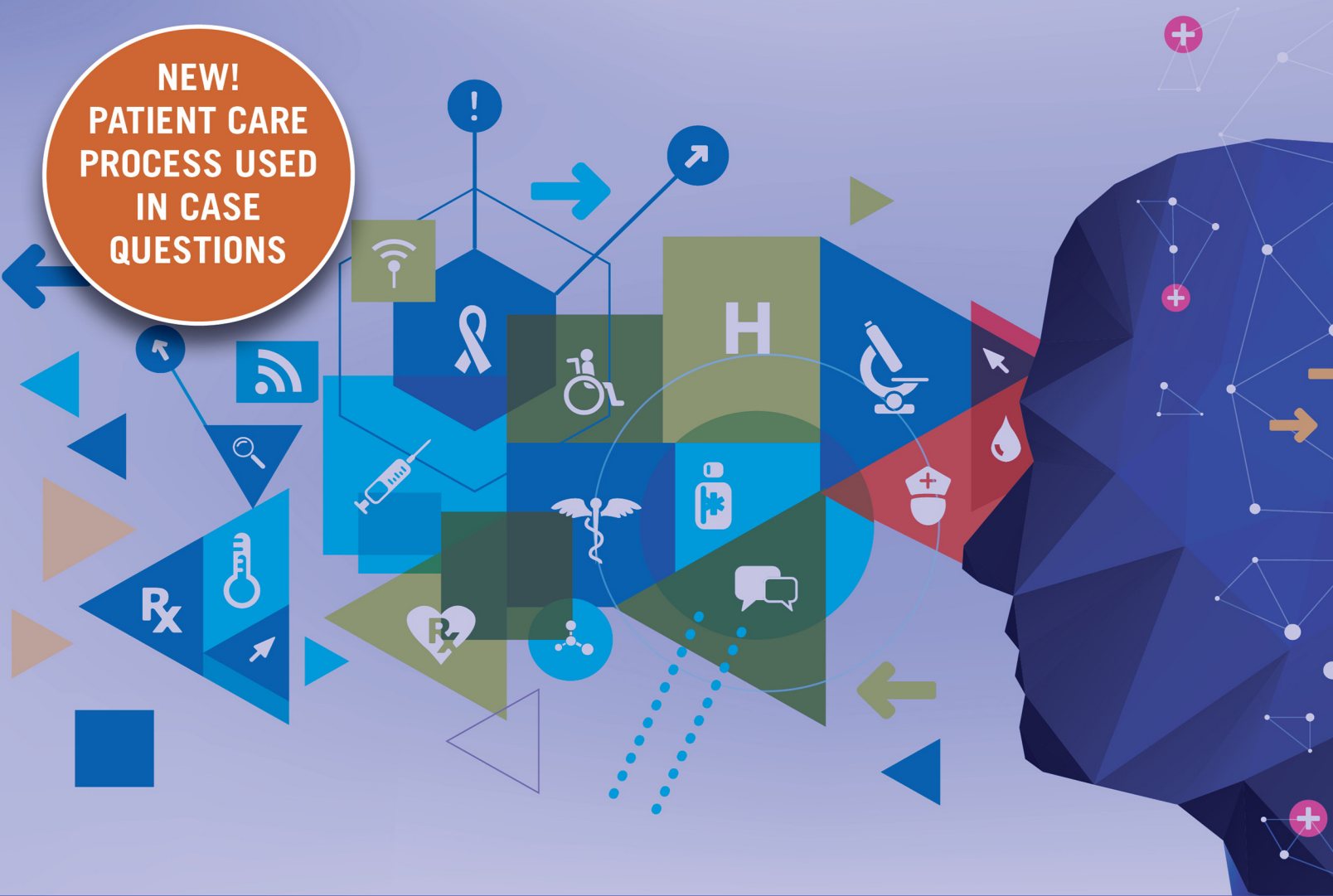


ELEVENTH EDITION

# PHARMACOTHERAPY CASEBOOK

A Patient-Focused Approach

NEW!  
PATIENT CARE  
PROCESS USED  
IN CASE  
QUESTIONS



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Graw  
Hill**

Terry L. Schwinghammer • Julia M. Koehler  
Jill S. Borchert • Douglas Slain • Sharon K. Park

# Pharmacotherapy Casebook

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# Pharmacotherapy Casebook

A Patient-Focused Approach

Eleventh Edition

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# PREFACE

The purpose of the *Pharmacotherapy Casebook* is to help students in the health professions and practicing clinicians develop and refine the skills required to identify and resolve drug therapy problems by using realistic patient cases. Case studies can actively involve students in the learning process; engender self-confidence; and promote the development of skills in independent self-study, problem analysis, decision-making, oral communication, and teamwork. Patient case studies can also be used as the focal point of discussions about pathophysiology, medicinal chemistry, pharmacology, and the pharmacotherapy of individual diseases. By integrating the biomedical and pharmaceutical sciences with pharmacotherapeutics, case studies can help students appreciate the relevance and importance of a sound scientific foundation in preparation for practice.

The patient cases in this book are intended to complement the scientific and clinical information in the 11th edition of *Pharmacotherapy: A Pathophysiologic Approach*. This edition of the casebook contains 157 unique patient cases, with case chapters organized into organ system sections corresponding to the *Pharmacotherapy* textbook. Students should read the relevant textbook chapter to become thoroughly familiar with the pathophysiology and pharmacotherapy of each disease state before attempting to identify and address the medication therapy problems of the patients described in this casebook. The *Pharmacotherapy* textbook, casebook, and other useful learning resources are also available on *AccessPharmacy.com* (subscription required). By using these realistic cases to practice creating, defending, and implementing pharmacotherapeutics care plans, students can begin to develop the skills and self-confidence that will be necessary to make the real decisions required in professional practice.

The knowledge and clinical experience required to answer the questions associated with each patient presentation vary from case to case. Some cases deal with a single disease, whereas others have multiple diseases and drug therapy problems. As a guide for instructors, each case is identified as being one of three complexity levels; this classification system is described in more detail in Chapter 1.

*Casebook Section 1: Principles of Patient-Focused Therapy* includes five chapters that provide guidance on use of the casebook and six patient cases related to managing special patient populations (pediatrics, geriatrics, palliative care) and toxicology situations.

**Chapter 1** describes the format of case presentations and the means by which students and instructors can maximize the usefulness of the casebook. Previous editions of the casebook employed a systematic problem-solving approach to each case. Briefly, the steps involved in this approach include: (1) identifying drug therapy problems, (2) establishing therapeutic goals, (3) evaluating therapeutic options to achieve the goals, (4) designing an optimal patient care plan, (5) establishing monitoring parameters, and (6) providing patient education. A major innovation for the 11th edition is that the case questions and answers now use the Joint Commission of Pharmacy

Practitioners (JCPP) Pharmacists' Patient Care Process (PPCP; <https://jcpc.net/patient-care-process/>). The disease state chapters in the *Pharmacotherapy* textbook also include an outline of the PPCP for the relevant disorders. It is important for all clinicians to use a consistent process in delivering care so patients and other healthcare providers know what to expect from them. In addition, the PPCP is similar to the patient care process used by other healthcare professionals, and the Accreditation Council for Pharmacy Education (ACPE) requires schools/colleges of pharmacy to teach the PPCP in the curriculum.

**Chapter 2** presents the philosophy and implementation of active learning strategies. This chapter sets the tone for the casebook by describing how these approaches can enhance student learning. The chapter provides useful active learning strategies for instructors and provides advice to students on how to maximize their learning opportunities in active learning environments.

**Chapter 3** discusses the importance of patient communication and offers strategies to get the most out of the time that the clinician shares with the patient during each encounter. The information can be used as the basis for simulated counseling sessions related to the patient cases.

**Chapter 4** describes in detail the steps involved in the PPCP: (1) Collect, (2) Assess, (3) Plan, (4) Implement, and (5) Follow-up: Monitor and Evaluate. The chapter includes example of patient case vignettes to demonstrate implementation of the PPCP. Implementing the PPCP profession-wide provides a common terminology for pharmacist patient care services and focuses on quality improvement, provider collaboration, improved patient outcomes, and cost savings. All pharmacists providing direct patient care should employ the PPCP, regardless of practice setting.

**Chapter 5** describes the critically important process of documenting patient encounters and interventions to serve as a record of patient care services provided and to communicate effectively with other healthcare providers. The authors discuss documentation of medication therapy management (MTM) and comprehensive medication management (CMM) encounters as well as use of the traditional SOAP note for documenting the identification and resolution of drug therapy problems. A sample case presentation is provided to illustrate construction of a SOAP note with appropriate documentation of drug therapy problems.

Casebook Sections 2 through 18 contain patient cases organized by organ systems that correspond to those of the *Pharmacotherapy* textbook. Section 19 (Complementary and Alternative Therapies) contains patient vignettes that are directly related to patient cases that were presented earlier in this casebook. Each scenario involves the potential use of one or more dietary supplements. Additional follow-up questions are then asked to help the reader gain the scientific and clinical knowledge required to provide evidence-based recommendations about use of the supplement in that particular patient. Sixteen different dietary supplements are discussed: garlic, fish oil (omega-3 fatty acids), ginger, butterbur,

feverfew, St. John's wort, kava, melatonin, cinnamon,  $\alpha$ -lipoic acid, black cohosh, soy, *Pygeum africanum*, glucosamine, chondroitin, and elderberry.

We are grateful for the broad acceptance that previous editions of the casebook have received. It has been adopted by many schools of pharmacy and nurse practitioner programs. It has also been used

in institutional staff development efforts and by individual pharmacists striving to upgrade their pharmacotherapy skills. It is our hope that this new edition will be even more valuable in assisting health-care practitioners to meet society's need for safe and effective drug therapy.

# ACKNOWLEDGMENTS

The editors would like to thank the 215 case and chapter authors from more than 100 schools of pharmacy, healthcare systems, and other institutions in the United States and Canada who contributed their scholarly efforts to this casebook. We especially appreciate their diligence in meeting deadlines, adhering to the new Patient Care Process casebook format, and providing up-to-date pharmacotherapy information. The next generation of healthcare practitioners will benefit from their willingness to share their expertise.

We also thank the individuals at McGraw-Hill Education whose cooperation, guidance, and commitment were instrumental in maintaining the high standards of this publication, especially Michael Weitz, Peter Boyle, Richard Ruzicka, Laura Libretti, and

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# Pharmacotherapy Casebook

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# SECTION 1

## PRINCIPLES OF PATIENT-FOCUSED THERAPY

### CHAPTER

# 1

## Introduction: How to Use This Casebook

TERRY L. SCHWINGHAMMER, PharmD, FCCP, FASHP, FAPhA

### CASE STUDIES AS A MEANS OF ENHANCING STUDENT LEARNING

The case method can assist learners in developing the skills of self-learning, critical thinking, problem identification, and decision making. When case studies from this *Casebook* are used in the curricula of the healthcare professions or for independent study by practitioners, the focus should be on learning the *process* of identifying and resolving drug therapy problems rather than simply finding answers to the individual case questions. Students do learn scientific and clinical facts as they resolve case study problems, but they usually learn more from their own independent study and from discussions with their peers than they do from the instructor. Working through subsequent cases with similar problems reinforces information recall. Educational programs in the healthcare professions that rely heavily on traditional lectures tend to concentrate on dissemination of scientific and clinical content with rote memorization of facts rather than developing higher-order thinking and problem-solving skills.

Case studies in the health professions provide the personal history of an individual patient and information about one or more healthcare problems that require resolution. The learner's job is to collect the relevant patient information, assess that clinical data, develop hypotheses about the underlying cause of problems, consider possible solutions to problems identified, decide on and implement optimal solutions, perform follow-up to identify the consequences of one's decisions, and then make adjustments in the plan as needed.<sup>1</sup> The role of the teacher is to serve as coach and facilitator rather than as the source of "the answer." In fact, in many situations, there is more than one acceptable answer to a given case question. Because instructors do not necessarily need to possess the correct answer, they need not be experts in the field being discussed if they enter the learning environment prepared to participate as engaged coaches. The students also become teachers of themselves and others, and both instructors and students learn from each other through thoughtful discussion of the case.

### PREPARATION FOR LEARNING WITH PATIENT CASES

The patient cases in this *Casebook* can be used for independent self-learning by individual students and for in-class problem-solving

discussions by student groups and their instructors. If meaningful learning and discussion are to occur, students must come to class sessions prepared to discuss the case material rationally, to make informed recommendations, and to defend their patient care plans. This requires a strong commitment to independent self-study prior to the session. The cases in this book were designed to correspond with the scientific and clinical information contained in the 11th edition of *Pharmacotherapy: A Pathophysiologic Approach*.<sup>2</sup> For this reason, thorough understanding of the corresponding textbook chapter is recommended as the principal method of student preparation. The McGraw-Hill online learning center *AccessPharmacy* ([www.AccessPharmacy.com](http://www.AccessPharmacy.com), subscription required) contains the *Pharmacotherapy* textbook, this *Pharmacotherapy Casebook*, and many other educational resources that can be beneficial in answering case questions. The patient cases in the *Casebook* can also be used with the textbook *Pharmacotherapy Principles & Practice*, 5th edition,<sup>3</sup> or other therapeutics textbooks. Primary literature should also be consulted as necessary to supplement textbook readings.

Most of the cases in the *Casebook* represent common diseases likely to be encountered by generalist practitioners. As a result, not all of the medical disorders discussed in the *Pharmacotherapy* textbook have an associated patient case in the *Casebook*. On the other hand, *Pharmacotherapy* textbook chapters that discuss multiple diseases may have several corresponding cases in the *Casebook*.

### LEVELS OF CASE COMPLEXITY

Each case is identified at the top of the first page as being one of the three levels of complexity. Instructors may use this classification system to select cases for discussion that correspond to the experience level of the student learners. These levels are defined as follows:

*Level I*—An uncomplicated case; only a single textbook chapter is required to complete the case questions. Little prior knowledge of the disease state or clinical experience is needed.

*Level II*—An intermediate-level case; several textbook chapters or other reference sources may be required to complete the case. Prior clinical experience may be helpful in resolving all of the issues presented.

*Level III*—A complicated case; multiple textbook chapters, additional readings, and substantial clinical experience may be required to solve all of the patient's drug therapy problems.

## USING LEARNING OBJECTIVES TO FOCUS LEARNING

Learning objectives are included at the beginning of each case for student reflection. The focus of these outcomes is on eventually achieving clinical competence rather than simply learning isolated clinical and scientific facts. These objectives reflect some of the knowledge, skills, and abilities that students should possess after reading the relevant textbook chapter(s), studying the case, preparing a patient care plan, and defending their recommendations. Of course, true clinical competence can only be gained by direct interaction with real patients in various healthcare environments.

The learning objectives provided are meant to serve as a starting point to stimulate student thinking, but they are not intended to be all-inclusive. In fact, students should also generate their own personal ability outcome statements and learning objectives for each case. By so doing, students take greater control of their own learning, which serves to improve personal motivation and the desire to learn.

## FORMAT OF THE CASEBOOK

### PATIENT PRESENTATION

The format and organization of cases reflect those usually seen in actual clinical settings. The patient's medical history, physical examination findings, and laboratory results are provided in the following standardized outline format.

#### Chief Complaint

The chief complaint (CC) is a brief statement from the patient describing the symptom, problem, condition, or other reason for a medical encounter. The CC is stated in the patient's own words and forms the basis for the healthcare provider's initial differential diagnosis. Medical terms and diagnoses are generally not used in the CC, so the patient's symptoms are documented accurately. The appropriate medical terminology is used only after an appropriate evaluation (ie, medical history, physical examination, laboratory and other testing) leads to a medical diagnosis.

In the United Kingdom, the term "presenting complaint" (PC) may be used. Other synonyms include reason for encounter (RFE), presenting problem, problem on admission, or reason for presenting.

#### History of Present Illness

The history of present illness (HPI) (called the history of presenting complaint or HPC in the United Kingdom) is a more complete description of the patient's symptom(s). Items usually included in the HPI are:

- Date of onset
- Precise location
- Nature of onset, severity, and duration
- Presence of exacerbations and remissions
- Effect of any treatment given
- Relationship to other symptoms, bodily functions, or activities (eg, activity, meals)
- Degree of interference with daily activities

#### Past Medical History

The past medical history (PMH) includes serious illnesses, surgical procedures, and injuries the patient has experienced previously.

Minor complaints (eg, influenza, colds) are usually omitted unless they might have a bearing on the current medical situation.

#### Family History

The family history (FH) includes the age and health of parents, siblings, and children. For deceased relatives, the age and cause of death are recorded. In particular, heritable diseases and those with a hereditary tendency are noted (eg, diabetes mellitus, cardiovascular disease, malignancy, rheumatoid arthritis, obesity).

#### Social History

The social history (SH) includes the social characteristics of the patient as well as environmental factors and behaviors that may contribute to development of disease. Items that may be documented are the patient's marital status; number of children; educational background; occupation; physical activity; hobbies; dietary habits; and use of tobacco, alcohol, or other drugs.

#### Medication History

The medication history (Meds) should include an accurate record of the patient's current use of prescription medications, nonprescription products, dietary supplements, and home remedies. Because there are thousands of prescription and nonprescription products available, it is important to obtain a complete medication history that includes the names, doses, routes of administration, schedules, and duration of therapy for all medications, including dietary supplements and other alternative therapies.

#### Allergies

Allergies (All) to drugs, food, pets, and environmental factors (eg, grass, dust, pollen) are recorded. An accurate description of the reaction that occurred should also be included. Care should be taken to distinguish adverse drug effects ("upset stomach") from true allergies ("hives").

#### Review of Systems

In the review of systems (ROS), the examiner questions the patient about the presence of symptoms related to each body system. In a brief ROS, only the pertinent positive and negative findings are recorded. In a complete ROS, body systems are generally listed starting from the head and working toward the feet and may include symptoms related to the skin, head, eyes, ears, nose, mouth and throat, neck, cardiovascular, respiratory, gastrointestinal, genitourinary, endocrine, musculoskeletal, and neuropsychiatric systems. The purpose of the ROS is to identify patient complaints related to each body system and prevent omission of pertinent information. Findings that were included in the HPI are generally not repeated in the ROS.

#### Physical Examination

The exact procedures performed during the physical examination (PE) vary depending on the CC, medical history, and type of encounter. A complete physical examination may be performed for annual screening, employment, or insurance purposes. In most clinical situations, only a limited physical examination is performed that is focused on the reason for the encounter. In psychiatric practice, greater emphasis is usually placed on the type and severity of the patient's symptoms than on physical findings. Most of the cases in this *Casebook* include comprehensive physical examination data so students become familiar with common procedures and learn which findings are relevant to the CC and which are routine, normal findings. A suitable physical assessment textbook should be consulted

for the specific procedures that may be conducted for each body system. The general sections for the PE are outlined as follows:

### General Appearance (Gen)

**Vital Signs (VS)**—blood pressure, pulse, respiratory rate, and temperature. In hospital settings in particular, the presence of acute and chronic pain should be assessed when appropriate, but pain is no longer referred to as “the fifth vital sign.”<sup>4</sup> For ease of use and consistency in this *Casebook*, weight and height are included in the vital signs section, but they are not actually considered to be vital signs.

- **Skin** (or Integumentary)
- **Head, Eyes, Ears, Nose, and Throat (HEENT)**
- **Lungs/Thorax** (or Pulmonary)
- **Cardiovascular (Cor or CV)**
- **Abdomen (Abd)**
- **Genitalia/Rectal (Genit/Rect)**
- **Musculoskeletal and Extremities (MS/Ext)**
- **Neurologic (Neuro)**

### Laboratory Data

The results of laboratory tests are included with most cases in this *Casebook*. **Appendix A: Conversion Factors and Anthropometrics** contains common conversion factors and anthropometric information that will be helpful in solving many case answers. Normal (reference) ranges for the laboratory tests used throughout the *Casebook* are included in **Appendix B: Common Laboratory Tests**. Values in the appendix are provided in both traditional units and SI units (*le système International d'Unités*). The reference range for a given laboratory test is determined from a representative sample of the general population. The upper and lower limits of the range usually encompass two standard deviations from the population mean, which includes a range within which about 95% of healthy persons would fall. The term *normal range* may therefore be misleading, because a test result may be abnormal for a given individual even if it falls within the so-called normal range. Furthermore, given the statistical methods used to calculate the range, about 1 in 20 normal, healthy individuals will have a value for a test that lies outside the range. For these reasons, the term *reference range* is preferred over normal range. Reference ranges differ among laboratories, so the values given in Appendix B should be considered only as a general guide. Institution-specific reference ranges should be used in actual clinical settings.

All of the cases include some physical examination and laboratory findings that are within normal limits. For example, a description of the cardiovascular examination may include a statement that the point of maximal impulse is at the fifth intercostal space; laboratory evaluation may include a serum sodium level of 140 mEq/L (140 mmol/L). The presentation of actual findings (rather than simple statements that the heart examination and the serum sodium were normal) reflects what will be seen in actual clinical practice. More importantly, listing both normal and abnormal findings requires students to carefully assess the complete database and identify the pertinent positive and negative findings for themselves. A valuable portion of the learning process is lost if students are only provided with findings that are abnormal and are known to be associated with the disease that is the focus of the patient case.

## HUMANISTIC CONSIDERATIONS

The patients described in this *Casebook* have been given fictitious names to humanize the situations and to encourage students to remember that they will one day be caring for patients, not treating diseases or correcting laboratory values. However, in actual

clinical settings, patient confidentiality is of utmost importance, and real patient names should not be used during group discussions in patient care areas unless absolutely necessary. To develop student awareness and sensitivity to this issue, instructors may wish to avoid using these fictitious patient names during class discussions. In this *Casebook*, patient names are usually given in the initial presentation and are then used infrequently in subsequent questions or other portions of the case.

The issues of race, ethnicity, and gender also deserve thoughtful consideration. The traditional format for case presentations usually begins with a description of the patient's age, race, and gender, as in: “The patient is a 65-year-old white male....” Single-word racial labels such as “black” or “white” are actually of limited value in many cases and may actually be misleading in some instances.<sup>5</sup> For this reason, racial descriptors are usually excluded from the opening line of each presentation in the *Casebook*. When ethnicity is pertinent to the case, this information is presented in the social history or physical examination. Adult patients in this *Casebook* are usually referred to as men or women, rather than males or females, to promote sensitivity to human dignity.

The patient cases in this *Casebook* include medical abbreviations and both generic and proprietary drug names, just as medical records do in actual practice. Although abbreviations and brand names are sometimes the source of clinical problems, the intent of their inclusion is to make the cases as realistic as possible. **Appendix C** lists the medical abbreviations used in the *Casebook*. This list is limited to commonly accepted abbreviations; thousands more exist, which can make it difficult for novice practitioners to efficiently assess patient databases. An accreditation standard of the Joint Commission International (JCI) mandates that health-care institutions ensure the standardized use of approved symbols and medical abbreviations across the hospital. In addition, use of abbreviations is prohibited in informed consent forms, patient rights documents, discharge instructions, and other documents that patients and families receive from the institution.<sup>6</sup> Clinicians must be aware of this institutional document and use only approved symbols and abbreviations in the medical record system. Appendix C of this *Casebook* also lists abbreviations and designations that should be avoided. Given the immense human toll resulting from medical errors, this section should be considered “must” reading for all student learners. Medical abbreviations were ubiquitous throughout the paper medical charts used in physician offices, clinics, and hospitals prior to the advent of electronic health records. Fortunately, abbreviations are used less frequently now with the widespread adoption of electronic health records that have click boxes for sections of the medical history, PE, and other areas, along with physician dictation of progress notes.

The *Casebook* also contains some photographs of commercial drug products. These illustrations are provided as examples only and are not intended to imply endorsement of those particular products.

## SOCIETAL NEED FOR COMPREHENSIVE MEDICATION MANAGEMENT SERVICES

Medication therapy plays a crucial role in improving human health by enhancing quality of life and extending life expectancy. The advent of biotechnology has led to the introduction of unique compounds for the prevention and treatment of disease that were unimaginable just a decade or two ago. Each year the US Food and Drug Administration (FDA) approves dozens of new drugs and biologic products containing molecular entities that have never before been marketed in the country. In 2017 the FDA reported approving 46 new drug therapies.<sup>7</sup> According to the Patient-Centered Primary



Care Collaborative, more than 3.5 billion prescriptions are written annually, and medications are involved in 80% of all treatments in the United States.<sup>8</sup> Although the cost of new therapeutic agents often receives intense scrutiny, appropriate drug therapy can be cost-effective and reduce total healthcare expenditures by decreasing the need for surgery, avoiding adverse drug reactions, preventing hospital admissions and readmissions, shortening hospital stays, and preventing emergency department and physician visits.<sup>9</sup>

Unfortunately, various types of drug therapy problems frequently interfere with the ability of healthcare providers and patients to achieve the desired health outcomes. The resulting cost of drug-related morbidity and mortality exceeds \$200 billion each year in the United States, which is more than the cost of the medications used.<sup>8,10</sup> An analysis conducted by researchers at Johns Hopkins University concluded that more than 250,000 Americans die each year from medical errors, and that if medical error were a disease, it would rank as the third-leading cause of death in the United States.<sup>11</sup> Medical errors include not only drug therapy problems but also any unintended act (either of omission or commission) or an act that does not achieve its intended outcome, failure of a planned action to be completed as intended, use of a wrong plan to achieve a goal, or deviation from the process of care that may or may not cause harm to the patient. Considering the magnitude of this problem, there is a clear societal need for better medication use.

*Comprehensive medication management* (CMM) is the standard of care that ensures that each patient's medications (prescription, non-prescription, nutritional supplements, and other types) are assessed to determine that each one is appropriate for the patient, effective for the medical condition, safe given patient comorbidities and other medications being taken, and able to be taken by the patient as intended.<sup>8</sup> When drug therapy problems are identified, pharmacists and other healthcare providers collaborate in a team-based approach to develop and implement an individualized care plan with specific therapeutic goals, drug therapy interventions, patient education, and follow-up evaluation to determine the actual patient outcomes achieved. Throughout this process, it is imperative that the patient understand, agree with, and participate actively in the treatment plan to optimize the medication experience and clinical outcomes.<sup>8</sup> Widespread implementation of CMM in patient-centered medical homes (PCMHs) and other clinical settings has the potential to optimize medication use and improve healthcare for society.

## CATEGORIES OF DRUG THERAPY PROBLEMS

A drug therapy problem has been defined as “any undesirable event experienced by a patient that involves, or is suspected to involve, drug therapy and that interferes with achieving the desired goals of therapy and requires professional judgment to resolve.”<sup>12</sup> Seven distinct types of drug therapy problems have been identified that may potentially lead to an undesirable event that has physiologic, psychological, social, or economic ramifications.<sup>12</sup> These seven problem types relate to assessment of medication appropriateness, effectiveness, safety, or adherence:

### *Appropriate indication for the medication:*

1. The medication is unnecessary because the patient does not have a clinical indication at this time.
2. Additional drug therapy is required to treat or prevent a medical condition.

### *Effectiveness of the medication:*

3. The medication being used is not effective at producing the desired patient response.
4. The dosage is too low to produce the desired patient response.

### *Safety of the medication:*

5. The medication is causing an adverse reaction.
6. The dose is too high, resulting in actual or potential undesirable effects.

### *Adherence to the medication:*

7. The patient is not able or willing to take the drug therapy as intended.

These drug therapy problems are discussed in more detail in **Chapter 4**. Because this *Casebook* is intended to be used as a companion for the *Pharmacotherapy* textbook, one of its purposes is to serve as a tool for learning about the pharmacotherapy of disease states. For this reason, the primary drug therapy problem requiring identification and resolution for many patients in the *Casebook* is the need for additional drug treatment for a specific medical indication (problem 2 above). Other actual or potential drug therapy problems may coexist during the initial presentation or may develop during the clinical course of the disease.

## APPLYING A CONSISTENT PATIENT CARE PROCESS TO CASE PROBLEMS

In this *Casebook*, each patient presentation is followed by a set of questions that are similar for each case. These questions are applied consistently to each case to demonstrate that clinicians should use a systematic patient care process for identifying, preventing, and resolving drug therapy problems regardless of the disease state being addressed. The 11th edition of the *Casebook* has adopted the Joint Commission of Pharmacy Practitioners (JCPP) *Pharmacists' Patient Care Process* (PPCP)<sup>13</sup> as the framework for this purpose. The PPCP is the standard patient care process taught in schools and colleges of pharmacy in the United States. The Accreditation Council for Pharmacy Education (ACPE) Standard 10.8 states that “the curriculum prepares students to provide patient-centered collaborative care as described in the Pharmacists' Patient Care Process model endorsed by the Joint Commission of Pharmacy Practitioners.”<sup>14</sup> Although the PPCP includes the word “pharmacists,” the process mirrors the patient care process used by other healthcare providers. Thus, teaching pharmacy students to employ this process in clinical practice will help ensure that they “speak the same language” as other healthcare providers when they become healthcare providers.

Prior to embarking upon the patient care process for a given individual, the clinician must establish an appropriate professional relationship with the patient, family, and caregivers that will support active engagement and effective communication. Throughout the process, the medication management expert must continually collaborate, document, and communicate with physicians, pharmacists, and other healthcare professionals to provide safe, effective, and coordinated care. See **Chapter 4, Fig. 4-1** for an illustration of how the PPCP is implemented in clinical practice. A description of how the case questions in this *Casebook* employ the steps of the PPCP is included in the following paragraphs.

## 1. COLLECT INFORMATION

### 1.a. What subjective and objective information indicates the presence of (the primary problem or disease)?

The first step is to collect the necessary subjective and objective information to understand the patient's medical and medication history and his/her clinical status. Therefore, the first case question in the *Casebook* asks the learner to identify the subjective and objective information that indicates the presence of the patient's primary



disease state that is associated with the reason for the patient encounter.

*Subjective* information is obtained by communicating with the patient and cannot usually be verified by the clinician. As examples, a patient may report having chest pain, palpitations, shortness of breath, dizziness, or feelings of depression. Subjective information usually begins with the CC, which includes one or more symptoms. Subjective information is also obtained from the ROS, as discussed previously.

*Objective* information can be measured and verified by the clinician using the physical examination procedures of inspection, auscultation, palpation, and percussion as well as vital signs (heart rate, blood pressure, respiratory rate, temperature). Laboratory data and other diagnostic test results also provide objective information.

For purposes of CMM in real patient situations, it is critically important to obtain accurate and complete information about all of the patient's medications, including prescription, nonprescription, alternative therapies, vitamins, nutritional supplements, and products used from family or friends, regardless of who prescribed them.<sup>7</sup> It is also important to identify where the products were dispensed, purchased, or otherwise obtained. Even though not all of this information will be provided or known for the patient cases in the *Casebook*, it is important for students to realize the importance of collecting this information.

### 1.b. What additional information is needed to fully assess this patient's primary problem?

In many *Casebook* cases (just as in real life), some important pertinent information is missing from the patient presentation. A separate case question will ask the student to list other additional information that would be needed to fully assess the patient's main problem. Providing precise recommendations for obtaining the additional information needed to satisfactorily assess the patient's problems can be a valuable contribution to the patient's care. Therefore, it is important for students to have an in-depth understanding of the patient's medical conditions and medication therapy and be able to recognize the subjective and objective information that is available as well as the pertinent information that may be missing from the case presentation.

## 2. ASSESS THE INFORMATION

### 2.a. Assess the severity of the primary problem or disease based on the subjective and objective information available.

The next step is to review the information collected to assess the severity of the patient's clinical condition and determine whether drug therapy problems exist. Each medication should be assessed for its appropriateness, effectiveness, safety, and patient adherence. It is important to differentiate the process of identifying drug therapy problems from making a disease-related medical diagnosis. In fact, the primary medical diagnosis is often known for patients seen by pharmacists. However, pharmacists must be able to assess the patient's database to determine whether drug therapy problems exist that warrant a change in drug therapy. In the case of preexisting chronic diseases, such as asthma or rheumatoid arthritis, one must be able to assess information that may indicate a change in severity of the disease.

### 2.b. Create a list of the patient's drug therapy problems and prioritize them. Include assessment of medication appropriateness, effectiveness, safety, and patient adherence.

Novice student learners often struggle with writing statements of drug therapy problems. Simply put, a drug therapy problem statement must include a medical condition (disease) or health-related issue and a problem related to drug therapy. These statements should be clear, concise, and easily understood by other healthcare professionals. They must also contain sufficient detail so others can

understand the magnitude of the problem. Provided here are several examples of well-written drug therapy problem statements:

- Established rheumatoid arthritis (> 6 months duration) with high disease activity (DAS28 score > 5.1) inadequately treated with the current regimen of methotrexate monotherapy.
- Newly diagnosed stage IIIB classic Hodgkin lymphoma requiring treatment with pharmacotherapy that offers the best chance for cure.
- Dyslipidemia with need for change in statin therapy due to drug interaction (simvastatin and verapamil) and dose too low (inappropriate statin intensity).
- Allergic rhinitis treated with a medication (diphenhydramine) that is inappropriate for the patient and is likely causing an adverse reaction (excessive sedation).
- Recurrent falls, possibly related to medication use (diphenhydramine, metoprolol succinate, donepezil) and other factors.

The clinician should create a prioritized list of all of the drug therapy problems that were identified. Problems of the highest priority should be addressed first (immediately during the current encounter), whereas those of lower priority may be addressed later (eg, later in the course of a hospital stay or at subsequent follow-up visits). For many cases in the *Casebook*, the major drug therapy problem (highest priority) will be an untreated or inadequately treated indication. Other problems related to the primary or secondary diseases might be improper drug selection leading to ineffectiveness, subtherapeutic dosage, overdosage, failure to receive or take the drug(s) prescribed, adverse drug reactions, drug interactions, or drug use without indication.

### 2.c. What economic, psychosocial, cultural, racial, and ethical considerations are applicable to this patient?

Some patient cases will include a question related to these unique considerations that must be identified and addressed. For example, the patient may not have medical insurance or be able to afford high-cost biologic drug products for diseases such as inflammatory bowel disease, plaque psoriasis, or rheumatoid arthritis. Other patients may have family, social, or cultural issues that could interfere with effective drug therapy. The patient's race may have implications for precision medicine or appropriate medication selection for some diseases such as asthma and hypertension. Addressing these issues is an important part of developing an effective and comprehensive patient care plan.

## 3. DEVELOP A CARE PLAN

After all relevant patient information has been collected and assessed and the patient's drug therapy problems have been identified and prioritized, the pharmacist or other medication management expert develops an individualized patient-centered medication management plan in collaboration with other healthcare professionals and the patient (or caregiver). The plan must be evidence-based, cost-effective, and likely to be adhered to by the patient.

### 3.a. What are the goals of pharmacotherapy in this case?

The first step in designing a care plan is to establish treatment goals for each medical condition. The primary therapeutic outcomes include:

- Cure of disease (eg, bacterial infection)
- Reduction or elimination of symptoms (eg, pain from cancer)
- Arresting or slowing of the progression of disease (eg, rheumatoid arthritis, HIV infection)
- Preventing a disease or symptom (eg, coronary heart disease)

Other important outcomes of pharmacotherapy include:

- Not complicating or aggravating other existing disease states
- Avoiding or minimizing adverse effects of treatment
- Providing cost-effective therapy
- Maintaining the patient's quality of life

Sources of information for this step may include the patient or caregiver, the patient's physician or other healthcare professionals, medical records, and the *Pharmacotherapy* textbook or other literature references. Importantly, although national guidelines may stipulate population-level goals (eg, A1C <7% for type 2 diabetes), goals must be individualized for each patient based on potential risk, comorbidities, concomitant drug therapy, patient preference, and physician intentions.<sup>13</sup>

### 3.b. What nondrug therapies might be useful for this patient?

After the intended outcomes have been defined, attention can be directed toward identifying the types of treatments that might be beneficial in achieving those outcomes. The clinician should consider all feasible nondrug and pharmacotherapeutic alternatives available for achieving the predefined therapeutic outcomes before designing a regimen. Nondrug therapies that might be useful such as lifestyle measures (eg, diet, weight loss, and exercise), physical therapy, relaxation techniques, and surgical procedures should be included in the list of therapeutic alternatives.

### 3.c. What feasible pharmacotherapeutic alternatives are available for treating the disease or drug therapy problem?

Virtually all feasible drug therapy options should be considered while assessing the potential benefits and limitations of each one in light of the patient's particular situation. Some first-line agents may need to be avoided due to inadequate efficacy, potential for adverse effects, concomitant comorbidities or drugs, or high cost. For example, an asthma patient who requires new drug therapy for hypertension might better tolerate treatment with a thiazide diuretic rather than a  $\beta$ -blocker. On the other hand, a hypertensive patient with gout may be better served by use of a  $\beta$ -blocker rather than a thiazide diuretic. Useful sources of information on therapeutic options include the *Pharmacotherapy* textbook and other references, as well as the clinical experience of the healthcare provider and other healthcare professionals on the patient care team.

There has been a resurgence of interest in dietary supplements and other alternative therapies in recent years. The public spends billions of dollars each year on supplements for which there is little scientific evidence of efficacy, that are not standardized for potency and purity, and that are not regulated by the FDA as drug products. Furthermore, some products are hazardous, and others may interact with a patient's prescription medications or aggravate concurrent disease states. On the other hand, scientific evidence of efficacy does exist for some dietary supplements, and the National Institutes of Health Office of Dietary Supplements maintains fact sheets that give an overview of individual vitamins, minerals and other dietary supplements.<sup>15</sup> Healthcare providers must be knowledgeable about these products and prepared to answer patient questions regarding their efficacy and safety.

The *Casebook* contains a separate section devoted to dietary supplements (see **Section 19**). This portion of the *Casebook* contains a number of fictitious patient vignettes that relate to patient cases that were presented earlier in the *Casebook*. Each scenario involves the potential use of one or more dietary supplements by the patient. Additional follow-up questions are then asked to help the reader gain the scientific and clinical knowledge required to provide an evidence-based recommendation about use of the supplement in that particular patient. The use

of 16 different dietary supplements for 13 different disorders is included in this section:  $\alpha$ -lipoic acid (type 2 diabetes), black cohosh (menopausal symptoms), butterbur (migraine prevention, allergic rhinitis), cinnamon (diabetes), elderberry (influenza), feverfew (migraine prevention), fish oil (diabetes, dyslipidemia), garlic (dyslipidemia), ginger (nausea/vomiting), glucosamine/chondroitin (osteoarthritis), kava kava (anxiety), melatonin (insomnia), pygeum Africanum (benign prostatic hypertrophy), soy (menopausal symptoms), and St. John's wort (depression). Current reference sources are provided for all of the supplements.

### 3.d. Create an individualized, patient-centered, team-based care plan to optimize medication therapy for this patient's primary disease and other drug therapy problems. Include specific drugs, dosage forms, doses, schedules, and durations of therapy.

The purpose of this step is to determine the specific drugs, dosage forms, doses, routes of administration, schedules, and durations of therapy that are best suited to resolve each drug therapy problem that has been identified. Each pharmacotherapy regimen should be evidence based and individualized for the specific patient. Thus, the learner should be prepared to defend the rationale for the regimens selected and provide logical reasons for avoiding specific regimens in the care plan. Some potential reasons for drug avoidance include drug allergy, drug–drug or drug–disease interactions, patient age, renal or hepatic impairment, adverse effects, inconvenient dosage schedule, likelihood of poor adherence, pregnancy, and high treatment cost.

The specific dose selected may depend on the severity of the medical condition. For example, the initial oral dose of the loop diuretic furosemide for edema ranges from 20 to 80 mg per day and may be titrated up to 600 mg per day for severe edematous states.<sup>16</sup> Appropriate dosage also may vary depending on the indication for the drug; for example, the analgesic effect of the nonsteroidal anti-inflammatory drug ibuprofen may be achieved at lower doses than those required for anti-inflammatory activity.<sup>17</sup> The likelihood of adherence with the regimen and patient tolerance come into play in the selection of dosage forms. For example, some patients receiving the tumor necrosis factor inhibitor golimumab for rheumatoid arthritis may prefer to self-administer the medication subcutaneously at home; others may require golimumab intravenous infusions because they are either unwilling or unable to use subcutaneous injections. The economic, psychosocial, and ethical factors that are applicable to the patient should also be given due consideration in designing the pharmacotherapeutic regimen.

In many clinical situations, there is more than one acceptable drug regimen, so it is important for the healthcare team to agree on all drug therapy regimens selected for a given patient.

### 3.e. What alternatives would be appropriate if the initial care plan fails or cannot be used?

This optional question is included only for select patients in the *Casebook*. However, it is a good idea to always have an appropriate backup plan in place if the initial therapy fails or cannot be used.

## 4. IMPLEMENT THE CARE PLAN

In real-life clinical situations, the care plan that was agreed upon by the healthcare team and patient then requires thoughtful, collaborative implementation. Steps to be taken during the implementation process include<sup>13</sup>:

- Addressing medication- and health-related problems that exist or may arise
- Performing preventive care strategies, including administering vaccines

- Initiating, modifying, discontinuing, and administering medication therapy as authorized
- Providing education and self-management training to the patient or caregiver
- Contributing to coordination of care, including patient referral or transition to another healthcare professional
- Scheduling follow-up care as needed to achieve goals of therapy

#### 4.a. What information should be provided to the patient to enhance compliance, ensure successful therapy, and minimize adverse effects?

As described previously, CMM requires that healthcare providers establish a professional and personal relationship with the patient. Patients are our partners in healthcare, and our efforts may be for naught without their informed participation in the process. For chronic diseases such as diabetes mellitus, hypertension, and asthma, patients may have a greater role in managing their diseases than do healthcare professionals. Self-care is becoming widespread as increasing numbers of prescription medications receive over-the-counter status. For these reasons, patients must be provided with sufficient information to enhance compliance, ensure successful therapy, and minimize adverse effects. **Chapter 3** describes patient interview techniques that can be used efficiently to determine the patient's level of knowledge. Additional information can then be provided as necessary to fill in knowledge gaps.

In the questions posed with individual cases, students are asked to provide the kind of information that should be given to the patient who has limited knowledge of his or her disease. The information should be provided with the intent of improving adherence, ensuring successful therapy, and minimizing adverse effects. Under the Omnibus Budget Reconciliation Act (OBRA) of 1990, for patients who accept the offer of counseling, pharmacists should consider including the following items<sup>18</sup>:

- Name and description of the medication (which may include the indication)
- Dosage, dosage form, route of administration, and duration of therapy
- Special directions and precautions for preparation, administration, and use
- Common and severe adverse effects, interactions, and contraindications (with the action required should they occur)
- Techniques for self-monitoring
- Proper storage
- Prescription refill information
- Action to be taken in the event of missed doses

Instructors may wish to have simulated patient-interviewing sessions for new and refill prescriptions during case discussions to practice medication education skills. Factual information should be provided as concisely as possible to enhance memory retention. Various online and print resources are available for consumer information about individual drug products. MedlinePlus is the National Institute of Health's free website for consumers that contains information on prescription and nonprescription drugs, dietary supplements, medical conditions, wellness, diagnostic tests, and other medical information.<sup>19</sup>

#### 4.b. Describe how care should be coordinated with other healthcare providers.

As part of the team-based approach, patient care must be coordinated among healthcare providers and the patient, family, and caregivers.

Learner responses to this *Casebook* question should include more than simple descriptions of the roles of other healthcare professionals. More importantly, learners should be able to thoughtfully express how each unique professional role is integrated with others in providing collaborative, team-based care.

For pharmacists and some other providers, their roles includes (in part) initiating, modifying, discontinuing, and administering medication therapy as authorized. Others involved in team-based care might include primary care physicians, specialist physicians, surgeons, nurses, physical therapists, occupational therapists, social workers, dentists, dietitians, psychologists, and others. Consider which of them should be involved in the patient's care and how their efforts serve to coordinate and optimize care. For example:

- Who will educate the patient about their primary disease(s), and the impending changes in care?
- Who will discuss the disease prognosis with the patient?
- Who will counsel the patient about new medications, nondrug therapies, and lifestyle changes?
- Who will provide an updated medication list to the patient?
- Who will discuss options for surgical intervention or discharge to an assisted-care facility?
- If referrals to specialists or other transitions of care are needed, how will this be accomplished? For example, should the patient be referred to a diabetes or anticoagulation management expert for chronic care? Does the patient need dental care? Is a social worker needed to manage the patient's social/home situation?
- Who will be involved in follow-up visits, and who will communicate with the patient about them?
- How will team members communicate with each other during this patient encounter and in planning and conducting future visits?
- Who will document treatment plans in the record?

Documenting the medication therapy plan in the medical record is necessary to ensure accurate communication among practitioners. Oral communication alone can be misinterpreted or transferred inaccurately to others. This is especially true because there are many drugs that sound alike when spoken but have far different therapeutic uses.

The SOAP (Subjective, Objective, Assessment, and Plan) format has been used by clinicians for many years to assess patient problems and to communicate findings and plans in the medical record. Writing SOAP notes may not be the optimal process for learning to solve drug therapy problems because several important steps taken by experienced clinicians are not always apparent and may be overlooked. For example, the precise therapeutic outcome desired is often unstated in SOAP notes, leaving others to presume what the desired treatment goals are. Healthcare professionals using the SOAP format also commonly move directly from an assessment of the patient (diagnosis) to outlining a diagnostic or therapeutic plan, without conveying whether careful consideration has been given to all available feasible diagnostic or therapeutic alternatives. The plan itself as outlined in SOAP notes may also give short shrift to the monitoring parameters required to ensure successful therapy and to detect and prevent adverse drug effects. Finally, SOAP notes often do not include the treatment information that should be conveyed to the most important individual involved: the patient. If SOAP notes are used for documenting drug therapy problems, consideration should be given to including each of these components.

In **Chapter 5**, the SOAP note is presented as the usual method for documenting care plans in the patient's health record. Although



preparation of written communication notes is not included in written form with each set of case questions in the *Casebook*, instructors are encouraged to include the composition of a SOAP note as one of the requirements for successfully completing each case study assignment. A well-written SOAP note focusing on drug therapy problems should provide a clear statement of the drug therapy problem, the clinician's findings relevant to the problem, assessment of the findings, an actual or proposed plan for resolving the problem, and the clinical and laboratory parameters required for follow-up and monitoring.

Clinicians responsible for the outcomes of drug therapy should create and maintain a record of each patient's drug therapy problem list, the plans for resolving each problem, the interventions actually made, and the subsequent therapeutic outcomes achieved.

## 5. FOLLOW-UP: MONITOR AND EVALUATE

Monitoring the effectiveness of the care plan and modifying it in collaboration with other healthcare professionals and the patient (or caregiver) is performed to assess<sup>13</sup>:

- Medication appropriateness, effectiveness, and safety
- Patient adherence
- Clinical endpoints that contribute to the patient's overall health
- Outcomes of care achieved

The outcome parameters are evaluated against the predetermined goals of therapy to determine the progress made toward achieving the therapeutic goals and to determine if any new drug therapy problems have developed that could interfere with safe and effective medication use.<sup>8</sup> Patient follow-up should occur at intervals that are appropriate for the patient's clinical situation, the medical conditions being treated, and the drug therapy being used. Follow-up should be carefully coordinated with members of the healthcare team and the patient to avoid interfering with other ongoing patient care activities.<sup>8</sup>

### 5.a. What clinical and laboratory parameters should be used to evaluate the therapy for achievement of the desired therapeutic outcome and to detect or prevent adverse effects?

Clinicians must identify the clinical and laboratory parameters necessary to assess the therapy for achievement of the therapeutic goals and to detect and prevent adverse effects. Each outcome parameter selected should be specific, measurable, achievable, directly related to the therapeutic goals, and have a defined endpoint. As a means of remembering these points, the acronym SMART has been used (Specific, Measurable, Achievable, Related, and Time bound). If the goal is to cure bacterial pneumonia for a patient described in this *Casebook*, learners should outline the subjective and objective clinical parameters (eg, relief of chest discomfort, cough, and fever), laboratory tests (eg, normalization of white blood cell count and differential), and other procedures (eg, resolution of infiltrate on chest X-ray) that provide evidence of bacterial eradication and clinical cure of the disease. The intervals at which data should be collected are dependent on the outcome parameters selected and should be established prospectively. Some expensive or invasive procedures may not be repeated after the initial diagnosis is made.

Adverse effect parameters must also be well defined and measurable. For example, it is insufficient to state that one will monitor for potential drug-induced "blood dyscrasias." Rather, one should identify the likely specific hematologic abnormality (eg, anemia, leukopenia, or thrombocytopenia) and outline a prospective schedule for obtaining the appropriate parameters (eg, obtain

monthly hemoglobin/hematocrit, white blood cell count, or platelet count).

Monitoring for adverse events should be directed toward preventing or identifying serious adverse effects that have a reasonable likelihood of occurrence. For example, it is not cost-effective to obtain periodic liver function tests in all patients taking a drug that causes mild abnormalities in liver injury tests only rarely, such as omeprazole. On the other hand, the antipsychotic drug clozapine requires therapy-long periodic monitoring of white blood cell counts and absolute neutrophil counts to enable early detection of drug-induced leukopenia and agranulocytosis.

### 5.b. Develop a plan for follow-up that includes appropriate time-frames to assess progress toward achievement of the goals of therapy.

The care plan should outline the intervals at which the patient should return for team-based follow-up to ensure that progress is being made toward achieving the desired health outcomes. The return time may be short when there is a patient safety concern when a new potent medication is started that may have serious adverse effects. Longer intervals may be needed to allow a suitable time frame for new medications to exert either partial or full therapeutic effect, such as medications for dyslipidemia or depression.

## CLINICAL COURSE

The patient care process requires assessment of the patient's progress to ensure movement toward achieving the desired therapeutic outcomes. A description of the patient's clinical course is included with many cases in this *Casebook* to reflect this process. Some cases follow the progression of the patient's disease over months to years and include both inpatient and outpatient treatment. Follow-up questions directed toward ongoing evaluation and problem solving are included after presentation of the clinical course.

## SELF-STUDY ASSIGNMENTS

Each case concludes with several study assignments related to the patient case or the disease state that may be used as independent study projects for students to complete outside class. These assignments may require students to obtain additional information that is not contained in the corresponding *Pharmacotherapy* textbook chapter.

## LITERATURE REFERENCES AND INTERNET SITES

Literature references relevant to the patient case are included at the end of each presentation. References selected for inclusion will be useful to students for answering the questions posed. Most of the citations relate to major clinical trials or meta-analyses, authoritative review articles, and clinical practice guidelines. The *Pharmacotherapy* textbook contains a more comprehensive list of references pertinent to each disease state.

Some cases list internet sites as sources of drug therapy information. The sites listed are recognized as authoritative sources of information, such as the FDA ([www.fda.gov](http://www.fda.gov)) and the Centers for Disease Control and Prevention ([www.cdc.gov](http://www.cdc.gov)). Students should be advised to be wary of information posted on the internet that is not from highly regarded healthcare organizations or publications. The uniform resource locators (URLs) for internet sites sometimes change,

and it is possible that not all sites listed in the *Casebook* will remain available for viewing.

## DEVELOPING ANSWERS TO CASE QUESTIONS

The use of case studies for independent learning and in-class discussion may be unfamiliar to many learners. For this reason, students may find it difficult at first to devise complete answers to the case questions. **Appendix D** contains the answers to two cases in order to demonstrate how case responses might be prepared and presented. The authors of the cases contributed the recommended answers provided in the appendix, but they should not be considered the sole “right” answer. Thoughtful students who have prepared well for the discussion sessions may arrive at additional or alternative answers that are also appropriate.

With diligent self-study, practice, and the guidance of instructors, students will gradually acquire the knowledge, skills, and self-confidence to develop and implement patient care plans for their own future patients in collaboration with other members of the healthcare team. The goal of the *Casebook* is to help students progress along this path of lifelong learning.

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## Active Learning Strategies

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Healthcare practitioners face situations that require the use of effective problem solving, critical thinking, and communication skills on a daily basis. Therefore, providing students with knowledge alone is insufficient to equip them with the tools needed to be valuable contributors to patient care. Students must understand that it is imperative to provide more than just drug information, which is readily obtained in today's world from internet sites, smartphone apps, and online reference texts. They must be able to evaluate, analyze, and synthesize information, and apply their knowledge to prevent and resolve drug-related problems. As clinicians, they will be required to contribute their expertise to team discussions about patient care, ask appropriate questions, integrate information, and develop action plans.

Professional students must also recognize that learning is a lifelong process. Scores of new drugs are approved every year, drug use practices change, and innovative research alters the way that diseases are treated. Students must be prepared to proactively expand their knowledge base and clinical skills to adapt to the changing profession.

Warren identified several traits that prepare students for future careers: analytic thinking, polite assertiveness, tolerance, communication skills, understanding of one's own physical well-being, and the ability to continue to teach oneself after graduation.<sup>1</sup> To prepare students to become healthcare professionals who are essential members of the healthcare team, many healthcare educators are using active learning strategies in the classroom.<sup>2,3</sup>

### ACTIVE LEARNING VERSUS TRADITIONAL TEACHING

Active learning has numerous definitions, and various methods are described in the educational literature. Simply put, *active learning is the process of having students engage in activities that require reflection on ideas and how students use them.*<sup>3</sup> Most proponents of active learning strategies agree that compared with passively receiving lectures, active engagement of students promotes deeper learning, enhances critical thinking skills, provides feedback to students and instructors, and promotes social development. Learning is reinforced when students are actively engaged and apply their knowledge to new situations.<sup>3</sup> Active learning is learner-focused and helps students take responsibility for their own learning.<sup>2</sup>

In contrast, traditional teaching involves a teacher-centered approach. At the beginning of the course, students are given a course syllabus packet that contains “everything they need to know” for the semester. In class, the teacher lectures on a predetermined topic that does not require student preparation and allows students to be passive recipients of information. The testing method is usually a written examination that employs a multiple-choice or short-answer format, which focuses on the student's ability to recall isolated facts

that the teacher has identified as being important. They do not learn to apply their knowledge to situations that they will ultimately encounter in practice. The reward is an external one (ie, exam or course grade) that may or may not reflect a student's actual ability to use the knowledge they have to improve patient care.

To teach students to be lifelong learners, it is essential to stimulate them to be inquisitive and actively involved with the learning that takes place in the classroom. This requires that teachers move away from more comfortable teaching methods and learn new techniques that will help students “learn to learn.” In classes with active learning formats, students are involved in much more than listening. The transmission of information is deemphasized and replaced with the development of skills and application of knowledge. Active learning shifts the control of learning from the teacher to the students; this provides an opportunity for students to become active participants in their own learning.<sup>2</sup>

### ACTIVE LEARNING STRATEGIES

Teachers implement active learning exercises into classes in a variety of ways. While some strategies engage individual students with the material, such as giving students the opportunity to pause and recall information, other active learning strategies involve the use of student groups, such as problem-based learning (PBL), team-based learning (TBL), or cooperative or collaborative learning whereby students work together to perform specific tasks in a small group (ie, solve problems, discuss case studies).<sup>2,4-6</sup> Technology is increasingly used in active learning in numerous ways to maximize the use of class time for higher-order thinking tasks such as analysis, synthesis, and evaluation.<sup>7-9</sup> The following are the examples of active learning strategies that involve students in the learning process.

### EXERCISES FOR INDIVIDUAL STUDENTS

These exercises can complement lectures and are easily implemented. Quick writing tasks can assess student understanding of (or reaction to) material. Writing helps students to identify knowledge deficits, clarify understanding of the material, and organize thoughts in a logical manner. The “minute paper” or “half-sheet response” has students provide written responses to a question asked in class.<sup>10</sup> Example questions might be, “What was the main point of today's class session?” or “What was the muddiest point of today's class session?” In-class quizzes can be strategically placed to break up lecture time and engage students. Quizzes given at the beginning of class on pre-class readings help stimulate students to review information they did not know and listen for clarification during class. Quizzes can also be given throughout class (eg, using electronic audience response systems [ARS]) and may or may not be graded. ARS can help instructors engage students in lecture content,



promote interactivity, identify misconceptions, and stimulate discussion.<sup>8</sup> ARS questions posed immediately after presentation of the content will more likely test immediate recall than substantive knowledge. Quizzes at the end of class allow students to use their problem-solving skills by applying what they have just learned to a patient case or problem.

## QUESTIONS AND ANSWERS

Active learning strategies that involve questions and answers can increase student involvement and comprehension. “Wait time” is a method whereby the instructor poses a question and asks students to think about it.<sup>11</sup> After a brief pause, the instructor can ask for volunteers or randomly call on a student to answer the question. This wait time forces every student to think about the question rather than relying on those students who immediately raise their hands to answer questions. With the “fish bowl” method, students are asked to write questions related to the course material for discussion at the end of class or at the beginning of the next class session.<sup>11</sup> Instructors then draw several questions out of the “fish bowl” to discuss or ask the class to answer. Questions can also be submitted electronically, using a learning management system or programs such as Google Forms or Poll Everywhere. In classes that use active learning, much of the learning will come from class discussion. However, many students may not pay attention to their classmates, but rather wait for instructors to either repeat or clarify what one of their classmates has said. To promote active listening, after one student has volunteered to answer a question, instructors could ask another student if they agree with the previous response and why.

## THINK–PAIR–SHARE

The “think–pair–share” exercise involves providing students with a question or problem to solve.<sup>2</sup> After working on the assignment individually (think) for 2–5 minutes, they discuss their ideas for 3–5 minutes with the student sitting next to them (pair). Finally, student pairs are chosen to share their ideas with the whole class (share). By sharing ideas with a partner first, students are kept on task and can have a more intimate discussion to work out problems before sharing with others. This method provides immediate feedback and can lead to productive class discussion. Another type of sharing involves small-group discussions. Preassigned small groups of three to four students work together throughout the course to complete activities. Groups may have 20–30 minutes for discussion and apply a topic presented in class to a new situation. To create heterogeneity for discussion, one example is to group students with different experiences (eg, community vs hospital IPPE).<sup>12</sup> Assigning functional roles and role-playing can create multiple perspectives.

## CONCEPT MAPPING

Concept maps are diagrams used to visually connect concepts. This strategy can be used to link new information to previously learned material, critically think through a process, or simply describe ideas in a pictorial form. Concept mapping can reveal how students organize their knowledge, understand relationships between various concepts, and display their creativity in incorporating new information.<sup>13</sup> This may be particularly useful in clinical therapeutics courses where foundational theories are connected with pharmacotherapy. The activity can help students organize information about a disease state and focus on relevant information for clinical decision making.<sup>14</sup> There are several free web-based programs available to build concept maps, but paper or any computer-based drawing tool is equally acceptable. Many different topics can be visualized using a concept map; therefore, detailed instructions and clear expectations are necessary for

successful implementation of the activity. In the classroom, concept maps work best when used during group activities to facilitate collaborative and cooperative learning.<sup>15</sup>

## PROBLEM-BASED LEARNING

Problem-solving skills can be developed during a class period by applying knowledge of pharmacotherapy to a patient case. Application reinforces the previously learned material and helps students understand the relevance of the topic in a real-life situation. PBL is a teaching and learning method in which a complex problem is used as the stimulus for developing critical thinking and problem-solving skills, group skills, and investigative techniques. The process of PBL starts with the student identifying the problem in a patient case. The student spends time either alone or in a group exploring and analyzing the case and identifying learning resources needed to solve the problem. After acquiring the knowledge, the student applies it to solve the problem.<sup>16</sup> Small or large groups can be established for case discussions to help students develop communication skills, respect for other students’ opinions, satisfaction for contributing to the discussion, and the ability to give and receive constructive feedback.<sup>16</sup> Interactive PBL computer tools and the use of real patient cases also stimulate learning both outside and inside the classroom.<sup>17,18</sup> Computer-assisted PBL can provide instant feedback throughout the process and incorporate other methods of active learning such as quizzes.<sup>19</sup> Programs that create virtual patients can be used creatively in PBL cases to simulate actual patient outcomes based on student recommendations.<sup>20</sup>

## COOPERATIVE OR COLLABORATIVE LEARNING

Cooperative or collaborative learning strategies involve students in the generation of knowledge.<sup>5</sup> Students are randomly assigned to groups of four to six at the beginning of the school term. Several times during the term, each group is given a patient case and a group leader is selected. Each student in the group volunteers to work on a certain portion of the case. The case is discussed in class, and each member receives the same grade. After students have finished working in their small groups or during large-group sessions, the teacher serves as a facilitator of the discussion rather than as a lecturer. Students actively participate in the identification and resolution of the problem. The integration of this technique helps with development of skills in teamwork, interdependency, and communication.<sup>12</sup> Group discussions help students formulate opinions and recommendations, clarify ideas, and develop new strategies for clinical problem solving. These skills are essential for lifelong learning and will be used by the students throughout their careers.

## TEAM-BASED LEARNING

Team-based learning (TBL) is a learner-centered, instructor-directed, small-group learning strategy that can be implemented in large-group educational settings. The course is structured around the activity of teams of five to seven students who work together over an entire semester. TBL focuses on deepening student learning and enhancing team development. This is accomplished by the TBL structure, which involves: (1) pre-class preparation, (2) assurance of readiness to apply learned concepts, and (3) application of content to real-world scenarios through team problem-solving activities in class. A peer-review process provides important feedback to help team members develop the attitudes, behaviors, and skills that contribute positively to individual learning and effective teamwork.<sup>6,21,22</sup> A growing number of schools are adopting this strategy, resulting in various combinations and permutations of TBL. Guidance documents describing the core elements of TBL that should be

incorporated to maximize student engagement and learning within teams have been published.<sup>22,23</sup>

## CASE-BASED LEARNING

Case-based learning (CBL) is used by a number of professional schools to teach pharmacotherapy.<sup>2,17,24</sup> CBL involves a written description of a real-world problem or clinical situation. Only the facts are provided, usually in chronologic sequence similar to what would be encountered in a patient care setting. Many times, as in real life, the information given is incomplete, or important details are not available. When working through a case, the student must distinguish between relevant and irrelevant facts and realize that there is no single “correct” answer. CBL promotes self-directed learning because the student is actively involved in the analysis of the facts and details of the case, selection of a solution to the problem, and defense of his or her solution through discussion of the case.<sup>25,26</sup> In CBL, students use their recall of previously learned information to solve clinical cases.<sup>27</sup>

During class, active participation is essential for the maximum learning benefit to be achieved. Because of their various backgrounds, students learn different perspectives when dealing with patient problems. Some general steps proposed by McDade<sup>26</sup> for students when preparing cases for class discussion include:

- Skim the text quickly to establish the broad issues of the case and the types of information presented for analysis.
- Reread the case very carefully, underlining key facts as you go.
- Note on scratch paper the key issues and problems. Next, go through the case again and sort out the relevant considerations and decisions for each problem.
- Prioritize problems and alternatives.
- Develop a set of recommendations to address the problems.
- Evaluate your decisions.

## ADVICE ON ACTIVE LEARNING FOR STUDENTS AND INSTRUCTORS

The use of active learning strategies provides students with opportunities to take a dynamic role in the learning process. Willing students, innovative teachers, and administrative support within the school are required for active learning to take place and be successful.<sup>27</sup>

### ADVICE FOR STUDENTS

Students may have concerns about active learning. Some students may be accustomed to passively receiving information and feel uncomfortable participating in the learning process. Taking initiative is the key to deriving the benefits of active learning.

**Prepare for class.** Assigned readings and homework must be completed before class in order to use class time efficiently for questions and discussion. Time management is important. Use time between classes wisely, identify the times of day when you are most productive, and focus on the results rather than the time to complete an activity.<sup>1</sup> When reading assignments, take notes and summarize the information using tables or charts. Alternatively, make lists of questions from class or readings to discuss with your colleagues or faculty or try to answer them on your own.

**Seek to understand versus memorize.** To develop appropriate therapeutic recommendations or answers to a question, you may have to look beyond the required reading materials. You may need to

review notes from previous courses or perform literature searches and use the library or the internet to retrieve additional information. It is important that you understand “why” and “how” and not just memorize “what.” Memorizing results in short-term retention of knowledge, whereas understanding results in long-term retention and will enable you to better justify your clinical recommendations. In active learning, much of what you learn you will learn on your own. You will probably find that you read more, but you will gain understanding from reading. At the same time, you are developing a critical lifelong learning skill. Your reading will become more “depth processing” in which you focus on:

- The intent of the reading
- Actively integrating what you read with previous parts of the text or previous courses
- Using your own ability to make a logical construction
- Thinking about the functional role of the different parts of an argument

**During class, take an active role in the learning process.** Be an active participant in class or group discussions; lively debates about pharmacotherapy issues allow more therapeutic options to be discussed. Discussing material helps you to apply your knowledge, verbalize the medical and pharmacologic terminology, engage in active listening, think critically, and develop interpersonal skills. When working in groups, all members should participate in problem solving because teaching others is an excellent way to learn the subject matter.<sup>1</sup> Listen carefully to and be respectful of the thoughts and opinions of classmates. Writing about a topic develops critical thinking, communication, and organization skills. Stopping to write allows you to reflect on the information you have just heard and reinforces learning. Although many options for digital note-taking are available, it is not known whether these enhance or deter learning.<sup>28</sup> Taking an active role through team discussions, note-taking, identifying connections between patient cases, and applying what you have learned to the current cases will promote development of self-directed and autonomous learning skills.

### ADVICE FOR INSTRUCTORS

Instructors may also have concerns about incorporating active learning strategies. They may feel that their class is too large to accommodate active learning, have concerns that they will not be able to cover all the content or that it will take too much time to change their course, or even fear that students may be resistant to active learning strategies. Some of the hesitation may lie in the belief that active learning is an alternative to lecture. Rather, active learning strategies can be incorporated into didactic lectures to enhance learning sessions. Educators can move some course content online by assigning pre-class mini-lectures or quizzes.<sup>2</sup> Several strategies can be used to increase the successful implementation of active learning.

**Discuss course expectations.** Take time to describe teaching, learning, and assessment methods and how students can be successful in the course. Help students to understand the benefits of active learning.<sup>29</sup>

**Consider slowly implementing a change in the classroom.** To implement active learning strategies, teachers must overcome the anxiety that change often creates. Experiment with simple active learning methods (ie, the pause technique) and slowly implement other active learning approaches.

**Consider techniques to maximize student discussion.** Allowing students to discuss content in pairs or small groups before asking them to share their ideas with the entire class can help minimize student

anxiety about engaging in classroom discussions. Consider moving around the room during discussions, if possible, and make an effort to learn student names.

**Take a stepwise approach.** Learners become self-directed in stages, not in one single moment of transformation. Sequence activities and assignments that gradually develop all three stages: learning, intellectual development, and interpersonal skills.<sup>30</sup>

**Prepare students for group learning.** Group learning is not intuitive. Instructors who use group learning should create a workable environment, ensure that expectations of students are understood, and structure the learning sessions to maximize student engagement and learning within teams.

**Have a preconceived plan for how the learning session will go and stick to it.** Determine what learning objectives you would like to achieve during the session. Consider developing an outline for the learning session, estimating the time that will be spent on each active learning activity.<sup>2</sup>

## USING THE CASEBOOK

The *Casebook* was prepared to assist in the development of each student's understanding of a disease and its management as well as problem-solving skills. It is important for students to realize that learning and understanding the material is guided through problem solving. Students are encouraged to solve each of the cases individually or with others in a study group before discussion of the case and topic in class. These cases can be used as an active learning strategy by allowing time for students to work on the cases during class as an application exercise for TBL.<sup>21</sup> Teams or individuals can then report verbally on the questions and debate various treatment options.

## SUMMARY

The use of case studies and other active learning strategies will enhance the development of essential skills necessary to practice in any setting. The role of the healthcare professional is constantly changing; thus, it is important for students to acquire the knowledge, skills, behaviors, and attitudes to develop the lifetime skills required for continued learning. Teachers who incorporate active learning strategies into the classroom are facilitating the development of lifelong learners who will be able to adapt to change that occurs in their profession.

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