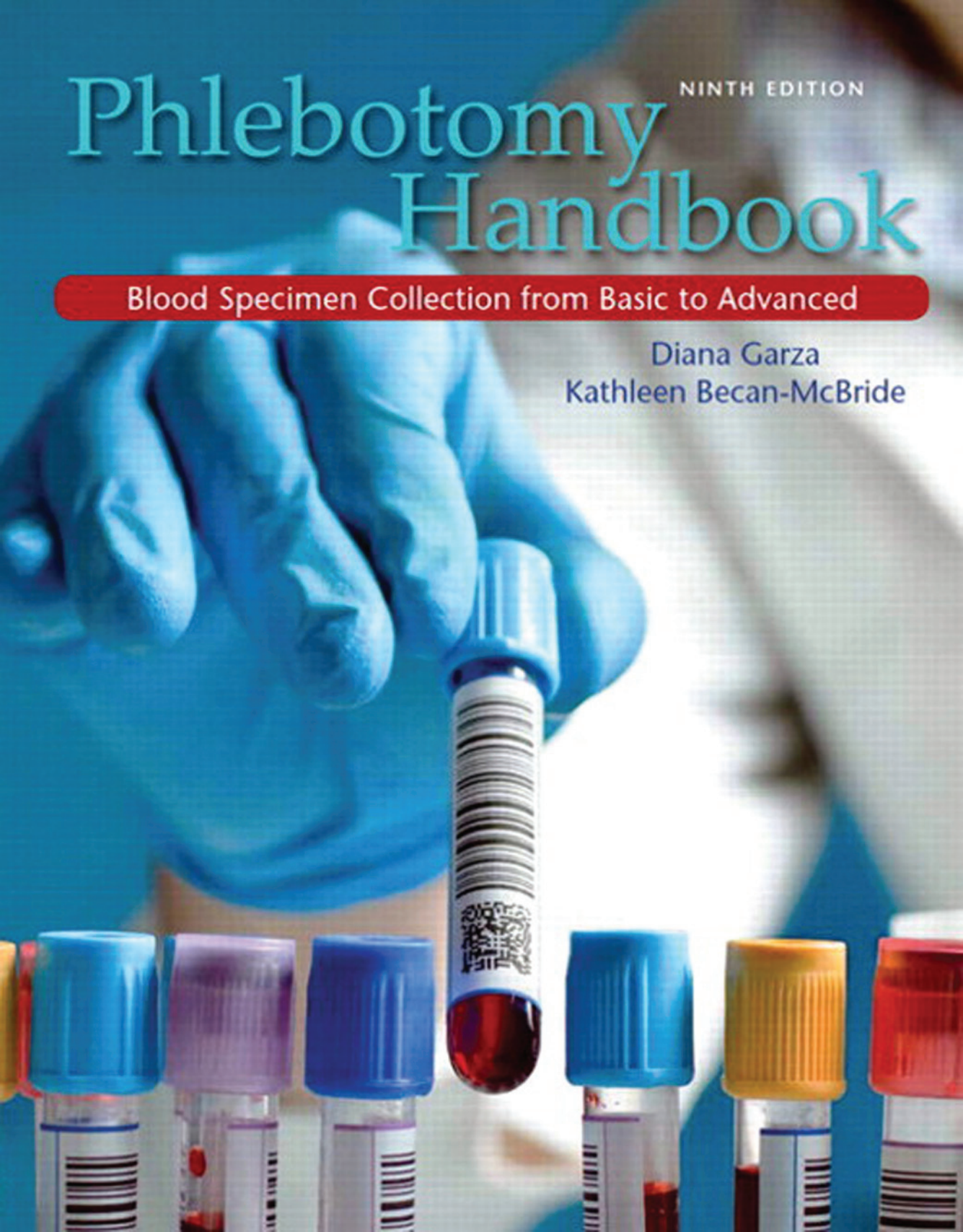
# Phlebotomy Handbook

NINTH EDITION

## Blood Specimen Collection from Basic to Advanced

Diana Garza
Kathleen Becan-McBride



**PATIENT TIPS FOR SUCCESS:**

# Before, During, and After a Blood Collection Procedure

## Before a Venipuncture or Skin Puncture

To confirm your identity, the health professional will only ask for essential information (such as name, birthdate, patient identification number, etc.) to avoid having your blood specimens confused with other patients' specimens.

Feel free to share important information about any health conditions that could help with the blood collection or testing process. For example, mention if you:

- are on blood thinners, chemotherapy, or other medications.
- have had a mastectomy.
- have ever fainted during a procedure or had other complications.
- have a preferred arm/hand from which to do the procedure.
- forgot to fast and ate a snack or drank coffee or a soda.

This information can make the procedure and/or your laboratory test results safer and reduce the risk of inaccurate test results. The health professional may use his or her judgment as to which arm vein would be best but will try to accommodate your preferences when possible.

Stay hydrated by drinking modest (not excessive) amounts of fluids, preferably water. If you have been fasting, drink only water. Proper hydration helps maintain normal veins so the health professional can feel for a "good" vein or have a successful skin puncture (fingerstick).

Hold your arms/hands downward for 5-10 seconds just prior to the procedure to use gravity to get blood into your arms. Again, this helps the health professional select the best site for the venipuncture or fingerstick. Other useful aides might be used by the health professional to achieve the same effect such as warming your arm.

Feel free to ask questions about the procedure.

## During the Procedure

Try to relax and be still. Take a deep breath prior to the puncture.

Keep in mind that routine blood collections are, at most, only minimally painful during the initial puncture. For most blood collection procedures, this minimal discomfort actually lasts for a very short period of time (usually less than 45 seconds). The needle prick or sting is normal and should be expected. However, notify the health professional if your tourniquet is too tight or uncomfortable or if you experience sharp intense pain. A tourniquet can easily be reapplied in a more comfortable manner. (It is only tightened during the first seconds after the needle puncture and then it is released.) And, if the pain of the needle is too intense, the procedure can be stopped.

During the procedure you might notice the beginning of a bruise (hematoma). This occurs if blood leaks out of the vein into tissues below the skin. It may begin to swell slightly or turn a red-bluish color. The health professional can easily stop the procedure and apply gentle pressure with sterile gauze.

If you feel faint or queasy, tell the health professional immediately. Your safety and well-being is of utmost importance.

## After the Procedure

The health professional may ask you to help apply pressure to your puncture site while your blood is forming a clot. This will prevent or reduce bruising when the needle is removed from the vein. Relax and rest your arm and keep the sterile gauze on the site using gentle pressure for a few minutes. Do not rush the process. It may be helpful to avoid doing anything strenuous with that arm for a few hours.

Double check that the health professional labeled your blood specimen tubes with your correct name.

Again, if you feel faint or queasy, tell the health professional immediately. Your safety and well-being is of greatest importance.

***Other Resources for Patients:***

The American Society for Clinical Laboratory Science (ASCLS) Patient Safety Committee has developed flyers in English and Spanish that inform patients about laboratory procedures.

# Phlebotomy Handbook

## Blood Specimen Collection from Basic to Advanced

NINTH EDITION


Diana Garza, EdD, MLS (ASCP)CM
Medical Writer/Editor
Health Care Consultant
Houston, Texas

Kathleen Becan-McBride, EdD, MASCP, MLS (ASCP)CM
Director, Community and Educational Outreach
Medical School Professor in the Department of Family & Community Medicine
The University of Texas Health Science Center at Houston
Texas Medical Center, Houston, Texas

**Contributing Authors**

Donna Hermis, MHA, FACHE, MT(ASCP)SC
Director, Laboratory Services and Hospital Safety Officer
Houston Methodist Sugar Land Hospital
Sugar Land, Texas

Passion Sparrow Lockett, Dr.PH, MBA, MT (ASCP) DLMCM, CCRC
Laboratory Manager
Clinical & Translational Research Center (CTRC) Laboratory
University of Texas M. D. Anderson Cancer Center
Houston, Texas



PEARSON

Boston Columbus Indianapolis New York San Francisco Upper Saddle River
Amsterdam Cape Town Dubai London Madrid Milan Munich Paris Montreal Toronto
Delhi Mexico City Sao Paulo Sydney Hong Kong Seoul Singapore Taipei Tokyo

To my husband, Peter McLaughlin; my daughters, Lauren and Kaitlin, and my son, Kevin; and my parents for their affection, patience, and constant support.

*—Diana Garza*

To my husband, Mark; my sons, Patrick and Jonathan, and my daughter-in-law, Danielle; my grandsons, Finnaveir and Mitchell; my granddaughter, Madeleine, my parents; my sister; and my parents-in-law for their support and devotion.

*—Kathleen Becan-McBride*

**Publisher:** Julie Levin Alexander
**Publisher's Assistant:** Regina Bruno
**Editor in Chief:** Marlene McHugh Pratt
**Executive Editor:** John Goucher
**Editorial Program Manager:** Jonathan Cheung
**Editorial Assistant:** Ericia Vivani
**Development Editor:** Cathy Wein
**Director of Marketing:** David Gesell
**Marketing Manager:** Katrin Beacom
**Marketing Specialist:** Michael Sirinides
**Project Management Lead:** Cynthia Zonneveld
**Project Manager:** Patricia Gutierrez
**Operations Specialist:** Nancy Maneri-Miller
**Art Director:** Mary Siener
**Text and Cover Designer:** Eva Ruutopold
**Cover Art:** angellodeco
**Media Director:**
**Lead Media Project Manager:** Lorena Cerisano
**Full-Service Project Management:** Bruce Hobart, Laserwords
**Composition:** Laserwords
**Printer/Binder:** Courier Kendallville
**Cover Printer:** Lehigh-Phoenix Color/ Hagerstown
**Text Font:** 10/12 Palatino LT Std

Credits and acknowledgments for content borrowed from other sources and reproduced, with permission, in this textbook appear on appropriate page within text.



**Library of Congress Cataloging-in-Publication Data**
Garza, Diana, author.
Phlebotomy handbook: blood specimen collection from basic to advanced/Diana Garza, Kathleen Becan-McBride; contributing authors, Donna Hermis, Passion Sparrow Lockett. — Ninth edition.
p. ; cm.
Includes bibliographical references and index.
ISBN 978-0-13-314456-7 — ISBN 0-13-314456-9
I. Becan-McBride, Kathleen, 1949- author. II. Hermis, Donna, author. III. Sparrow Lockett, Passion, author. IV. Title.
[DNLM: 1. Phlebotomy—Handbooks. QY 39]
RB45.15
616.07'561—dc23

2014011620

**Pearson**® is a registered trademark of Pearson plc

Pearson Education Ltd., London.
Pearson Education Singapore, Pte. Ltd.
Pearson Education Canada, Inc.
Pearson Education—Japan
Pearson Education Australia PTY, Limited
Pearson Education North Asia Ltd., Hong Kong
Pearson Educación de Mexico, S.A. de C.V.
Pearson Education Malaysia, Pte. Ltd.
Pearson Education Upper Saddle River, New Jersey

10 9 8 7 6 5 4 3 2 1

PEARSON

ISBN-13: 978-0-13-314456-7
ISBN-10: 0-13-314456-9

# Contents

# About the Authors

**Diana Garza** received her Bachelor of Science degree in Biology from Vanderbilt University in Nashville, Tennessee, followed by an additional year to complete her Medical Laboratory Science certification requirements at Vanderbilt University Medical Center. Her interest in laboratory sciences and in teaching led her to earn a Masters in Science Education at the Peabody School of Vanderbilt University. She worked at Vanderbilt Medical Center in the Microbiology Department while a graduate student. A move back to her home state of Texas led her to a collaborative graduate program with Baylor College of Medicine at the University of Houston, and resulted in her Doctorate of Education in Allied Health Education and Administration, all while she worked in the Microbiology Laboratory at the University of Texas M. D. Anderson Cancer Center (MDACC). Her laboratory and teaching experience continued at the University of Texas Health Science Center at Houston and for many years at MDACC, where she later became the Administrative Director of the Division of Laboratory Medicine. While in Houston, Drs. Garza and Becan-McBride were involved in numerous courses for technologists, nurses, and physicians to teach phlebotomy techniques. As young faculty members, they began to develop curriculum materials for their own use, and in 1984 collaborated in publishing one of the first comprehensive textbooks focused solely on phlebotomy pracitices. Their successful coauthoring partnership has endured for over two decades. In 1990, Dr. Garza joined the faculty of Texas Woman's University–Houston Center, where she taught Internet-based quality improvement courses and became editor of several journals and continuing education publications. She has taught extensively; been a reviewer/inspector in many regulatory processes; participated in accreditation procedures; and authored, edited, and published numerous manuscripts in the field of phlebotomy, health care, and quality management. She has been on numerous health care advisory boards and nationwide committees, including those for certification examinations, and served as a consultant for companies and health care organizations. She continues her writing and editorial pursuits primarily in the field of phlebotomy.

**Kathleen Becan-McBride** is Director of Community and Educational Outreach at The University of Texas Health Science Center at Houston (UTHealth) and tenured Medical School Professor in the Department of Family and Community Medicine at UTHealth. She received her Bachelor of Science degree in Biology from University of Houston with completion of her medical laboratory science education at St. Luke's Episcopal Hospital in Houston, Texas, and national board certification as a Medical Laboratory Scientist. While working at St. Luke's Episcopal Hospital Clinical Laboratory, she received a full scholarship to the University of Houston/Baylor College of Medicine collaborative Masters in Allied Health Education and Administration Program. This inspired her to continue her studies and she completed her Doctorate in Higher Education and Administration while teaching in the Medical Laboratory Science program and Physician Assistant program at University of Texas Medical Branch Galveston and Medical Laboratory Technician program at Houston Community College. She then became a faculty member and Chair of the Clinical Laboratory Science Department at the University of Texas Health Science Center at Houston (UTHealth). And in more recent years, she has become the Director of Community and Educational Outreach, Director of Workforce and Resource Development, and Professor in the Medical School Department of Family and Community Medicine.

She has published 24 books and more than 55 articles and has been on numerous national and international health care advisory boards and several editorial boards for health care journals. Dr. Becan-McBride has had research projects related to the medical laboratory sciences and also community (i.e., UV/TB Prevention Research Project in Homeless Shelters in Houston). Most recently, she has received a National Institute of Health (NIH) grant in research on new point-of-care (POC) technology as defined through blood collection techniques. She is on educational advisory boards for medical laboratory science educational programs and community outreach programs. She has had invitational medical laboratory science presentations nationally and internationally to countries including Singapore, China, Russia, France, South America, New Zealand and more recently, Croatia. She was the elected Chair of the ASCP Board of Certification Board of Governors from 2008 to 2010 and received the ASCP Mastership Award in 2012 and ASCP Board of Certification Distinguished Service Award in 2012.

During her years at UTHealth, she has been fortunate to have the opportunity to receive several grants for phlebotomy training programs. Drs. Becan-McBride and Garza became involved in developing curricular materials to teach phlebotomy students as well as nursing and other health professional students. These two faculty developed one of the first comprehensive textbooks devoted strictly to phlebotomy and its importance in the health care settings. Drs. Becan-McBride and Garza have been collaborators for over 31 years on numerous phlebotomy textbooks and curricular materials and as presenters at national and international meetings.

# Preface

***Phlebotomy Handbook: Blood Specimen Collection from Basic to Advanced,* 9th edition,** is designed for health care students and practitioners who are responsible for blood and specimen collections (i.e., nurses, phlebotomists, medical laboratory technicians, medical laboratory scientists, respiratory therapists, and others). The primary goal of this book is to link the phlebotomist (blood collector) to the latest safety information, techniques, skills, and equipment for the provision of safe and effective collection procedures, for the improvement of diagnostic and therapeutic laboratory testing, for enhancement of customer satisfaction, and ultimately, for the promotion of better health outcomes. This award-winning textbook provides the most up-to-date comprehensive compilation of information about phlebotomy available. It covers a wide range of competencies, including communication, clinical, technical, and safety skills that any health care worker will use in the practice of phlebotomy and other specimen collection procedures. The equipment chapter (ch. 8) emphasizes the most recent and comprehensive safety features of phlebotomy supplies and equipment. This edition also includes the latest information about standards from the Clinical and Laboratory Standards Institute (CLSI), error reduction, patient and worker safety, updates linked to needlestick prevention, and The Joint Commission National Patient Safety Goals. The content also addresses generational traits, age-specific considerations, transcultural communication, and patients with special needs. In addition, the chapters provide extensive information and insights about quality issues to support and improve technical skills.

This book highlights the professional role that phlebotomists play as essential members of the health care team. Part of being an effective member of the health care community is learning to communicate effectively, so this edition has a greater focus on medical terminology, roles of other health care providers, and health literacy. The scope of work for the blood collector has expanded to encompass additional patient care duties and clinical responsibilities, a more patient-sensitive role, and improved interpersonal communication skills to deal effectively with patients, treat their families with respect, handle any special needs, and establish effective collaborations with other members of the health care teams. These roles and responsibilities are important and applicable around the world.

The order in which the material is presented generally follows the way in which a phlebotomist approaches the patient (i.e., beginning with important communication skills, knowledge of ethical behavior and legal implications, and a basic understanding of physiologic aspects, then moving to safety and infection control considerations in preparation for the phlebotomy procedure, preparation of supplies and equipment, actual venipuncture or skin puncture, and potential complications). Specialized specimen collection procedures, point-of-care testing, pediatric care, and considerations for the elderly are included. Problem-solving cases, Action in Practice cases, and Check Yourself sections integrate the information into real-life situations. The Competency Assessments provide a Check Yourself feature or can be used by instructors for evaluation. And the Glossary has been updated and expanded to include key words and other words important to phlebotomists. The appendices provide useful procedures (such as taking vital signs) and important terms, phrases, and symbols.

The content is divided into four major parts:

- **PART I: Overview, Safety Procedures, and Medical Communication**—provides a knowledge base of the roles and functions of a phlebotomist in the health care industry and presents information about safety and infection control in the workplace.
- **PART II: Anatomy and Physiology of the Human Body**—provides the basics of anatomy and physiology with an emphasis on the circulatory system.
- **PART III: Phlebotomy Equipment and Procedures**—provides comprehensive coverage on the latest equipment and supplies, the most updated information and comprehensive description of the actual techniques used in phlebotomy, and documentation and transportation procedures needed for safe handling of biohazardous specimens. Clinical and technical complications that may occur during the procedure are also reviewed.
- **PART IV: Point-of-Care Testing and Special Procedures**—provides information about pediatric phlebotomy procedures, blood culture collections, arterial and IV collections, and special considerations for the elderly, homebound, and long-term care patients. In addition, topics such as donor phlebotomy and drug and forensic laboratory testing are reviewed.

## Key Features of the Ninth Edition

- **Objectives** at the beginning of each chapter list the important concepts discussed in the chapter.
- **Key Terms** list the vocabulary introduced and defined in the chapter. These terms also appear in boldface type within the body of the chapter so that they are easier to find.
- **Clinical Alerts** indicate procedures or concepts that have vitally important clinical consequences for the patient. Each Clinical Alert! indicates that extra caution should be taken by the health care worker to comply with the procedure, thereby avoiding adverse outcomes for the patient.
- **Procedures** throughout the text provide step-by-step instructions with an "on-the-job" perspective.
- **Colorful photographs** illustrate important concepts and show procedural steps and equipment.
- **Study questions** at the end each chapter help test your knowledge of the chapter content.
- **Case Studies** help you develop problem-solving and troubleshooting skills.
- **Action in Practice** presents an additional case study with questions to test your critical thinking skills.
- **Check Yourself** presents a brief description of a procedure to be performed along with questions to test your knowledge of the requirements and steps to perform to complete the procedure.
- **Competency checklists** provide a list of competencies you should master relevant to the chapter content and the National Accrediting Agency for Clinical Laboratory Sciences (NAACLS) competencies.
- **References** correlate to the endnotes in the chapter.
- **Resources** provide additional readings and websites related to the chapter content.
- The **Glossary** has been updated to include more terms as a valuable reference.
- A full-color **Tube Guide chart** provides a list of the types of blood collection tubes and shows the appropriate color codings with additives.
- The **Appendices** include a guide to NAACLS phlebotomy competencies coverage in the text, essential elements for finding a job, basic procedures for taking vital signs, hand hygiene recommendations, laboratory tests and blood requirements, blood

donation procedures, units of measurement and symbols, formulas and calculations used in laboratories, military time, Spanish phrases, and several other topics.

## Video Program

A four-hour DVD video library is available for separate purchase, serving as the most complete skills collection of its kind. The series contains 38 segments demonstrating a wide array of blood specimen collection procedures and patient interactions (including pediatrics and adults in both clinic and hospital settings). The video is based on current Clinical and Laboratory Standards Institute (CLSI) guidelines and standards, and emphasizes safety, infection control, effective communication, quality assessment, and avoiding errors. The footage correlates directly with the procedures shown in ***Phlebotomy Handbook*, 9th edition,** and was filmed in collaboration with the authors. The video series is ideal for independent self-study or review for those aiming to enhance their understanding and performance. It is also an excellent classroom teaching tool for instructors who wish to supplement their teaching with dynamic footage of experts in action. The series helps fulfill National Association for Accreditation of Clinical Laboratory Sciences competencies for accredited programs in Phlebotomy. Educators should contact their Pearson sales representative to learn about special offers and institutional pricing.

## Additional Resources for Educators

This ninth edition has digital companion resources that are cross-referenced to the text. The *Instructor's Resource Manual* contains a wealth of material to help faculty plan and manage their course. It includes a detailed lecture outline, a complete test bank, teaching tips, and more for each chapter. For instructors, log on to www.pearsonhighered.com to access the complete test bank and PowerPoint lectures that contain discussion points with embedded color images from the book.

## An Accompanying Guide for Examination Review

Available for separate purchase is Pearson's *SUCCESS! in Phlebotomy: Q&A Review,* 7th edition. This is an aid to students and health care workers preparing for a certification examination. It has over 850 exam-type questions and an accompanying access to www.myhealthprofessionskit.com multiple-choice questions, flashcards, and an audio glossary.

In summary, the authors have created a book with several audio and visual learning tools that health care professionals and students will use as a central authority on blood collection practices. Instructors can also use this as the central text for teaching specimen collection skills.

# Acknowledgments

We are grateful to many generous individuals, product suppliers, manufacturing companies, professional organizations, and health care organizations for their assistance in preparing the previous editions of this text. The first edition was conceptualized in the 1980s, when phlebotomy was learned in an apprentice-type situation and teaching materials were scarce. As licensing, credentialing, manufacturing of new products, procedures, competencies, hazards, and safety regulations expanded, so did our text. Each edition used previous editions as a framework for updating, redesigning, and improving the next. In 2006, *Phlebotomy Handbook,* 7th edition, won a first-place Book Award from the American Medical Writers Association in the Allied Health Category, and we are proud to continue the tradition of excellence in this ninth edition with the participation of so many talented people. Thus, we thank many phlebotomists, medical technicians and technologists, artists, photographers, and educators who have given us countless editorial tips and practical advice over the years. We also thank health care workers around our country and the world who have taken the time to read about new and better ways of improving the practice of phlebotomy.

We are particularly grateful to BD Vacutainer Systems, Greiner Bio-One, Marketlab, the American Society for Clinical Pathology, The University of Texas M. D. Anderson Cancer Center (MDACC), Memorial Hermann Health Care System, and The University of Texas Houston Health Science Center for their support throughout many stages of our previous and current editions. We thank Donna Hermis and Dr. Passion Lockett for their assistance and expertise as contributing authors. We also thank the many students, faculty, and staff of the Diagnostic Center at the University of Texas M. D. Anderson Cancer Center who were models for the photographs and technical experts, especially Dr. Brandy Greenhill, Program Director, Clinical Laboratory Science Program; Kimberly Murray; and Peter McLaughlin, MD. Thanks also go to photographer Patrick Watson for his patience, effieicncy, and organizational skills.

We greatly appreciate our positive working relationships with editors and copyeditors, past and present, who have encouraged us and improved our writing through eight editions. Special thanks go to Jane Licht, Cheryl Mehalik, Lin Marshall, Mark Cohen, Melissa Kerian Bashe, Cathy Wein, and Amy Peltier.

Last, and most important, we gratefully acknowledge our families, who have proudly grown up with this text as part of their lives. They have continued to encourage us and have supportively tolerated the thousands of hours over many years that we have spent writing the previous and current edition of this textbook. They will always hold a special place in our hearts.

*Diana Garza*
*Kathleen Becan-McBride*

# Reviewers

Thank you to the following reviewers for their valuable contributions:

**Pamela Audette, MBA, MT, RMA**
Program Chair, Medial Assistant Program
Finlandia University
Hancock, Michigan

**Jerry Barton, MLS (ASCP)**
Phlebotomy Program Director
Cape Fear Community College
Wilmington, North Carolina

**Doris Beran, MPH, MT (ASCP)**
Allied Health Instructor
Coconino Community College
Flagstaff, Arizona

**Jimmy Boyd, MLS (ASCP)**
Program Director
Arkansas State University Beebe
Beebe, Arkansas

**Jennifer Elenbaas**
Instructor
Davenport University
Grand Rapids, Michigan

**Penny Ewing, BS, CMA (AAMA)**
Instructor
Gaston College
Dallas, North Carolina

**Michelle Mantooth, MSc., MLS (ASCP)CM, CG(ASCP) CM**
Instructor
Trident Technical College
North Charleston, South Carolina

**Kimberly Meshell**
Instructor
Angelina College
Lufkin, Texas

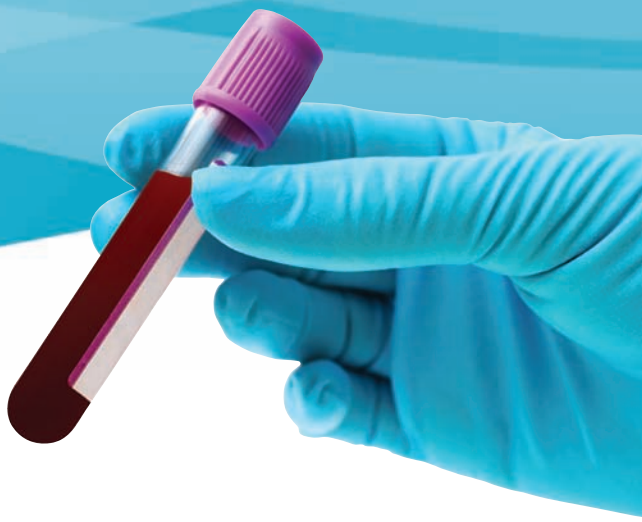
**Margaret Oliver, MT (ASCP)**
Instructor
Neosho County Community College
Ottawa, Kansas

**Evelyn Paxton, MS, MT (ASCP)**
Program Director
Rose State College
Midwest City, Oklahoma

**Pam Tully, MHS, MT (ASCP), PBT (ASCP)**
Phlebotomy Program Director
Bossier Parish Community College
Bossier City, Louisiana

*This page intentionally left blank*

# Chapter 1



# Phlebotomy Practice and Quality Assessment

## Chapter Objectives

### Upon completion of Chapter 1, the learner is responsible for doing the following:

1. Define phlebotomy and identify health professionals who perform phlebotomy procedures.
2. Identify the importance of phlebotomy procedures to the overall care of the patient.
3. List professional competencies for phlebotomists and key elements of a performance assessment.
4. List members of a health care team who interact with phlebotomists.
5. Describe the roles of clinical laboratory personnel and common laboratory departments/sections.
6. Describe health care settings in which phlebotomy services are routinely performed.
7. Explain components of professionalism and desired character traits for phlebotomists.
8. Describe healthy behaviors, fitness, and coping skills to reduce stress in the workplace.
9. List the basic tools used in quality improvement activities and give examples of how a phlebotomist can participate in quality improvement activities.
10. Define the difference between quality improvement and quality control.

## KEY TERMS

accuracy
acute care
aliquot
ambulatory care
American Society for Clinical Laboratory Science (ASCLS)
American Society for Clinical Pathology (ASCP)
anatomic pathology
Centers for Medicare & Medicaid Services (CMS)
clinical decisions
clinical pathology
competency statement
continuing education (CE)
continuous quality improvement (CQI)
examination (analytical phase)
Food and Drug Administration (FDA)
home health personnel
hospital- or health care-acquired infections (HAIs)
inpatients
International Organization for Standardization (ISO)
long-term care
nanotechnology
National Phlebotomy Association (NPA)
personal protective equipment (PPE)
phlebotomist
phlebotomy

CONTINUED

**KEY TERMS CONTINUED**

physician's office laboratories (POLs)
point-of-care (POC)
postexamination (postanalytical phase)
preexamination (preanalytical phase)
professionalism
quality
quality control (QC)
quality improvement
reliability
Six Sigma
stakeholders
standards of practice

# Phlebotomy Practice and Definition

**Clinical decisions** are based on medical standards of practice, diagnostic testing (e.g., laboratory tests and x-rays), a patient's history, and observation of signs and symptoms. Therefore, before physicians can make clinical decisions, they need laboratory test results for the patient. The development of modern diagnostic techniques, clinical laboratory automation, computer technology, standardization, globalization, and changes in the delivery of health care services have increased the variety and number of laboratory test options available for clinical decisions. Since laboratory test results influence the majority of medical decisions and play such an important role in the clinical management of patients, many health care workers are taking greater roles in the specimen collection process. Among those who perform phlebotomy tasks are clinical or medical laboratory personnel (including certified phlebotomists), nurses and nurse aides, respiratory therapists, medical assistants, home health personnel, and others. Regardless of specific job backgrounds, common elements about the practice of phlebotomy should be known by all who are responsible for blood specimen collections.

The term **phlebotomy** is derived from the Greek words, *phlebo,* which relates to veins, and *tomy,* which relates to cutting. In ancient times, phlebotomy was practiced to withdraw blood using various means, including knives, crude lancets, leeches, blood cups or bowls, pumps, and glass syringes. In some cultures, phlebotomy was thought to cleanse or purify the body and/or get rid of unwanted spirits. However, today, modern phlebotomy equipment and practices are very advanced. The current definition of *phlebotomy* can be summarized as the incision of a vein for collecting a blood sample (a portion of blood removed that is small enough so as not to cause harm) for laboratory testing or other therapeutic purposes (e.g., blood donations). Synonymous words are *venesection* or *venisection,* and the **phlebotomist,** or blood collector, is the individual who performs phlebotomy. The term *phlebotomist* will be used throughout this text even though it is interchangeable with *blood collector.* Phlebotomists often assist in the collection and transportation of specimens other than venous blood (e.g., arterial blood, urine, tissues, sputum) and may perform clinical, technical, or clerical functions. However, the primary function of the phlebotomist is to assist the health care team in the accurate, safe, and reliable collection and transportation of specimens for laboratory analyses.

In this text, numerous phlebotomy procedures and practices are covered, ranging from the most basic to more advanced procedures. However, the two most common phlebotomy techniques are extensively covered and are the essence of all phlebotomy practices:

- **Venipuncture**—Withdrawing a venous blood sample (from a vein, not an artery) using a needle attached to an evacuated tube system or other collection devices (covered in Chapters 8 and 10).
- **Skin Puncture**—Puncturing a finger with a specially designed safety lancet to withdraw a smaller amount of capillary blood (covered in Chapters 8 and 11).
- Advanced and/or specialized procedures are covered in Chapters 13, 15, 16, and 17.

Patients' blood specimens are discrete portions of blood taken for laboratory analysis of one or more characteristics to determine the character of the whole body.[1] Laboratory analyses of a variety of specimens are used for *three* important clinical purposes:

- **Diagnostic and Screening Tests**—To figure out what is wrong with the patient (e.g., tests that detect abnormalities) or to detect irregularities that require more extensive follow-up testing.

- **Therapeutic Assessments**—To develop the appropriate therapy or treatment of the medical condition (e.g., tests that predict the most effective treatment or the drug of choice)
- **Monitoring**—To make sure the therapy or treatment is working to alleviate the disease or illness (e.g., tests to confirm that the abnormality has returned to normal or that the drug is reaching its effective dosage)

Thus, the requirement for a high-quality specimen that is correctly identified, collected, and transported is vital to the overall care of a patient. Phlebotomists' duties vary in scope and range, depending on the setting. They may have duties related to all phases of laboratory analysis or may be assigned to only specimen collection duties in one area of a hospital. Technology has enabled laboratory testing to be performed closer to the **point-of-care (POC);** for example, at the patient's bedside, at ancillary or mobile clinic sites, in the home, or even in an ambulance (**BOX 1–1**). Phlebotomists' duties have become more coordinated with other health care processes. In some cases, health professionals—such as nurses, respiratory therapists, patient care technicians, medical assistants, and others—have been cross-trained to assume phlebotomy duties; in other cases, traditional laboratory-based phlebotomists have been cross-trained to assume expanded clerical or patient care duties—for example, performing electrocardiograms and low-risk laboratory procedures. Whatever the case, the workplace settings and roles and responsibilities of the health care professional who performs phlebotomy procedures will continue to evolve and change.

## HEALTH CARE SETTINGS AND HEALTH CARE TEAMS

Health care organizations in the United States vary widely but most fit into two categories: **inpatient,** where patients are in a hospital for more serious conditions and care and outpatient or **ambulatory care,** where patients's conditions are less critical and can be treated without hospitalization. Traditional hospitals are organized into departments according

**BOX 1–1**

### Potential Job Sites for Phlebotomists

**Hospital (Inpatient) Settings**

Acute-care hospitals (urban or rural)
Specialty hospitals (cancer, psychiatric, long-term care, pediatric)
Hospital-based clinics
Hospital-based emergency centers

**Ambulatory Care (Outpatient) Settings**

Health department clinics
Community health centers (CHCs)
Rural health clinics
Community-based mental health centers
School-based clinics
Prison health clinics
Dialysis centers
Screening centers
Home hospice
Durable medical equipment suppliers
**Physician's office laboratories** (POLs) (in medical clinics)
**Home health care** (provided in the patient's home)
Health maintenance organizations (HMOs)
Insurance companies
Physician group practices
Individual or solo medical practices
Specialty practices
Rehabilitation centers
Mobile vans for blood donations
Mobile vans for primary care delivery
Free-standing surgical centers
Reference laboratory collection sites
Drug screening sites
Mobile mammography units

to medical/surgical specialties and/or around organs systems as shown in **TABLE 1–1**. Sometimes, departments are organized by therapy services or procedures offered to the patient. Phlebotomists should become knowledgeable about these areas of the hospital and the personnel who work there because patients spend time in them prior to, during, and/or after their phlebotomy procedures. Some factors that relate to these departments may affect the outcome of the laboratory test, and they all involve members of the health care team.

## HOSPITALS IN THE UNITED STATES

There are over 5,700 hospitals in the United States. They vary according to the following factors:

- Mission (patient care, education, research)
- Number of staffed beds (over 920,000 beds in the United States)[2]
- Admissions (a total of over 37 million per year)[2]
- Ownership (public or nonprofit, governmental, for profit [investor owned or proprietary])
- Length of stay (short term [e.g., less than 30 days] or long-term [e.g., greater than 30 days])
- Type of care (e.g., **acute care** [short term treatment for an urgent injury or medical condition], cancer center, psychiatric, **long-term care** [treatment for chronic conditions], pediatric, rehabilitation, etc.)
- Location (urban or rural)
- Relationship to other health facilities (e.g., hospital system-managed by a central organization or a network of providers that work together to coordinate care and may or may not be affiliated with each other)

**TABLE 1–1**

### Medical, Surgical, and Ancillary Service Departments in Large Health Care Facilities

Health care professionals make up one of the largest workforce segments in the United States. For every one physician, there are approximately 16 health care workers who provide direct and support services to the patient and physician. The following list is only a partial listing of common clinical departments and personnel. There are many levels of education, experience, credentialing processes, and licensing requirements for the health care industry, and it is beyond the scope of this text to cover all the important individuals. There are also a variety of specialties and subspecialties for physicians (medical doctors, MDs), scientists, biomedical engineers, nurses, physician assistants (PAs), social workers, pharmacists, therapists, technical individuals, and spiritual support personnel who are valuable members of the health care team but too numerous to mention here.

| Department | Functions | Personnel |
|---|---|---|
| Allergy | Diagnosis and treatment of persons who have allergies or "reactions" to irritating agents. | Physicians, nurses, medical assistants |
| Anesthesiology | Pain management before, during, and after surgery. | Anesthesiologist, nurse anesthetist |
| Cardiology | Medical diagnosis and treatment of conditions relating to the heart and circulatory conditions. | Cardiologist (MD) |
| Cardiovascular | Surgical diagnosis and treatment of heart and blood circulation disorders. | Cardiovascular surgeon (MD), surgical nurse |
| Dermatology | Diagnosis and treatment of skin conditions. | Dermatologist (MD), nurse, medical assistant |
| Diagnostic Imaging or Radiology | Uses ionizing radiation for treating disease, fluoroscopic and radiographic x-ray instrumentation and imaging methods for diagnosis, and radioisotopes for both diagnosing and treating disease. Sometimes patients are injected with dye that might interfere with some laboratory tests. The phlebotomist should document the circumstances as appropriate. In addition, the phlebotomist should be aware of applicable safety requirements. | Radiologist, radiologic technician/ technologist |
| Electrocardiography | Uses the electrocardiograph (ECG or EKG) to record the electric currents produced by contractions of the heart. This assists in the diagnosis of heart disease. | Cardiologist, nurse, medical assistant, EKG technician |
| Electroencephalography | Uses the electroencephalograph (EEG) to record brain wave patterns. | Neurologist (MD), nurse |
| Endocrinology | Diagnosis and treatment of disorders in the organs and tissues that produce hormones (e.g., estrogen, testosterone, cortisol). | Endocrinologist (MD), nurse |
| Family medicine/General practice | Care of general medical problems of all family members. | Family practice or primary care physician (MD) |

## TABLE 1–1

### Medical, Surgical, and Ancillary Service Departments in Large Health Care Facilities (*continued*)

| Department | Functions | Personnel |
|---|---|---|
| Gastroenterology | Diagnosis and treatment of conditions relating to esophagus, stomach, and intestines. | Gastroenterologist |
| Geriatrics/Gerontology | Diagnosis and treatment of the elderly population. | Gerontologist |
| Hematology | Diagnosis and treatment of conditions relating to the blood. | Hematologist |
| Immunology | Diagnosis and treatment of conditions relating to the immune system | Immunologist |
| Internal Medicine | General diagnosis and treatment of patients for problems of one or more internal organs | Internist (MD) or doctor of osteopathic medicine (DO), nurse, physician assistant (PA) |
| Laboratory Medicine/Pathology | Uses sophisticated instrumentation to analyze blood, body fluids, and tissues for pathological conditions. Laboratory results are used in diagnosis, treatment, and monitoring of patients' health status. | Pathologist, pathology assistant, laboratory personnel (Box 1–2) |
| Neonatal/Perinatal | Study, support, and treatment of newborn and prematurely born babies and their mothers. | Neonatologist |
| Nephrology | Kidneys. | Urologist |
| Neurology | Nervous system. | Neurologist, neurosurgeon |
| Nuclear Medicine | Uses radioactive isotopes or tracers in the diagnosis and treatment of patients and in the study of the disease process. The radioactive substance is injected into the patient and emits rays that can be detected by sophisticated instrumentation. Phlebotomists should be knowledgeable of special safety requirements for entering this area. Also, the radioisotopes may interfere with laboratory testing, so documentation of this therapy may be required. | Radiotherapist (MD) |
| Nutrition and Dietetics | Perform nutritional assessments and patient education, and design special diets for patients who have eating-related disorders (e.g., diabetes, obesity, anorexia). | Nutritionist, dietician |
| Obstetrics/Gynecology | Diagnosis and treatment relating to the sexual reproductive system of females, using both surgical and nonsurgical procedures. | Obstetrician, gynecologist (MD) |
| Occupational Therapy | Assists the patient in becoming functionally independent within the limitations of the patient's disability or condition. Occupational therapists (OTs) collaborate with the health care team to design therapeutic programs of rehabilitative activities for the patient. The therapy is designed to improve functional abilities or activities of daily living (ADLs). | Occupational therapist (OT) |
| Oncology | Diagnosis and treatment of malignant (life-threatening) tumors (i.e., cancer). | Oncologist (MD) |
| Ophthalmology | Diagnosis and treatment of the eyes and vision-related medical problems. | Ophthalmologist (MD), optometrist (DO) |
| Orthopedics | Care of medical concerns related to bones and joints. | Orthopedic Surgeon (MD), physical therapist |
| Otolaryngology | Diagnosis and treatment of medical problems related to ears, nose, and throat (ENT). | Otolaryngologist, speech pathologist, audiologist |
| Pathology | *See* Laboratory Medicine/Pathology | |
| Pediatrics | General diagnosis and therapy for children. | Pediatrician (MD) |
| Pharmacy | Dispenses medications ordered by physicians. Pharmacists also collaborate with the health care team on drug therapies. Phlebotomists may collect blood specimens at timed intervals to monitor the level of the drug in the patient's bloodstream. | Doctor of Pharmacy (Pharm. D), pharmacist |
| Physical Medicine | Diagnosis and treatment of disorders of the neuromuscular system. | Physical therapist (PT), occupational therapist (OT) |
| Physical Therapy | Assists in restoring physical abilities that have been impaired by illness or injury. Rehabilitation programs often use heat/cold, water therapy, ultrasound or electricity, and physical exercises designed to restore useful activity. | PT and OT |
| Plastic Surgery | Cosmetic surgery or surgical correction of the deformity of tissues, including skin. | Plastic surgeon (MD) |
| Proctology | Diagnosis and treatment of diseases of the anus and rectum. | Proctologist (MD) |
| Psychiatry/Neurology | Diagnosis and treatment for people of all ages with mental, emotional, and nervous system problems, using primarily nonsurgical procedures. | Psychiatrist/Neurologist (MD) |
| Pulmonary | Diagnosis and treatment of conditions relating to the respiratory system. | Pulmonologist (MD) |
| Radiotherapy | Uses high-energy x-rays, such as from cobalt treatment, in the treatment of disease, particularly cancer. Safety precautions are important to avoid unnecessary irradiation. | Radiotherapist (MD), nuclear medicine technician |
| Rheumatology | Diagnosis and treatment of joint and tissue diseases, including arthritis. | Rheumatologist (MD) |
| Surgery | Diagnosis and treatment in which the physician physically alters a part of the patient's body. | General surgeon, specialty surgeon (orthopedic, cardiovascular, etc.) (MD) |
| Urology | Diagnosis and treatment of medical conditions related to sexual/reproductive system in men, and renal system for men and women. | Urologist, nephrologist (MD) |

## BECOMING A PART OF THE HEALTH CARE TEAM

All health care workers are expected to be valuable members of a health care team (**FIGURE 1–1**). Even though there are many levels and types of health care teams (self-directed work groups, manager-led group, etc.) and roles/responsibilities that are assigned to each, there are important questions to ask in each situation:

What do I need to do to maximize team/group effectiveness?
How can I be a better team member?

In high-performance teams, every team member should:

- Understand the mission of the organization, the goals of the group, and/or the project
- Know basic skills for group processes (listening skills, setting norms for the team, etc.)
- Show reliability and dependability in work assignments
- Communicate one's own ideas and feelings
- Actively and respectfully participate in decision making
- Learn how to be flexible in decision making (give and take)
- Constructively manage conflicts
- Contribute to the cohesion of the team
- Contribute to problem-solving strategies
- Support and encourage other team members

Individuals should reflect on this list periodically as they go through this text and through their careers. To make it a self-assessment, simply add the words "Do I . . ." to each phrase in the list. Professional growth and maturity occur if one can honestly answer these questions and strive for improvement if there are deficits. Additional resources for team development and communication are listed at the end of this chapter and in Chapter 2.

**FIGURE 1–1**
Health Care Team

Daily communication with a health care team is part of the job. Discussions that occur within a patient's hearing range must be highly professional.

# The Clinical Laboratory and Specimen Collection Services

A typical hospital-based clinical laboratory has two components: clinical pathology and anatomic pathology. In the **clinical pathology** area (also called the *clinical laboratory* or *medical laboratory*), blood and other types of body fluids and tissues are analyzed (e.g., urine, cerebrospinal fluid [CSF], sputum, gastric secretions, and synovial fluid). In the **anatomic pathology** area, autopsies are performed, histologic and cytologic procedures are utilized for tissue and fluid specimens, and fine-needle aspirates and surgical biopsy tissues are analyzed.

Laboratories can also be independently owned and operated outside the hospital setting i.e., physicians office laboratories. Large hospital laboratories typically have organizational structures that have an administrative/management hierarchy, a central specimen processing area, and divisions or sections for the testing processes (**FIGURE 1–2**). Each section may have a pathologist as the director and supervisors who oversee the technical procedures and troubleshoot issues that arise in that section.

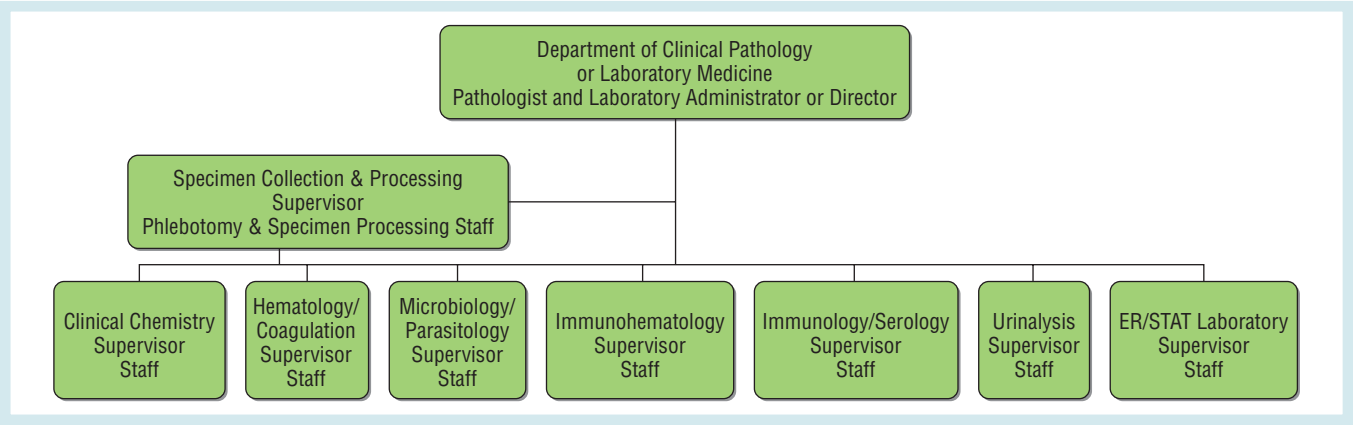



**FIGURE 1–2**
Example of an Organizational Chart for a Clinical Laboratory

This figure shows an overview of the major sections of a hypothetical hospital-based clinical laboratory.

Regardless of the type or size of the clinical laboratory, it is important to understand that the phlebotomist plays a vital role early in the process of producing laboratory results/reports. **Reliability** (reproducibility and consistency) and **accuracy** (the degree of correctness) of *all* patient test results depend on the **preexamination process (preanalytical phase)** of specimen collection—that is, the part of the process that occurs from the time laboratory tests are ordered through the time that specimens are actually delivered to the laboratory and then processed and/or transported to a referral laboratory (i.e., before the actual testing and analysis is performed). The preexamination process is the fundamental and crucial domain of every phlebotomist. **FIGURE 1–3** depicts the functional phases of laboratory testing, the preexamination (preanalytical phase), the **examination (analytical phase),** and the **postexamination (postanalytical phase)**.[1]


**FIGURE 1–3**
The Clinical Laboratory's Workflow Pathway

The Clinical and Laboratory Standards Institute (CLSI) describes the basic workflow of a clinical laboratory as beginning with a request for a laboratory test and ending with laboratory examination results and their interpretation by a health care provider. The workflow concept is depicted here in general terms and in reality involves many steps and actions; only a few examples are listed under each heading. The importance of these processes cannot be overstated because any failure to perform them correctly or completely can result in harm to patients, medical errors, waste of resources, and repeated work. All steps in each of these domains must be done according to standards of practice and must be traceable to the individual who performs the tasks. **Standards of practice** are procedural guidelines set by governmental, accreditation, certification agencies; professional organizations; and/or manufacturing and equipment requirements.

Smaller clinical laboratories can be located in remote locations or in clinics, physicians' offices, and mobile vans. Health care workers who perform the testing must maintain the same high standards of quality as are found in larger, high-volume laboratories.

The federal government has several agencies that regulate and oversee all clinical laboratories; they include the U.S. **Food and Drug Administration (FDA),** the **Centers for Medicare & Medicaid Services (CMS)** in the federal Department of Health and Human Services, the Occupational Safety and Health Administration (OSHA) in the Department of Labor, and the Department of Transportation (DOT). Some of these will be discussed more extensively in later chapters. Other regulatory agencies also have oversight of clinical laboratories, depending on the health care setting, the type and complexity of the testing they do, and employee certification. Among these are the International Association of Blood Banks, the American Society for Clinical Pathologists (ASCP), the College of American Pathologists (CAP), and The Joint Commission.

Also, some states (including California, New York, and Florida) have licensure/certification regulations and/or testing requirements for laboratory personnel. Phlebotomists should be knowledgeable about the licensure requirements when applicable because they may be allowed to perform certain procedures in one state but not in another. For example, many phlebotomists are allowed to perform basic point-of-care tests in most states, but they are not allowed to do so in California. Also, in California, the Department of Public Health requires specific proficiency areas for three different levels of licensed phlebotomists: Limited Phlebotomy Technician, Phlebotomy Technician I, and Phlebotomy Technician II. Refer to the Resources at the end of the chapter for more information.

### CLINICAL/MEDICAL LABORATORY DEPARTMENTS

Clinical laboratories, especially those that are hospital based, typically have an administrative office headed by a pathologist and/or a director who oversees the many financial and operational aspects of the laboratory. Administrative responsibilities include all financial matters, such as cost accounting and budgeting, as well as human resources, strategic planning, operational issues, and regulatory issues. Depending on the size of the organization, the laboratory may have multiple supervisory/management personnel and/or physicians or scientists overseeing specific areas of the clinical laboratory. Large clinical laboratories usually cluster similar testing processes according to the sections listed in the organizational chart in Figure 1–2.

### CLINICAL/MEDICAL LABORATORY PERSONNEL

Laboratory personnel work as a team to provide essential clinical data to physicians for diagnosing, treating, and monitoring patients. They provide the many pieces of a complex puzzle that make up a patient's condition. Laboratory professionals have some common characteristics: They like to solve problems, they strive for accuracy and reliability in their job tasks, they communicate well, they work under pressure and follow through on complex tasks, and they set high-quality standards for themselves and their work. Regardless of the level of education, health care workers involved with phlebotomy should familiarize themselves with various members of the clinical laboratory team (**BOX 1–2**).

## Competencies, Certification, and Professionalism for Phlebotomists

The requirements for a phlebotomist vary across health care settings and regions of the country. A high school diploma or its equivalent is most often required to enter a phlebotomy training program in hospitals, community colleges, or technical schools. Typically, the length of training ranges from a few weeks to months, depending on the location, size of the facility, and the complexity of patients being served. Prior to