

SECTION I

Pharmacology for Nurses: Basic Principles

Introduction to Pharmacology

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KEY TERMS

Assessment
Controlled substances
Drug classification

Drug name
Goals
Medication errors

Nursing diagnoses
Nursing process
Pharmacology

Prescription drugs

CHAPTER OBJECTIVES

At the end of the chapter, the reader will be able to:

1. Discuss how drugs are classified.
2. Differentiate between *brand* versus *generic* drug names.
3. List the five steps of the nursing process.
4. Identify categories of controlled substances.
5. Name two sources for obtaining drug information.
6. Discuss legal and ethical responsibilities of the nurse when administering medication.
7. Define *medication error*.

Introduction

In modern health care, there is an increasing reliance on medication therapy to manage illness and disease, to slow progression of disease, and to improve patient outcomes. Medications offer a variety of potential benefits to the patient: relief of symptoms, support for necessary physiological processes, and destruction of toxic substances or organisms that cause disease, to name a few. Yet medications also have the potential to do harm, even when administered properly—and the harm is likely to be exacerbated if medications are administered incorrectly. The administration of drugs introduces opportunity to affect either remedy or harm.

As the persons most often charged with administering medications to patients, nurses can minimize any harm associated with medications by carrying out this task with few, if any, errors (Institute of Medicine [IOM], 2007). A 2007 IOM (now the National Academy of Science) report on medication safety, titled *Preventing Medication Errors*, emphasized the urgency of reducing medication errors, improving communication with patients, continually monitoring for medication errors, providing clinicians with decision-support and information tools, and improving and standardizing medication labeling and drug-related information (IOM, 2007).

If one of nursing's primary roles is the safe administration of medications, it is important to realize that this requires knowing not only how to correctly administer medications to patients, but also how to determine whether the intended effects are achieved and whether any adverse, or unintended, effects have occurred. Without adequate understanding of drugs and their effects on the body, nurses are unable to meet their professional and legal responsibilities to their patients. This text will provide the reader with that knowledge.

Nursing and Pharmacology

Pharmacology is the study of the actions of drugs, incorporating knowledge from other interrelated sciences, such as

pharmacokinetics (how the body absorbs, distributes, metabolizes, and excretes a drug) and pharmacodynamics (a drug's mechanism of action and effect on an organism). Knowledge of the various drug classes enables the nurse to understand how drugs work in the body, to achieve the therapeutic (intended) effects, and to anticipate and recognize the potential side effects (unintended or unavoidable) or toxicities. To understand the pharmacology of drugs, and related information, such as drug interactions and side effects, it is important to understand drugs' mechanisms of action, at the *molecular* level. Rather than merely understanding a drug's actions, interactions, side effects and dosage requirements, the nurse should strive to understand the process behind these elements of drug administration. This requires at least a fundamental understanding of drug–drug receptor interactions, even if at an elementary “lock and key” level. Only then will drug effects, interactions, and side effects, and the logic behind dosing regimens, reveal a complete picture. Chapter 2 continues this discussion in depth.

The value of this knowledge in nursing cannot be overemphasized. The nurse's role as caretaker puts the nurse in the position of being closest to the patient and best able to assess both the patient's condition prior to use of a medication as well as the patient's response to the medication—two key components of appropriate medical therapy. Clearly, under these circumstances, it is ideal for the nurse to have a solid, in-depth understanding of when, how, and for whom medications are best used, and what the expected response is when specific pharmaceutical therapies are implemented.

At the most basic level, nurses must learn the various diagnostic and therapeutic classes of medications; recognize individual drug names, both trade and generic; know about the applications and availability of prescription and nonprescription medications, a particularly the restrictions regarding controlled substances; and be familiar with sources, both printed and online, where the nurse may obtain specific information about



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particular drugs, including dosage, interactions, and contraindications.

Drug Classifications

Drugs are classified by how they affect certain body systems, such as the use of *bronchodilators* for respiratory conditions; by their therapeutic use, such as *antinausea*; or based on their chemical characteristics, such as *beta-blockers*. Many may fit into more than one **drug classification** due to the various effects that they exert in the body. Because drugs in the same *class* have many features in common, categorizing them in these ways helps nurses become familiar with many of the drugs they are administering. For example, although there are many types of angiotensin-converting-enzyme inhibitors, they have many common side effects.

Drug Names

Nurses must know both the *trade* name of a drug, which is assigned by the pharmaceutical company that manufactures the drug, and the *generic* name, which is the official **drug name** and is not protected by trademark. When a manufacturer receives a patent for a new drug, this means that no other company can produce the drug until the patent expires. Once this patent has expired, other companies may manufacture the drug with a different trade name but equivalent chemical makeup. Some companies choose to use the generic name only—for example, **lisinopril** is now manufactured by many different drug companies. Generic names are not capitalized.



Drugs may be prescribed and dispensed by either trade name or generic name, as generic drugs are considered equivalent in most cases. Generic drugs are typically less expensive than trade-name drugs.

Prescription and Nonprescription Drugs

In the United States, consumers have two ways to legally access drugs. One is to obtain a *prescription* for the drug from a licensed provider, such as a physician, dentist, or nurse practitioner; the other is to purchase drugs that do *not* require a prescription on an *over-the-counter (OTC)* basis. Some drugs previously available only by prescription have now become available OTC. Thus, it is essential for the nurse to gather information about the patient's use of both **prescription drugs** and OTC medications, as some combinations of different types of drugs can affect the actions and toxicities of either. Various drug laws regulate these ways of acquiring drugs.

Controlled Substances

The Comprehensive Drug Abuse Prevention and Control Act was passed in 1970 and

Best Practices

Nurses are required to keep controlled substances in secure, locked locations, administering them only to patients with valid prescriptions or physician's orders.

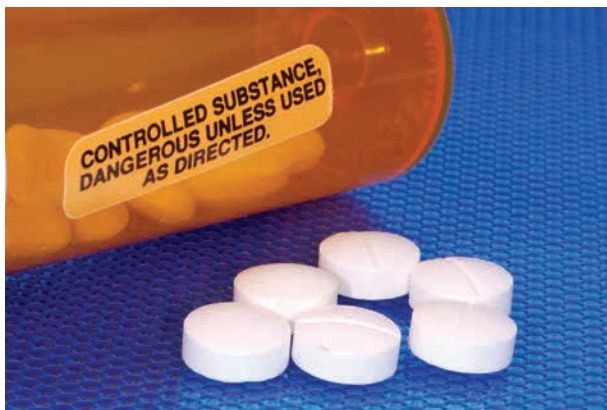
regulates the manufacturing and distribution of substances with a potential for abuse—examples include narcotics, hallucinogens, stimulants, depressants, and anabolic steroids. These **controlled substances** are categorized by schedule (Schedules I–V), based on their therapeutic use and potential for abuse (**TABLE 1-1**). The Drug Enforcement Agency (DEA) enforces the law and requires all individuals and companies that handle controlled substances to provide storage security, keep accurate records, and include the provider number assigned by the DEA on all prescriptions for controlled substances. Schedule I drugs have a high potential for abuse and the potential to create severe psychological and/

or physical dependence; and in most cases, Schedule I drugs are illegal substances. Therefore, Schedule I drugs are not dispensed, except in rare instances of specific scientific or medical research. No refills can be ordered on Schedule II drugs; instead, providers must write a new prescription.

Nurses are required to keep controlled substances locked in a secure room or cabinet, administering them only to patients with valid prescriptions or physician's orders. Nurses must maintain accurate records of each dose given and the amount of each controlled substance on hand, and must report any discrepancies to the proper authorities.

Sources of Drug Information

With Internet access readily available for personal as well as professional use, obtaining drug information is easy. For the beginning student, however, access to a pharmacology textbook is helpful for learning and understanding the therapeutic uses of drugs. Drug reference guides are helpful when looking up a specific drug and the nursing implications of administering that agent. Drug information can be obtained through authoritative sources such as *American Hospital Formulary Service*, published by the American Society of Health-System Pharmacists (www.ahfs.org).



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TABLE 1-1 Controlled Substances Categories Designated by the U.S. Government

Schedule	Dispensing Requirements	Examples
I	Drugs not approved for medical use, except specific protocols: high abuse potential.	LSD, marijuana, heroin, gamma-hydroxybutyrate (Ecstasy)
II	Drugs approved for medical use: high abuse potential. Must be kept in locked safe. No refills without a new prescription.	Opioid analgesics (e.g., codeine, morphine, hydromorphone, methadone, oxycodone), central nervous system stimulants (e.g., cocaine, amphetamine), depressants (e.g., barbiturates—pentobarbital)
III	Less potential for abuse than Schedule I or II drugs but may lead to psychological or physical dependence. Prescription expires in 6 months.	Anabolic steroids; mixtures containing small amounts of controlled substances, such as codeine
IV	Some potential for abuse. Prescription expires in 6 months.	Benzodiazepines (e.g., diazepam, lorazepam), other sedatives (e.g., phenobarbital), some prescription appetite suppressants (e.g., mazindol)
V	Written prescription requirements vary with state law.	Antidiarrheal drugs containing small amounts of controlled substances (e.g., Lomotil)



ahfsdruginformation.com); *Tarascon Pharmacopoeia*, published by Jones & Bartlett Learning; or *Drug Facts and Comparisons*, published by Lippincott Williams & Wilkins/Wolters Kluwer. These resources are updated periodically. *The Physicians' Desk Reference* is published yearly and includes pharmaceutical manufacturers' package inserts for specific drugs. Nurses can also obtain package inserts from the dispensing pharmacy—this is helpful when a drug is relatively new and information is not readily available from other resources.

Online resources and mobile applications include Micromedex and Lexicomp, both of which are searchable databases offering drug information, drug interactions, drug identification tools, medical calculators, and patient counseling information.

Continuing education about drug therapy is an essential part of professional nursing. Reading current peer-reviewed journal articles, which often include information about drug therapy for specific conditions, should be part of every nurse's professional development.

QSEN Competencies

The Quality and Safety Education for Nurses (QSEN) project, developed by the American

Association of Colleges of Nursing, identified six competencies to prepare nurses with the knowledge, skills, and attitude needed to improve workplace quality and safety within healthcare systems. These competencies are as follows:

- Patient-centered care
- Teamwork and collaboration
- Evidence-based practice
- Quality improvement
- Safety
- Informatics

Overview of the Nursing Process

The **nursing process** is a systematic, rational, and continuous method of planning, providing, and evaluating individualized nursing care to optimize the administration of medications. The nursing process involves critical thinking throughout each of its five steps: assessment, nursing diagnosis, planning and establishing goals or outcomes, intervention, and evaluation. Administering medications involves much more than the psychomotor skill of preparing and giving medications; the nurse must use cognitive skills throughout the nursing process to ensure patient safety during drug therapy. The QSEN competencies, especially safety and patient-centered care, are woven into the framework of the nursing process.

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Assessment

Assessment involves collecting subjective and objective data from the patient, significant others, medical records (including laboratory and diagnostic tests) and others involved in the patient's care. These data may affect whether a medication should be given as ordered, or whether a provider's order should be questioned and confirmed. In addition, in the assessment step the nurse gathers data about the drug(s) that he or she is responsible for administering and monitoring. Assessment is ongoing throughout the entire nursing process, as patients' conditions may change. Nurses must continually monitor drug effects, both therapeutic and unintended. A complete medication history and nursing physical assessment are parts of the assessment step.

Nursing Diagnosis

The second step of the nursing process involves clustering the data gathered during the assessment, analyzing it for patterns, and making inferences about the patient's potential or actual problems. **Nursing diagnoses**, as developed by the North American Nursing Diagnosis Association (NANDA), are statements of patient problems, potential problems, or needs. This text will address nursing diagnoses that pertain more specifically to drug therapy. Some examples of selected diagnoses follow:

- Patient has a knowledge deficit related to drug therapy and reasons for use; need for follow-up tests and office visits
- Patient is at risk for injury related to adverse effects of medication
- Patient is at risk for falls related to various anticipated or unanticipated side effects of medications
- Diarrhea (or constipation) related to side effects of medications
- Ineffective health maintenance related to inability to make appropriate judgments or to lack of resources

Planning

Once the data have been analyzed and nursing diagnoses identified, the planning phase

begins. During this phase, **goals** and outcome criteria are formulated. Nurses will prioritize identified needs, keeping patient comfort and safety as top priorities. The planning step incorporates the QSEN competency of patient-centered care. Patients are seen as full partners in the planning process and the goals recognize the patient's preferences and values. In *patient* terms, the goals and outcome criteria identify the expected behaviors or results of drug therapy. For example, the patient may be expected to and agree to do the following:

- List the steps for correctly drawing up his or her insulin dosage
- Demonstrate the correct technique for self-administration of a medication patch
- Verbalize the most common side effects of a medication
- Report pain relief of at least 3 on a scale of 10 within 30 minutes

Goals are usually broad statements for achievement of more specific outcome criteria. A timeline is often included so that there can be realistic achievement of goals. During the planning phase, the nurse must familiarize himself or herself with any special information or equipment needed to administer a medication. If knowledge attainment by the patient is the goal, appropriate patient teaching materials must be obtained. Because many medications are administered by the patient himself or herself (or the family), teaching is an important part of the nursing process for drug therapy.



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Intervention

The intervention (or implementation) phase of the nursing process involves carrying out the planned activities, being mindful that ongoing assessment of the patient is needed before every intervention. For example, perhaps a patient has a laxative ordered daily but has been having loose stools all night. The nurse will need to assess this patient's current condition (i.e., complaint of loose stools) and decide how to proceed with the intervention (e.g., withhold the medication and notify the prescriber). Here, the nurse will value the patient as expert on his or her own health and symptoms, in conjunction with objective assessment. As this example illustrates, interventions for drug therapy involve not only the actual administration of medications, but also observation of the effects of the medications, as well as provision of additional measures to optimize the effects of certain medications, such as increased fluid intake to promote bowel elimination or reduce fever.

During the intervention process, the nurse encounters a variety of points at which he or she is required to make assessments and decisions about whether to proceed. Certain medications, such as antihypertensive or cardiac drugs, will require specific actions at the time of administration, such as measuring blood pressure or heart rate. If the identified parameters for these vital signs are not met, the medication may not be given.



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Clearly, nurses require specific skills related to the intervention decision-making process. While these skills will not be enumerated in detail in this chapter, in general they include the following elements:

- Knowing and following correct procedures for confirming whether the medication is appropriate for the patient
- Knowing and following correct procedures for administering medications via different routes (oral, injection, intravenous, and so forth)
- Having the ability to identify and avoid factors that contribute to errors

Evaluation

The evaluation phase of the nursing process is a continuous process of determining progress toward identified goals. For some medications, the response can be identified quickly—for example, relief of pain following administration of an analgesic, again, utilizing patient-centered care as an approach to the evaluation. For other medications, the response is slower and must be monitored on an ongoing basis. A newly prescribed antihypertensive medication, for example, may require follow-up visits to the clinician's office for blood pressure checks and assessment of side effects. Evaluation may involve reviewing pertinent laboratory and other diagnostic tests, observing patient performance of a learned procedure, or interviewing patients and significant others about the effects of their medications.

Documentation is an essential component of all phases of the nursing process. Specific guidelines for documentation of medication administration and related teaching are prescribed by state nursing practice statutes and The Joint Commission (formerly the Joint Commission on Accreditation of Healthcare Organizations).

Patient- and drug-specific variables affect the nursing process as it relates to drug therapy. Factors such as the patient's age, physical condition (e.g., renal or liver impairment),

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Documentation is an essential component of all phases of the nursing process.

psychological/mental ability to self-administer medication, and educational level are integral parts of the nurse's knowledge base for safe medication administration.

The nursing process is a dynamic tool used to enhance the quality of patient care. Each step involves critical thinking to provide individualized, safe, effective, and thoughtful patient care. Use of this process enables nurses to incorporate safe administration and monitoring of drug therapy into the overall plan of care for each patient, whatever the setting.

Cultural Aspects of Drug Therapy

As the United States becomes increasingly culturally diverse, nurses administering and monitoring medications must be aware of how various cultural beliefs and practices affect health care, particularly the use of medications. In addition, physical differences may affect how certain cultural or ethnic groups respond to specific medications. For many years, research on drugs was carried out using only white male subjects. Thus, the medications' effects on females or nonwhite males could not be accurately predicted, but rather were determined only by observing patient outcomes. Response to drug therapy is highly individualized, and nurses must be careful not to assume an eventual successful or failed

response just because a patient appears to belong to a certain ethnic or cultural group.

Examples of cultural considerations affecting nursing care in drug therapy include pain response, belief in traditional "healers" versus belief in the medication's effectiveness for restoring health, use of herbal remedies, ability to communicate effectively with healthcare providers, and compliance with long-term drug therapy. A careful nursing assessment will include cultural beliefs and practices that may impact drug therapy. Nurses are encouraged to learn about cultural and ethnic groups commonly encountered in the healthcare settings of their practices.

Legal-Ethical Aspects of Drug Therapy

The legal responsibilities of nurses for medication administration are defined in state nurse practice acts and healthcare organization policies and procedures. The Eight Rights of Medication Administration, discussed in detail in Chapter Three, form the basis of safe drug therapy (Bonsall, 2011). These eight rights, briefly, ensure that (1) the right drug is given to (2) the right patient at (3) the right dose via (4) the right route at (5) the right time, for (6) the right reasons, with (7) the right documentation, to obtain (8) the right response. Some clinicians and institutions include two additional rights: right education (correctly educating the patient in therapeutic effects of the drug as well as expected side effects) and right to refuse (the patient or responsible party has the right to refuse medication administration). Most **medication errors** result from the failure to follow one of these "rights." Beyond maintaining awareness of these Eight Rights, nurses must possess the cognitive and psychomotor skills required to safely administer medication and monitor the effects.

Ethical aspects of nursing care were identified by the American Nurses Association (ANA) in the 2001 *Code of Ethics* (ANA, 2001). These guidelines provided

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A careful nursing assessment will include cultural beliefs and practices that may impact drug therapy.



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ethical principles to be adhered to by every professional nurse. The Code included principles recommending that nurses (1) respect the dignity of all patients, regardless of ethnicity, socioeconomic status, or specific health problem; (2) participate in activities to support maintenance of their professional competence; (3) protect patients' privacy and confidentiality; and (4) make a commitment to providing quality patient care in every setting.

Since the original *Code of Ethics* was released, the ANA has added more provisions, along with interpretive statements. The 2015 *Code of Ethics for Nurses with Interpretive Statements* comprised nine provisions (ANA, 2015):

1. Respect for human dignity
2. Primacy of patient interests
3. Protection of patient privacy and confidentiality
4. Authority, accountability, and responsibility for nursing practice
5. Duty to self and others
6. Maintaining an ethical environment
7. Contributions through research and scholarly inquiry
8. Health as a universal right
9. Articulation and assertion of nursing values

Medication Errors

Medication errors are a daily occurrence in many healthcare facilities, sometimes resulting in serious—even fatal—consequences. It should be the goal of every healthcare professional to be aware of the potential for errors and to strive for prevention of these problems. Errors can occur during the prescribing, dispensing, administration, or documentation phases of medication administration. Thus, the error may be detected by the pharmacist, physician, nurse, or other staff, such as the person transcribing the order to the patient's medication administration record (MAR). The ECRI Institute noted in their Top 10 Patient Safety Concerns for 2017 list that information management in electronic health records, unrecognized patient deterioration,

and implementation and use of clinical decision support were the top three causes for medical errors. Opioid administration and management of new oral anticoagulants were medication-specific concerns on the list (ECRI Institute, 2017).

How Often Do Medication Errors Occur?

Medication errors have the potential to occur at numerous times during the complex delivery process, but their actual incidence is difficult to quantify. The reason the frequency of medication administration errors is difficult to calculate is because error rates vary depending on the method of measurement used to assess the errors (McBride-Henry & Foureur, 2006). The most accurate way to measure the occurrence of medication administration errors is through direct observation of practice (Barker, Flynn, & Pepper, 2002; Barker, Flynn, Pepper, Bates, & Mikel, 2002; Keers, Williams, Cooke, & Ashcroft, 2013b; Thomas & Peterson, 2003); self-reported data underrepresents true error rates (Nanji, Patel, Shaikh, Seger, & Bates, 2016). Two observational studies discovered that medication administration error rates in acute care settings varied between 14.9% (Tissot et al., 2003) and 32.4% (Schneider, Cotting, & Pannatier, 1998), with medication error rates for intravenous medications being significantly higher during the preparation (26%) and administration (34%) stages (McBride-Henry & Foureur, 2006; Keers, Williams, Cooke, & Ashcroft, 2013b; Wirtz, Taxis, & Barber, 2003). Observed medication administration demonstrated errors in nearly one out of every five doses (Barker, Flynn, Pepper, et al., 2002). Of note, studies primarily target inpatient care; thus, medication errors occurring in nursing homes or ambulatory surgery centers (and other outpatient care facilities) are not captured in the data (Makary & Daniel, 2016).

How Can Medication Errors Be Prevented?

In 2003, the Institute for Safe Medication Practices (ISMP) identified several key areas

Best Practices

Many medication errors occur during times of a patient transfer—for example, when a patient is being transferred from intensive care to a patient unit, from an inpatient unit to an outpatient facility or home, or from the care of one provider to another.

of focus for error prevention. Many errors occur during patient transfer—for example, when a patient is being transferred from intensive care to a patient unit, from an inpatient unit to an outpatient facility or home, or from the care of one provider to another. Medication reconciliation forms are now being used in many facilities to prevent medications from being omitted during transfers and to prompt physicians to review existing medication orders when transferring care. Bedside rounds, in which

the nurse coming onto the succeeding shift accompanies the nurse going off-shift, are another helpful means of communicating medication changes. Nurses must be vigilant to ensure that these tools are utilized properly if they are to be effective in preventing errors.

Another area of focus is patient identification. Recent technological advances have been developed to reduce medication error rates by better associating patient and medication identities. Special patient wrist bracelets with bar-coding that require nurses to scan the bracelet before administering a medication are now being used, which facilitates matching the “right drug” to the “right patient.” Every nurse should develop the habit of verifying patients’ identities by asking each to state his or her name and date of birth. Photo identification can be used for nonverbal patients.

Environmental factors may also contribute to errors. Increased workload, working with acutely ill patients, distractions while preparing and administering medications, problems with medicine supply and storage, and nurse/staff fatigue have all been noted to lead to a higher number of errors (Anderson & Townsend, 2010; Keers, Williams, Cooke, & Ashcroft, 2013a).

The ISMP continues to identify areas of best practice. They released the 2016–2017 Targeted Medication Safety Best Practices for Hospitals, which consists of 11 medication-specific practices for



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hospital-based and other healthcare settings, targeting areas in which there continue to be harmful and fatal errors (ISMP, 2016). Nurses should be active on committees and in professional organizations that are looking at these practice issues.

Hospitals and other providers have worked with pharmaceutical companies to reduce errors caused by similarly named drugs. Nurses should assess the patient and know why a patient is receiving a particular medication. They must carefully read medication labels, compare the labels to the prescribed order, and follow guidelines for proper use. For example, a medication label may say, “Do not crush.”

Finally, all nurses must be responsible for maintaining and updating their knowledge of the medications they administer and the equipment they use. Patient teaching is also a key to preventing errors. An informed patient will question his or her nurse if the medication looks different from the usual “pill.” In some cases, a generic version of a drug could have been substituted; in other cases, an error might be prevented.

Conclusion: Pharmacology in Nursing Practice

Given the central role of medical therapy in modern health care, the need for nurses to have a solid foundation in pharmacology is profound. Understanding how a drug acts in the body, how the body acts on the drug, and anticipating potential positive and adverse effects of drugs is tantamount if nurses are to knowledgeably administer drugs to patients. Recognizing drug actions based on knowledge of pharmacology enables the nurse to anticipate whether changes in patient symptoms indicate drugs are having its intended or adverse effects, whether medications are acting as drugs or poisons—“pharmacons.” The act of administering medications is where the theory of medicine is put into practice. It is also where the general understanding of human biochemistry manifests in the reality that all people are different. Nurses are tasked with identifying how these differences may affect the use of a medical therapy in a patient and with determining the actions necessary to ensure the therapy’s success. By learning about pharmacology, nurses can equip themselves to make sure that the tools of medicine are used appropriately to heal illness and relieve distress in their patients.

CHAPTER SUMMARY

- Pharmacology is the study of the actions of drugs, incorporating knowledge from other sciences.
- Drugs are classified based on their action or effect on the body or by their chemical characteristics.
- Nurses must be familiar with both generic and trade names of drugs.
- Controlled substances are categorized based on their potential for abuse and their prescribed uses.
- Drug information is available from many sources; nurses should familiarize themselves with reliable tools to gain knowledge of drug therapy.
- The five steps of the nursing process—assessment, nursing diagnosis, planning and goal setting, intervention, and evaluation—are a key part of safe drug administration.
- The success of drug therapy may vary because of cultural beliefs or ethnic differences.

- Nurses must follow legal and ethical guidelines for drug administration.
- Nurses must be aware of the potential for medication errors, working to provide a safe environment for drug therapy.

Critical Thinking Questions

1. What is pharmacology?
2. List three characteristics of a medicine used as a basis for drug classification.
3. Discuss the rationale for nurses knowing both generic and trade names of drugs.
4. What is an example of a Schedule II drug? What are the prescriptive limitations placed on such a drug?
5. Describe the five steps of the nursing process.
6. Identify at least three factors that can contribute to medication errors.

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