PRINCIPLES OF PHARMACOLOGY

SCENARIO

Kathy Augustino, CMA (AAMA), was hired recently to work for a primary care physician in her hometown. Her responsibilities include administering medications to a wide range of patients. To give patients medications correctly and safely in the ambulatory setting, she must understand the basic principles of pharmacology.

While studying this chapter, think about the following questions:

- What should Kathy know about the management of controlled substances in the ambulatory care setting?
- If Kathy is not familiar with a medication, how can she learn about the properties of the drug?
- Is it important that Kathy understand the clinical uses of prescribed drugs as well as over-the-counter (OTC) drugs?
- One of Kathy’s responsibilities is phoning in drug orders to the pharmacy. What parts of the prescription should she recognize?
- A primary care practice has patients of all ages. What factors related to age might affect the action of medications on Kathy’s patients?

LEARNING OBJECTIVES

1. Define, spell, and pronounce the terms listed in the vocabulary.
2. Apply critical thinking skills in performing patient assessment and care.
3. Distinguish among the government agencies that regulate drugs in the United States.
4. Cite the areas covered in the regulations established by the Drug Enforcement Administration (DEA) for the management of controlled or regulated substances.
5. List the DEA regulations for prescription drugs for each of the five schedules of the Controlled Substance Act.
6. Explain the medical assistant’s role in preventing drug abuse.
7. Differentiate among a drug’s chemical, generic, and trade names.
8. Describe the use of drug reference materials.
9. Summarize the clinical uses of drugs.
10. Cite safety measures for the use of OTC drugs.
11. Diagram the parts of a prescription.
12. Demonstrate the ability to transcribe a prescription accurately.
13. Relate the principles of pharmacokinetics to drug use.
14. Describe factors that affect the action of a drug.
15. Compare the therapeutic classifications of medications.
16. Differentiate among commonly used herbal remedies and alternative therapies.
17. Examine the role of the medical assistant in drug therapy education.
18. Identify the medical assistant’s legal responsibilities in medication management in an ambulatory care setting.
VOCABULARY

angina pectoris (an-ji'-nuh/pehk'-toh-ruhs) A spasmodic pain in the chest caused by myocardial anoxia.

bronchodilator (brahn-ks-di'-la-toh) A drug that relaxes contractions of the smooth muscle of the bronchioles to improve lung ventilation.

cirrhosis (suh-roh'-sih) A chronic, degenerative disease of the liver that interferes with normal liver function.

colloidal (kah-loyd'-uh) Pertaining to a gluelike substance.

enteric-coated A term that refers to an oral medication that is coated to protect the drug against the stomach juices; this design is used to ensure that the medicine is absorbed in the small intestine.

generic A medication that is not protected by trademark.

hypercholesterolemia (hi-per-kuh-leh-toh-leh'-uh) Elevated blood levels of cholesterol.

lumen An open space, such as within a blood vessel, the intestine, the inside of a needle, or an examining instrument.

metabolic alkalosis A condition characterized by significant loss of acid in the body or an increased amount of bicarbonate; severe metabolic alkalosis can lead to coma and death.

over-the-counter (OTC) drugs Medications sold without a prescription.

spermicide (spanahr'-sih-uh-dee) A chemical substance that kills sperm cells.

therapeutic range The blood concentration of a drug that produces the desired effect without toxicity.

tinnitus A noise sensation of ringing heard in one or both ears.

Pharmacology is the broad science of the origin, nature, chemistry, effects, and uses of drugs. Clinical pharmacology is the study of the biologic effects of a drug used as a medical treatment and the actions of a drug in the body over time, including the rate at which it is absorbed by body tissues; where it is distributed or localized in the tissues; the route by which it is excreted; and its toxicity, or poisonous effect.

Medical assistants must have a general understanding of the types of drugs available and their uses. For every medication administered, a medical assistant must understand the drug's action, typical side effects, route of administration and recommended dose, and the individual patient factors that can alter the drug's effect and elimination. Drugs constantly are being developed and released for patient treatment; therefore, medical assistants must continually update their knowledge of specific drugs used in the ambulatory care setting. Correct management of drug administration and patient education are crucial factors in providing safe drug therapy for all patients.

GOVERNMENT REGULATION

Several federal agencies combine forces to regulate, safeguard, and manage the development and use of medications in the United States. The Food and Drug Administration (FDA), a division of the Department of Health and Human Services, regulates the development and sale of all prescription and over-the-counter (OTC) drugs. Pharmaceutical companies developing new medications must gain FDA approval before the drugs can be sold to consumers. The approval process begins with chemical testing in the laboratory and progresses to toxicity testing in laboratory animals and finally to human clinical trials, which involve volunteers who participate in controlled drug studies. Only one of 10 new drugs ever reaches the clinical testing phase. If the drug is found to have an acceptable benefit-to-risk ratio (i.e., it is effective without causing an unacceptable degree of harm to the user), the FDA approves the medication for release.

The original manufacturer of the drug is awarded copyright protection on that particular chemical compound for 17 years; this means that during the 17-year period, other pharmaceutical companies cannot produce generic copies of the drug. Besides approving new drugs for the marketplace, the FDA establishes manufacturing standards for drug purity and strength and ensures that generic brands are effective and safe.

STANDARDS FOR GENERIC DRUG MANUFACTURERS

The Food and Drug Administration (FDA) has found no difference in the rates of reported side effects between brand name and generic drugs. Generic drugs must meet the following standards:

- The generic version must have the same active ingredients, labeled strength, route of administration, and dosage form (e.g., tablet, patch, and so on).
- The generic does not to replicate the human clinical trials of the brand-name drugs, but applicants must prove that the product performs exactly as the brand-name version does.
- Generic versions must act in the same period of time as the brand-name version, delivering the same amount of active ingredient into the bloodstream in the same amount of time.

OTHER FEDERAL AGENCIES INVOLVED IN THE REGULATION OF DRUGS

Besides the Food and Drug Administration, two other agencies are involved in the regulation of drugs in the United States:

- Drug Enforcement Administration (DEA): The DEA is the federal law enforcement agency responsible for controlling narcotics,
investigating the illegal sale of dangerous substances, and preventing drug abuse through public education.

- Federal Trade Commission (FTC): The FTC regulates the advertising of over-the-counter drug preparations.

## Controlled Substances

The Drug Enforcement Administration (DEA) was established in 1973 as part of the Department of Justice to enforce federal laws regarding the use of illegal drugs. According to the Controlled Substances Act (CSA), which was passed in 1970, a drug or other substance that has the potential for illegal use and abuse must be placed on the controlled substance list. Any new medication with an action similar to a drug already on the controlled substance list also is considered to have the potential for abuse.

Most controlled drugs provide significant assistance to patients in need of their particular actions, such as pain relief or anesthesia for surgery. However, certain guidelines must be followed to comply with the storage of controlled substances, their record-keeping, and security requirements. In addition, federal law requires that all medical personnel, including medical assistants, share the responsibility for managing controlled substances on site. Precautions must be taken to monitor patients’ drug use, protect prescription pads, maintain the records required by law, and report any known or suspected drug diversion or theft.

According to the guidelines set forth in the CSA, controlled substances are divided into five sections, or schedules, depending on their addictive abilities and likely degree of abuse. The classifications range from Schedule I drugs, which are illegal and cannot be prescribed, to Schedule V medications, which have the least potential for addiction and abuse (Table 33-1).

Every medical practice that stores and administers medications that fall into any of the schedule categories should have a copy of the controlled substances regulations. This list can be obtained from the regional DEA office. It also is important to have the office on the DEA’s mailing list, so that the practice receives updates as drugs are added, deleted, or moved from one schedule to another.

### Regulation of Controlled Substances

Specific CSA regulations govern the record keeping, physician registration, and inventory of controlled substances. Complete, accurate records must be maintained on the purchase and

### Table 33-1 Classification of Controlled Substances

<table>
<thead>
<tr>
<th>SCHEDULE</th>
<th>GUIDELINES</th>
<th>DRUG EXAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>No accepted medical use</td>
<td>Heroin, LSD, marijuana, methaqualone (Quaalude), mescaline (peyote), amphetamine variations, phencyclidine (PCP), Ecstasy, GHB, acetylcodone, Diphenix</td>
</tr>
<tr>
<td>II</td>
<td>Accepted for medical use but with severe restrictions</td>
<td>Opium extracts, morphine, methadone, cocaine precursors, amphetamine, barbiturates, methylphenidate (Ritalin), oxycodone (Percocet or OxyContin), hydromorphone HCl (Dilaudid), meperidine HCl (Demerol), codeine, alfentanil (Alfenta), alphaprodine (Naxpan), Buprenex, seconal (Secobarbital), fentanyl</td>
</tr>
<tr>
<td>III</td>
<td>Accepted for medical use</td>
<td>Paregoric, acetaminophen and codeine (Tylex), diazepam (Valium), flurazepam (Dalmane), chloral hydrate, propoxyphene napsylate (Darvon), Rohypnol (date rape drug), pentazocine lactate (Talwin), alprazolam (Xanax), nizazolam (Halcyon), temazepam (Restoril), chlorazepate dipotassium (Tranxene), lorazepam, Klonopin, (Ativan), zolpidem tartrate (Ambien), barbitol, Lexonin, Uranyl, clonazepam (Klonopin), diethylpropion (Tenuide), Motofen, Caplo, midazolam (Versed), Donnatal, Meridia, zolpidem tartrate (Ambien), eszopiclone (Lunesta)</td>
</tr>
<tr>
<td>IV</td>
<td>Accepted for medical use</td>
<td>Meprobamate (Equanil), chloralhydratedmethyl (Librium), diazepam (Valium), flurazepam (Dalmane), chloral hydrate, propoxyphene napsylate (Darvon), Rohypnol (date rape drug), pentazocine lactate (Talwin), alprazolam (Xanax), nizazolam (Halcyon), temazepam (Restoril), chlorazepate dipotassium (Tranxene), lorazepam, Klonopin, (Ativan), zolpidem tartrate (Ambien), barbitol, Lexonin, Uranyl, clonazepam (Klonopin), diethylpropion (Tenuide), Motofen, Caplo, midazolam (Versed), Donnatal, Meridia, zolpidem tartrate (Ambien), eszopiclone (Lunesta)</td>
</tr>
<tr>
<td>V</td>
<td>Accepted for medical use</td>
<td>Cough medicines containing codeine (Robitussin A-C), alkaloids, kaolin and pectin, belladonna (Donnagel), diphenoxylate with atropine (Lomotil)</td>
</tr>
</tbody>
</table>
management of scheduled drugs in the ambulatory care setting. These records must be kept separate from the patient's medical record for 2 years and must be readily available for inspection by the DEA at all times. Each time a controlled substance is dispensed and administered in the office, documentation of that process includes the number of doses of the drug on site both before and after the medication is dispensed. Medical practices that dispense and administer controlled substances on site have forms developed for this purpose. Any discrepancy in the count of the medication available must be documented and co-signed by two employees.

Every physician who prescribes or who has controlled substances on site must register with the DEA for a Controlled Substance Registration Certificate. The physician receives a specific DEA registration number that must be included on all controlled substance prescriptions. The certificate is renewable every 3 years and is specific to a particular site of practice. Therefore, if the physician dispenses or prescribes scheduled drugs at more than one site, a DEA registration number must be obtained for each site.

All controlled substances must be stored in a safe or immovable locked cabinet, and the keys must be kept in a secure location. Prescription forms should be kept out of areas used by patients and preferably secured in an area that prohibits unauthorized or illegal use. All DEA forms used by the facility to order controlled substances also must be kept in a locked area.

Many ambulatory practices no longer keep controlled substances on site. However, if drugs are lost or stolen, the incident must be reported to the regional DEA office and local law enforcement authorities immediately. If a controlled substance is damaged or must be discarded (e.g., a pill falls to the floor during dispensing), two employees must be present to witness the medication being flushed down the sink or toilet, and both must document the procedure on the controlled substance inventory form used by that office. If a large quantity of scheduled drugs must be discarded, the local DEA office should be contacted for guidance.

**Critical Thinking Application 33-1**

Kathy is responsible for maintaining the inventory of the controlled substances in the office. While checking the supply of meperidine, she notices that the expiration date of the medication is today. She must dispose of the remaining two pills. According to DEA regulations, how should she dispose of the medication?

Individual states also may regulate controlled substances; therefore, it is essential that medical assistants know their state's legal requirements.

Specific guidelines apply to prescription orders for controlled substances:

- The prescription must be written in ink or typed.
- It must include the date prescribed; the name and address of the patient; and the name, address, and DEA number of the physician.
- The amount prescribed must be written out ("ten" rather than "10"), and the prescription usually is for small amounts of the drug.

- The physician must manually sign all prescriptions for controlled substances, although the medical assistant can prepare the prescription for the physician's signature.
- Drugs in Schedules II, III, and IV must include this label when dispensed by the pharmacy: Federal law prohibits the transfer of this drug to anyone other than the patient for whom it is prescribed.

Other specific rules may apply, depending on the schedule to which the prescribed controlled substance is assigned. The symbols C-I, C-III, C-IV, and C-V are used to indicate the specific schedule:

- **Schedule II (C-II) prescriptions:**
  - Must be written unless an absolute emergency exists that requires a telephone prescription order. The amount in the phone order is limited to that needed during the emergency, and the physician must deliver a written prescription to the pharmacy within 72 hours.
  - Cannot be refilled.
  - In certain states, must be provided as multiple-copy prescription order forms.

- **Schedule III (C-III) and IV (C-IV) prescriptions:**
  - May be given orally or written.
  - May be refilled up to five times within 6 months of the original order.

- **Schedule V (C-V) prescriptions:**
  - May be given orally or written.
  - May be refilled up to five times within 6 months of the original order.
  - Depending on the state, may be dispensed by the pharmacist without a prescription.

**Critical Thinking Application 33-2**

Kathy is responsible for the orientation of a new medical assistant in the practice. Summarize the important points about government regulation of controlled substance prescriptions that she should include in the orientation.

**Drug Abuse**

Any drug, from aspirin to alcohol, can be misused or abused. The use of illegal and legal drugs has increased tremendously. Treatment programs for drug abuse are available throughout the United States for people from all walks of life. Programs include detoxification, rehabilitation, and long-term rehabilitation maintenance.

Medical assistants may encounter patients who are misusing or abusing drugs. It is important to be alert to the symptoms of drug dependence and to notify the physician when you suspect a patient, or a co-worker, of having a problem with drug or alcohol dependency.

Drug misuse is the improper use of common drugs that can lead to dependence or toxicity. Examples of people with chronic dependencies include those who cannot have a bowel movement unless they take a laxative; those who have used nasal decongestants for so long that they cannot breathe without the use of nasal sprays; and those who take so many antacids that they suffer systemic metabolic alkalosis.
Drug abuse is the continuous or periodic self-administration of a drug that could result in addiction (physical dependence). Drug dependency is the inability to function unless under the influence of a substance, and it may be either psychological or physical. Psychological dependency is the compulsive craving for the effects of a substance. Habituation is a mild form of psychological dependency, such as the need for caffeine. Physical dependency, or addiction, is a person's need to use a substance continuously so that the body can function and also to prevent physical discomfort. This type of dependency occurs when abused substances produce biochemical changes in cells and tissues, most commonly in the nervous system. When a substance that causes physical dependency is discontinued, withdrawal symptoms occur. Withdrawal symptoms may be mild or potentially serious, leading to convulsions and possibly death.

Regardless of the type of drug abused, it will have two effects on the person: acute and chronic. The acute effect is what the person feels when intoxicated, or directly under the influence of a particular substance. Chronic effects include the temporary or permanent physical and mental changes that result from long-term abuse.

Medical assistants often must answer patients’ questions about drug abuse. The medical assistant should read and keep up to date on drug-related issues. Pamphlets and agency referral names should be available for patients. In addition, patients’ concerns and questions about drug abuse should be conveyed to the physician.

THE MEDICAL ASSISTANT’S ROLE IN PREVENTING DRUG ABUSE

By following these guidelines, the medical assistant can help prevent drug abuse:

- Carefully monitor patients who repeatedly call for prescription refills of controlled substances.
- Request medical records for patients who report previous prescriptions for scheduled drugs.
- Keep prescription blanks in a safe place away from patient treatment areas, and minimize the number of prescription pads in use at any given time.
- Never use prescription pads for notepads, and never use preprinted or presigned forms.
- Keep only a limited supply of controlled substances on hand.
- Keep accurate, complete records of the controlled substances dispensed on site and those prescribed. Include specific documentation in the patient’s chart for all prescribed controlled substances.

DRUG NAMES

A single drug may have up to three names: a chemical name, a generic name, and a trade name. The chemical name represents the drug’s exact formula. For example, the chemical name of the analgesic acetaminophen is N-(4-hydroxyphenyl) acetaminophen. Acetaminophen is the generic name, and the trade name is Tylenol. All drugs are assigned a generic, or nonproprietary (official), name. This name is much simpler than the chemical name, and it is not protected by copyright. The trade, or brand, name is assigned by the manufacturer and is protected by copyright. To prevent confusion, the use of generic names rather than trade names is encouraged. Drugs also are classified by their use. For example, Advil is a brand name for the generic drug ibuprofen, which is classified as an analgesic and an anti-inflammatory agent.

APPROACHES TO STUDYING PHARMACOLOGY

A pharmaceutical glossary could be a book in itself. Many terms are combinations of the condition to be treated plus the prefix anti- (e.g., antianginal, antianxiety, antiarrhythmic, anticoagulant, anticonvulsant, anti diarrheal). Notice how these names emphasize the drug’s effect (use) rather than its action in the body. More recent classifications, such as parasympathomimetic and cholinesterase inhibitor, describe the pharmacologic action rather than the therapeutic use. Both viewpoints are necessary for a more complete understanding of drugs and their action in the human body. No one can remember all there is to know about clinical pharmacology. The number of new drugs introduced into use far exceeds the number of older drugs replaced or discontinued. The number of drugs available for clinical use grows beyond the ability to learn all there is to know about each medication. Therefore, it is essential that a medical assistant understand how to use pharmacology resource books as references.

Drugs Reference Materials

Reference books that are updated annually or periodically should be available for easy reference at all medical facilities. Most reference lists drug information in the following sequence:

1. **Action**: How the drug provides the therapeutic results in the body, or the use of the drug.
2. **Indication**: The conditions for which the drug is used.
3. **Contraindications**: Conditions that make administration of the drug improper or undesirable.
4. **Precautions**: Necessary actions that must be taken because of special conditions of the patient, the drug, or the environment; these need to be considered if the drug is to be successful or not harmful. The drug’s pregnancy risk category is included in this section, as are precautions for nursing mothers (Table 33-2).
5. **Adverse reactions**: Commonly observed side effects on a tissue or organ system other than the one targeted by the medication. Adverse reactions include hypersensitivity, which causes an allergic reaction to the drug; idiosyncrasy, or an unexplained, unusual response to the drug; psychological dependence or habituation to the drug; or physical dependence to the compound, causing signs and symptoms of withdrawal in the patient if the medication is removed. For example, patients prescribed certain diuretics (e.g., Lasix) are at risk of potassium depletion, so they must either take a potassium supplement or eat a daily dietary source of potassium (bananas are a common source) to prevent complications.
TABLE 33-2 Pregnancy Risk Drug Categories

<table>
<thead>
<tr>
<th>DRUG CATEGORY</th>
<th>RISK/DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Remote risk. Controlled studies in women have failed to demonstrate risk to fetus.</td>
</tr>
<tr>
<td>B</td>
<td>Slightly more risk than A. Animal studies show no risk, but controlled human studies have not been done; or animal studies show risk, but controlled studies in women have shown no risk.</td>
</tr>
<tr>
<td>C</td>
<td>Greater risk than B. Animal studies have shown risk, but no controlled human studies have been done; or no studies have been done in animals or women.</td>
</tr>
<tr>
<td>D</td>
<td>Proven risk of fetal harm. Human studies show proof of fetal damage, but the potential benefits of use during pregnancy may make its use acceptable.</td>
</tr>
<tr>
<td>X</td>
<td>Proven risk of fetal harm. Studies in women or animals show definite risk of fetal abnormality. Risks outweigh any possible benefit.</td>
</tr>
</tbody>
</table>

6. Dosage and administration: The usual route, dosage, and timing for administering the drug.
7. How supplied: A description of how the medication is packaged and specifics on how it should be administered.

Package Inserts
Every drug package contains an insert describing all the significant aspects of using the drug, including information on the chemical formulation of the drug and clinical studies. The information in the insert is controlled by the FDA and is an excellent quick reference on new medications in the ambulatory setting.

Physicians' Desk Reference
The Physicians' Desk Reference (PDR) is published annually by Thomson Medical Economics Company (Oradell, New Jersey). The PDR is provided free to physicians who subscribe to Medical Economics magazine. Copies can be purchased through the publisher or in local bookstores. Supplements are published quarterly throughout the year. The PDR contains information on approximately 2,500 drugs and includes product descriptions that are identical to the information provided on package inserts. The drug manufacturers pay for this space, so the PDR could be considered the Yellow Pages of the drug industry. The PDR is the most commonly used drug reference book and should be available in all healthcare facilities.

The book’s sections are color coded and cross referenced for easy use. The various sections allow you to begin searching for information about a drug from any starting point. You can start with the usage, classification, generic name, manufacturer's name, or trade name of a drug or what the drug looks like. A special photographic section enables visual identification of products.

Once you know which drug you want to study, the product information section lists the actual package insert information alphabetically, first by the manufacturer, then by the brand name. A separate PDR volume, the Physicians' Desk Reference for Nonprescription Drugs, is published annually for OTC drugs and dietary supplements. The six sections of the PDR are color coded as follows:

- Manufacturer's index (white): An alphabetical listing of pharmaceutical companies that includes the drugs manufactured by each company; it also provides contact information for each manufacturer.
- Brand and generic section (pink): An alphabetical listing of all drugs included in the PDR volume, with complete information for each.
- Product category index (blue): An alphabetic listing compiled according to drug category; drugs with similar actions are listed alphabetically in each category.
- Product identification section (gray): An illustrated section that shows actual-size photographs of the tablets and capsules listed in the PDR.
- General and diagnostic product information area (white): An alphabetic listing of diagnostic product information and the uses of these products.

U.S. Pharmacopeia/National Formulary
The U.S. Pharmacopeia/National Formulary (USP/NF) is the official source of drug standards for the United States. The Pharmacopeia was combined with the National Formulary, which lists the chemical formulas for all accepted drugs. This combined reference lists and describes all the approved medications in the United States considered useful and therapeutic in the practice of medicine. Single drugs rather than combined products (compound mixtures) are listed. If a drug name is the same as the official name in this volume, the drug is followed by the initials USP (e.g., digoxin, USP).

Learning about Drugs
The study of pharmacology is difficult at best. However, a few tips can help make it easier.

- First, take advantage of opportunities to observe the use of drugs in patient care. Studying about atorvastatin calcium (Lipitor) becomes more meaningful when you see how its lipid-lowering action actually affects a patient’s blood cholesterol level.
- Second, concentrate on the most important drugs in each classification. As you expand your knowledge to other drugs in each category, you will easily understand new drugs by noting the similarities and differences between them and the basic, important drugs you studied first.
- Third, learn about a drug’s primary action and use, then expand your knowledge to its other actions and uses. Soon you will be able to name the drug that is usually indicated for a particular condition. Then, by knowing a drug’s secondary effects, you will be able to understand what side effects are likely to occur during use of the drug. More important, you will be aware of the contraindications to use of the drug.
Knowledge of the drug’s actions also will enable you to predict what toxic reactions might occur from an overdose.

### Dispensing Drugs

Drugs are dispensed in two ways: over the counter and by prescription. OTC drugs are available to the public for self-medication without a prescription. These drugs have been approved by the FDA for general consumer use, but patients taking prescription drugs should keep their healthcare providers informed about their OTC drug use.

A medical assistant directly involved in patient care should have an understanding of some basic facts about OTC drugs. Today patients are better informed about their personal healthcare, and many want to be active participants in healthcare decisions. They need facts to make informed choices when using OTC preparations. Most OTC preparations are safe if used as directed on the package; however, patient education contributes greatly to the safe and correct use of OTCs. Patients should be encouraged to do the following when choosing or using an OTC:

- Carefully read the package label and insert for use guidelines.
- Take only the recommended dose.
- Monitor the expiration date and discard the medication when appropriate.
- Never combine an OTC with a prescription drug without the pharmacist’s knowledge.
- Recognize that many OTC drugs are contraindicated in pregnancy, for nursing mothers, and for young children, and if certain diseases are present.
- Check with the pharmacist if questions or concerns arise.

The number of prescription drugs that have been granted OTC status is constantly increasing, and as the list of OTC drugs increases, so does the need for consumer education. Many OTC medications influence the safety and effectiveness of prescription drugs; therefore, gathering information for a complete and accurate pattern of the patient’s use of OTC drugs should be part of every visit to the physician.

### Prescription Drugs

Federal law makes drugs that are dangerous, powerful, or habit-forming illegal to use except under a physician’s order. A prescription is an order written by the physician for the dispensing of a particular medication by the pharmacist and its administration to the patient. Sometimes an order may be written by the physician on the patient’s medical record; however, it most often is an order written on a prescription blank for the pharmacist to fill (Figure 33-1). The prescription must be signed by the physician, or the order cannot be carried out (Procedure 33-1). If the physician requests that the medical assistant phone in a prescription to the pharmacy, all the pertinent information for the medication order must be written down and reviewed by the physician for accuracy before the call is made. A note also is made in the patient’s chart that a medication order was phoned into the pharmacy, with all of the pertinent information about the order included.

Appropriate medical terminology and abbreviations must be used to complete the prescription. The more common terms and abbreviations are listed in Table 33-3. In an attempt to reduce the number of medication errors caused by incorrect use of medical terminology, the Joint Commission (formerly known as the Joint Commission on Accreditation of Healthcare Organizations [JCAHO]) recently developed a “Do Not Use” list of abbreviations, acronyms, and symbols that should not be used for documentation purposes in accredited institutions. The commission also created an ancillary list of possible future inclusions. Both of these lists are presented in Table 33-4. In addition to the Joint Commission lists, facilities have the option of creating their own list of problematic abbreviations employees should avoid using.

Table 33-5 lists the 50 most prescribed drugs in the United States in 2007, along with their classifications. Review this list to become familiar with some of the most commonly prescribed medications.

### TERMINOLOGY DESCRIBING DRUG USES

<table>
<thead>
<tr>
<th>diagnostic</th>
<th>Helps to determine the cause of a particular health problem (e.g., injecting antigen serum for allergy testing).</th>
</tr>
</thead>
<tbody>
<tr>
<td>palliative</td>
<td>Indicates that the drug does not cure but provides relief from pain or symptoms related to the disorder (e.g., the use of an antihistamine for allergy symptoms or narcotics for pain relief).</td>
</tr>
<tr>
<td>prophylactic</td>
<td>Prevents the occurrence of a condition (e.g., vaccines prevent the occurrence of specific infectious diseases).</td>
</tr>
<tr>
<td>replacement</td>
<td>Provides the patient with a substance needed to maintain health (e.g., insulin for patients with diabetes or levothyroxine sodium [Synthroid] for patients with hypothyroidism).</td>
</tr>
<tr>
<td>therapeutic</td>
<td>Treats a disorder and cures it (e.g., antibiotics cure bacterial infections).</td>
</tr>
</tbody>
</table>

**FIGURE 33-1** Sample prescription.
THE SIX PARTS OF A PRESCRIPTION

- **Superscription:** Patient’s name and address, the date, and the symbol Rx (for the Latin word *recipe*, meaning “take”).
- **Inscription:** Main part of the prescription; name of the drug, dosage form, and strength.
- **Subscription:** Directions for the pharmacist; size of each dose, amount to be dispensed, and the form of the drug (e.g., tablets, capsules, or some other form).
- **Signature:** Directions for the patient; usually preceded by the symbol Sig: (for the Latin word signa, meaning “mark”); the place where the physician indicates the instructions to be put on the label to tell the patient how, when, and in what quantities to use the medication.

- **Refill information:** May be regulated by federal law if the drug is a controlled substance; the physician must write the number of times a refill is allowed on the script.
- **Physician’s signature:** Must include the physician’s manual signature, as well as his or her DEA registration number when indicated.

CRITICAL THINKING APPLICATION 33-3

Dr. Simon asks Kathy to prepare the following prescription for his signature. “Take one 20-mg tablet of Lipitor daily at bedtime. Dispense 4 weeks’ worth, and the prescription may be refilled two times.” How would Kathy write the prescription using the correct format, medical terminology, and abbreviations?

### PROCEDURE 33-1

**PROCEDE MEDICATION AND IMMUNIZATION RECORDS: PREPARE A PRESCRIPTION FOR THE PHYSICIAN’S SIGNATURE**

**GOAL:** To accurately prepare a prescription for the physician’s signature using the appropriate abbreviations and prescription format.

**EQUIPMENT and SUPPLIES**

- Prescription pad
- Drug reference materials if needed
- Black pen
- Patient chart

**PROCEDURAL STEPS**

1. Refer to the physician’s written order for the prescription. If the physician gives a verbal order to write a prescription, write down the order and review it with the physician for accuracy.
   **PURPOSE:** To ensure accuracy in writing the ordered medication.

2. If you are unfamiliar with the medication, look it up in a drug reference book (e.g., the *Physicians’ Desk Reference* [PDR]).
   **PURPOSE:** The medical assistant should be familiar with the details of the drug, including the correct spelling, form in which it is dispensed, strength, recommended dose, storage guidelines, drug-to-drug interactions, and possible side effects, to make sure the transcription is correct and to be prepared to answer the patient’s questions about the medication.

3. Ask the patient about drug allergies.
   **PURPOSE:** The patient should be asked about drug allergies each time a medication is prescribed or dispensed, because these can change over time.

4. Using a prescription pad that has the physician’s name, address, telephone number, and DEA registration number preprinted on the slip, begin to transcribe the physician’s order.

5. Record the patient’s name and address and the date on which the prescription is being written.

6. Next to the Rx, write in legible handwriting the name of the drug (correctly spelled), the dosage form (e.g., tablet, capsule, or other, using correct abbreviations), and the strength ordered. This is the inscription. For example, if the physician orders Lipitor, 40-mg tablets, by mouth, one tablet at bedtime, the first line of the prescription should read: Lipitor 40 mg tabs.

7. On the next line, write Disp. This is the subscription, which includes directions to the pharmacist on the amount to be dispensed and the form of the drug. For the Lipitor order, the subscription would read: Disp: #30.

8. Next comes the signature. This includes directions for the patient, such as how and when to take the medicine; it usually is preceded by the abbreviation Sig: For the Lipitor order, the signature would read: Sig: 1 tab po hs.

9. The physician has told you that the patient can get three refills of the prescription, so this information should be added at the bottom of the prescription on the designated line.

10. The physician must review and sign the prescription before it is given to the patient.

11. Document on the patient’s chart the medication order and any pertinent details, including patient education and refill information.
   **PURPOSE:** All patient education should be documented for future reference, and the details about the prescription, as well as refill information, must be included for future prescriptions and/or refill orders.
<table>
<thead>
<tr>
<th>ABBREVIATION</th>
<th>MEANING</th>
<th>ABBREVIATION</th>
<th>MEANING</th>
<th>ABBREVIATION</th>
<th>MEANING</th>
</tr>
</thead>
<tbody>
<tr>
<td>aa</td>
<td>of each</td>
<td>ID</td>
<td>intradermal</td>
<td>pt</td>
<td>patient</td>
</tr>
<tr>
<td>cc</td>
<td>before meals</td>
<td>IM</td>
<td>intramuscular</td>
<td>pt</td>
<td>pint</td>
</tr>
<tr>
<td>od</td>
<td>as desired</td>
<td>IV</td>
<td>intravenous</td>
<td>pulv</td>
<td>powder</td>
</tr>
<tr>
<td>agit</td>
<td>shake, stir</td>
<td>K</td>
<td>potassium</td>
<td>qh</td>
<td>every hour</td>
</tr>
<tr>
<td>am</td>
<td>morning</td>
<td>kg</td>
<td>kilogram</td>
<td>q2h</td>
<td>every 2 hours</td>
</tr>
<tr>
<td>amp</td>
<td>ampule</td>
<td>KVO</td>
<td>keep vein open</td>
<td>q3h</td>
<td>every 3 hours</td>
</tr>
<tr>
<td>AD</td>
<td>right ear</td>
<td>L</td>
<td>liter</td>
<td>q4h</td>
<td>every 4 hours</td>
</tr>
<tr>
<td>AS</td>
<td>left ear</td>
<td>lb</td>
<td>pound</td>
<td>qid</td>
<td>four times a day</td>
</tr>
<tr>
<td>ASA</td>
<td>aspirin</td>
<td>LR</td>
<td>Lactated Ringers Solution</td>
<td>qm</td>
<td>every morning</td>
</tr>
<tr>
<td>AU</td>
<td>both ears</td>
<td>mcg</td>
<td>minim</td>
<td>qn</td>
<td>every right</td>
</tr>
<tr>
<td>aq</td>
<td>water</td>
<td>mg</td>
<td>microgram</td>
<td>qod</td>
<td>every other day</td>
</tr>
<tr>
<td>bid</td>
<td>twice a day</td>
<td>med</td>
<td>medicine</td>
<td>qs</td>
<td>quantity sufficient</td>
</tr>
<tr>
<td>c</td>
<td>cup, Celsius</td>
<td>meq</td>
<td>milliequivalent</td>
<td>qt</td>
<td>quart</td>
</tr>
<tr>
<td>°C</td>
<td>with</td>
<td>mg</td>
<td>milligram</td>
<td>R</td>
<td>rectal</td>
</tr>
<tr>
<td>cap</td>
<td>capsule</td>
<td>mL</td>
<td>milliliter</td>
<td>Rx</td>
<td>take, treatment</td>
</tr>
<tr>
<td>CC</td>
<td>chief complaint</td>
<td>MLD</td>
<td>minimum lethal dose</td>
<td>r/o</td>
<td>rule out</td>
</tr>
<tr>
<td>cc</td>
<td>cubic centimeter</td>
<td>mn</td>
<td>midnight</td>
<td>S, Sig</td>
<td>give the following directions</td>
</tr>
<tr>
<td>cm</td>
<td>centimeter</td>
<td>MO</td>
<td>mineral oil</td>
<td>s or w/o</td>
<td>without</td>
</tr>
<tr>
<td>c/o</td>
<td>complaining of</td>
<td>MOM</td>
<td>milk of magnesia</td>
<td>SC, SQ, subQ</td>
<td>subcutaneous</td>
</tr>
<tr>
<td>D/C</td>
<td>discharge</td>
<td>MS</td>
<td>morphine sulfate</td>
<td>SOB</td>
<td>shortness of breath</td>
</tr>
<tr>
<td>D/x</td>
<td>diagnosis</td>
<td>MTD</td>
<td>maximum tolerated dose</td>
<td>SS</td>
<td>one-half</td>
</tr>
<tr>
<td>dil</td>
<td>dilute</td>
<td>NKA</td>
<td>no known allergies</td>
<td>stat</td>
<td>immediately</td>
</tr>
<tr>
<td>disp</td>
<td>dispense</td>
<td>noct</td>
<td>at night</td>
<td>subq</td>
<td>subcutaneous</td>
</tr>
<tr>
<td>dr</td>
<td>dram</td>
<td>NPO</td>
<td>nothing by mouth</td>
<td>T, tbs</td>
<td>tablespoon</td>
</tr>
<tr>
<td>EENT</td>
<td>eye, ear, nose, throat</td>
<td>N/S</td>
<td>normal saline</td>
<td>t, tsp</td>
<td>teaspoon</td>
</tr>
<tr>
<td>ext</td>
<td>extract</td>
<td>N/V</td>
<td>nausea/vomiting</td>
<td>TAE</td>
<td>tablet</td>
</tr>
<tr>
<td>F</td>
<td>Fahrenheit</td>
<td>O₂</td>
<td>oxygen</td>
<td>tid</td>
<td>three times a day</td>
</tr>
<tr>
<td>FDA</td>
<td>Food and Drug Administration</td>
<td>OD</td>
<td>overdose</td>
<td>tinct</td>
<td>tincture</td>
</tr>
<tr>
<td>FE</td>
<td>iron</td>
<td>OD</td>
<td>right eye</td>
<td>TO</td>
<td>telephone order</td>
</tr>
<tr>
<td>fl</td>
<td>fluid</td>
<td>OS</td>
<td>left eye</td>
<td>tus</td>
<td>cough</td>
</tr>
<tr>
<td>fx</td>
<td>fracture</td>
<td>OU</td>
<td>both eyes</td>
<td>ung</td>
<td>aintment</td>
</tr>
<tr>
<td>gal</td>
<td>gallon</td>
<td>OTC</td>
<td>over-the-counter (drugs)</td>
<td>vag</td>
<td>vagina</td>
</tr>
<tr>
<td>gm, g</td>
<td>gram</td>
<td>oz</td>
<td>ounce</td>
<td>ves</td>
<td>bladder</td>
</tr>
<tr>
<td>gr</td>
<td>grain</td>
<td>pc</td>
<td>after meals</td>
<td>VO</td>
<td>verbal order</td>
</tr>
<tr>
<td>gtt</td>
<td>drops</td>
<td>PL</td>
<td>placebo</td>
<td>VS</td>
<td>vital signs</td>
</tr>
<tr>
<td>h</td>
<td>hour</td>
<td>pm</td>
<td>afternoon</td>
<td>W/O</td>
<td>water in oil</td>
</tr>
<tr>
<td>hs</td>
<td>at bedtime</td>
<td>PMI</td>
<td>patient medication instruction</td>
<td>WNL</td>
<td>within normal limits</td>
</tr>
<tr>
<td>HTN</td>
<td>hypertension</td>
<td>po</td>
<td>by mouth</td>
<td>’x’</td>
<td>times</td>
</tr>
<tr>
<td>Hx</td>
<td>history</td>
<td>pr</td>
<td>per rectum</td>
<td>y/o</td>
<td>years old</td>
</tr>
<tr>
<td>inj</td>
<td>injection</td>
<td>pm</td>
<td>as needed</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TABLE 33-4 The Joint Commission’s “Do Not Use” List and Possible Future Inclusions

<table>
<thead>
<tr>
<th>DO NOT USE</th>
<th>POTENTIAL PROBLEM</th>
<th>USE INSTEAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>U (for unit)</td>
<td>Mistaken as zero, four, or cc.</td>
<td>Write “unit”</td>
</tr>
<tr>
<td>IU (for international unit)</td>
<td>Mistaken as IV (intravenous) or 10 (ten)</td>
<td>Write “international unit”</td>
</tr>
<tr>
<td>Q.D., qd, Q.O.D., qod</td>
<td>Mistaken for each other. The period after the Q can be mistaken for an “1” and the “0” can be mistaken for “1”</td>
<td>Write “daily” and “every other day”</td>
</tr>
<tr>
<td>Trailing zero (X.0 mg), Lack of leading zero (.X mg)</td>
<td>Decimal point is missed</td>
<td>Never write a zero by itself after a decimal point (X mg), and always use a zero before a decimal point (0.X mg)</td>
</tr>
<tr>
<td>MS</td>
<td>Confused for one another</td>
<td>Write “morphine sulfate” or “magnesium sulfate”</td>
</tr>
<tr>
<td>MISO4</td>
<td>Can mean morphine sulfate or magnesium sulfate</td>
<td></td>
</tr>
<tr>
<td>Possible Future Inclusions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; (greater than) or &lt; (less than)</td>
<td>Misinterpreted as the number “7” or the letter “L”</td>
<td>Write “greater than” or “less than”</td>
</tr>
<tr>
<td>Abbreviations for drug names</td>
<td>Multiple drugs have similar abbreviations</td>
<td>Write drug names in full</td>
</tr>
<tr>
<td>Apothecary units</td>
<td>Unfamiliar to many practitioners; confused with metric units</td>
<td>Use metric units</td>
</tr>
<tr>
<td>@</td>
<td>Misunderstood as a “2”</td>
<td>Write “at”</td>
</tr>
<tr>
<td>c.c. or cc</td>
<td>Misunderstood as a “U” (units) when poorly written</td>
<td>Write “ml” or milliliters</td>
</tr>
<tr>
<td>μg (for microgram)</td>
<td>Misunderstood as mg (milligrams), resulting in one thousand-fold dosing overdose</td>
<td>Write “mcg” or micrograms</td>
</tr>
</tbody>
</table>


**DRUG INTERACTIONS WITH THE BODY**

Pharmacology is the study of drugs, their desired effect, and what happens to a drug while it is in the body. Different patients may react to the same dose of a drug in very different ways, and the same patient may react to the same dose of a drug differently at various times. Therefore, the management of medication therapy is concerned primarily with the effectiveness of a drug’s action and the drug’s potential side effects. Pharmacokinetics is the study of the movement of drugs throughout the body. Four basic actions occur when a drug is taken: absorption, distribution, metabolism, and excretion. By knowing what happens to the drug in the body, we can know the onset of a drug’s activity (when the drug action starts), when the effects of the drug are likely to peak, the minimum amount of drug needed to bring about the desired effect (therapeutic dose), and the duration of a particular drug’s activity. All these factors help the physician determine the appropriate form, amount, route, and frequency of administration of a medication for a particular patient.

**Drug Absorption**

The rate at which drugs are absorbed from the site of administration into the bloodstream depends on many factors, including the drug’s ability to be dissolved, the characteristics of the medication, the concentration of the dose, and the route of administration. Liquid oral medications are dissolved more rapidly than solid forms because they do not have to be dissolved by gastrointestinal (GI) fluids before they are absorbed. In addition, drugs that are soluble in fat pass more readily through the cell membrane, because cell membranes have a fatty acid layer. More acidic drugs are absorbed well in the stomach, whereas others cannot be absorbed until they reach the small intestine. For some medications, such as antibiotics, the physician may order an initial loading dose of the drug, usually twice the typical amount, so that the patient’s blood levels reach the therapeutic range more quickly.

An important point to remember is that regardless of the route of administration, a drug can have one of two actions on the body: local (restricted to one spot or part; not general) or systemic (affecting the body as a whole). Most drugs are used for their systemic effects. Even when drugs are used for local purposes, we know that no drug remains completely localized in the body. Any chemical that comes into contact with even the most superficial surface, such as the skin, has the potential to be absorbed into the bloodstream and to circulate to other tissues and organs.

**Oral Route**

Oral medications are convenient, safe, and relatively inexpensive. However, drugs that can be destroyed in any way by the digestive tract must be given by injection. Insulin and heparin are examples of drugs that are destroyed by the digestive process and therefore cannot be administered orally. Injection of medications leads to rapid absorption into the bloodstream, but this increases the danger of overdose or infection. Most oral medications are absorbed by the small intestine, but a few are absorbed more rapidly in the stomach. After absorption into the bloodstream from the small intestine, drugs are carried to the liver.
### TABLE 33-5 Top 50 Prescribed Drugs in the United States in 2007

<table>
<thead>
<tr>
<th>BRAND NAME</th>
<th>GENERIC NAME</th>
<th>CLASSIFICATION BY USE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lipitor</td>
<td>Atorvastatin calcium</td>
<td>Lowers cholesterol</td>
</tr>
<tr>
<td>Nexium</td>
<td>Esomeprazole</td>
<td>Antacid; inhibits gastric acid secretion</td>
</tr>
<tr>
<td>Advair Diskus</td>
<td>Salmeterol xinafoate</td>
<td>Steroidal inhalant with bronchodilator</td>
</tr>
<tr>
<td>Prevacid</td>
<td>Lansoprazole</td>
<td>Inhibits gastric acid secretion</td>
</tr>
<tr>
<td>Plavix</td>
<td>Clopidogrel bisulfate</td>
<td>Antiplatelet agent</td>
</tr>
<tr>
<td>Singulair</td>
<td>Montelukast sodium</td>
<td>Antiinflammatory; leukotriene inhibitor</td>
</tr>
<tr>
<td>Serquel</td>
<td>Quetiapine</td>
<td>Antipsychotic</td>
</tr>
<tr>
<td>Effexor XR</td>
<td>Venlafaxine hydrochloride</td>
<td>Extended-release antidepressant</td>
</tr>
<tr>
<td>Lexapro</td>
<td>Escitalopram; Sirmvastatin</td>
<td>Antidepressant</td>
</tr>
<tr>
<td>Actos</td>
<td>Pioglitazone</td>
<td>Oral hypoglycemic</td>
</tr>
<tr>
<td>Pratorinix</td>
<td>Pantoprazole</td>
<td>Proton pump inhibitor; inhibits gastric secretion</td>
</tr>
<tr>
<td>Vyltorin</td>
<td>Ezetimibe</td>
<td>Lowers cholesterol</td>
</tr>
<tr>
<td>Topamxx</td>
<td>Topiramate</td>
<td>Anticonvulsant, antimigraine</td>
</tr>
<tr>
<td>Risperdal</td>
<td>Risperidone</td>
<td>Antipsychotic</td>
</tr>
<tr>
<td>Abilify</td>
<td>Aripiprazole</td>
<td>Antipsychotic</td>
</tr>
<tr>
<td>Cymbalta</td>
<td>Duloxetine</td>
<td>Antidepressant</td>
</tr>
<tr>
<td>Lamictal</td>
<td>Lamotrigine</td>
<td>Anticonvulsant</td>
</tr>
<tr>
<td>Zyprexa</td>
<td>Olanzapine</td>
<td>Antipsychotic</td>
</tr>
<tr>
<td>Levaquin</td>
<td>Levofoxacin</td>
<td>Antibiotic</td>
</tr>
<tr>
<td>Celebrex</td>
<td>Celecoxib</td>
<td>Antiinflammatory</td>
</tr>
<tr>
<td>Zetia</td>
<td>Ezetimibe</td>
<td>Lowers cholesterol</td>
</tr>
<tr>
<td>Voltrex</td>
<td>Valacyclovir</td>
<td>Antiviral</td>
</tr>
<tr>
<td>Crestor</td>
<td>Rosuvastatin</td>
<td>Lowers cholesterol</td>
</tr>
<tr>
<td>Fosamxx</td>
<td>Alendronate</td>
<td>Treats or prevents osteoporosis</td>
</tr>
<tr>
<td>Zyrtec</td>
<td>Cetirizine</td>
<td>Seasonal allergic rhinitis (OTC in 2008)</td>
</tr>
<tr>
<td>Lantus</td>
<td>Insulin glargine</td>
<td>Diabetes mellitus</td>
</tr>
<tr>
<td>Adderall XR</td>
<td>Amphetamine and dextroamphetamine</td>
<td>Central nervous system stimulant; attention deficit/hyperactivity disorder</td>
</tr>
<tr>
<td>Diovan</td>
<td>Valsartan hydrochlorothiazide</td>
<td>Antihypertensive</td>
</tr>
<tr>
<td>Avandia</td>
<td>Rosiglitazone</td>
<td>Oral hypoglycemic</td>
</tr>
<tr>
<td>Tricor</td>
<td>Fenofibrate</td>
<td>Cholesterol lowering</td>
</tr>
<tr>
<td>Aciphex</td>
<td>Rabeprazole</td>
<td>Antacid; gastroesophageal reflux disease (GERD)</td>
</tr>
<tr>
<td>Diovan HCT</td>
<td>Valsartan</td>
<td>Antihypertensive</td>
</tr>
<tr>
<td>OxyContin</td>
<td>Oxycodone</td>
<td>Narcotic analgesic; extended release</td>
</tr>
<tr>
<td>Concerta</td>
<td>Methylphenidate</td>
<td>Central nervous system stimulant</td>
</tr>
<tr>
<td>Coreg</td>
<td>Coredilin</td>
<td>Antihypertensive beta blocker</td>
</tr>
<tr>
<td>Flomax</td>
<td>Tamsulosin</td>
<td>Alpha-adrenergic blocker</td>
</tr>
<tr>
<td>Lyrica</td>
<td>Pregabalin</td>
<td>Anticonvulsant; peripheral neuropathy</td>
</tr>
<tr>
<td>Wellbutrin XL</td>
<td>Bupropion</td>
<td>Antidepressant; extended release</td>
</tr>
<tr>
<td>Aricept</td>
<td>Donepezil</td>
<td>Alzheimer’s disease</td>
</tr>
<tr>
<td>Immitrex</td>
<td>Sumatriptan</td>
<td>Antimigraine</td>
</tr>
<tr>
<td>Ambien</td>
<td>Zolpidem tartate</td>
<td>Hypnotic; sleep agent</td>
</tr>
<tr>
<td>Lotrel</td>
<td>Amlodipine; benazepril</td>
<td>Antihypertensive; calcium channel blocker</td>
</tr>
<tr>
<td>Mazonex</td>
<td>Mometasone</td>
<td>Steroidal decongestant</td>
</tr>
</tbody>
</table>
TABLE 33-5 Top 50 Prescribed Drugs in the United States in 2007—cont’d

<table>
<thead>
<tr>
<th>BRAND NAME</th>
<th>GENERIC NAME</th>
<th>CLASSIFICATION BY USE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toprol-XL</td>
<td>Metoprolol</td>
<td>Antihypertensive; beta-blocker, extended release</td>
</tr>
<tr>
<td>Ambien CR</td>
<td>Zolpidem tartrate</td>
<td>Hypnotic; sleep agent; controlled release</td>
</tr>
<tr>
<td>Enbrel</td>
<td>Etanercept</td>
<td>Antiinflammatory; antiarthritic</td>
</tr>
<tr>
<td>Spiriva</td>
<td>Tiotropium inhalation</td>
<td>Anticholinergic agent; prevents bronchospasm</td>
</tr>
<tr>
<td>Viagra</td>
<td>Sildenafil</td>
<td>Erectile dysfunction</td>
</tr>
<tr>
<td>Lidoderm</td>
<td>Lidocaine topical</td>
<td>Topical anesthetic</td>
</tr>
<tr>
<td>Actonel</td>
<td>Risedronate</td>
<td>Osteoporosis; slows bone loss</td>
</tr>
</tbody>
</table>

www.drugs.com/top50_2007.html

Much of the drug's potency is inactivated in this organ before the drug circulates to the tissues. This inactivation by the liver often makes it necessary to administer higher doses orally than those given by injection.

Food slows the absorption of drugs; therefore, many medications are absorbed best when taken either 1 hour before or 2 hours after the ingestion of food. Food also may bind with a medication or in some other way inactivate it. For example, tetracycline is destroyed by milk products and antacids containing calcium salts. Therefore, patients taking tetracycline should be advised not to eat dairy products or ingest liquid or solid forms of antacids. Stomach acid that naturally occurs during digestion may destroy certain drugs. Because some drugs are destroyed by the components of the digestive tract or irritate the empty lining of the stomach, oral drugs may be enteric-coated to keep them intact for passage into the small intestine or to prevent gastric irritation or vomiting.

Some drugs are not affected by the digestive processes, but they cannot be absorbed through the intestinal walls into the bloodstream. For example, neomycin has no therapeutic effect when taken orally (unless it is used to sterilize the bowel before bowel surgery). Other drugs may be unable to cross the bowel mucosa because of their poor solubility in lipids (fats) or because they are inactivated by the pH of the GI tract.

It is important to remember these absorption factors when administering medication by the oral route. If a patient has previously responded to a drug but is no longer responding, it may be important to question the patient's food-medication cycle. It could be that the patient is no longer taking the medication on an empty stomach as directed.

Parenteral Route

Parenteral refers to the administration of drugs by injection. The parenteral route results in the fastest action, because the medication is administered directly into the bloodstream or into tissues with a rich blood supply. However, several factors determine the effectiveness and rate of absorption of injected medications.

A drug in an aqueous (water) solution is absorbed more quickly in an area with more blood vessels. Therefore, drugs deposited in the muscle are absorbed faster than drugs given subcutaneously. The intramuscular (IM) route is chosen in an emergency for fast action or when larger amounts of the medication must be absorbed. The subcutaneous (SC) route is chosen when a slower, prolonged effect is desired.

Drug absorption also may be controlled physically. Absorption may be quickened by hand massage after injection, and it may be slowed by pharmaceutical preparation of the drug in a physical form that slows absorption. These methods include suspending the drug in a solution that prolongs absorption, such as colloidal substances, fatty substances (oil), or insoluble salts or esters. Drugs suspended in these substances slowly dissolve in the tissues over a long time, and the patient can be spared costly, frequent, and sometimes painful injections. Penicillin G is suspended with procaine (hydrochloride) salts for this purpose. Local anesthetics sometimes are mixed with epinephrine to keep the medication and its effects in an area longer, because epinephrine (adrenaline) constricts blood vessels at the site, reducing circulation and the rate of absorption.

The third parenteral route is the intravenous (IV) route, in which the medication is injected directly into the vein. Because of the dangers of IV administration, only members of the medical team who are licensed to do so may inject medication intravenously.

**SAFETY ALERT**

A medical assistant is not licensed to perform IV administration of medications to patients. Because IV administration is so dangerous, medications given intravenously usually are administered in small doses through an IV infusion (IV drip) so that the effects in the body can be monitored.

Other forms of parenteral routes include intradermal injection, which is injection of the drug within the dermal layer of the skin and superficial to the subcutaneous tissues. This route is used mostly for allergy testing and skin testing, such as testing for tuberculosis. Intrathecal, or intraspinal, injections are used for spinal anesthesia and for administering certain medications into the spinal column. Intraarticular injections are used for administering corticosteroids into joints, and intraosseous medications are injected directly into a lesion, or an anticancer drug is administered into a cancerous tumor.
**Mucous Membrane Absorption**

Drugs may be absorbed by the mucous membranes of the mouth, throat, nose, eyes, rectum, vagina, and respiratory tracts. Some applications, such as nasal sprays, eye drops, and rectal suppositories for constipation, have a local effect. Others have a systemic effect, such as a rectal suppository given to control vomiting or a nitroglycerin tablet dissolved under the tongue (sublingual) to dilate coronary arteries and relieve the pain of angina pectoris. Inhalation is used to concentrate drugs locally in the lower respiratory passages or to produce systemic effects, such as general anesthesia. For example, a bronchodilator such as metaproterenol sulfate (Alupent), is inhaled during an asthma attack to relieve bronchospasms.

**Topical Absorption**

Topical routes include the application of medications to the skin, eyes, and ears. Drugs in ointments, creams, lotions, and aerosols can be applied for the treatment of skin itching, inflammation, or other discomforts and for the treatment of skin infections with antibiotics. Nitroglycerin (for angina) can be absorbed through the skin from a dermal patch, which releases it systemically. Hormones such as testosterone and estrogen also can be administered via a dermal patch for systemic purposes.

**TERMS RELATED TO DRUG INTERACTIONS**

<table>
<thead>
<tr>
<th>Antagonism</th>
<th>The action of one drug diminishes the effect or shortens the duration of action of another drug.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synergism</td>
<td>A drug enhances the intensity or prolongs the action of another drug. This can have a positive effect, as when two different antibiotics are used to treat an infection, or a negative effect, as when two drugs lower blood pressure to dangerous levels.</td>
</tr>
<tr>
<td>Potentiation</td>
<td>A form of synergism in which the effect of one drug is enhanced by the presence of another drug. In this case, the two drugs have different actions, but one increases the effect of the other.</td>
</tr>
</tbody>
</table>

**Drug Distribution**

Once a drug has been absorbed, it must be transported by the circulatory system to the area where it will have its effect. In the bloodstream, drugs can attach to plasma proteins and then are freed to pass from the blood into the site of action. Drugs are carried through the fluids into the cells of the tissues and organs. The blood supply to a part affects the speed with which drugs reach certain tissues.

The blood-brain barrier is a functional cellular barrier between the brain cells and the capillaries circulating blood through the brain. The barrier is poorly permeable to water-soluble materials, which makes it difficult for dissolved substances in the blood to pass through. For the substances that do cross through, the barrier regulates the degree and rate of their absorption into the brain tissue. The general anesthetic thiopental (Pentothal) is able to cross the blood-brain barrier immediately and produces sleep within seconds, whereas other sleep-producing drugs, such as the barbiturates, cross slowly and may take as long as 30 minutes to 1 hour to produce the same effect. The blood-brain barrier is a mixed blessing. It provides a physical barrier that protects the brain from potentially dangerous chemicals, but it also makes it very difficult to treat central nervous system (CNS) disorders. In contrast, the placenta has no method for blocking substances, so whatever the mother consumes is readily passed through the placenta to the developing fetus. This means that childbearing women must be extremely careful of all chemicals they consume or inhale, because these are quickly transferred to the baby's bloodstream.

**Drug Action**

Multiple theories explain the actions of drugs. Drugs are believed to combine with body chemicals on the cell surface or within the cell itself. Pharmaceutical developers create compounds that have an affinity for a specific target cell. The target cell recipient is called a receptor, and the drug that has the affinity for it and produces a functional change in the cell is called the agonist. Not all drugs that bind to specific cells cause a functional change in the cell. These drugs act as an antagonist to the natural process and work by blocking a sequence of biochemical events.

Some drugs are believed to act by affecting the enzyme functions of the body. Drugs attach to enzyme substances and rob the enzymes from cells. As a result, the enzyme products needed for normal cellular function are not supplied, and the cell fails to function properly.

Certain antibacterial drugs have a selected toxicity for pathogens or parasites that have invaded the body. Penicillin and sulfonamides work because they poison or interfere with the life processes of bacteria without affecting the life processes of normal human cells. Research scientists continue to look for differences between cancer cells and normal cells so that they can apply the principle of selected toxicity in cancer treatment. Only recently have anticancer drugs been produced that are selective and therefore nontoxic to human cells.

Both drugs that have a selective affinity for cells and those that bind with enzymes may be counteracted by administering large amounts of natural substances with which the drugs compete. This process is known as administering an antidote to a drug that may be acting as a poison. For example, an antidote such as naloxone hydrochloride (Narcan) can be administered if a patient receives too much anesthesia or has taken a drug overdose.

Some drugs alter the function of a cell by affecting the physical properties of the cell membrane rather than altering the biochemical processes within the cell. This is especially true of drugs that affect nerve cells, such as anesthetics and alcohol. A change in the cell membrane alters the permeability of the membrane, which in turn changes the flow of ions into and out of the cells. This change in ion flow alters the polarity (opposite effects at two extremities, the two extremities being inside and outside the cell membrane) on which nerve pulses are conducted, resulting in general sleep or stupor.
Drug Metabolism

After the drug has been absorbed and distributed, it is metabolized for excretion. During metabolism the drug is converted into harmless byproducts, which are more easily eliminated by the kidneys. Most drugs are broken down by the enzyme activity of the liver. For oral medications that are absorbed in the small intestine, this process begins in the liver before distribution.

The ability to break down the chemical components of a drug varies among individuals. Factors that determine this ability include age, the presence of other drugs, and liver disease. Infants and aging individuals have more difficulty effectively metabolizing medications. Patients taking multiple medications also may be at increased risk for liver-related problems with metabolism because of the sheer number of chemicals the liver is exposed to on a daily basis. Individuals with chronic liver disease, such as cirrhosis, may not be able to metabolize even normal doses of medications. A cumulative effect, meaning the total amount of the drug present in the body after multiple doses, may result in a toxic condition if the drug is absorbed faster than it is metabolized. Because of these factors, drug therapy must be monitored closely in very young and aging patients, those taking multiple medications, and patients with chronic liver disease. In contrast, patients receiving long-term therapy may develop overstimulation of the enzyme activity of the liver. This results in rapid destruction of the drug, and the patient has to take larger and larger doses for the drug to be effective. This situation is called tolerance.

Drug Excretion

After the drug has been metabolized, its byproducts must be excreted from the body. The kidneys are the most important routes for the elimination of drugs. Most drugs are filtered out of the blood, circulated through the kidneys, and excreted in the urine. Because the kidneys are so important in the elimination of chemicals from the body, drug therapy must be carefully monitored in patients with kidney disease or malfunction. Drugs are also eliminated through the sweat glands, saliva, and feces. Exhalation, another mechanism for drug elimination, is the basis for measuring alcohol concentrations in the body by the breathalyzer test. Drugs may be eliminated through the milk gland of a lactating mother, which means a breastfeeding woman must be extremely careful about taking medications.

The combination of metabolism and excretion reduces the amount of drug in the body at any given time. The therapeutic dose of a medication depends on many factors, including the drug’s half-life. The half-life is the amount of time it takes for half a dose of the medication to be metabolized and excreted from the body. Some drugs have extremely short half-lives (only minutes), whereas others can take days to leave the body. The amount of drug lost during one half-life depends on how much drug is present. Physicians use the half-life of a drug to determine the timing of medication administration, or the dose intervals. The shorter the half-life of the drug, the closer the times when it should be administered. If the next dose of the drug is not given within the half-life, blood levels drop and the patient does not receive adequate therapeutic effects from the treatment.

Factors that Affect Drug Action

As stated earlier, different people react to the same dose of medication in different ways, and the same patient can react to the same dose of the same drug differently on various occasions. A number of factors are important in determining the correct medication for a patient.

Body Weight

A person’s weight is directly related to the effect of a medication. Basically, the same dose has a lesser effect on a patient who weighs more and a greater effect on a person who weighs less. Manufacturers of adult medications calculate dosages based on a normal adult weight (approximately 150 pounds). Sometimes the physician adjusts the dose to better suit the patient’s body size. Pediatric medications are designed for the body weight or body surface area of children. If adult medications are used for children, the correct dose must be calculated and adjusted for the child’s body weight (see Chapter 34).

Age

The most significant effect of age on the body’s response to a drug occurs in newborns and elderly individuals. This usually is because of immature or deteriorating body systems. In addition, both patient groups are particularly sensitive to drugs that affect the CNS and are at risk of developing toxic drug levels. Consequently, dosage amounts for these two groups must be carefully calculated. The physician may opt to start therapy with very small doses and increase the dose over time based on the presence or absence of side effects. Table 33-6 summarizes the altered effects.

<table>
<thead>
<tr>
<th>PHYSIOLOGIC CHANGES ASSOCIATED WITH AGING</th>
<th>EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stomach takes longer to empty, and gastric acidity is reduced.</td>
<td>Increases the risk of stomach irritation and ulceration.</td>
</tr>
<tr>
<td>Increased percentage of adipose (fat) tissue in the body.</td>
<td>Increases likelihood of drug storage in fat; may lead to drug toxicity.</td>
</tr>
<tr>
<td>Fewer protein-binding sites available in bloodstream.</td>
<td>Reduces drug passage through cell membranes; increases blood level of drug; may lead to toxicity.</td>
</tr>
<tr>
<td>Liver function declines.</td>
<td>Slows rate of drug metabolism; increases risk of toxicity.</td>
</tr>
<tr>
<td>Kidney function declines.</td>
<td>Slows rate of elimination of drug byproducts; increases risk of toxicity and complications.</td>
</tr>
<tr>
<td>Peripheral vascular disease present; venous tone diminished.</td>
<td>Reduces distribution of drug to the periphery; may cause orthostatic hypotension.</td>
</tr>
<tr>
<td>Fat-soluble medications pass through blood-brain barrier more easily.</td>
<td>May affect central nervous system; increases risk of vertigo and confusion.</td>
</tr>
</tbody>
</table>
of medications on aging individuals. (Chapter 48 discusses the effects of aging on body systems in more detail.)

Gender

Drugs may affect men and women differently. As previously mentioned, a pregnant woman must be extremely cautious when taking medications to prevent possible damage to the developing fetus. In addition, the side effects of some drugs can stimulate uterine contractions, causing premature labor and delivery. Intramuscular medications are absorbed faster by men because they generally have higher levels of muscle mass, which is rich in blood vessels. Because women typically have a higher body fat content and less muscle (therefore fewer blood vessels in peripheral tissues compared with men), intramuscular drugs remain in their tissues longer. In the past, most clinical trials were conducted only on men; therefore, until newer trial results are released that include women, the effect of gender on the action and safety of medications is impossible to predict accurately.

Time of Day

Diurnal refers to during the day or time of light. Diurnal body rhythms play an important part in the effects of some drugs. Sedatives given in the morning are not as effective as those administered before bedtime, because the CNS is more alert in the morning, causing increased resistance to the effects of the drug. Corticosteroid administration is preferred in the morning, because this best mimics the body's natural pattern of corticosteroid production and elimination.

Pathologic Factors

Patients may adversely respond to drugs if they have liver or kidney disease, because the body is unable to detoxify and excrete chemicals properly. Drugs may also produce pathologic conditions of the liver or kidneys, and patients may need monitoring for potentially serious drug complications. For example, patients taking statin medications (e.g., atorvastatin calcium [Lipitor]) for hypercholesterolemia should have liver function studies done routinely, because these drugs are very hard on liver cells.

Patients with liver or kidney disease have an increased risk of drug toxicity, which may result in unconsciousness or death. Reactions in patients with other diseases or disorders may be quite different from the expected response. Therefore, a thorough medical history of the patient must always be taken before medications are prescribed and administered.

Immune Responses

The presence of a drug can stimulate a patient's immune response, causing the patient to develop antibodies to a particular chemical. If the same drug is administered again, the patient will have an allergic reaction to the drug, ranging from a mild reaction to anaphylaxis, a serious respiratory and circulatory emergency. Antibiotics are the group of drugs that most commonly cause allergic responses. A typical allergic response to an antibiotic is urticaria, or the formation of hives.

Psychological Factors

People may respond differently to a drug because of the way they feel about the drug. If a patient believes in the therapy, even a placebo (a sugar pill or sterile water thought to be a drug) may help or bring about relief. A patient's personality can affect whether he or she will be cooperative in following the directions for a particular drug, and a patient's negative mindset, or mental attitude, can reduce an expected response to a drug.

Tolerance

Tolerance is the phenomenon of reduced responsiveness to a drug. Acquired tolerance occurs after a particular drug has been taken for a period of time. Cross-tolerance occurs when a patient acquires a tolerance to one drug and becomes resistant to other, similar drugs. Physical dependence, such as occurs with narcotic addictions, often accompanies tolerance. The body becomes so adapted to the presence of the drug that it cannot function properly without it. To withdraw the drug is to throw the body out of its equilibrium, causing withdrawal symptoms.

Accumulation

When a drug is taken too frequently to allow for proper elimination, it accumulates in the tissues. The result is a more intense effect and a longer duration. Accumulation can cause overdose and/or toxic effects. An example of a toxic accumulation of medication is ototoxicity (a toxic condition affecting the ears) which results in nausea, vomiting, tinnitus, and vertigo. Proper dosage and timing of administration are the best methods for preventing drug accumulation.

Idiosyncrasy

Occasionally a person reacts to a drug in a manner that is unexpected and peculiar to that individual only. An idiosyncratic response may manifest in many different ways, such as a hypnotic drug keeping a person awake, acting as a stimulant to this person rather than as a depressant. Usually these reactions cannot be explained.

Drug-Drug Interactions

Special care must be taken with patients who take more than one drug on a regular basis. One medication may increase or decrease the effects of another or cause unexpected side effects. To safeguard patients from potentially negative drug interactions, it is important at each visit to record a complete list of all drugs the patient is taking, including OTC medications and herbal products. However, because many patients do not know or get confused about the names and dosages of their medications, the best way to maintain an accurate record is to ask that patients bring their medication containers with them to each office visit. This way, you can list information about their medications on their charts and at the same time ask whether they have any questions about their treatment. It is also a good idea to advise patients to fill prescriptions at the same pharmacy, because the pharmacist can monitor medications for potential drug interactions.

An example of a drug interaction is the effect of some antibiotics on oral contraceptives. Certain antibiotics can interact with birth control pills, making the birth control pills less effective and pregnancy more likely. Patients should be told that spotting (midcycle bleeding) may be the first sign that an antibiotic is interfering with the effectiveness of birth control pills.
Examples of Drug Classifications

**Adrenergics**

**Actions:** Vasoconstriction (i.e., narrow the lumen of a blood vessel); dilate pupils and bronchioles; relax muscles of the GI and urinary tracts.

**Examples:** Epinephrine; phenylephrine (Neo-Synephrine); pseudoephedrine (Sudafed); isoproterenol (Isuprel); oxymetazoline (Visine).

**Primary uses:** Stop superficial bleeding; raise and sustain blood pressure; relieve nasal congestion.

**General side effects:** Chest pain, tachycardia, headache, increased blood glucose levels, nervousness, tremors.

**Adrenergic Blockers**

**Actions:** Vasodilation; reduce blood pressure; increase muscle tone of GI walls.

**Examples:** propranolol (Inderal); atenolol (Tenormin); carvedilol (Coreg); tamsulosin (Flomax).

**Primary uses:** Control hypertension and peripheral vascular disease; treat prostatic hypertrophy.

**General side effects:** Confusion, lowering of blood pressure, lowering of blood glucose levels, fatigue, reduced heart rate.

**Analgesics**

**Actions:** Lessen the sensory function of the brain; block pain receptors

**Examples:** Nonnarcotic: aspirin; acetaminophen (Tylenol); ibuprofen (Advil, Motrin). Narcotic hydrocodone w/AAP (Tylentol with codeine); oxycodeone (OxyContin); Propoxyphene N/AAP (Darvocet); meperidine (Demerol); hydrocodone (Vicodin); propoxyphene (Darvon).

**Primary use:** Relieve pain.

**General side effects:** Nonnarcotic: GI disorders, liver and kidney disorders, tinnitus. Narcotic: Suppression of vital signs, agitation, blurred vision, confusion, constipation, oversedation, restlessness.

**Anesthetics**

**Actions:** Produce insensibility to pain or the sensation of pain; block nerve impulses to the brain, resulting in unconsciousness; dilate pupils; lower blood pressure; reduce respiratory and pulse rates.

**Examples:** Local: lidocaine (Xylocaine); bupivacaine (Marcaine); lidocaine topical (Lidoderm). General: thiopental (Pentothal).

**Primary uses:** Produce local anesthesia (absence of sensation without loss of consciousness) or general anesthesia (loss of consciousness).

**General side effects:** Hypotension, cardiopulmonary depression, sedation, nausea, vomiting, headaches.

**Antacids**

**Action:** Reduce acidity in the stomach.

**Examples:** omeprazole (Prilosec); esomeprazole (Nexium); rabeprazole (Aciphex); lansoprazole (Prevacid); pantoprazole (Protonix); magnaldate (Riopan); calcium carbonate (Maalox).

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**Critical Thinking Application 33-4**

Sylva Kramer, a 72-year-old patient of Dr. Simon, calls today and asks Kathy how she should be taking her heart medicine, dilatizem HCl (Cardizem). Mrs. Kramer has hypertension, and a history of heart disease. She also is overweight, has the potential for kidney disease, and takes a number of other prescriptions. What factors may have an impact on the potential effect of Mrs. Kramer's medication?

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**Classifications of Drug Actions**

Clinical pharmacology is a complex subject. To make the subject easier, drugs are classified into groups according to their actions in the body (e.g., diuretics or emetics), the symptoms they relieve (e.g., antihistamine), or the body system they affect (e.g., drugs that act on the cardiovascular system). The following is a glossary of terms that describe some basic drug actions. As you read some of the examples, remember that a drug classified as one type of agent may have other uses and actions in other body systems. For example, a drug classified as a diuretic may also be an antihypertensive drug, and a vasodilator may also be a respiratory antispasmodic. It takes time to understand not only the basic classification of a particular drug, but also the many secondary uses and effects the drug has on the human body.

These are just a few examples of the different classifications of medications. Remember to research and review all medications before administering them.

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**Pharmacokinetic Terms**

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absorption</td>
<td>The movement of a drug into the bloodstream. The rate of absorption depends on many factors, including the route of administration.</td>
</tr>
<tr>
<td>Distribution</td>
<td>The transport of a drug from the site of administration to the location in the body where it is meant to act (i.e., the target tissue).</td>
</tr>
<tr>
<td>Metabolism</td>
<td>The inactivation of a drug, including the time required for a drug to be detoxified and broken down into byproducts. The liver typically metabolizes medications.</td>
</tr>
<tr>
<td>Excretion</td>
<td>The elimination of a drug from the body, including the route of elimination and the time required for this process. The kidneys typically excrete drug metabolites.</td>
</tr>
</tbody>
</table>
Primary use: Treat gastric hyperacidity.
General side effects: Constipation, diarrhea, electrolyte imbalance, flatulence, kidney stones, osteoporosis.

Antianxiety Agents
Action: Reduce anxiety and tension.
Examples: chlordiazepoxide (Librium); diazepam (Valium); alprazolam (Xanax).
Primary uses: Produce calmness and release muscle tension.
General side effects: Agitation, amnesia, bizarre behaviors, confusion, reduced white blood cell (WBC) count, depression, drowsiness, lethargy, oversedation tremors, photosensitivity.

Antibiotics
Action: Kill or inhibit growth of microorganisms.
Examples: Azithromycin (Zithromax); levofloxacin (Levaquin); cefaclor (Cedir); tetracycline (Sumycin); amoxicillin (Amoxil); ciprofloxacin (Cipro); cephalaxin (Keflex).
Primary uses: Treat bacterial invasions and infections.
General side effects: Hypersensitivity reaction, nausea, diarrhea, GI distress, light sensitivity, urticaria.

Anticholinergics
Action: Parasympathetic blocking agents; reduce spasms in smooth muscles.
Examples: Scopolamine or atropine sulfate; tiotropium inhalation (Spiriva).
Primary uses: Dry secretions before surgery; prevent bronchospasm.
General side effects: Blurred vision, confusion, reduced GI and genitourinary motility, dilation of pupils, fever, flushing, headache, increased heart rate.

Anticoagulants
Action: Delay or block clotting of blood.
Examples: Heparin; enoxaparin sodium (Lovenox); warfarin sodium (Coumadin).
Primary uses: Treat blood clots, thrombophlebitis; prevent clot formation.
General side effects: Increased bleeding, blood irregularities; GI, liver, and kidney disease.

Anticonvulsants
Action: Prevent seizures; reduce excessive stimulation of the brain.
Examples: clonazepam (Klonopin); gabapentin (Neurontin); phenytoin (Dilantin); phenobarbital; carbamazepine (Tegretol); lamotrigine (Lamictal); pregabalin (Lyrica).
Primary uses: Treat epilepsy and other neurologic disorders (e.g., peripheral neuropathy).
General side effects: Sedation, vertigo, visual disturbances, GI disturbances, liver complications.

Antidepressants
Action: Treat depression.
Examples: Venlafaxine hydrochloride (Effexor); sertraline (Zoloft); escitalopram (Lexapro); duloxetine (Cymbalta); bupropion (Wellbutrin); trazodone HCl (Desyrel); fluoxetine (Prozac); imipramine pamoate (Tofranil); amitriptyline (Elavil).
Primary uses: Elevate mood; treat other neurologic disorders (e.g., migraines).
General side effects: Anorexia, anxiety, sexual dysfunction, fatigue, drowsiness, vertigo, weight gain, confusion, blurred vision.

Antiemetics
Action: Act on hypothalamic center in the brain.
Examples: prochlorperazine (Compazine); trimethobenzamide (Tigan); metoclopramide (Reglan); graziateron (Kytril); ondansetron (Zofran).
Primary uses: Prevent and relieve nausea and vomiting.
General side effects: Dry mouth, sedation, drowsiness, diarrhea, blurred vision.

Antifungals
Action: Slow or retard multiplication of fungi.
Examples: Miconazole (Monistat); nystatin (Mycostatin); fluconazole (Diflucan); ketoconazole (Nizoral).
Primary use: Treat systemic or local fungal infections.
General side effects: Anemia, chills, hypotension, vertigo, fever, kidney and liver damage, malaise, photophobia, muscle and joint pain.

Antihistamines
Action: Counteract the effects of histamine by blocking action in tissues; may be used to inhibit gastric secretions.
Examples: cetirizine (Zyrtec); fexofenadine (Allegra); chlorpheniramine (Chlor-Trimezin); diphenhydramine (Benadryl); promethazine (Phenergan); cimetidine (Tagamet); ranitidine (Zantac).
Primary uses: Relieve allergies; prevent gastric ulcers.
General side effects: CNS depression, muscle weakness, epigastric distress, dry mouth.

Antihypertensive Agents
Action: Block nerve impulses that cause arteries to constrict; slow the heart rate, reducing its contractility; restrict the hormone aldosterone in the blood.
Examples:amlodipine (Norvasc); atenolol (Tenormin); doxazosin mesylate (Cardura); metoprolol (Lopressor or Toprol); methylodopa (Aldomet); valsartan (Diovan); amlodipine plus benazepril (Lotrel).
Primary use: Reduce and control blood pressure.
General side effects: Headache, vertigo, GI disturbances, rash, hypotension, nonproductive cough.

Antiinflammatory Agents
Action: Reduce inflammation.
Examples: Nonsteroidal antiinflammatory drugs (NSAIDs): ibuprofen (Advil, Motrin); naproxen (Naprosyn) celecoxib (Celebrex). Steroidal antiinflammatory drugs (SAIDs): dexamethasone (Decadron); prednisone (Cortisone);
montelukast sodium (Singular); fluticasone propionate (Flonase).

**Primary use:** Treat arthritis and other inflammatory disorders, including asthma and allergic rhinitis.
**General side effects:** GI upset, GI bleeding, hepatitis, drowsiness, tinnitus, irregular heart rate, kidney disorders.

**Antimigraine Agents**

**Action:** Alter circulation to the brain.
**Examples:** topiramate (Topamax); sumatriptan (Imitrex); zolmitriptan (Zomig).

**Primary use:** Treatment or prevention of migraine headaches.
**General side effects:** Confusion, psychomotor slowing, difficulty concentrating, memory problems, rare but serious cardiac events.

**Antineoplastics**

**Action:** Inhibit development of and destroy cancerous cells.
**Examples:** interferon alfa-2a (Roferon-A); hydroxyurea (Hydrea); cyclophosphamide (Cytoxan); fluorouracil (Adrucil); chlorambucil (Leukeran); cytarabine (Cytosar-U).

**Primary use:** Cancer chemotherapy.
**General side effects:** Nausea, vomiting, bone marrow depression, splenic anemia, hair loss, GI ulcers.

**Antipsychotics**

**Action:** Alter chemical actions in the brain.
**Examples:** quetiapine (Seroquel); risperidone (Risperdal); aripiprazole (Abilify); olanzapine (Zyprexa).

**Primary use:** Treat the symptoms of schizophrenia and bipolar disorder.
**General side effects:** GI distress, hypotension, electrocardiographic (ECG) changes, vertigo, sedation, headache, photosensitivity.

**Antipruritics**

**Action:** Relieve itching.
**Examples:** calamine lotion; hydrocortisone ointment; Benadryl.

**Primary use:** Treat allergies or topical exposures that cause itching.
**General side effects:** Topical agents have no side effects; Benadryl can cause vertigo, sedation, and nervousness.

**Antipyretics**

**Action:** Lower body temperature.
**Examples:** aspirin, acetaminophen; ibuprofen.

**Primary use:** Reduce fever.
**General side effects:** GI disturbance, liver disease; with aspirin, possibility of Reye's syndrome if given during or after a viral disease.

**Antispasmodics**

**Actions:** Relieve or prevent spasms from musculoskeletal injury or inflammation.
**Examples:** methocarbamol (Robaxin); carisoprodol (Soma); cyclobenzaprine (Flexeril).

**Primary use:** Treat sports injuries.
**General side effects:** CNS suppression, drowsiness, vertigo.

**Antitussives**

**Action:** Inhibit the cough center.
**Examples:** Narcotic: codeine sulfate. Nonnarcotic: dextromethorphan (Romilar, Robitussin DM).

**Primary uses:** Temporarily suppress a nonproductive cough; reduce the thickness of secretions.
**General side effects:** Codeine cough suppressants cause CNS depression and constipation.

**Antiviral Agents**

**Action:** Inhibit the growth or reduce the spread of viral cells.
**Examples:** acyclovir (Zovirax), interferon, valacyclovir (Valtrex), oseltamivir (Tamiflu), famciclovir (Fanvir); includes the human immunodeficiency virus (HIV) medications efavirenz (Sustiva), abacavir (Ziagen), and ritonavir (Norvir).

**Primary use:** Treat viral infections, including oral and genital herpes, influenza, and HIV.
**General side effects:** Confusion, diarrhea, headache, kidney disease, urticaria, vomiting.

**Bronchodilators**

**Action:** Relax the smooth muscle of the bronchi.
**Examples:** aminophylline (Aminophyllin); theophylline (Theo-Dur); epinephrine (Adrenalin, Sus-Phrine); albuterol (Ventolin, Proventil); isoproterenol (Isuprel).

**Primary uses:** Treat asthma, bronchospasm; promote bronchodilation.
**General side effects:** CNS stimulation, tremors, tachycardia, increased blood glucose level, elevated blood pressure.

**Cathartics (Laxative)**

**Action:** Increase peristaltic activity of the large intestine.
**Examples:** magnesium hydroxide (Milk of Magnesia); bisacodyl (Dulcolax); casanthranol (Peri-Colace); psyllium hydrophilic muciloid (Metamucil).

**Primary uses:** Increase and hasten bowel evacuation (defecation).
**General side effects:** Nausea, bloating, flatulence, cramping.

**Contraceptives**

**Action:** Inhibit conception.
**Examples:** medroxyprogesterone acetate (Depo-Provera); norgestrel (Ovrette); ethinyl estradiol and ethynodiol diacetate (Demulen 1/35); Ortho Evra; etonogestrel/ethinyl estradiol (NuvaRing).

**Primary use:** Prevent pregnancy.
**General side effects:** Breast enlargement and tenderness; cardiovascular risk; GI upset; headache; irregular menstrual bleeding; deep vein thrombosis, PE.

**Decongestants**

**Action:** Relieve local congestion in the tissues.
**Examples:** epinephrine or phenylephrine (Neo-Synephrine); pseudoephedrine (Sudafed); oxymetazoline (Afrin); mometasone (Nasonex).
Primary use: Relieve nasal and sinus congestion caused by common cold, hay fever, or upper respiratory tract disorders.

General side effects: Arrhythmias, hypertension, headache, nausea, dry mouth.

Diuretics

Actions: Inhibit reabsorption of sodium and chloride in the kidneys; promote excretion of excess fluid in the body.

Examples: hydrochlorothiazide (Dyazide, Esiotrix, HydroDIURIL); furosemide (Lasix); triamterene (Dyrenium).

Primary use: Increase urinary output; lower blood pressure.

General side effects: Dehydration, muscle weakness, fatigue, gout, hyperglycemia.

Expectorants

Action: Liquefy secretions in the bronchial tubes so that they can be coughed out.

Examples: dextromethorphan (Benylin); guaifenesin guaiacolate (Fenestin, Robitussin).

Primary use: Relieve upper respiratory tract congestion.

General side effects: Vomiting, diarrhea, abdominal pain.

Hematopoietic Agents

Action: Promote red blood cell production.

Examples: epoetin alfa (Epogen, Procrit).

Primary use: Treat anemia in patients undergoing chemotherapy.

General side effects: Headache, arthralgia, nausea, hypertension, diarrhea.

Hemostatic Agents

Actions: Control bleeding; act as a blood coagulant.

Examples: phytonadione, vitamin K (Konakion); absorbable hemostatic agents (e.g., Gelfoam, Surgicel) are applied directly to a wound.

Primary use: Control acute or chronic blood-clotting disorder; promote formation of absorbable, artificial clot.

General side effects: Hypersensitivity reactions, transient flushing, dizziness; newborn hyperbilirubinemia.

Hormone Replacement Agents

Actions: Replace hormones or compensate for hormone deficiency.

Examples: insulin (Humulin); levothyroxine sodium (Synthroid or Levoxyl); estrogen (Premarin); vasopressin (Pitressin).

Primary use: Maintain adequate hormone levels.

General side effects: Estrogen replacement therapy: Hot flashes, decreased sex drive, nausea, vomiting.

Hypnotics (Sedatives)

Actions: Induce sleep; lessen the activity of the brain.

Examples: zolpidem tartrate (Ambien); eszopiclone (Lunesta); secobarbital (Seconal); flurazepam (Dalmane); temazepam (Restoril); barbiturates.

Primary uses: Treat insomnia; obtain sedation (lower doses).

General side effects: Daytime sedation, confusion, dry mouth, vertigo.

Lipid-Lowering Agents

Actions: Reduce blood cholesterol levels and/or increase high-density lipoprotein (HDL) level.

Examples: atorvastatin calcium (Lipitor); simvastatin (Zocor); ezetimibe (Vytorin or Zetia); rosuvastatin (Crestor); fenofibrate (Tricor).

Primary use: Manage high blood cholesterol.

General side effects: GI discomfort, muscle pain and weakness, liver complications.

Miotics

Action: Cause the pupil to contract.

Examples: carbachol (Isopto Carbachol); isoflurophate (Floropryl); pilocarpine (Isopto Carpine).

Primary use: Counteract pupil dilation.

General side effects: Corneal edema, clouding, stinging, tearing, headache.

Mydriatic Agents (Anticholinergic)

Action: Dilate the pupil.

Examples: atropine sulfate (Isopto Atropine).

Primary use: Ophthalmologic examinations.

General side effects: Stinging, burning, photosensitivity.

Narcotics

Action: Depress the CNS, causing insensibility or stupor.

Examples: Natural narcotics: opium group (codeine phosphate, morphine sulfate). Synthetic narcotics: meperidine (Demerol), methadone (Dolophine), and propoxyphene HCl (Darvon).

Primary use: Relieve pain.

General side effects: Suppression of vital signs, agitation, blurred vision, confusion, constipation, oversedation, restlessness.

Oral Hypoglycemic Agents

Action: Reduce blood glucose level by increasing insulin production and/or reducing target cell resistance to insulin, or by delaying glucose absorption.

Examples: Pioglitazone (Actos); rosiglitazone (Avandia); metformin HCl (Glucophage); acarbose (Precose); chlorpropamide (Diabinese); glimepiride (Amaryll); glipizide (Glucotrol); glyburide (Micronase).

Primary use: Manage diabetes mellitus type 2.

General side effects: GI irritation, fatigue, hypoglycemia and vertigo; possibly hypersensitivity reactions.

Osteoporosis Agents

Actions: Inhibit bone reabsorption and/or promote use of calcium.

Examples: alendronate (Fosamax); risedronate (Actonel); calcitonin (Miacalcin nasal spray and Calcimar).

Primary use: Promote bone mineral density and reverse progression of osteoporosis.

General side effects: GI disorders, esophageal irritation.
HERBAL AND ALTERNATIVE THERAPIES

The use of alternative therapies, often called either complementary or holistic medicine, has become very popular in the United States. According to estimates, more than 42% of adult patients use some form of alternative therapy, such as herbal medicine, acupuncture, massage therapy, chiropractic care, or mind-body therapies. Even though only limited scientific studies prove the effectiveness of herbs, their use to relieve the symptoms of common patient complaints are definitely on the rise. It is estimated that 15 million adults take prescription drugs along with herbal and vitamin supplements. Patients typically are hesitant to discuss their use of herbal products with their physician, which makes it difficult for physicians to assess potential drug-herb interactions. Therefore, it is important that medical assistants become familiar with common alternative therapies and that they include questions about the use of these therapies when gathering information about the patient’s medication history.

Herbal Products

Regulation of Herbal Products

Herbal medicine uses plant-based products to promote health and treat the symptoms of a wide range of diseases. These remedies typically are marketed by manufacturers and regulated by the federal government as dietary supplements. The FDA is responsible for regulating dietary supplements under the Dietary Supplement Health and Education Act of 1994 (DSHEA). Under DSHEA, manufacturers are responsible for performing tests and securing the safety of dietary supplements before they are sold. However, these products are not registered with the FDA and do not have to go through the rigorous process of FDA approval that new drugs face before they are produced and sold. In addition, there is no federal control over the standardization of herbal dietary supplements. Pharmaceutical companies must prove that each batch of a drug is standardized or consistent with previous batches. Because this is not the case with dietary supplements, there are no guarantees that the amount of active ingredient in an herbal supplement remains the same over time or is similar to the amounts found in the same supplement produced by a different company.

This lack of government oversight recently was addressed by Congress, and new regulations are being implemented that give the FDA the authority to oversee the manufacture of domestically made and foreign made supplements. By June, 2010, all supplement manufacturers must provide evidence that their products actually contain what the labels claim and that the products are free of contaminants.

According to current FDA regulations, dietary supplement labels must list the following:

- The product name with the word “supplement” on the label.
- The name and location of the manufacturer or distributor.
- A structure/function claim: Claims of specific benefits may be made, but the following statement must be included: This statement has not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease.
- The directions for use.
- For plant-based herbal preparations, the name of the plant or the part of the plant used.
- For blended products created by the manufacturer, the components and weight of each ingredient.
- All nondietary ingredients (e.g., fillers, artificial colors, sweeteners, flavors) listed in descending order of weight.
- The label may include warnings about use, but the lack of cautionary statements does not mean that no adverse effects are associated with the supplement.

Commonly Used Herbal Products

Table 33-7 summarizes the most commonly used herbal products. Information about herbal remedies is constantly changing, but the federal government has several Web sites that can be used as references. These include the National Center for Complementary and Alternative Medicine (http://nccam.nih.gov/) and the National Institutes of Health Office of Dietary Supplements (http://ods.od.nih.gov/index.aspx).

Alternative Therapies

Acupuncture

Acupuncture treatments are part of traditional Chinese medicine, which is based on the concept that disease is caused by a disruption in the flow of life force and an imbalance between yin and yang. Acupuncture treatments use thin metal needles inserted through the skin to stimulate specific points in the body to restore and maintain health. Studies indicate that acupuncture may help reduce pain and relieve the nausea associated with chemotherapy treatments. Therapy involves a series of treatments with the placement of as many as 12 needles in various locations on the body.

During the procedure, the patient is placed either supine, prone, or in Sims’ position, depending on the needle insertion site. Although the procedure is not painful, the patient may notice a sharp sensation when the needles initially are placed. After the needles have been in place for a time, they may be rotated gently, heated, or electrically stimulated to achieve the benefit sought by the treatment. The needles usually are left in place for 5 to 20 minutes, and after they have been removed, the practitioner typically discusses the results of treatment with the patient.

Chiropractic Care

Chiropractic practitioners apply techniques that focus on the body’s physical structure (usually the spine) and perform manipulations or anatomic adjustments to correct alignment problems and help the body heal itself. Many patients combine chiropractic therapy with conventional medical treatment to obtain relief of chronic pain in the lower back and neck and to relieve persistent headaches. Chiropractors must earn a Doctor of Chiropractic degree at an accredited college and pass a state licensing examination before they can practice. Besides spinal adjustments, patient treatment plans may include a combination of hot and
### TABLE 33-7 Commonly Used Herbal Products

<table>
<thead>
<tr>
<th>NAME</th>
<th>USE</th>
<th>SIDE EFFECTS AND CAUTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black cohosh</td>
<td>Relieve symptoms of menopause; treat menstrual irregularities and premenstrual syndrome; induce labor</td>
<td>Headaches, gastric complaints, heaviness in the legs, weight problems; safety unknown for pregnant women or those with breast cancer.</td>
</tr>
<tr>
<td>Echinacea</td>
<td>Treat or prevent colds, flu, and other infections; believed to stimulate the immune system</td>
<td>Most studies indicate it does not appear to prevent colds or other infections; some people experience allergic reactions, including rashes, increased asthma, and anaphylaxis; gastrointestinal side (GI) effects.</td>
</tr>
<tr>
<td>Flaxseed</td>
<td>Laxative; treat hot flashes and breast pain; flaxseed oil used to treat arthritis; both flaxseed and flaxseed oil used to treat high cholesterol levels and prevent cancer</td>
<td>Few reported side effects; contains soluble fiber, like that found in oat bran, and is an effective laxative; should be taken with plenty of water; may diminish body’s ability to absorb medications taken by mouth; should not be taken at same time as oral medications.</td>
</tr>
<tr>
<td>Garlic</td>
<td>Treat high cholesterol, heart disease, hypertension; prevent certain types of cancer, including stomach and colon cancer</td>
<td>Some evidence indicates garlic can slightly lower blood cholesterol levels and may slow development of atherosclerosis. Side effects include breath and body odor, heartburn, GI upset, and allergic reactions. Acts as a mild anticoagulant (similar to aspirin); may be a problem during or after surgery; avoid dietary and supplemental garlic for at least 1 week before surgery. Interferes with effectiveness of saquinavir, a drug used to treat infections with the human immunodeficiency virus (HIV).</td>
</tr>
<tr>
<td>Ginger</td>
<td>Treat stomach aches, nausea, diarrhea; ginger extract a component of many cold and flu dietary supplements; used to alleviate nausea associated with postoperative state, motion sickness, chemotherapy, and pregnancy; used for rheumatoid arthritis, osteoarthritis, and joint and muscle pain</td>
<td>Short-term use can safely relieve pregnancy-related nausea and vomiting. Side effects most often reported are gas, bloating, heartburn, and nausea.</td>
</tr>
<tr>
<td>Asian ginseng</td>
<td>Support overall health and boost immune system; improve mental and physical performance; treat erectile dysfunction, hepatitis C, and menopause symptoms; lower blood glucose and control blood pressure</td>
<td>Some studies show it may lower blood glucose and possibly boost immune function. When taken by mouth, ginseng usually is well tolerated; most common side effects are headaches; sleep disorders; GI problems; possible allergic reactions. Diabetics using medications for treatment should use ginseng with caution.</td>
</tr>
<tr>
<td>Ginkgo biloba</td>
<td>Treat a variety of conditions including asthma, bronchitis, fatigue, and tinnitus (ringing or roaring sounds in the ears); typically used to improve memory; treat or help prevent Alzheimer’s disease and other types of dementia; decrease intermittent claudication (leg pain caused by narrowing arteries); treat sexual dysfunction and multiple sclerosis</td>
<td>Some studies show helps in Alzheimer’s disease, dementia, and intermittent claudication. Side effects may include headache, nausea, GI upset, diarrhea, dizziness, or allergic skin reactions; severe allergic reactions occasionally are reported; can increase bleeding risk, so people who take anticoagulant drugs, have bleeding disorders, or have scheduled surgery or dental procedures should use caution. Uncooked ginkgo seeds contain a toxic chemical that can cause seizures.</td>
</tr>
<tr>
<td>Glucosamine plus chondroitin sulfate</td>
<td>Natural substances found in and around the cells of cartilage; used to treat arthritis/joint pain</td>
<td>Recent study shows participants with moderate to severe pain had significant relief with the combined supplement. Most common side effect is GI upset.</td>
</tr>
<tr>
<td>Melatonin</td>
<td>Treatment of sleep disorders</td>
<td>May help individuals with normal sleep patterns but has limited or no effect on those with sleep disorders. Most common side effects are nausea and drowsiness.</td>
</tr>
</tbody>
</table>
TABLE 33-7 Commonly Used Herbal Products—cont’d

<table>
<thead>
<tr>
<th>NAME</th>
<th>USE</th>
<th>SIDE EFFECTS AND CAUTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saw palmetto</td>
<td>Primarily used to treat urinary symptoms associated with an enlarged prostate gland; also used for chronic pelvic pain, bladder disorders, reduced sex drive, hair loss, and hormone imbalances</td>
<td>Studies suggest it may be effective for treating prostate symptoms, but no evidence indicates that it reduces the size of an enlarged prostate; does not appear to affect readings of prostate-specific antigen (PSA) level, which is used as screening tool for cancer of the prostate. May cause mild GI upset and tender breasts and decline in sexual desire in male patients.</td>
</tr>
<tr>
<td>St. John’s wort</td>
<td>Traditionally used to treat mental disorders and nerve pain; may be used as a sedative; treatment for malaria; balm for wounds, burns, and insect bites; currently used for depression, anxiety, and/or sleep disorders</td>
<td>Some scientific evidence shows it helps treat mild to moderate depression; not effective in treating major depression. Side effects include photophobia (increased sensitivity to sunlight), anxiety, dry mouth, dizziness, GI symptoms, fatigue, headache, or sexual dysfunction. Affects way the body processes or breaks down many drugs; may speed or slow a drug’s metabolism. When combined with certain antidepressants, it may increase side effects such as nausea, anxiety, headache, and confusion. Drugs that can be affected include: Antidepressants Birth control pills Cyclosporine (prevents rejection of transplants) Digoxin (strengthens myocardial contractions) Indinavir and possibly other drugs used for HIV Imatinib and possibly other drugs used to treat cancer Warfarin and related anticoagulants St. John’s wort is not a proven therapy for depression. If depression is not adequately treated, it can become severe.</td>
</tr>
</tbody>
</table>


cold therapies; electrical stimulation; rest and rehabilitation exercises; dietary and lifestyle counseling; and the use of dietary supplements.

Mind-Body Therapy
Mind-body therapy uses biofeedback to teach patients to use their thoughts to control certain body reactions. It is based on the scientific principle that our thoughts can influence the body’s involuntary functions. For example, a child experiencing the sudden onset of an asthma attack may become extremely anxious because he or she is having serious difficulty breathing. Panic and anxiety increase the urgency to breathe. If the child can be taught to relax and keep breathing at a normal rate, the asthma attack will not be influenced by the child’s anxiety, and medications taken to relieve bronchospasm will be more effective.

Biofeedback specialists use special monitoring equipment to demonstrate the body’s reaction to certain stimuli and to help teach patients how to control physical responses to stress. During a biofeedback session, the practitioner applies electrical sensors to various locations on the body. The sensors monitor and provide feedback about the body’s physiologic responses to stress. For example, if a patient is experiencing chronic tension headaches, the sensors demonstrate that the headache is just part of overall muscular tension. Tension that is registering throughout the body causes either a beeping sound or lights flashing from the equipment as a cue for the patient to associate muscular tension with the development of the headache. The goal is to help patients recognize that one body action results in another. Once this goal has been achieved, patients are taught relaxation techniques designed to prevent the stressful response. Biofeedback methods are effective in managing multiple stress-related conditions, including muscle tension, headaches, chronic low back pain, altered heart rates, and hypertension.

## CLOSING COMMENTS

### Patient Education

It is important for the patient to be aware of the effects a drug may have and should have on his or her system. The medical assistant plays an important role in helping patients understand their medications, promoting compliance with treatment, and preventing complications. The following should be considered when interviewing a patient and documenting in the patient’s chart:

- Make a comprehensive list of all medications, including OTC agents and alternative therapies that the patient takes regularly.
• Ask the patient whether she is pregnant or breastfeeding.
• Prescreen the patient for any adverse effects, such as drug allergies and drug-to-drug or drug-to-food interactions.
• Observe the patient for any adverse effects for a minimum of 20 minutes after administration of a medication in the office; also, inform the patient of possible adverse reactions to the medication that may occur at home.
• Discuss with the patient how and when the prescribed drug is to be taken and whether any special storage precautions are required.
• Reassess that the patient is taking the medication properly.
• Provide comfort, encouragement, and guidance to patients to ensure their understanding, safety, and cooperation while on drug therapy.
• Answer any questions asked. Remember: If you are not sure of the answer, consult the prescribing physician.

Therapeutic Communication with Patients from Diverse Cultures
Health beliefs can affect compliance with medication therapy. Patients from various cultures may be using home remedies or herbal treatments that could interfere with the effectiveness and safety of medications prescribed by the physician. Guidelines that the medical assistant may find helpful include the following:
• Investigate the healing practices of the primary cultures in your area so that you are better equipped to discuss these practices with your patients.
• Encourage cultural sensitivity in your co-workers.
• Provide patients with educational materials in their native language.
• Ask patients if they are using home remedies or are consulting a healer from their culture. If so, get as much detail as possible so that you can share this information with the physician.

Legal and Ethical Issues
The medical assistant plays a key role in the management of controlled substances in the ambulatory care setting. It is important that all rules for record keeping, inventory, prescribing, dispensing, and documentation of scheduled drugs be followed according to state and federal regulations. The medical assistant may be responsible for requesting the physician’s initial DEA registration and also for continuing certification renewal. The area DEA office can provide instructions for this. Each DEA number is specific to a site, so multiple practice locations require a DEA number for each facility.

Accurate, complete documentation is essential for correct management of patient medications. Each time the patient is prescribed or administered a medication, complete details must be included in the patient’s chart using approved medical terminology and abbreviations. Failure to do this may result in a serious error that could harm the patient and result in litigation.

HIPAA Applications
According to the Health Insurance Portability and Accountability Act (HIPAA), patients have the right to request restrictions on the disclosure of protected health information (PHI) for treatment, payment, and health care operations (TPO). For example, if a patient has a history of substance abuse and this information is not pertinent to current TPO circumstances, the patient can request that this information not be disclosed.

The facility does not have to agree to the patient’s request; however, a process must be established within the practice to review the demand and explain the physician’s decision to the patient. If the physician agrees not to release this information, the specific restriction must be documented in the patient’s chart, and staff members must review and comply with the restrictions each time material is sent out of the facility for TPO purposes.

SUMMARY OF SCENARIO
Kathy has a great deal of responsibility in managing medications in the ambulatory care setting. She must be familiar with and follow DEA regulations governing the management of controlled substances. In addition, she must be able to use drug reference materials; identify the general clinical uses of prescribed drugs and OTC products; understand the parts of a prescription and use accepted medical terms and abbreviations; recognize the significance of patient education in the safe use of OTC drugs; and understand the factors that affect drug action.
SUMMARY OF LEARNING OBJECTIVES

1. Define, spell, and pronounce the terms listed in the vocabulary. Spelling and pronouncing medical terms correctly bolster the medical assistant's credibility. Knowing the definition of these terms promotes confidence in communication with patients and co-workers.

2. Apply critical thinking skills in performing the patient assessment and care. Completing the Critical Thinking Application exercises throughout the chapter can help the student medical assistant become more adept at critical analysis of real-life situations.

3. Distinguish among the government agencies that regulate drugs in the United States. Several federal agencies combine forces to regulate drugs in the United States. The FDA regulates the development and sale of all prescription and OTC drugs; the DEA enforces laws designed to prevent drug abuse and also educates the public about drug abuse prevention; and the FTC regulates OTC advertising.

4. Cite the areas covered in the regulations established by the Drug Enforcement Administration (DEA) for the management of controlled or regulated substances. DEA regulations for the management of controlled substances include specific record-keeping guidelines; physician registration; and the inventory, storage, and disposal of controlled substances.

5. List the DEA regulations for prescription drugs for each of the five schedules of the Controlled Substance Act. Prescriptions written for controlled substances must comply with both state and federal regulations. The prescription must include details about the patient; information about the physician, including the DEA number; and the amount of the drug, written out (“ten” not “10”). The prescription must be manually signed by the physician. Orders for Schedule II drugs cannot be phoned in except in an emergency, and these prescriptions cannot be refilled. Schedule III, IV, and V drugs may be refilled up to five times in a 6-month period. In some states, Schedule V drugs can be dispensed by the pharmacist without a physician's prescription.

6. Explain the medical assistant's role in preventing drug abuse. The medical assistant should keep track of patients who repeatedly call for prescription refills of controlled substances and request their medical records from other physicians when necessary to track the substance abuse history; keep prescription pads in a safe place and not use them for any other purpose; maintain a small supply of controlled substances in the office and accurately record their administration.

7. Differentiate among a drug's chemical, generic, and trade names. The chemical name is the drug's formula. The generic, or official, name is assigned to the drug and may reflect the chemical name. The trade, or brand, name is given to the compound by the pharmaceutical company that developed it and is protected by law for 17 years.

8. Describe the use of drug reference materials. The use of drug reference materials is crucial for the safe administration of medications. Most drug reference books include the action, indication, contraindications, precautions, adverse reactions, dosage, administration guidelines, and method of packaging. The most frequently used drug reference guide is the Physicians' Desk Reference (PDR), but package inserts also can be used.

9. Summarize the clinical uses of drugs. Clinically, drugs are used as therapeutics, or curative, medications; palliative medications, to relieve symptoms; prophylactic medications, to prevent the occurrence of a condition; diagnostic medications, to help determine the cause of a disease; and replacement medications, to provide substances that normally occur in the body.

10. Cite safety measures for the use of OTC drugs. OTC drugs may interfere or interact with prescription drugs. Some safety measures for the use of OTC drugs include carefully reading directions, taking only the recommended dose, discarding the drug when it expires, informing the physician of OTC drug use, and being aware of contraindications to OTC drug use in certain conditions.

11. Diagram the parts of a prescription. The parts of a prescription are the superscription, inscription, subscription, signature, refill information, and physician's signature. A prescription also must provide the patient's name and address and the date the drug is prescribed.

12. Demonstrate the ability to transcribe a prescription accurately. Procedure 33-1 outlines the method for transcribing a prescription for the physician's signature. It is important that the medical assistant follow a written order; look up the information about the medication in a drug reference text; ask the patient about drug allergies and record the patient's personal information on the prescription note; and correctly write the name of the drug, form, dosage, strength, route of administration, amount of the drug to be given to the patient, specifics about time of administration if appropriate, and the number of refills. The prescription should be reviewed and signed by the physician before it is given to the patient.

13. Relate the principles of pharmacokinetics to drug use. Pharmacokinetics comprises the actions of absorption, which depends on the route of administration (oral, parenteral, mucous membrane, or topical); distribution through the bloodstream; metabolism in the liver; and excretion, primarily by the kidneys.

14. Describe factors that affect the action of a drug. Multiple factors affect drug action, including weight, age, gender, diurnal rhythms, pathologic factors, immune responses, psychological factors, tolerance, accumulation, idiosyncrasy, and drug-to-drug interactions.

15. Compare the therapeutic classifications of medications. Drugs are classified into groups according to their actions in the body, by the symptoms they relieve, or according to the body system that they affect. Drugs may have multiple actions and therefore multiple classifications.

16. Differentiate among commonly used herbal remedies and alternative therapies. Table 33-7 summarizes common herbal remedies, their uses, and possible side effects. Acupuncture treatments use thin metal needles inserted
SUMMARY OF LEARNING OBJECTIVES—cont’d

through the skin to stimulate specific points in the body to restore and maintain health. Chiropractic practitioners perform manipulations or anatomical adjustments to correct alignment problems and help the body heal itself. Mind-body therapy uses biofeedback to teach the patient to use their thoughts to control certain body reactions.

17. Examine the role of the medical assistant in drug therapy education.
The medical assistant plays an important role in helping patients understand their medications, promoting compliance with treatment, and preventing complications. Conducting comprehensive interviews that ask detailed questions about patient use of drugs and documenting this information on the chart provide vital information for the physician. Culturally sensitive interviews with patients help gather details about home remedies and patient belief systems that may affect compliance with drug therapy.

18. Identify the medical assistant’s legal responsibilities in medication management in an ambulatory care setting.
The medical assistant’s legal responsibilities in medication management include compliance with DEA regulations for controlled substances; maintaining complete and accurate documentation on all medications administered and prescribed for each patient; and following HIPAA regulations on the release of confidential information.

CONNECTIONS

Study Guide Connection: Go to the Chapter 33 Study Guide. Read and complete the activities.

Evolve Connection: Go to the Chapter 33 link at evolve.elsevier.com to complete the Chapter Review and Chapter Quiz. Peruse other resources listed for this chapter to increase your knowledge of Principles of Pharmacology.