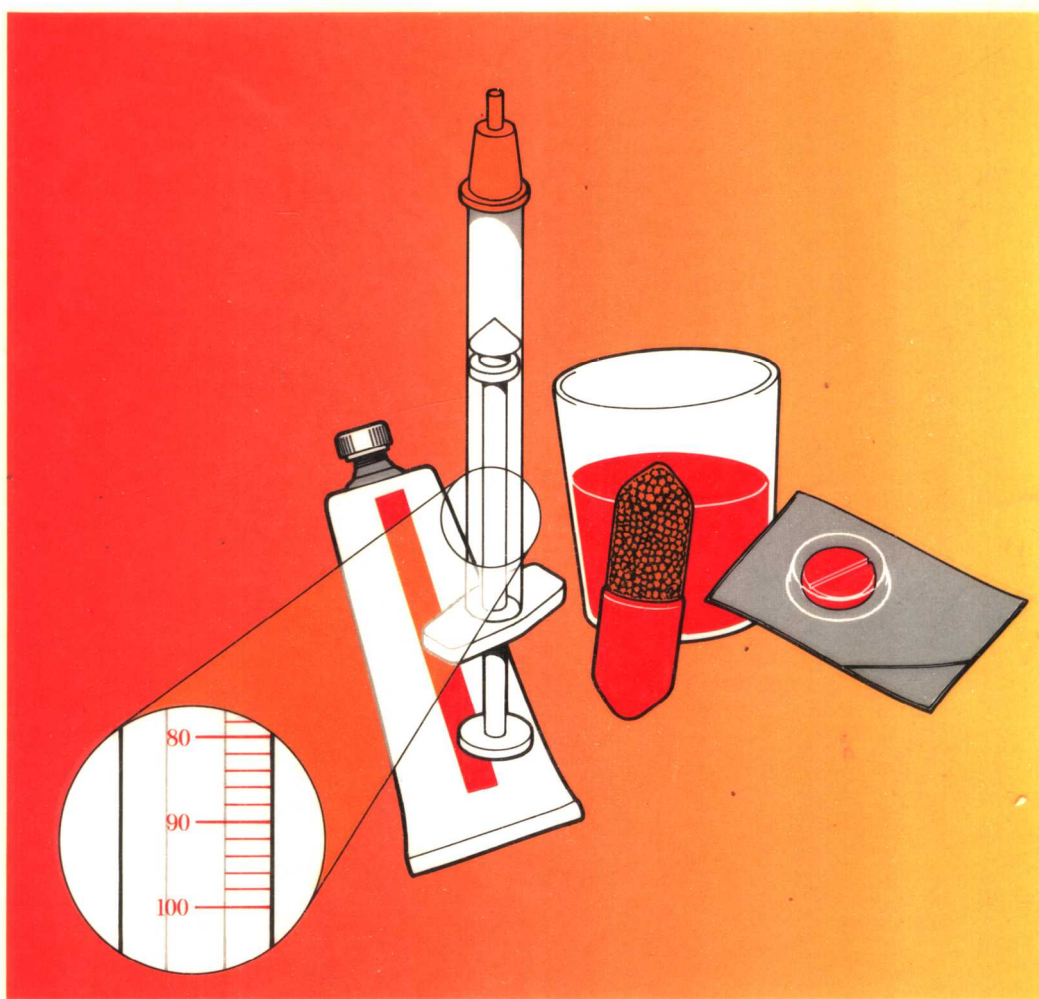


# INTRODUCTION TO CLINICAL PHARMACOLOGY



Marilyn W. Edmunds

---

# INTRODUCTION TO CLINICAL PHARMACOLOGY

**Marilyn W. Edmunds, R.N., Ph.D.**  
Nursing Consultant in Pharmacology  
Baltimore, Maryland

**With 99 illustrations**

 **Mosby  
Year Book**

St. Louis Baltimore Boston Chicago London Philadelphia Sydney Toronto



Executive Editor: Don Ladig  
Developmental Editor: Robin Carter  
Project Manager: Mark Spann  
Production Editor: Mary Stueck  
Book Designer: Candace Conner  
Cover Design: David Zielinski  
Illustrations and Cover Art: Mark Swindle

The author and publisher have made every attempt to check dosages and nursing content for accuracy. Because the science of pharmacology is continually advancing, our knowledge base continues to expand. We therefore recommend that the reader always check product information for changes in dosage or administration before administering any medication. This is particularly important with new or rarely used drugs.

**Copyright © 1991 by Mosby-Year Book, Inc.**  
A Mosby imprint of Mosby-Year Book, Inc.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means electronic, mechanical, photocopied, recorded, or otherwise, without prior written permission from the publisher.

Printed in the United States of America  
Mosby-Year Book  
11830 Westline Industrial Drive  
St. Louis, Mo 63146

#### **Library of Congress Cataloging-in-Publication Data**

Edmunds, Marilyn W.

Introduction to clinical pharmacology / Marilyn W. Edmunds.

p. cm.

Includes bibliographical references.

Includes index.

ISBN 0-8016-1487-2

1. Clinical pharmacology. 2. Nursing. I. Title

[DNL.M: 1. Drug Therapy—nurses' instruction. 2. Drugs—administration & dosage—nurses' instruction. 3. Pharmacology. Clinical—nurses' instruction. QV 38 E24i]

RM301.28.E33 1991

615.5'8—dc20

---

# Preface

---

*Introduction to Clinical Pharmacology* is a basic guide for nursing students beginning the study of pharmacology. This book is the result of countless suggestions from educators in a variety of nursing programs. Each of their generous comments was taken into account in planning and writing this text. Deciding which information to include and—perhaps more important—which information *not* to include was first and foremost in mind throughout its preparation. Of equal importance was making the content as clear and understandable as possible for today's nursing student. The goals of *Introduction to Clinical Pharmacology* include the following:

- To focus on only the essential information that the nurse needs to know for safe administration of drugs.
- To present the material clearly and understandably.
- To feature a comprehensive unit on mathematics and calculations to enable students to review the mathematic skills required for medication administration.
- To use a consistent, practical format and extensive illustrations to help students develop a logical thinking process in the administration of drugs.
- To provide learning aids that help the student identify and learn what he or she needs to know.
- To use color to clarify concepts introduced in illustrations, mathematics, and conversions and to highlight what is most important for the student.
- To provide a comprehensive and useful Instructor's Resource Manual that helps the instructor teach pharmacology.

---

## Organization

---

Pharmacology is a science: there are both right answers and wrong answers. Accuracy and precision are extremely important. In fact, nurses are legally responsible and accountable for how they administer medications. The science of medication administration for nurses is outlined in **Unit One: General Principles**. This unit stresses the nursing process, the importance of working with patients to assess medication needs and actions, and the differences among many types of medications; it also discusses establishing patient trust, teaching the patient or family about the medication and how to take it appropriately, and evaluating patient responses to medications. **Unit Two: Mathematics and Calculations** also emphasizes precision—the precision required in dosage calculations. This unit includes review chapters on mathematic principles, equivalents, and drug dosage calculations. **Unit Three: Drug Groups** briefly outlines essential information on 12 specific groups of medications.

*Introduction to Clinical Pharmacology* uses a **consistent, practical format** to help the student develop logical thinking skills in preparing and administering medications. Drugs are grouped by their therapeutic class within body system chapters, allowing students to learn quickly by making generalizations about similar drugs in a class. Each **drug class** is presented in a consistent format: its action, uses, adverse reactions, drug interactions, and a highlighted section "What the Nurse and Patient Need to Know." Content in this especially pertinent section is consistently divided into a **functional nursing process format**: assessment, planning, implementation, evaluation,

and patient and family teaching. Headings throughout are bold so the student can find specific information easily and so that the organizing framework, which represents a useful, clinical approach to pharmacology, is reinforced by frequent repetition of these key headings.

---

## Student and Faculty Input

---

As mentioned previously, our *focus* is on only the most essential information that nurses need to know. We have solicited input from experienced faculty members who, in addition to providing their input in the planning of this book, reviewed selected chapters to ensure that the content is relevant, accurate, and current. We carried this one step further, having students class-test selected chapters, asking for their input, and incorporating their suggestions on the following:

- Usefulness of chapter objectives
- Clarity of writing
- Amount of detail
- Helpfulness of illustrations
- General reaction to the readability of the material, including whether it was enjoyable and instructive

In many cases, the input from students was positive and gratifying. The input from students and faculty members was also invaluable for improving the readability and limiting the content throughout the book to only the most essential information.

In talking to faculty members and sending chapters out for review, we learned the importance of differentiating between what the student must learn from reading a pharmacology text and what kind of material to include strictly for reference. Because educators continually stressed the nursing students' need for both in a pharmacology textbook, we decided to give the book a unique format that would meet both of these needs: **narrative content** deals exclusively with major drug groups, whereas all the information related to specific drugs appears in **reference tables**. Using this approach, the student is not overwhelmed with extensive reading material but, at the same time, has ready access to generic names, trade names, forms, and dosages for individual drugs. We have marked trade name drugs available only in Canada with a ♦ for Canadian educators and students.

---

## Readability

---

In discussing this book with those who regularly teach nursing students, it became clear that pharmacology is a subject that is difficult to teach and to learn. We have made this text as *clear and readable* as possible to facilitate the instruction of pharmacology. Because of a combination of many factors, many of today's students are not as well prepared as instructors would desire. Students from a variety of backgrounds add a welcome diversity to an educational program and, with it, a host of challenges in identifying and meeting the needs of today's student. We have used shorter sentences, simpler terminology, and shorter paragraphs to make the book less intimidating and more engaging to students.

---

## Mathematics Review

---

A **comprehensive unit on mathematics and calculations** has been included to allow students to review the mathematic concepts necessary for understanding pharmacology. The content was also limited to what is most essential; numerous equivalencies and other mathematic reference features are included for student review or reference. Another feature of the mathematics unit is the use of **key task** or **reminder boxes** that break up the text and remind the student of basic mathematic principles or reinforce what has just been learned. This feature was included because of the difficulty many students have in learning and retaining basic mathematic skills. Color has been used specifically in these chapters to clarify and convey problem-solving concepts.

**Numerous sample problems**, which are solved in a logical step-by-step approach, provide students with concrete examples of how to work problems, in addition to giving them a systematic approach to solving the problems. Expanded problems for students to solve are included on **reproducible worksheets** and **quizzes** included in the Instructor's Resource Manual. These additional mathematic review tools can be used in a variety of ways: to assess students' current mathematic skills and abilities, to enable students to review mathematics at their own pace, and to test students in the classroom. A complete list of worksheets, quizzes, and tests is included in the front of the Instructor's Resource Manual for the educator's reference and class planning.

---

## Illustrations

---

Over 70 two-color illustrations have been created specifically for this book. In discussing which concepts to illustrate, students reminded us that “a picture is worth a thousand words,” especially when it relates to safe drug administration. We have included extensive illustrations of medication administration techniques; equipment; various forms and preparations; and sample forms relating to documentation, charting, or drug administration. The illustrations are clear, simple, and also attractive, and—perhaps most important—they employ color and various screens in a fresh and interesting way. Students who class-tested portions of the book consistently rated the illustrations as outstanding.

---

## Pedagogy

---

In addition to making the book readable, consistently and logically organized, and well illustrated, we have included numerous pedagogical features to further enhance learning. These include unit objectives and overviews, chapter objectives and overviews, key terms printed in color where they are first introduced and defined, chapter summaries, and an alphabetical listing of the color key terms with page cross references at the end of each chapter. Each of these features has been built-in to help the student identify and learn what is important. We believe that each of these features will make the student’s learning experience and the instructor’s teaching experience as positive as possible.

---

## Instructor’s Resource Manual

---

Our Instructor’s Resource Manual is unique to the teaching of pharmacology. It includes unit objectives and overviews, chapter objectives and overviews, a list of key terms introduced and explained in each chapter, a chapter outline with related lecture content and reference material from the text, role plays, resources, and reproducible practice worksheets and quizzes. There are 83 worksheets and 11 quizzes in all. Also included in the Instructor’s Resource Manual are 24

illustrations from the text that have been enlarged for conversion to transparency masters.

---

## Conclusion

---

Nothing teaches the nurse more about pharmacology than actually giving medications to a patient. To develop mastery of this content, the nursing student should approach each encounter with a patient as an opportunity to learn. The nurse should accept it as a personal challenge to learn about each medication ordered for a patient under his or her care and to understand why the medication is given in that particular situation. Completing medication cards and personalizing the information to a specific patient are invaluable experiences in learning about medications. Because pharmacology is a rapidly changing and dynamic field, it is recommended that the student be exposed early on to supplemental drug information, such as package inserts or current drug handbooks. The student should be encouraged to develop the habit of seeking up-to-date and timely information to supplement this book and to provide specific details that cannot be covered in a textbook.

In working with patients, the nursing student will quickly learn that medication administration is one of the most challenging components of the nursing role. A nurse who develops the knowledge and skills needed to competently administer medications is highly visible and will gain the respect of both patients and colleagues in the health care system. Both the responsibilities and the personal rewards are great. The author and publisher sincerely hope this book helps the student to gain both. We welcome your suggestions or comments on *Introduction to Clinical Pharmacology* so that we may continue to provide a clear and useful exposition of introductory pharmacology in future editions.

---

## Acknowledgments

---

Writing a pharmacology text is like running a race that never ends. There are always new drugs arriving on the market and new information available about old products. The available information is endless, and it is a real challenge to try to acquire enough knowledge to be a safe practitioner.

I wish to acknowledge my personal stimulation from the many students who have asked challenging questions throughout my years as a teacher, the support of my professional colleagues, and the opportunity provided by Don Ladig from Mosby-Year Book to present this material. I am especially grateful for the help of Robin Carter, who is a talented Developmental Editor, as well as a gracious and caring person, and whose special efforts helped this book through a trying time. I also appreciate the skill of Mary Stueck, Senior Production Editor, whose careful editing greatly improved the accuracy and style of this manuscript. I am grateful to Mark Swindle for his highly original illustrations, including the cover illustration, and to designer Dave Zielinski. I would also like to thank Sheila Rankin Zerr, R.N., M.Ed., Visiting Assistant Professor at the University of Victoria, British Columbia, for her careful research on Canadian drug legislation and trade names. As always, I owe a special debt of gratitude to my family, who are so important in my life and who support me in all the things in which I get involved.



*Marilyn Edmunds*

---

# Consultants

---

**Julie Buntjer, R.N., A.D.N**

Willmar Technical College  
Willmar, Minnesota

**Lola Cress, R.N., M.Ed.**

Lawrence County Vocational School  
Chesapeake, Ohio

**Wanda Huffman, R.N., B.S.N.**

Lawrence County Vocational School  
Chesapeake, Ohio

**Shirley P. Jones, R.N., B.S.**

Isabella Graham Hart School of Practical Nursing  
Rochester, New York

**Linda North, R.N., M.S.N.**

Reid State Technical College  
Evergreen, Alabama

**Patricia B. Simmons, R.N., M.S.N**

Reid State Technical College  
Evergreen, Alabama

**Marilyn Fuqua Thompson, R.N., M.S.**

Lake Land College  
Mattoon, Illinois

**Richard E. Watters, R.N., B.Sc., B.Ed.**

Nursing Consultant  
Ottawa, Ontario

The author and publisher are especially grateful to the Fall 1989 practical nursing students at Willmar Technical College, Willmar, Minnesota, for their willingness to class-test portions of the manuscript and their many helpful comments.



---

# Contents

---

## Unit One

### General Principles

---

1. The Nursing Process, 2
2. Legal Aspects Affecting the Administration of Medications, 10
3. Basic Concepts of Pharmacology, 30
4. Preparing and Administering Medications, 38

## Unit Two

### Mathematics and Calculations

---

5. Review of Mathematical Principles, 86
6. Mathematical Equivalents Used in Pharmacology, 94
7. Calculating Drug Dosages, 100

## Unit Three

### Drug Groups

---

8. Allergy and Respiratory Medications, 112
9. Antiinfective Medications, 134
10. Antineoplastic Agents, 170
11. Cardiovascular Medications, 176
12. Central Nervous System Medications, 214
13. Gastrointestinal Medications, 272
14. Hematologic Products, 294
15. Hormones and Steroids, 302
16. Immunologic Agents, 334
17. Musculoskeletal and Antiarthritis Medications, 340
18. Topical Preparations, 360
19. Vitamins, Minerals, and Electrolytes, 372
- Bibliography, 391

---

# Unit One

## General Principles

### OBJECTIVES

---

At the conclusion of this unit you should be able to:

1. Discuss the steps of the nursing process and how they are used in the administration of medications.
2. List the federal, state, and institutional regulations or policies that affect the nurse who administers medications.
3. Use basic terminology to describe the absorption, distribution, metabolism, and excretion of medications.
4. Evaluate whether responses to medications are therapeutic or nontherapeutic.
5. Describe the procedures for administration of enteral, parenteral, and percutaneous medications.
6. Outline the nurse's responsibility in giving medications.

### OVERVIEW

---

The first four chapters of this book describe the basic nursing actions that will be used in the text. Chapter 1 explores the nursing process and shows how assessment, planning, implementation, and evaluation are used in administering medications. The goal is to give the nurse a clear idea of the special responsibility involved in giving medications.

Chapter 2 focuses on the legal rules and the basic federal laws that have shaped federal policy about drugs. A clear picture of how the federal regulations differ from other regulations is presented. State Nurse Practice Acts are discussed in detail, since they specify who has the authority to administer medications and how that authority must be obtained. Other state and institutional policies are discussed, relating to legal medication orders, ordering medications, and the use and supervision of controlled substances.

Chapter 3 discusses how drugs are used for medicinal purposes. The basic processes that all medications go through in the body are described, as well as the variables that affect the drug's action in the body.

Chapter 4 introduces information that applies to the following chapters. It covers the specific procedures for administering medications. The focus is on accuracy, accepting nursing responsibility, and maintaining asepsis as medications are given enterally (orally, nasogastrically, or rectally), parenterally (intradermally, subcutaneously, intramuscularly, or intravenously) or percutaneously (by application to the skin surface or through mucous membranes).

---

# The Nursing Process

---

## OBJECTIVES

---

At the conclusion of the chapter you should be able to:

1. List the four steps of the nursing process.
2. Discuss how the nursing process is used in administering medications.
3. Identify subjective and objective data.
4. List specific nursing activities related to planning, implementing, and evaluating the patient's response to medications.

---

## Steps of the Nursing Process

---

Nursing actions are specific and deliberate, and are not performed in a random manner. A plan that organizes and coordinates the nurse's activities has developed over the years and is known as the **nursing process**. The nursing process consists of the following four major parts:

1. Assessment
2. Planning
3. Implementation
4. Evaluation

All of these steps are followed when giving medications to patients. The nursing process is illustrated in Fig. 1-1.

## ASSESSMENT

**Assessment** is a process that gathers information about the patient, the problem, and any factors that may influence the drug to be given. This step of the nursing process is especially important because it provides the beginning information, or **data base**, from which all other nursing process decisions will be made.

Assessment involves collecting information by taking the patient's history and evaluating the physical findings. When the patient is admitted to the hospital, she or he should be carefully questioned about present problems, past history of illnesses, surgery, and medications, and the response to previous drug therapy. This information is extremely important and helps the health

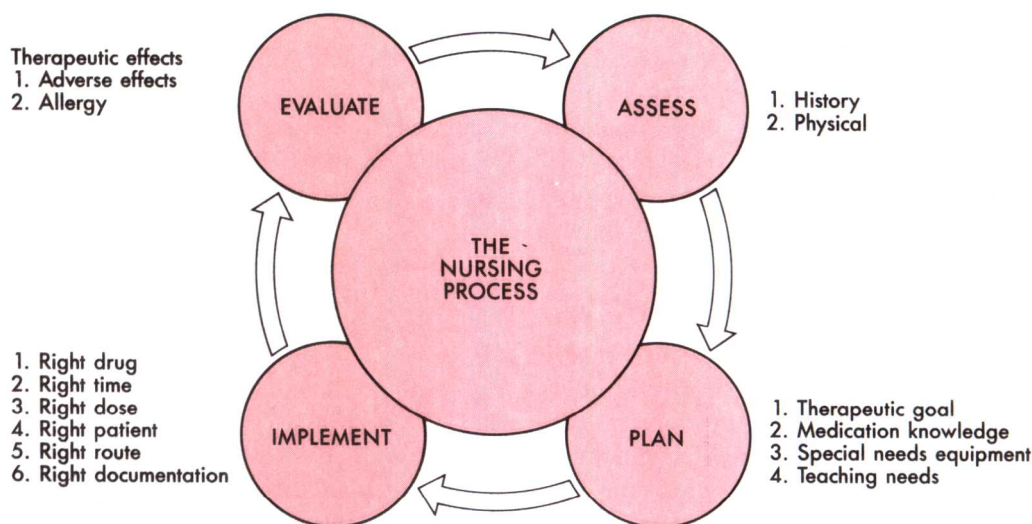


Fig. 1-1 The nursing process.

care team members plan the patient's care. Information provided by the patient's history often directs the nurse and the physician to look for physical signs that may be present.

Information obtained through assessment is classified into two categories: subjective data and objective data. **Subjective data** are supplied by the patient or family, and may be felt or known only to the patient and may not be detected directly by anyone else. Examples of subjective information might include the following:

1. The chief complaint of the patient (in their own words)
2. The detailed history of the course of the present illness
3. Past medical history
4. The family history of diseases
5. Social profile
6. Review of complaints and problems found in different body systems

Some patient complaints are more subjective than others. For example, if a patient complains of pain in the abdomen, the nurse must accept the patient's word that the pain is present. The nurse cannot see, hear, or feel the patient's abdominal pain. A patient may state that they have difficulty breathing. Although the nurse may observe the patient breathing more rapidly, the degree of difficulty experienced by the patient is not obvious. This is the patient's internal feeling; the

nurse cannot actually document this. Information is considered to be subjective if the nurse has no documentation or evidence to support the patient's statement or if the perception cannot be discerned by anyone other than the patient. Information about the patient obtained in the history may be considered subjective until there are medical records or laboratory findings to document the existence of the problem.

**Objective data** are obtained from documentation that the patient may bring with them, such as old electrocardiograms or x-ray scans, or information obtained during the physical examination. Vital signs (respiratory rate, pulse, blood pressure, weight, height, temperature), physical findings discovered during **inspection** (looking closely), **palpation** (feeling), **percussion** (detecting differences in sound produced by vibration), and **auscultation** (listening with the stethoscope), and recent findings from laboratory tests and diagnostic procedures all provide objective evidence.

It is especially important to obtain subjective and objective assessment data when the patient is first examined or on admission to the hospital. This provides initial or baseline information that can be used to determine the severity of the patient's problems. Assessment is performed throughout the course of the disease to determine whether the patient is responding appropriately to the treatment.

The nurse may not always be responsible for collecting the subjective and objective data. However, the nurse is always responsible for learning this information from the chart, the physician, the family, or other health care team members, and using the information to plan nursing care.

### Factors to consider in assessing the patient

Although the information in the patient's history and physical examination helps the nurse understand the patient and plan nursing care, certain information is especially important in planning drug therapy. The nursing assessment at the time of the patient's admission to the hospital should give special attention to the drug history. Information should be obtained from the patient (primary source), but occasionally a patient's relatives, old medical records, ECGs, or laboratory reports may provide the information (secondary sources). Literature about particular diseases, medications, or problems might also provide helpful information (tertiary sources).

When asking about the patient's drug history, the nurse makes assessments in the following areas:

1. Symptoms, signs, or diagnosed diseases that document the patient's need for medication (such as high blood-sugar levels, high blood pressure, or pain).
2. Current (and sometimes past) use of all medications and drugs.
  - a. All prescription medications (patients often forget to mention birth control pills in this category).
  - b. Over-the-counter medications (such as aspirin, vitamins, laxatives, cold and sinus preparations, and antacids).
  - c. Street drugs used for recreational purposes (such as marijuana or cocaine).
3. Any problems with drug therapy.
  - a. Allergies: what is the patient's response to a medicine to which they believe they are allergic? Does it represent a true allergy? An adverse effect? A common side effect?
  - b. Diseases that may contraindicate or limit prescription of some medications (such as sickle cell anemia, G6-PD deficiency, migraine headaches or angina).

Assessment of the individual is not just conducted at the beginning of treatment or hospitalization. Assessment of changes in patient status that may influence drug therapy must be performed constantly during the course of the hospital stay.

**KEY TASK:** Collect information.

### PLANNING

Based on the data collected, goals are established and care plans are developed. Plans have two audiences: the nurse and the patient. Patient goals help the patient learn about the medication and how to use it properly. Nursing goals help the nurse plan what equipment or procedures are needed to give the medication. Using the information about the patient's history, medical and psychosocial problems, risk factors, and severity of problems, both types of plans can be constructed. The patient-oriented care plan should include any medications that will be given on either a short-term or long-term basis. For example, goals may be established for applying ointments or medicated patches, or for demonstrating patient-administered aerosol nebulizer treatments. Nursing goals may include developing the site rotation of injections, or educating the patient about specific side effects of medications that should be anticipated and reported.

### Factors to consider in planning to give a medication

Planning to give a medication involves the following four steps:

1. Determine the therapeutic goal for each medication to be administered (for example, what is this drug to accomplish?)
2. Review specific information about the medication
  - a. Anticipated action of the drug
  - b. Side effects that may develop
  - c. Recommendations for dosage, route, and frequency
  - d. Contraindications to the drug (in what situations the drug must *not* be given)

- e. Drug interactions (what is the influence of another drug given at the same time?)
- 3. Anticipate special storage or administration procedures, techniques, or equipment needs
- 4. Develop a teaching plan for the patient
  - a. What the patient needs to know about the medication's action and side effects
  - b. What the patient needs to know about the administration of the medication
  - c. What the patient needs to report to the nurse or physician about their medication and/or their response

The most important step in planning is to collect and use information about the patient and the medication. This step requires knowledge of drug agents and exercise of professional judgment.

Once the medication is ordered, the nurse must verify the accuracy of the order. This is usually done by comparing the medication card or Kardex order with the physician's original order in the chart. This step must be performed each time the medication is given. In this way, errors caused in recopying the order onto the medication card can be avoided.

The nurse must also compare the information known about the drug and the specific drug order to determine whether the drug and the dosage ordered seem correct. The nurse should also know enough about the patient's problem so that the reason the medication is being given is understood. No part of the order or the reason for giving the medication should be unclear. Any questions about the appropriateness or the safety of the medication for that patient should be answered before the medication is administered. The nurse must use professional judgment in carrying out the medication order. If the nurse decides (1) that any part of the order is incorrect or unclear, (2) the patient's condition would be worsened by the medication, (3) the physician may not have all the information needed about the patient in planning the therapy, or (4) there has been a change in the patient's condition so that the medication should not be given, the medication should be withheld until the physician can be contacted. If the physician cannot be contacted or does not change the order under question, the nurse should notify the head nurse and nursing

supervisor immediately. Most institutions have clear policies about who to contact, how to report this problem, and what to do next.

**KEY TASK:** Clarify and understand each part of the medication order.

The planning phase gives the nurse time to do the following:

1. Obtain any special equipment needed to administer the medication (such as I.V. infusion pumps, TB syringes, or nebulizers)
2. Review administration procedures or techniques (such as Z-track injection technique, IV push policy)
3. Determine in advance what information the patient will need

This information can be recorded on the nursing care plan or in the Kardex file so that other team members are included in the plan.

## IMPLEMENTATION

**Implementation** is the performance of the nursing care plan by administering a helpful medication (therapeutic agent). This phase of the nursing process requires that the nurse understand all of the information about each patient and about the drug ordered as therapy. It is the nurse's responsibility to understand why each medication is ordered, to know detailed information about the drug itself, and to know how to safely administer it. For example, the nurse who adds an antibiotic solution to an intravenous line should have knowledge of the proper equipment, aseptic technique, rate of flow, interactions with the chemicals already in the tubing, and flushing of the line following therapy. Or perhaps the nurse may take the patient's pulse before giving digitalis to determine whether the medication may be given safely.

Implementation also implies that the nurse is aware of any changes in the patient's status that may make it unwise to give the medication. For example, if the patient receiving antibiotics complains of an itchy rash on the chest and arms, the nurse will withhold the antibiotic and notify the patient's physician.

### *The right drug*

Many drug names are complicated and difficult to read. Many drug names are very similar. It is important to carefully check the spelling and concentration of each medication *before* the medication is administered. For example, digitoxin and digoxin are both cardiotonic drugs, but they are quite different in dosage and duration of action. Sometimes confusion arises when a medication is ordered by a trade name, (such as Valium), but the pharmacy may send up a medication with the generic name (diazepam). The nurse must not assume that the correct medication has been sent without checking a reliable book or calling the pharmacy.

The drug may be delivered in a unit dose system, an individually prepared prescription, or the medication may be taken from a unit stock. Regardless of the delivery method, the nurse must read the drug label at least three times:

1. Before removing the drug from the unit dose cart or shelf
2. Before preparing or measuring the prescribed dose of medication
3. Before replacing the medication on the shelf or just before opening the medication at the time of administration

### *The right time*

The drug order should specify when the medication is to be given. Hospitals have policies that determine which hours medications will be given when they are ordered (such as "every four hours" or "qid"). The nurse must be familiar with hospital policy and use only standard abbreviations in administering and recording medication therapy. To be effective, many drugs must be given on a rigid schedule day and night to keep the level of medication constant in the blood. Other medications may be given only during the day.

Medication administration often has to be planned around other patient activities. For example, if a patient is taking an anticoagulant to thin the blood and prolong the clotting time (to decrease the risk of blood clots), the medication must be given at the same time every day and a blood test to monitor the clotting time should also be taken at the same time every day. Patients with infections should have specimens cultured before

starting antibiotic therapy. Patients undergoing evaluation of thyroid function should have blood tests done before having gallbladder x-ray scans, which confuse or make inaccurate thyroid function study results.

Medications are usually given when there is the maximum chance for absorption and the least risk for side effects. This may mean some medications should be given when the patient's stomach is empty; others need to be taken with food. Some medications require that the patient not eat certain foods (for example, Imipramine has special dietary restrictions). Others are incompatible with alcohol (for example, metronidazole [Flagyl] causes severe vomiting if the patient takes any alcohol while taking the drug). When a patient is taking several medications, the patient must be observed for drug interactions. For example, some medications reduce the absorption of birth control pills, thus placing the patient unknowingly at risk for pregnancy.

Finally, one-time only or emergency medications are especially important to check. The nurse must be certain that no one else has already administered the medication and that the appropriate time interval has elapsed for the administration of the drug. Narcotics are often given irregularly as "stat" or "prn" medications. Their administration should be promptly noted on the patient's chart so that it is clear whether or not the patient has been given the medication.

The box below summarizes the important considerations in giving the medication at the right time.

#### **Factors to Consider in Administering Medication at the Right Time**

- Understand and follow the institution's policies regarding designated times for regularly scheduled drugs.
- Follow drug treatment guidelines to maximize drug absorption and reduce chances for drug incompatibilities.
- Give medications as ordered to enhance constant blood levels.
- Coordinate drug therapy with other diagnostic and laboratory testing plans.
- Be especially cautious in giving prn or stat medications to avoid risk of overdosing.

***The right dose***

Medication dosages are usually intended for the “average” patient. A patient who is emaciated (bony and shrunk from severe weight loss as a result of illness), small, or obese may require variation in dosages. Pediatric patients often have dosages based on their body weight. Geriatric or elderly patients may be unusually sensitive to the action of many medications. If they have a co-existing disease or reduced liver or kidney function, this may further complicate the dosage requirements. Patients who are nauseated and vomiting may be unable to take oral medications. Although the physician may order the correct dosage of the medication, changes in the patient’s status may require that the dosage be altered.

Obtaining the correct dosage of a medication also requires that the nurse use the proper equipment (for example, insulin measured in an insulin syringe), the proper drug form (oral or rectal, water or oil base, scored or coated capsules), the proper concentration (0.25 mg or 2.5 mg), and that accurate calculations are used to determine the drug dosage. Most institutions have specific policies that require two nurses to check any medication dosage that must be calculated, particularly medications such as narcotics, heparin, insulin, or intravenous medications.

***The right patient***

Although it seems like common sense to make certain the right patient gets the medication, errors may occur on a busy hospital unit. Four groups of patients are most at risk for error: the pediatric patient, the geriatric patient, the non-English-speaking patient, and the very confused or critically ill patient. The common factor these four groups share is their decreased ability to identify themselves accurately to the nurse. They also may not understand what the nurse is asking or what is being given to them. The identification bracelets on some patients may have been removed for tests or when blood is drawn for testing. Children especially enjoy hiding, changing beds, answering to another name, and so on. Each patient should be asked their name *as the nurse checks their identification bracelet*. Medications should *never* be administered to a patient without an identification bracelet.

***The right route***

The drug order should clearly specify the route of drug administration. One route must never be substituted for another without consulting the physician and having the order changed. There is great variation in the rate of absorption of medications administered by various routes.

The oral route is usually the preferred route of administration if the patient is oriented. In some cases, faster and higher blood concentrations are needed, and the medication may be given intravenously or subcutaneously. There may be special precautions for medications administered through these routes (such as rate of administration or dosage). Some injections should be given subcutaneously rather than intramuscularly. This requires proper technique by the nurse. Some medications are very painful if given intramuscularly, and intravenous administration would be more appropriate.

When breathing nebulizers are ordered, the nurse needs to find out whether the nebulizer is to be used through the nose or the mouth. The nurse must teach the patient the appropriate way to use the nebulizer so that the medication reaches the intended place. The same principle applies to the use of eye drops, ear drops, ointments, lotions, shampoos, and rectal and vaginal medications.

***The right documentation***

A notation of the drug’s administration should be made on the patient’s chart as soon as possible after the drug is given. For emergencies and medications used only occasionally, this is very important. Institutional policy may require that the chart notation of intramuscular medications also include the site of the injection and any complaints made by the patient at the time of administration. The chart notation should identify the drug given, the dosage, and the time it is actually given (not the time it is supposed to be given). Progress notes should include any comments describing the patient’s response to the medications. Any complaints or adverse effects should be noted in the chart and reported to the head nurse and the physician. The nurse should never record on the chart medications that were not given or before they are given.

It is clear that if all these principles are fol-



lowed, the nurse must never give medication prepared by another nurse. Even when nurses are very busy, when emergencies occur, or when they are interrupted, the nurse cannot assume that all the "rights" are followed unless the person who prepares the medication is the one who gives the medication. Occasionally a physician will ask the nurse to prepare the medication for them to give. The nurse may then prepare the medication, but should go with the physician to see that the medication is given as ordered. It should be clearly documented that the physician then gave the medication.

Following institutional policy, using common sense, and remembering the high standards that nurses should have will reduce the chance for medication error. Should an error be made, honesty in discussing the problem and prompt action to correct any damage are especially important in protecting the patient from harm.

#### KEY TASK

##### RIGHT

- Drug
- Time
- Dose
- Patient
- Route
- Documentation

## EVALUATION

**Evaluation** is the process of looking at the results produced when the plan is implemented. When related to medications, it requires the nurse to consider the patient's response to the drug, noting both expected and unexpected findings. When antipyretic medications (drugs that reduce fever) are given, the nurse should take the patient's temperature to determine whether the medication has been effective. When antidysrhythmic agents are given to make the patient's heartbeat more regular, taking the pulse will help determine the patient's response to the medication.

Evaluation of previous therapy is frequently part of the assessment process for continued drug therapy. Thus the nursing process may be viewed as a circular process (see Fig. 1-1, p. 3). For example, when the nurse gives a patient

aspirin to reduce fever, the patient's temperature should be taken to determine whether the medication has been effective. Taking the patient's temperature is part of the evaluation phase of the nursing process, but it may also become an assessment that the patient's temperature is still elevated, requiring more medication or additional nursing actions.

### Factors to consider in evaluating response to medication

Once medication has been administered to the patient, the nurse must closely observe the patient to see the response to the medication. The nurse checks for two types of responses to drug therapy: therapeutic effects and adverse effects.

**Therapeutic effects** are seen when the drug produces the intended reaction. If the nurse understands why the medication is being given or the therapeutic goal of the medication, the nurse will be able to decide whether or not that goal is being met. For example, if the patient has a fever and aspirin is given, the nurse should see a lower temperature when the temperature is taken in 1 to 2 hours.

Adverse or side effects are seen when the patient fails to respond to the medication in the anticipated manner or develops other signs or symptoms that create problems. For example, a patient with pneumonia may be given penicillin. Although the pneumonia infection may be controlled by the antibiotic, presence of a rash may indicate that the patient has developed an allergy to the medicine, and the penicillin must be stopped. A patient receiving an anticoagulant must be closely observed for signs of bleeding or bruising, which would indicate overdosage or overresponse to the medication. Sometimes side effects such as nausea or vomiting may be eliminated by decreasing the dosage or by giving the medication with food. Grading the severity of the side effects will help the physician determine whether the medication should be continued or stopped.

Because the nurse is the health care provider who is most often with the patient, the nurse is in an important and unique position to examine the patient's response to drug therapy. *The careful and repeated assessment of the patient and the*