic teaching. During this exercise, the practice faculty member found it very difficult to refrain from providing the student with clues to help answer the 23 learning objectives. Once the practice faculty member determined that the student's answer was incorrect and recorded behavior and responses, the faculty member provided clues to help the student think through and provide the expected response. Answers and explanations to all learning objective questions were reviewed with the student during the questioning process. The students provided helpful feedback to the practice faculty member regarding delivery of course material. For example, two of the three students mentioned that they recalled information regarding a pharmacology question because they could picture the table used in class. To the practice faculty member, this represented a teaching

success and an opportunity to improve teaching by using this format for other suitable content.

Although the overall evaluation scores in the clinical setting were rather low, two of three students did at least as well on the verbal (clinical) examination as they did on multiple choice (didactic) examination, when the same questions were evaluated. Had we used a multiple choice format in the clinical setting, we expect that the grade scores would have been better, by simply increasing the odds of picking a correct answer. Since practitioners are not provided a list of multiple choices when facing clinical issues, we felt that verbal testing was more appropriate.

It is imperative in peer review to go through the process not just as an exercise or a check off list for promotion, faculty evaluation, or tenure. The emphasis should be on the findings of the review and an application of what can be incorporated to improve. The resulting plan of action should be carefully crafted and applied as a feedback loop for improvement and excellence. The design of this study allows this to occur.

The practice faculty member considered himself a good teacher, with above average student evaluations of didactic teaching, and excellent scores as an experiential preceptor. Despite this notion, the practice faculty member recognized a key deficiency in the development of learning objectives. Integral to the development of pertinent course material is the construction of good learning objectives. The instruction design faculty member was instrumental in teaching how to construct meaningful, specific and measurable learning objectives. With the implementation of appropriate learning objectives, the practice faculty member was interested in measuring his teaching effectiveness by testing students' short term recall of course material, as applied to real patients.

Ultimately, this exercise accomplished four things. First, the faculty member gained valuable feedback and development as a teacher. Second, the students who participated gained practical, real world experience. Students self-reported being more aware of practicality and applicability of the information presented in lecture.

Third, lessons learned from this experience shall be incorporated into the classroom to provide curricular improvement for future students. As a result of this process, the faculty member made changes to learning objectives, lecture content and pedagogy.

Fourth, an unexpected outcome was the sense of connectedness and opportunity of modeling interpersonal competence self-reported by both the faculty member and the students. The students were able to see

the esteem and respect that the faculty member had earned from physicians, nurses, and patients in the acute care setting of the hospital. The faculty member self-reported enjoying the time spent with students whom he did not know well and observing them in a setting other than the lecture hall. Each student reported the desire to spend more time with the faculty member and learn from him. They regretted the fact that their fellow classmates were not having this experience and that they wished all topics could be “made real” by applying didactic theory to real patients. The scholarly contact with the faculty member in the clinical setting positively impacted the students, focusing their attention to their future roles as pharmacists beyond their role of being students and passing a test. Raushenbush captures this by stating:

The ways in which teachers affect seriously the education of their students are many; but however the teachers function in the classroom, whatever their style, their subject, their way of talking to the students or with them, what students remember, what reached the heart of their learning, what they cherished more than any other one this, is the sense of shared experience with a teacher (6).

Each of the students emphasized that the experience made the information “stick” and “lock in” which supports the learning theory of creating scaffolding with what a student already knows and then build upon it to a greater understanding and application. This is well described by Donald A. Schon’s theory of the reflective practitioner in which there is time for “reflection-in-action” (7) where the student or performer responds to *variation* in the clinical setting. The faculty member was there beside the student, guiding and assessing.

Reflections of the Practice Faculty Member

When meeting with the instruction design faculty member, I thought about the best way to determine [my] teaching effectiveness. Effective delivery of content is important in the classroom but I reasoned that the best way to measure teaching effectiveness would be to somehow assess the carryover of what is taught in the classroom, to student recall in the clinical setting. As a clinical practice faculty member, I see an average of 10 to 12 students per year on experiential rotations. Empirically, it seems that those students who recall important points taught in the classroom tend to progress more quickly during experiential rotation, and can offer a higher level of inpatient acute care.

As an oncology pharmacy specialist, I have developed learning objectives for didactic teaching which [I believe] reflect important issues facing the general practicing pharmacist, whether in the community or acute care setting. As part of peer review, the Instruction Design Faculty member helped me to match learning objectives with important constructs in oncology pharmacy. Together, we set out to design a method of testing ones effectiveness in didactic teaching by assessing short-term recall [by students] of material taught, as applied to real patients in the clinical setting.

The key to real world application is the availability of patients with disease states and problems discussed in class. For this reason, I decided to match pertinent learning objectives with patients who were available and willing to participate, at the time of this evaluation. I was able to identify three patients in which the majority of questions were pertinent. Allowing for approximately one hour completing the process, a sufficient number of questions were posed to provide comprehensive review of topics taught during the oncology module. In applying this methodology to other practice sites, I believe this presents a major challenge, depending on the practice site and content taught. For instance, if course material covers the treatment of tuberculosis, the likelihood of finding a patient with this disease state at a given point in time may be low.

In planning this methodology, we wanted to make sure that students were comfortable and acclimated to the oncology unit so that we could maximize their performance during the questioning session. Although most of the time spent on this process involved orientation and patient interview, I believe it was a necessary step. None of the three students had experience working in the acute care setting and in fact one student had never been inside a hospital before. During the questioning process, all students appeared at ease and eager to proceed. I did not detect any anxiety or nervousness.

An oral testing method was used for this process because we felt it more closely mimicked communication which would occur on a clinical unit. It also provided opportunity for feedback and discussion with the student.

We allotted one hour per student to complete the entire process. In reality, an average of two hours was spent per student. In the future we will consider using two separate sessions per student; one session for orientation and another to interview patients and administer the questions. Because of scheduling conflicts, we arranged to have the first student participate in this process two days prior to the other two students. Unfortunately, a change in a patient's health status prevented the last

two students from interviewing him. Therefore, if possible, the patient interviews should all take place on the same day.

Overall, the experience was a valuable one. The students found the exercise to be very helpful and good relationships were established with faculty. Students really liked the real world application of their studies and looked forward to experiential rotations. From a faculty evaluation perspective, I was somewhat disappointed to find poor performance by the students who participated in this process. The most likely explanation for the difference in performance is the difference in evaluation tools; one being multiple choice and the other a verbal response. It is difficult to draw any quantitative conclusions from this exercise since we only used three student participants. Students stated that they recalled information used in didactic lecture that was presented in table format and case studies. In the future I will use more case studies to incorporate real patients into didactic lecture and make use of table format to present suitable information. I am grateful to the Instruction Design Faculty member who provided insightful peer review and helped to improve my skills in writing meaningful objectives.

Future Implications and Limitations

Future utilization of this methodology can focus on transfer of learning. Transfer of learning, also termed transfer-of-training or applications process, can be viewed in terms of behavior as to how students apply and act on concepts taught didactically, applying them to clinical situations (8).

This process and methodology supports the Center for the Advancement of Pharmaceutical Education (CAPE) Educational Outcomes which guides curricular development in, “. . . helping students connect what they learn in the classroom and experiential setting to the practice of pharmacy (9).” Although this study follows one teacher, 3 students, and oncology topics, it establishes a methodology and process by which teaching in the didactic setting is evaluated by student recall and behavior in the clinical setting. Equally important, the authors created and documented a process by which student recall and behaviors in the clinical setting were recorded and correlated to classroom pedagogy. As a result of participating in this process, the faculty member who taught the didactic material made changes in his lectures to more clearly assist the student in recalling material to help in clinical decision making and patient care. Although it would be impractical to have all students come to an oncology unit, this process can be utilized for a representative

sampling of students in clinical settings in addition to the oncology unit. The authors plan to repeat this process as part of the peer review process and expand into other clinical settings such as cardiac, intensive care, and ambulatory out patient. In each didactic lecture that has implications for student interaction with clients or patients, learning objectives from the lecture can be chosen and correlated to patient or clients in acute care or ambulatory settings.

Time for acclimating the student in the sometimes foreign environment of hospital acute care or similar areas may have been helpful prior to observation and testing of the student in the clinical setting. Due to lack of time on the part of the practice faculty and the demanding schedule of the students, this was not possible. Future studies will include acclimatization of the acute care hospital setting.

CONCLUSION

This process creates a framework and model for evaluation of student recall of objectives presented in the didactic setting in the clinical acute care hospital environment. This framework and model also provided the opportunity for the practice faculty member to determine what was retained and applied by the student in the clinical setting. The faculty member immediately conversed with the student as to what didactic pedagogy was most helpful in assisting with retention and recall. This study also highlighted the need for incorporating current patient data in didactic lectures which emphasizes the applicability and importance of patient care of what may seem like abstract concepts. Ensuring that this pedagogy is included early in the course topics will set the framework for the students of approaching the didactic lectures in terms of applying the information to clients and patients rather than isolating the lecture as an abstract stand alone set of facts. The entire course can be mapped in terms of curriculum and interface with clinical courses.

This process also creates a model for what Chickering and Reiss state as crucial for student development which is for faculty to make themselves available outside of class, to model interpersonal competence for students. "Too many college buildings hold only large classrooms or lecture halls, filled with rows of passive, listening students. . . . Emphasis on research and publishing dominates the reward system and may block opportunities for positive relationships (10)."

Lastly, this process develops an avenue for faculty peer review to extend beyond the confines of the classroom to patients and clients where

the ultimate outcomes of teaching and learning make the greatest impact.

Received: August 18, 2006

Reviewed: September 22, 2006

Revised: December 21, 2006

Reviewed and Accepted: January 19, 2007

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doi:10.1300/J060v14n01_04

APPENDIX A. Specific questions posed to students in the clinical setting.

Patient # 1 Correct answers in bold

- 1) Calculate body surface area, BSA- 5'11" tall & 75kg

$$\text{BSA} = 1.93 \text{ m}^2$$

Most chemotherapeutic dosage is based on body surface area (BSA). This basic calculation is required of practitioners caring for oncology patients. BSA calculation is also used in pediatrics. To solve this question, the student must be able to extract the patient's height and weight from the medical record &/or by patient interview. This is a RECALL type question.

- 2) Calculate absolute neutrophil count (ANC)—get CBC with differential for pt #1

$$(4\% \text{ segs} + 5\% \text{ bands}) \times 1100 \text{ cells/mm}^3 \text{ WBC} = 99 \text{ cells/mm}^3$$

Most chemotherapeutic drugs cause bone marrow suppression. Calculation of the Absolute Neutrophil Count is important in assessing a patient's risk for developing infection. To solve this question, the student must be able to extract laboratory data from the medical record or laboratory database. This is a RECALL type question.

- 3) Provide accurate consultation regarding the onset of action (OOA) and most common adverse effects of megestrol acetate, as used for appetite stimulation.

OOA = weeks; Adverse effects = edema, thromboembolism, impotence (male), vaginal bleeding, adrenal suppression

These are two major teaching points. Patients who expect to see improvement in appetite shortly after beginning megestrol may assume the drug is not working and stop therapy prematurely. Likewise, it is important for patients to be aware of these potential side effects so that they can seek prompt medical attention. This is a RECALL type question.

- 4) Rank the prevalence and mortality of lung cancer versus other cancers in the U.S.

second most prevalent; first in mortality

Question # 4 & # 5 point out the tremendous prevalence and mortality of lung cancer and the importance of smoking cessation. This is a RECALL type question.

- 5) State the greatest risk factor for the development of lung cancer.

cigarette smoking

See question # 4 above. The student should be able to pick out this risk factor in the medical record &/or patient interview. This is a RECALL type question.

- 6) Distinguish between small cell lung cancer (SCLC) and non-small cell lung cancer (NSCLC), in terms of staging and treatment strategy.

SCLC = rapidly growing; limited & extensive stage; chemotherapy/XRT sensitive, not generally amenable to surgery. NSCLC = slow growing; stage I → IV; less sensitive to chemotherapy/XRT; surgery is considered in stage I → IIIB

Since lung cancer is one of the most common cancers in the U.S., the student should be familiar with general staging and treatment concepts. In their daily practice, the pharmacy practitioner will encounter numerous patients with lung cancer. A basic understanding of the disease state is necessary in order to provide good patient counseling. This is a RECALL type question.

- 7) State the standard chemotherapy agent which forms the basis for combination chemotherapy regimens used to treat lung cancer. **platinum-based**

See question #6 above. Knowing that platinum agents are typically used to treat lung cancer, the pharmacist can anticipate side effects and effectively counsel patients. This is a RECALL type question.

- 8) State the typical circulating life for the three blood cell lines.

neutrophils = 6hrs; platelets = 6 days; RBC's = 120 days

This information is most useful to the hematology/oncology pharmacist but is applicable to general pharmacy practice as well. Prediction of neutrophil and platelet nadir (lowest value), helps to guide supportive treatment and patient counseling. Anemia as a consequence of chemotherapy toxicity occurs later in the course of treatment. Response to treatment [of anemia] takes several weeks. This is important when making therapeutic decisions and counseling patients. This is a RECALL type question.

- 9) State the usual nadir period following cytotoxic chemotherapy.

7-10 days post chemotherapy

See question #8. This is a RECALL type question.

- 10) List the signs and symptoms associated with a decrease in each of the three blood cell lines (RBCs, WBCs & platelets).

RBCs: fatigue, palpitations, lightheadedness, pallor

WBCs: s/s of infection (fever, cough, sore throat, chills, sweats, etc.)

Platelets: bleeding (hemoptysis, petechiae, mucosal bleeding, etc.)

Drug-induced hematologic disorders are somewhat rare in general. However, certain drugs are associated with a significant incidence of hematologic toxicity. From a monitoring standpoint, it is essential for pharmacists to understand the clinical signs and symptoms resulting from declining numbers of each of the three blood cell lines. This is a RECALL type question.

Patient # 2 Correct answers in bold

- 1) List 4 common adverse effects of opioids.

sedation, respiratory depression, constipation, nausea

Knowledge of opioid toxicity is essential in order to prevent and manage these bothersome and sometimes debilitating side effects. These pharmacologic effects are often confused with “allergies.” The student should be able to glean information from the medical record and conduct an effective patient interview in order to uncover these drug related problems.

This is a RECALL type question. Although I asked this as a general question, I could have asked the student to uncover patient-specific opioid-induced adverse effects. The question then becomes one of CRITICAL THINKING as well as recall.

- 2) Describe an effective plan to prevent constipation due to chronic opioid use.

stimulant (irritant) laxative, +/- stool softener

Perhaps the most common and lingering side effect of opioids is constipation. In the patient managed with opioids chronically, an effective strategy to prevent constipation is mandatory.

This is a critical thinking question.

- 3) Provide an appropriate equianalgesic dose of fentanyl transdermal patch for a patient being converted from parenteral hydromorphone.

9 mg IV hydromorphone in 12 hours = 18mg in 24 hours = 360 mg oral morphine equivalents → 100 µg/hr fentanyl patch applied every 72 hours

Pharmacists are uniquely qualified and often consulted to provide dosing recommendations for patients being converted from one opioid or opioid dosage form to another. The student should know how to approach this problem, using published equianalgesic tables and patient-specific data. This is a CRITICAL THINKING type question.

- 4) Evaluate a patient for the appropriateness of parenteral nutrition support.

not a good candidate for parenteral nutrition support; GI tract functional

This question pertains to appropriate medication use. Inappropriate use of specialized nutrition support increases risk to the patient and adds to the cost of care, without providing benefit. After reviewing the patient record, the student should be able to assess the patient's therapeutic goals, nutritional status and gastrointestinal function. This is a CRITICAL THINKING type question.

- 5) Provide an effective treatment plan for chemotherapy-associated mucositis.

magic mouthwash– swish/swallow 5-10 mL before meals and every 2 hours as needed for pain (this pt is not eating [npo] so dosing before meals is not pertinent)

Palifermin has not been studied in this setting.

Good oral hygiene shortens the course and helps to prevent infection.

Salt & soda rinses provide good debridement of necrotic tissue.

Radiacare® can be recommended for symptomatic relief.

Systemic analgesia (NSAIDS, corticosteroids, opiates) is often necessary.

Antifungals, antivirals and antibiotics are recommended for concomitant infections with Candida, Herpes simplex virus and bacteria, respectively.

Oral mucositis (stomatitis) is a common adverse effect of chemotherapy and radiation therapy. Pharmacists are well suited to provide supportive care recommendations and patient counseling.

This is a RECALL type question.

Patient # 3 Correct answers in bold

- 1) Rank the prevalence and mortality of prostate cancer versus other cancers facing men in the U.S.

1 incidence & # 3 mortality

The most common cause of death in U.S. citizens under the age of 85 is cancer. Aside from skin cancer, prostate cancer accounts for the most common cancer in men in the U.S. The student should appreciate the prevalence and mortality of prostate cancer to help them guide appropriate screening. This is a RECALL type question.

- 2) Explain the mechanism of action of leutenizing hormone releasing hormone LHRH agonists and anti-androgens used in treating prostate cancer.

LHRH agonists shut off testicular testosterone production; anti-androgens compete

with endogenous androgens for dihydrotestosterone (DHT) receptor binding See #1 above. Due to the prevalence of this disease, pharmacists should be knowledgeable of general treatment principles. This is a RECALL type question.

- 3) Discuss the role of chemotherapy in the treatment of prostate cancer.

Limited to hormone-refractory prostate cancer (HRPC)

See #1 & #2 above. This is a RECALL type question.

- 4) State the 2006 American Cancer Society recommendations for prostate cancer screening for average risk men. **Annual DRE & PSA starting at age 50**

See #1 above. This is a RECALL type question.

Miscellaneous Questions Correct answers in bold

- 1) State the pharmacologic class of capecitabine.

Antimetabolite; oral 5-fluorouracil analog

Identifying chemotherapy agents by mechanism of action helps to predict side effects common to that class. The student may use this association to help recall important monitoring and patient counseling points. This is a RECALL type question.

- 2) State 1 important patient counseling point regarding the administration of capecitabine, and 2 important adverse effects.

Take within 1/2 hour of finishing a meal (B & S). Diarrhea & hand-foot syndrome (palmar-plantar erythrodysesthesia) are 2 important adverse effects.

See #1 above. These are very important counseling points with major clinical significance.

This is a RECALL type question.

- 3) List the major adverse effects associated with antiestrogens and aromatase inhibitors. **Anti-estrogens: hot flashes, vaginal discharge, thrombosis, endometrial hyperplasia/cancer**

Aromatase inhibitors: hot flashes, osteoporosis, myalgias/artralgias

Aside from skin cancer, breast cancer is the most prevalent cancer among women in the U.S. Hormonal medications are commonly prescribed and depending on the indication, may be taken continuously for 5 years. Compliance is often difficult, especially with the significant incidence of adverse effects. Effective counseling helps to identify, address and prevent some of these well-established toxicities. This may also improve compliance. This is a RECALL type question.

- 4) State 1 important counseling point regarding the administration of thalidomide and 4 important adverse effects.

The dose should be taken at bedtime, due to sedation.

Adverse effects: sedation, neuropathy, rash, constipation, teratogenicity

As in question #3 above, patient counseling is so important with this therapy. The student should be aware of special counseling that is required for patients taking thalidomide. Students (pharmacists) should remember that there are important points to discuss with the patient and be able to provide the information to them. This is a RECALL type question.

APPENDIX B. Qualitative Coding

Categories and subcategories of students' reflections on clinical experience

- 1) The experience was positive
 - a) Good comfort level with faculty member, patients, staff
 - b) Met new people who helped me apply what I knew
 - c) Gained a sense of satisfaction in applying knowledge
 - d) Excellent inter-disciplinary teaching with nurses, physician assistants, nurse practitioners, and physical therapists

- 2) Positive integration of didactic and clinical environment
 - a) Dull facts presented in class came to life in clinical environment
 - b) Working with patients created relevance
 - c) Recognition of not knowing something and still had time to revisit and study
 - d) Gain an understanding of how oncology practice really works
- 3) Trust developed by the students for their faculty member
 - a) Sense of awe by the students for their faculty member when seeing the great esteem that patients and medical staff had for him
 - b) Knowledge that student would not be left flailing or alone
 - c) Given just enough freedom to allow for exploration
 - d) Able to respond to wrong answers and use wrong answers to get the right answer
 - e) Had time with the faculty member beyond the classroom to learn more about him and he could learn more about the students.

Categories and subcategories of faculty member's reflections on clinical experience:

- 1) Peer review with both didactic and clinical portion leads to improved teaching
 - a. Traditional peer review with Instruction Design faculty member in didactic setting helpful
 - b. Insightful to get quick feedback of which learning objectives were clear to students in applying information in a clinical setting
 - c. Emphasis of what pedagogical technique to use in didactic lecture that assist students in recall in the clinical setting
- 2) Time is of essence
 - a. Great difficulty in scheduling time with large numbers of students for clinical exposure following didactic lecture
 - b. Desire to spend more time with students in clinical setting