

# CLINICAL PHARMACOLOGY AND NURSING MANAGEMENT

*Fourth Edition*

*Spencer  
Nichols  
Lipkin  
Henderson  
West*



J. B. LIPPINCOTT COMPANY

# ***Clinical pharmacology and nursing management***

**Fourth  
edition**



J. B. Lippincott Company  
Philadelphia

Acquisitions Editor: Ellen M. Campbell  
Developmental Editor: Marian Bellus  
Project Editor: Amy P. Jirsa  
Indexer: Maria Coughlin  
Design Coordinator: Kathy  
Kelley-Luedtke  
Interior Designer: Anne O'Donnell  
Cover Photo: Steve Weinrebe

Cover Designer: Louis Fuiano  
Production Manager: Helen Ewan  
Production Coordinator: Maura C.  
Murphy, Kathryn Rule  
Compositor: Circle Graphics  
Printer/Binder: Courier/Westford  
Cover Printer: Lehigh Press

4th Edition

Copyright © 1993, by Roberta Todd Spencer, Lynn Wemett Nichols,  
Gladys B. Lipkin, Helen Sabo Henderson, and Frances M. West.

Copyright © 1989, by Roberta Todd Spencer, Lynn Wemett Nichols,  
Gladys B. Lipkin, Helen M. Sabo, and Frances M. West.

Copyright © 1986, 1983, by Roberta Todd Spencer, Lynn Wemett Nichols,  
Gladys B. Lipkin, Helen Pianta Waterhouse, Frances M. West, and Esther Graber  
Bankert.

All rights reserved. No part of this book may be used or reproduced in any manner  
whatsoever without written permission except for brief quotations embodied in  
critical articles and reviews. Printed in the United States of America. For information  
write J. B. Lippincott Company, 227 East Washington Square, Philadelphia,  
Pennsylvania 19106.

6 5 4 3

Library of Congress Cataloging-in-Publication Data

Clinical pharmacology and nursing management / Roberta Todd Spencer  
... [et al.]. — 4th ed.

p. cm.

Includes bibliographical references and index.

ISBN 0-397-54935-0

1. Pharmacology. 2. Nursing. I. Spencer, Roberta Todd.

[DNLM: 1. Pharmacology, Clinical—nurses' instruction. QV 38

C6415]

RM300.C526 1993

615'1'024613—dc20

DNLM/DLC

for Library of Congress

92-20818

CIP

Any procedure or practice described in this book should be applied by the  
healthcare practitioner under appropriate supervision in accordance with  
professional standards of care used with regard to the unique circumstances that  
apply in each practice situation. Care has been taken to confirm the accuracy of  
information presented and to describe generally accepted practices. However, the  
authors, editors, and publisher cannot accept any responsibility for errors or  
omissions or for any consequences from application of the information in this book  
and make no warranty express or implied, with respect to the contents of the book.  
Every effort has been made to ensure drug selections and dosages are in accordance  
with current recommendations and practice. Because of ongoing research, changes in  
government regulations and the constant flow of information on drug therapy,  
reactions and interactions, the reader is cautioned to check the package insert for  
each drug for indications, dosages, warnings and precautions, particularly if the drug  
is new or infrequently used.

The publisher wishes to acknowledge the following persons at Kentmere Nursing  
Care Center in Wilmington, Delaware, for their kind assistance in obtaining  
photographs in Chapter 13: Judy Loring, Elva Mitchell, Ellen Pindus Kurtz, and  
Louise Jackson.

***Clinical pharmacology  
and nursing management***

**Roberta Todd Spencer, R.N., M.S.**

Emeritus Associate Professor  
Department of Nursing  
State University of New York College at Plattsburgh  
Plattsburgh, New York

**Lynn Wemett Nichols, B.S.N., M.S.N.**

Associate Professor  
Department of Nursing  
State University of New York College at Plattsburgh  
Plattsburgh, New York

**Gladys B. Lipkin, R.N., C.S., M.S.,  
F.A.A.N.**

Nurse Psychotherapist in Private Practice  
Childbirth (Lamaze) Instructor; Lecturer  
Bayside, New York

**Helen Sabo Henderson, B.S.N., M.Ed.**

Emeritus Associate Professor  
Department of Nursing  
State University of New York College at Plattsburgh  
Plattsburgh, New York

**Frances M. West, R.N., M.S.N.**

Vice-President, Patient Services Division  
Champlain Valley Physicians Hospital Medical  
Center  
Plattsburgh, New York

**Contributors**

Mary X. Britten, ED.D., R.N.  
Associate Dean and Associate Professor  
Decker School of Nursing  
State University of New York at Binghamton  
Binghamton, New York

Frances R. Brown, PH.D., R.N.  
Assistant Professor  
Decker School of Nursing  
State University of New York at Binghamton  
Binghamton, New York

Martha Fortune, R.N., M.S.  
Hospice Nurse  
Visiting Nurse Service of New York  
New York, New York

Patricia Hryzak Lind, R.N., M.S.  
Director of Nursing Operations, Analysis, and  
Evaluation  
Strong Memorial Hospital  
Rochester, New York

Charlotte Shimmons Torres, ED.D., R.N., C.S.  
Assistant Professor  
University of Rochester School of Nursing  
Rochester, New York

## **Dedication**

The meaning of the word *dedication* may include setting apart and devoting to a special purpose or addressing to another as a token of respect or affection. In accord with these definitions, we would like to once more dedicate this volume to nursing clients, through its use by students and faculty of schools of nursing and practicing nurses, and to our families and friends, with thanks for their understanding and support.

## ***Contributors' chapters***

The following is a list of the chapters written by each author. An asterisk (\*) indicates chapters authored by more than one contributor.

Mary X. Britten  
*Chapter 37*

Frances R. Brown  
*Chapter 21*

Martha Fortune  
*Chapter 19, Appendix\**

Helen Sabo Henderson  
*Chapters 11 and 26*

Patricia Hryzak Lind  
*Chapter 17*

Gladys B. Lipkin  
*Chapters 16, 35, 36, 38, and 41–46*

Lynn Wemett Nichols  
*Chapters 9, 27, 28, 39, 47–49, and 50\**

Roberta Todd Spencer  
*Chapters 1–4, 7, 8, 10, 13, 14, 20, 22–25, 29–34, 40, 50\*, 51–54, Appendix\**

Charlotte Shimmons Torres  
*Chapter 18*

Frances M. West  
*Chapters 5, 6, 12, and 15*

# ***Consultants for the fourth edition***

Virginia Birnie, R.N., B.S.C.N.  
Professor  
Okanagan College  
School of Nursing  
Kelowna, British Columbia, Canada

Regina Stanback-Stroud, R.N., M.S.H.R.  
Professor  
Health Sciences Department  
Rancho Santiago College  
Santa Ana, California

Janet L. Stewart, R.N., B.S.N., M.N.E.D.  
Instructor  
The Western Pennsylvania Hospital  
School of Nursing  
Pittsburgh, Pennsylvania

Barbara L. MacDermott, M.S., R.N.  
Assistant Dean and Associate Professor  
Syracuse University College of Nursing  
Syracuse, New York

Maxine C. Mott, R.N., B.N., M.E.D.  
Instructor  
Department of Nursing and Allied Health  
Mount Royal College  
Calgary, Alberta, Canada

Sandra Clark, R.N., M.S.N.  
Assistant Professor  
Armstrong State College  
School of Nursing  
Savannah, Georgia



# **Preface**

*Clinical Pharmacology and Nursing Management* was originally conceived when we, as nursing instructors, had difficulty selecting a suitable pharmacology textbook for our students because no one volume seemed to present all aspects of the discipline pertinent to nursing. Most texts handled one or more facets of the subject well but omitted or slighted others. We also recognized that there seemed to be a considerable body of knowledge about the nursing aspects of pharmacology that did not appear at all in the standard references. In this fourth edition of *Clinical Pharmacology and Nursing Management* we have refined, updated, and expanded our original concept of providing all the nursing aspects of pharmacology in a concise and readable style.

## **Purpose**

Our intent is to provide a useful textbook for nursing students who are beginning the study of pharmacology. Our objective is to produce a text that presents (1) the concepts necessary for good judgment in the use of chemical agents, (2) a theoretical base for the skills required to administer medications, and (3) a ready reference for drug data required most frequently by nurses. We address the social use and abuse of chemicals, toxicology, and the medicinal use of drugs across a broad spectrum of health-care situations.

## **Structure**

The text is divided into 14 sections. *Unit One*, Introduction to Pharmacology, presents a brief history of the discipline and discusses its relationship to nursing, describes legal controls over drug production and use and harmful effects of chemical exposure, presents the nursing process as it pertains to pharmacotherapeutics, and suggests approaches helpful to the study of pharmacology. *Unit Two*, Therapy With Drugs, discusses concepts underlying the medicinal use of drugs, including pharmacodynamics and pharmacokinetics, interaction of drugs and food and psychosocial aspects of drug use, and describes currently used drug preparations. A theoretical base for the skills relevant to the administration of medications is offered in *Unit Three*.

A variety of considerations is treated in *Unit Four*, Special Considerations in Drug Therapy. This unit includes individual chapters on maternal, pediatric, and gerontologic care as well as unique chapters on drug therapy in community health nursing and self-medication with over-the-counter drugs.

*Units Five through Fourteen* present information on drugs in current use,

including discussions of major drug classifications and data on specific medicinal agents. Included in these sections are the physiology and the pathophysiology of the particular body system being discussed, and their relevance to medication. In most cases, the discussion of drugs is broken down into pharmacodynamics, pharmacokinetics, therapeutic uses, adverse reactions, and precautions and contraindications.

## **Nursing process content**

Specific nursing information has been worked into the design of the book so that it is easy to find. Most chapters—and all within the drug family unit—have sections called Nursing Management. These sections are further broken down into sections entitled Nursing Implications and Nursing Process. New for this edition is the delineation of collaborative problems, which are listed following the nursing diagnoses wherever applicable. A checklist of nursing actions provides a quick review, in imperative (command) form, of the important nursing actions. The wellness/illness continuum is evident throughout the book, especially in some of the client education sections.

In addition, the nursing process as it pertains to pharmacotherapeutics is presented in Chapter 3. The responsibilities of the nurse are defined broadly, encompassing those responsibilities inherent in the evolving roles of primary-care provider and client advocate.

## **Pedagogical features**

*Learning Experiences and Enrichment Experiences.* Experiential materials that promote or enrich the student's learning are suggested at strategic points in the text and in the Student Workbook. Some may form the basis for group field trips or class discussion. Others may be pursued by the individual. Not all of these experiences will be possible in any given setting, but all are designed to increase the reader's awareness of the pervasiveness of chemical use and the implications of pharmacologic issues in nursing practice.

*Review Displays.* As in the previous edition, review materials and information to be emphasized have been set off from the text, in this edition in screened displays rather than boxes.

*Drug Tables.* These provide at-a-glance specifics for individual drugs. Each group of drugs displayed is discussed in terms of their pharmacodynamics, dosage and route of administration, therapeutic uses, adverse reactions, and precautions and contraindications.

*Examples of Nursing Process.* Case studies are presented with related care plans as examples of the nursing care of clients undergoing drug therapy.

*Illustrations.* Using photos and drawings, both nursing actions involved in the administration of medications and concepts of chemical structure and action are illustrated.

*Glossary.* The glossary, consisting of over 350 common drug-related terms, is intended to be a useful reference to the student.

*Appendix.* The Appendix has been expanded for this edition to include more materials for easy reference.

*References and Bibliography.* In each chapter, these provide sources for text information and resources for additional information.

## **New features for the fourth edition**

- Two new displays have been added to this edition:

*Focus Boxes.* These give the reader an overview of the similarities and the

differences between the individual drugs in a pharmacologic class in a readable and concise format.

*Issues in Drug Therapy Boxes.* These present discussion of some of the current topics that have arisen in connection with the use of a particular drug or group of drugs.

- More information for easy reference is provided in the drug tables:  
*The FDA Pregnancy Category*, where assigned  
*Canadian Trade Names*, where appropriate
- Updated drug information throughout the text and drug tables
- Delineation of collaborative problems, listed separately in the nursing process sections
- Index entries re-designed to give more information at a glance: generic drug names in boldface, trade names in small caps, Canadian trade names followed by (Can). The designations *t*, *f*, and *d* direct the reader to the specific type of discussion: table, figure, or display.

## Ancillaries

Also available with the fourth edition of *Clinical Pharmacology and Nursing Management* are the *Student Workbook*, the *Instructor's Manual*, and a Computer Test Bank.

The *Student Workbook* enables the student to follow the text chapter by chapter. A variety of materials is used to supplement learning, including some of the Learning Experiences presented in the text in the previous edition. The *Instructor's Manual* provides each chapter with a list of concepts with which the text deals, and from which program-specific objectives can be derived. In this way learning objectives can be tailored specifically to the program of study pursued by the reader. The Computer Test Bank provides NCLEX-style test items, to assist both the faculty and the student in effectively measuring learning.

We believe that we have produced a package that will give a practical background in pharmacology to all nursing students and will provide an easy reference for special nursing needs.

*The Authors*

## ***About the factual content of this textbook***

The authors, contributors, and editors of this book have expended considerable time and effort to ensure that the facts and opinions offered in the text and tables of this book are in accordance with official standards and with the consensus of foremost authorities at the time of publication.

However, drug therapy is a very dynamic branch of medicine, marked by the continual marketing of new drugs and the discontinuation and withdrawal (often without notice) of older drug products. In addition, the Food and Drug Administration (FDA) constantly orders changes in the labeling of even well-established drug products, on the basis of ongoing studies of their safety and efficacy. For this reason, no claims are made that statements made here concerning the current status of these drugs will continue to reflect the views of the drug industry or the FDA or that the data presented in tabular form are, or will remain, complete and correct in every detail.

The most important aspect of this problem lies in the area of dosage recommendations. Every effort has been made to check that statements made in the tables are, within the limits of space, precisely correct. However, dosage schedules are frequently ordered changed in accordance with accumulating clinical experience.

For this reason, we urge that *before administering any drug, you check the manufacturer's latest dosage recommendations* as presented in the package insert that accompanies each unit of every drug product.

# ***Acknowledgments***

The preparation of a textbook requires the involvement of many people who support and complement the work of the authors. This book is no exception. It would be impossible to name everyone who contributed to its publication. However, we would like to acknowledge, with gratitude, the following contributions to this fourth edition:

*Contributors:* Mary Britten, Frances Brown, Patricia Hryzak Lind, Martha Fortune, and Charlotte Torres

*Editors:* Ellen Campbell, Margaret Belcher, Marian Bellus, Amy Jirsa, and Kathy Kelley-Luedtke

***Clinical pharmacology  
and nursing management***

# Contents

## 1

### **Introduction to pharmacology 1**

#### **1 Introduction to pharmacology 2**

- Scope of pharmacology 2
  - Definition 2
  - An interdisciplinary study 2
- History of pharmacology 3
  - Prehistoric/primitive era 3
  - Ancient civilizations 4
  - Medieval to modern times 4
  - Modern medicine 5
  - The future 6
- Nursing implications 7
  - Significance of pharmacology in nursing 7
  - Pharmacology in nursing education 7

#### **2 Standards and controls 9**

- Drug controls 9
  - International controls 9
  - National controls 10
  - State controls 13
  - Local regulations 15
  - Institutional controls 15
  - Individual control 16
  - Nursing implications 16
- Drug standards 16
  - Purity 17
  - Potency 17
  - Bioavailability 17
  - Efficacy 18
  - Safety/toxicity 18
  - Testing procedures 18
  - Nursing implications 18

#### **3 Nursing process in the management of drug related problems 20**

- Assessment 20
  - Data base 20
  - Analysis 22
- Nursing diagnosis 27
- Planning 28
- Intervention 28
- Evaluation 28

#### **4 Development of a knowledge base in pharmacology 30**

- A personal drug file 30
  - Name of drug 31
  - Drug family 31
  - Desired physiologic effects 31
  - Side effects 31
  - Adverse effects 31
  - Toxic effects 32
  - Contraindications 32
  - Dosage range and administration route 32
  - Elimination 32
  - Nursing implications 32
- Sources of drug information 33
  - Pharmacopeiae (Compendia) 33
  - Textbooks 33
  - Journals 36
  - Subscription services 36
  - Package inserts and the *Physicians' Desk Reference* 36
  - The pharmacist 36
  - Drug firms 37
  - Supplementary information 37
  - Nursing implications 37

#### **5 Toxicology 39**

- Access routes of toxic substances 39
  - Percutaneous route 39
  - Gastrointestinal route 39

Parenteral route	39
Inhalation route	40
Scope of poisoning	40
Causes of poisoning	41
Poison management	41
Information	42
First aid for acute poisoning or exposure	43
Administering an antidote	44
Eliminating the poison	45
Poison prevention	46
Lead poisoning	47
Pathophysiology	47
Signs and symptoms	47
Interventions	48
Prevention	48
Mercury poisoning	48
Pathophysiology	48
Signs and symptoms	49
Interventions	50
Toxins in the hospital environment	50
Surgical hazards	50
Chemical sterilants	50
Chemical disinfectants	51
Chemotherapy	51

## 2

**Therapy with drugs 57****6 Approaches to drug therapy 58**

Three major approaches	58
Magical approach	58
Empirical approach	59
Rational approach	59

**7 Pharmacodynamics and pharmacokinetics 62**

Pharmacodynamics	62
Alteration of cellular environments	62
Alteration of genetic material	62
Provision of substrate material	63
Alteration of the speed of cell functions	63
Agonist/antagonist interaction	65
Pharmacokinetics	66
Drug absorption	66
Drug distribution	73
Drug biotransformation	75
Drug excretion	77
Interaction of pharmacokinetic processes	79

**8 Drug preparations 82**

Drug Nomenclature	82
Chemical name	82
Generic name	82
Official name	82
Trade name	82
Abbreviations	83
Drug families	83
Sources of drugs	85
Plant kingdom	85
Animal kingdom	85
Mineral resources	85
Synthetic chemicals	85
Drug constituents	86
Active ingredients	86
Additives	86
Types of preparations	88
Solids	88
Semisolids	89
Liquids	89

**9 Drug reactions and interactions 91**

Adverse reactions to drugs	92
Toxic reactions	92
Side effects	92
Allergic reactions	92
Idiosyncratic reactions	95
Chain reactions	96
Cumulative reactions	96
Tolerance and dependence	97
Mechanism of drug interaction	97
Absorption	97
Distribution	99
Biotransformation	100
Excretion	102
Clinically desirable interactions	103

**10 Interactions between food and medications 109**

Pharmacologic properties of food	109
Toxins	109
Protectants	110
Food additives	112
Government testing	113
Research by others	113
Alteration of drug effect by food	116
Modification of pharmacokinetics	116
Modification of drug actions	117
Nutritional changes induced by medications	118
Drugs influencing gastrointestinal function	118
Other therapeutic agents	118



Epidemiology of drug-induced nutritional deficiency 119

## **11 Psychological aspects of drug therapy 124**

Behavioral responses to drugs 124  
 Attitudes 124  
 Motivation 124  
 Meaning attached to drugs 124  
 Power of suggestion 126  
 Type of illness 127  
 The nurse's behavioral response 127  
 Behavioral factors 127

## **12 Cultural aspects of drug therapy 130**

Ethnomedicine 130  
 Black Americans 131  
 Hispanic Americans 132  
 Puerto Rican Americans 134  
 Asian Americans 135  
 Native Americans 140  
 White Americans of European descent 141  
 Ethnopharmacology 142  
 Preparation and use of herbs 145  
 Applications of ethnopharmacology 150

### **3**

## **Administration of medications 155**

## **13 Basic principles of medication 156**

Role functions related to drug therapy 156  
 Pharmacist 156  
 Physician, dentist, and veterinarian 158  
 Paraprofessionals 158  
 Professional nurses 159  
 Trends in the assignment of role functions 159  
 Delivery of drug doses 163  
 The right drug 163  
 The right dose 163  
 The right client 164  
 The right route 166  
 The right time 166  
 Nursing management of drug therapy for institutionalized clients 166  
 Medication procedures used in institutions 167

Medication errors 168  
 Causes 168  
 Reporting an error 174

## **14 Special skills related to drug administration 176**

Storage and handling of drugs 176  
 Preservation 176  
 Containers 176  
 Childproof caps 176  
 Tamperproof packaging 177  
 Storage in the home 177  
 Storage in institutions 177  
 Insulin 178  
 Learning the language 178  
 Physicians' orders for medication 179  
 Computation of drug doses 181  
 The metric system 182  
 Household measures 183  
 Apothecary system 184  
 Conversion from one measurement system to another 185  
 Preparing solutions 189  
 Preparing fractional doses from solid drugs 190  
 Verifying computed dosage 190  
 Occupational hazards related to drug administration 190  
 Chemical dependence 191  
 Adverse reactions to toxic substances 191  
 Antibiotic-resistant infections 192  
 Blood-borne infections 192  
 Allergy 192  
 Nursing implications 192

### **4**

## **Special considerations in drug therapy 193**

## **15 Substance abuse 194**

Nature of dependence and addiction 194  
 Definition of terms 194  
 Circles of dependence 195  
 Classifications 196  
 Commonly abused substances 196  
 Opioid analgesics 196  
 General central nervous systems depressants 199  
 Central nervous system sympathomimetics (adrenergics) 203