

Seventh Edition

Basic Skills in
INTERPRETING
LABORATORY DATA

Christopher J. Edwards and Brian L. Erstad



Any correspondence regarding this publication should be sent to the publisher, American Society of Health-System Pharmacists, 4500 East-West Highway, Suite 900, Bethesda, MD 20814, attention: Special Publishing.

The information presented herein reflects the opinions of the contributors and advisors. It should not be interpreted as an official policy of ASHP or as an endorsement of any product.

Because of ongoing research and improvements in technology, the information and its applications contained in this text are constantly evolving and are subject to the professional judgment and interpretation of the practitioner due to the uniqueness of a clinical situation. The editors and ASHP have made reasonable efforts to ensure the accuracy and appropriateness of the information presented in this document. However, any user of this information is advised that the editors and ASHP are not responsible for the continued currency of the information, for any errors or omissions, and/or for any consequences arising from the use of the information in the document in any and all practice settings. Any reader of this document is cautioned that ASHP makes no representation, guarantee, or warranty, express or implied, as to the accuracy and appropriateness of the information contained in this document and specifically disclaims any liability to any party for the accuracy and/or completeness of the material or for any damages arising out of the use or non-use of any of the information contained in this document.

Vice President, Publishing Office: Daniel J. Cobaugh, PharmD, DABAT, FAACT

Editorial Director, Special Publishing: Lori N. Justice, PharmD

Editorial Coordinator, Special Publishing: Elaine Jimenez

Director, Production and Platform Services, Publishing Operations: Johnna M. Hershey, BA

Cover Design: DeVall Advertising

Cover Art: berCheck - stock.adobe.com

Page Design: David Wade

Library of Congress Cataloging-in-Publication Data

Names: Edwards, Christopher J. PharmD, editor. | Erstad, Brian, editor. | American Society of Health-System Pharmacists, issuing body.

Title: Basic skills in interpreting laboratory data / [edited by] Christopher J. Edwards, Brian L. Erstad.

Description: Seventh edition. | Bethesda, MD : American Society of Health-System Pharmacists, 2022. | Includes bibliographical references and index. | Summary: "Basic Skills in Interpreting Laboratory Data continues to be the most popular teaching text on laboratory data for pharmacy students as well as the go-to reference for pharmacists in therapeutic practice. Now in its seventh edition, Basic Skills has been expanded and updated to cover new drugs, research, and therapeutic approaches. Edited by new co-editors Christopher J. Edwards, PharmD, BCPS, and Brian L. Erstad, PharmD, FASHP, FCCP, MCCM, BCPS, the seventh edition is a comprehensive, in-depth guide to all aspects of lab work that apply to clinical practice. Written by a team of over 30 established clinicians and pharmacy faculty members and reviewed by additional experts, it is designed to make all information clear and quickly accessible. The seventh edition boasts new minicases that provide clinical scenarios for using tests and managing patients, and quickview charts throughout offer clear interpretations of lab results"—Provided by publisher.

Identifiers: LCCN 2021049621 (print) | LCCN 2021049622 (ebook) | ISBN 9781585286416 (paperback) |

ISBN 9781585286423 (adobe pdf) | ISBN 9781585286430 (epub)

Subjects: MESH: Clinical Laboratory Techniques | Reference Values | Clinical Laboratory Services

Classification: LCC RB37 (print) | LCC RB37 (ebook) | NLM QY 80 | DDC 616.07/5—dc23/eng/20211015

LC record available at <https://lcn.loc.gov/2021049621>

LC ebook record available at <https://lcn.loc.gov/2021049622>

© 2022, American Society of Health-System Pharmacists, Inc. All rights reserved.

No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, microfilming, and recording, or by any information storage and retrieval system, without written permission from the American Society of Health-System Pharmacists.

ASHP is a service mark of the American Society of Health-System Pharmacists, Inc.; registered in the U.S. Patent and Trademark Office.

ISBN: 978-1-58528-641-6 (paperback)

ISBN: 978-1-58528-642-3 (Adobe pdf)

ISBN: 978-1-58528-643-0 (ePub)

10987654321

DOI: 10.37573/9781585286423

DEDICATION

This book is dedicated to all of the
pharmacy educators helping to shape
the future of our profession.

Chris Edwards and Brian Erstad

CONTENTS

PREFACE	vii
CONTRIBUTORS	ix
REVIEWERS	xii
CLINICAL PROOFREADERS	xiv
ABBREVIATIONS	xv
PART I: BASIC CONCEPTS AND TEST INTERPRETATIONS	1
<hr/>	
CHAPTER 1 Definitions and Concepts.....	3
<i>Karen J. Tietze</i>	
CHAPTER 2 Introduction to Common Laboratory Assays and Technology.....	19
<i>Nicholas M. Moore</i>	
CHAPTER 3 Primer on Drug Interferences with Test Results.....	43
<i>Mary Lee</i>	
CHAPTER 4 Point-of-Care Testing	51
<i>Lisa M. Cillessen, Heather Lyons-Burney, and Paul O. Gubbins</i>	
CHAPTER 5 Interpretation of Serum Drug Concentrations	75
<i>Riane Ghamrawi and Lindsay Benedik</i>	
CHAPTER 6 Pharmacogenetics and Molecular Testing.....	119
<i>Jason H. Karnes and Laura B. Ramsey</i>	
PART II: SYSTEM DISORDERS AND DIAGNOSTIC TESTS	137
<hr/>	
CHAPTER 7 Cardiac Function and Related Tests	139
<i>Jessica DeAngelo and Jacqueline Finger</i>	
CHAPTER 8 Lipid Disorders.....	149
<i>Jill S. Borchert and Kathy E. Komperda</i>	
CHAPTER 9 Endocrine Disorders.....	165
<i>Eva Vivian</i>	
CHAPTER 10 Renal Function and Related Tests	201
<i>Kimmy T. Nguyen</i>	
CHAPTER 11 Electrolytes, Other Minerals, and Trace Elements.....	229
<i>Lingtak-Neander Chan and Jasmine S. Mangrum</i>	
CHAPTER 12 Interpretation of Laboratory Tests Associated with the Assessment of Nutritional Status.....	275
<i>Lingtak-Neander Chan and Sharon Wu</i>	
CHAPTER 13 Arterial Blood Gases and Acid–Base Balance.....	287
<i>Jeffrey F. Barletta</i>	

CHAPTER 14	Pulmonary Function and Related Tests	301
	<i>Lori A. Wilken and Min J. Joo</i>	
CHAPTER 15	Liver and Gastroenterology Tests.....	315
	<i>Paul Farkas, Joanna Sampson, Matthew Slitzky, and Jason Altman</i>	
CHAPTER 16	Hematology: Red and White Blood Cell Tests	355
	<i>Michael D. Katz and Timothy C. Jacisin</i>	
CHAPTER 17	Hematology: Blood Coagulation Tests.....	377
	<i>Lea E. Dela Peña</i>	
CHAPTER 18	Infectious Diseases: Bacteria.....	403
	<i>Sharon M. Erdman, Rodrigo M. Burgos, and Keith A. Rodvold</i>	
CHAPTER 19	Infectious Diseases: Fungi, Viruses, and Mycobacteria	445
	<i>Rodrigo M. Burgos, Sharon M. Erdman, and Keith A. Rodvold</i>	
CHAPTER 20	Rheumatic Diseases	491
	<i>Susan P. Bruce</i>	
CHAPTER 21	Cancers and Tumor Markers	513
	<i>Sarah A. Schmidt</i>	
CHAPTER 22	Drug Screens and Toxicological Tests	543
	<i>Peter A. Chyka</i>	
PART III: TESTS FOR SPECIAL POPULATIONS		571
CHAPTER 23	Interpreting Pediatric Laboratory Data.....	573
	<i>Jessica L. Jacobson, Beth S. Shields, and Donna M. Kraus</i>	
CHAPTER 24	Women's Health.....	601
	<i>Candi C. Bachour</i>	
CHAPTER 25	Men's Health.....	625
	<i>Mary Lee and Roohollah Sharifi</i>	
Appendix A	Therapeutic Ranges of Drugs in Traditional and SI Units	659
Appendix B	Nondrug Reference Ranges for Common Laboratory Tests in Traditional and SI Units.....	660
INDEX	663

The publication of this edition of *Basic Skills in Interpreting Laboratory Data* has been made possible by the dedicated chapter authors, reviewers, and the publishing staff at the American Society of Health-System Pharmacists. It has been an honor to serve as the editors and to work with this team.

The seventh edition of this work brings about several major changes. After serving as the sole editor for 5 editions of this work, Mary Lee, PharmD, has relinquished this role to pursue other projects, although she continues to be a chapter author. As the new editors, we are indebted to her for the countless hours she spent developing the foundations upon which this edition was built.

Similarly, with this edition, five new lead authors were invited to update existing chapters due to unavailability of the original chapter authors. Drs. Jason Karnes and Laura Ramsey joined as authors for the chapter on Pharmacogenetics and Molecular Testing. Drs. Jessica DeAngelo and Jacqueline Finger revamped the chapter on Cardiac Function and Related Tests to focus on laboratory values relevant to this aspect of practice. Drs. Michael Katz and Timothy Jacisin also joined to serve as authors for the chapter Hematology: Red and White Blood Cell Tests. Dr. Kimmy Nguyen took the role of lead author for the chapter on Renal Function and Related Tests, and Dr. Raine Ghamrawi stepped into the role of lead author for the chapter on Interpretation of Serum Drug Concentrations. All of the lead authors are established clinicians and/or experienced faculty at colleges of pharmacy or medicine, which enhance the quality of the chapter content.

A new group of reviewers has joined this project, and many reviewers are board-certified or otherwise recognized as established experts. Their specialty knowledge and scrutiny of the chapter content have helped to ensure that each chapter is up-to-date and content is relevant to clinical practice. As you use this book, you will find that the seventh edition includes updated chapter content with references, and almost all of the chapters have at least one new minicase and learning point. In addition, the abbreviations in the front of the book have been expanded for reader convenience.

Significant and notable new chapter content:

1. Pharmacogenomics: Significant expansion to add new information that has become available since the publication of the previous edition.
2. Cardiology: Expanded information about available laboratory testing relevant to cardiology practice.
3. Nutrition Support: A new chapter has been added to discuss laboratory testing pertinent to the assessment and monitoring of patients receiving parenteral nutrition.
4. Infectious Diseases has been divided into two sections given the amount of material relevant to this topic with each section being expanded to include new laboratory tests in each area.

Suggestions for using this book efficiently:

- For a general overview of the laboratory tests for various organ systems or types of diseases, use the table of contents to identify the most appropriate section or chapter(s). The chapters are grouped into three major sections: Basic Concepts and Test Interpretations, System Disorders and Diagnostic Tests, and Tests for Special Populations. By reading the section or a chapter from start to finish, you get a detailed summary of the laboratory tests used to evaluate that organ system or disease, why the test is used, what a normal value range is for the test, and how to interpret an abnormal laboratory test result.
- Minicases guide the reader through common clinical scenarios about ordering appropriate laboratory tests, interpreting results, managing patients, and addressing spurious laboratory tests. Learning points conclude each chapter and highlight key concepts about the laboratory tests. Using the book in this way will be helpful, especially when used as a companion to a disease state management course, a pharmacotherapeutics course, or a course that prepares students for full-time clinical rotations.
- For information on a specific laboratory test, use the alphabetical index to locate the test, and then go to the page(s) to access the following information: the purpose of the test; how the test result relates to the pathophysiology of a disease or the physiologic function of a cell or organ; the normal range for the test; causes for an abnormal test result; and causes of false-positive or false-negative results. This approach will be most useful in the clinical management of a patient.
- Quickview charts are provided for some of the most common laboratory tests. These charts are standardized template presentations of information that allow readers to quickly learn about a specific laboratory test (eg, what the test is used for, what a normal

result is, and causes of an abnormal result). This approach also will be most useful in the clinical management of a patient, but the Quickview content should be supplemented with the in-depth information in the chapters about a particular laboratory test. The authors, reviewers, and we as editors hope that *Basic Skills in Interpreting Laboratory Data* is useful to your practice.

Chris Edwards and Brian Erstad
December 2021

CONTRIBUTORS

EDITORS

Christopher J. Edwards, PharmD, BCPS

Assistant Professor
Department of Pharmacy Practice & Science
R. Ken Coit College of Pharmacy
University of Arizona
Tucson, Arizona

Brian L. Erstad, PharmD, FASHP, FCCP, MCCM, BCPS

Professor and Head
Department of Pharmacy Practice & Science
R. Ken Coit College of Pharmacy
University of Arizona
Tucson, Arizona

CONTRIBUTORS

Jason Altman, MD

Western Mass GI Associates
Springfield, Massachusetts

Candi C. Bachour, PharmD

Department of Clinical Pharmacy
University of Tennessee Health Science Center
Memphis, Tennessee

Jeffrey F. Barletta, PharmD, FCCM

Professor and Vice-Chair
Department of Pharmacy Practice
Midwestern University College of Pharmacy, Glendale Campus
Glendale, Arizona

Lindsay Benedik, PharmD, BCPS, BCGP

Director, Pharmacology Education, Foundations
Assistant Professor, Medical Education & Geriatrics
Write State University, Boonshoft School of Medicine
Dayton, Ohio

Jill S. Borchert, PharmD, BCACP, BCPS, FCCP

Professor and Vice-Chair, Pharmacy Practice
Midwestern University College of Pharmacy
Downers Grove, Illinois

Susan P. Bruce, PharmD, BCPS

Dean and Professor
Wingate University
School of Pharmacy
Wingate, North Carolina

DOI 10.37573/9781585286423.FM

Rodrigo M. Burgos, PharmD, MPH

Clinical Assistant Professor
College of Pharmacy
University of Illinois Chicago
Chicago, Illinois

Lingtak-Neander Chan, PharmD, BCNSP, FACN

Professor and Vice Chair
Department of Pharmacy
Interdisciplinary Faculty in Nutritional Sciences
School of Pharmacy & Graduate Program in Nutritional
Sciences
University of Washington
Seattle, Washington

Peter A. Chyka, PharmD, DABAT, FAACT

Professor Emeritus
College of Pharmacy, Knoxville Campus
The University of Tennessee Health Science Center
Knoxville, Tennessee

Lisa M. Cillessen, PharmD, BCACP

Clinical Associate Professor
UMKC School of Pharmacy at MSU
Springfield, Missouri

Jessica DeAngelo, PharmD, MBA, BCPS

Clinical Assistant Professor
R. Ken Coit College of Pharmacy
University of Arizona
Cardiology Clinical Pharmacist
Banner – University Medical Center Tucson
Tucson, Arizona

Lea E. Dela Peña, PharmD, BCPS

Associate Professor, Pharmacy Practice
Midwestern University Chicago College of Pharmacy
Downers Grove, Illinois

Sharon M. Erdman, PharmD, FIDP

Clinical Professor of Pharmacy Practice
Purdue University College of Pharmacy
Infectious Diseases Clinical Pharmacist
Eskenazi Health
Indianapolis, Indiana

Paul Farkas, MD, AGAF, FACP

Chief of Gastroenterology
Mercy Hospital
Assistant Clinical Professor of Medicine
Tufts University School of Medicine
Springfield, Massachusetts

Jacqueline Finger, PharmD, BCCP

Cardiovascular Critical Care Clinical Pharmacist
Banner – University Medical Center Tucson
Tucson, Arizona

Riane Ghamrawi, PharmD, BCPS, BCIDP

Clinical Pharmacy Specialist
Antimicrobial Stewardship/Infectious Diseases
UC Health West Chester Hospital
West Chester Township, Ohio
UC Health Daniel Drake Center for Post-Acute Care
Cincinnati, Ohio

Paul O. Gubbins, PharmD, FCCP, FIDP

Associate Dean
Vice Chair and Professor
Division of Pharmacy Practice and Administration
UMKC School of Pharmacy at MSU
Springfield, Missouri

Timothy C. Jacisin, PharmD

Clinical Pharmacy Specialist
Newark Beth Israel Medical Center
Newark, New Jersey

Jessica L. Jacobson, PharmD, BCPS, BCPPS

Clinical Pharmacy Specialist, Pediatric Intensive Care
Director, PGY2 Pediatric Pharmacy Residency
Rush University Medical Center
Chicago, Illinois

Min J. Joo, MD, MPH, FCCP

Professor of Medicine
Department of Medicine
University of Illinois at Chicago
Chicago, Illinois

Jason H. Karnes, PharmD, PhD, BCPS, FAHA, FCCP

Associate Professor
Department of Pharmacy Practice and Science
R. Ken Coit College of Pharmacy
University of Arizona
Tucson, Arizona

Michael D. Katz, PharmD

Professor
Department of Pharmacy Practice and Science
R. Ken Coit College of Pharmacy
University of Arizona
Tucson, Arizona

Kathy E. Komperda, PharmD, BCPS

Professor, Pharmacy Practice
Midwestern University College of Pharmacy
Downers Grove, Illinois

Donna M. Kraus, PharmD, FAPhA, FCCP, FPPAG

Associate Professor Emerita of Pharmacy Practice
College of Pharmacy
University of Illinois at Chicago
Chicago, Illinois

Mary Lee, PharmD, BCPS, FCCP

Vice President and Special Assistant to the President
Pharmacy and Optometry Education
Midwestern University
Professor, Pharmacy Practice
Midwestern University Chicago College of Pharmacy
Downers Grove, Illinois

Heather Lyons-Burney, PharmD

Clinical Associate Professor
UMKC School of Pharmacy at MSU
Springfield, Missouri

Jasmine S. Mangrum, PharmD, MPH

Assistant Teaching Professor, Clinical Practice
School of Pharmacy
University of Washington
Seattle, Washington

Nicholas M. Moore, PhD, D(ABMM), MLS (ASCP)^{CM}

Assistant Director
Division of Clinical Microbiology
Associate Professor
Department of Medical Laboratory Science
Rush University Medical Center
Chicago, Illinois

Kimmy T. Nguyen, PharmD

Assistant Professor
Wilkes University
Kingston, Pennsylvania

Laura B. Ramsey, PhD

Associate Professor, Department of Pediatrics
University of Cincinnati College of Medicine
Cincinnati Children's Hospital Medical Center
Cincinnati, Ohio

Keith A. Rodvold, PharmD, FCCP, FIDSA

Distinguished Professor
Colleges of Pharmacy and Medicine
University of Illinois Chicago
Chicago, Illinois

Joanna Sampson, MD

Western Mass GI Associates
Springfield, Massachusetts

Sarah A. Schmidt, PharmD, BCPS, BCOP

Clinical Assistant Professor—Hematology/Oncology
University of Oklahoma College of Pharmacy
Oklahoma City, Oklahoma

Roohollah Sharifi, MD, FACS

Section Chief of Urology
Jesse Brown Veterans Administration Hospital
Professor of Urology and Surgery
University of Illinois College of Medicine
Chicago, Illinois

Beth S. Shields, PharmD, BCPPS

Associate Director, Pharmacy Operations
Clinical Pharmacy Specialist, Pediatrics
Rush University Medical Center
Chicago, Illinois

Matthew Slitzky, MD

Western Mass GI Associates
Springfield, Massachusetts

Karen J. Tietze, PharmD

Professor of Clinical Pharmacy
Department of Pharmacy Practice and Pharmacy
Administration
University of the Sciences
Philadelphia College of Pharmacy
Philadelphia, Pennsylvania

Eva Vivian, PharmD, MS, PhD, FADCES

Professor, Pharmacy Practice
University of Wisconsin—Madison School of Pharmacy
Madison, Wisconsin

Lori A. Wilken, PharmD, BCACP

Clinical Assistant Professor, Pharmacy Practice
University of Illinois at Chicago College of Pharmacy
Chicago, Illinois

Sharon Wu, PharmD, BCACP

Assistant Clinical Professor
University of Washington School of Pharmacy
Seattle, Washington

REVIEWERS

Nabila Ahmed-Sarwar, PharmD, BCPS, BCACP, CDCES, BC-ADM

Associate Professor of Pharmacy Practice
Wegmans School of Pharmacy, St. John Fisher College
Rochester, New York

Rebekah Hanson Anguiano, PharmD, BCPS, BCACP

Clinical Pharmacist/Assistant Professor
University of Illinois at Chicago, College of Pharmacy
Chicago, Illinois

Madelyn Batey, PharmD, BCPS

Clinical Pharmacist in Internal Medicine
Adjunct Clinical Professor in Pharmacy
University of Michigan Medicine
Ann Arbor, Michigan

Suzanne G. Bollmeier, PharmD, FCCP, BCPS, AE-C

Professor, Pharmacy Practice
St. Louis College of Pharmacy
St. Louis, Missouri

Stacy Brown, PhD

Assistant Professor
Gatton College of Pharmacy
East Tennessee State University
Johnson City, Tennessee

Dr. Luigi Brunetti, PharmD, MPH

Associate Professor
Rutgers Ernest Mario School of Pharmacy
Department of Pharmacy Practice and Administration
Piscataway, New Jersey

Todd W. Canada, PharmD, BCNSP, BCCCP, FASHP, FTSHP

Regional Director, Galveston/Houston
Clinical Assistant Professor
MD Anderson Cancer Center
Division of Pharmacy
Houston, Texas

Katie E. Cardone, PharmD, BCACP, FNKF, FASN, FCCP

PharmD Program Director, Associate Professor
Albany College of Pharmacy and Health Sciences/Albany
Medical Center
Albany, New York

Amber B. Cipriani, PharmD, BCOP, CPP

Precision Medicine Pharmacy Coordinator
University of North Carolina Medical Center
Clinical Assistant Professor
UNC Eshelman School of Pharmacy
Chapel Hill, North Carolina

Amy C. Donihi, PharmD, BCPS, BC-ADM, FCCP

Professor, Pharmacy and Therapeutics
Clinical Pharmacist, Inpatient Diabetes Care and Education
University of Pittsburgh School of Pharmacy
Pittsburgh, Pennsylvania

Christine Eisenhower, PharmD, BCPS

Clinical Associate Professor
The University of Rhode Island
College of Pharmacy
Kingston, Rhode Island

Brian L. Erstad, PharmD, FASHP, FCCP, MCCM, BCPS

Professor and Head
Department of Pharmacy Practice & Science
R. Ken Coit College of Pharmacy
University of Arizona
Tucson, Arizona

Aaron P. Hartmann, PharmD, BCPS

Clinical Specialist, Internal Medicine
Department of Pharmacy
Barnes-Jewish Hospital
St. Louis, Missouri

Michael P. Kane, PharmD, FCCP, BCPS, BCACP

Professor, Department of Pharmacy Practice
Albany College of Pharmacy and Health Sciences
Clinical Pharmacy Specialist
Albany Medical Center Division of Community
Endocrinology/The Endocrine Group
Albany, New York

William M. Kolling, RPh, PhD

Associate Professor
Schools of Pharmacy and Medicine
Southern Illinois University Edwardsville
Edwardsville, Illinois

Lauren D. Leader, PharmD, BCPS

Clinical Pharmacy Specialist
Obstetrics and Gynecology
Michigan Medicine
Ann Arbor, Michigan

Joel Marrs, PharmD, MPH

Ambulatory Pharmacy Clinical Coordinator
Billings Clinic
Billings, Montana

Emily K. McCoy, PharmD, BCACP

Associate Clinical Professor, Department of
Pharmacy Practice
Auburn University Harrison School of Pharmacy
Adjunct Assistant Professor, Department of Internal Medicine
University of South Alabama College of Medicine
Mobile, Alabama

Rick Miller, PharmD, BCPS, BCOP, FASHP

Clinical Pharmacy Specialist
Ruby Memorial Hospital
Morgantown, West Virginia

Amanda Munson, PhD

Associate Professor
Program Director, MS in Pharmacogenomics &
Personalized Medicine
Department of Pharmacogenomics
Bernard J. Dunn School of Pharmacy
Shenandoah University, ICPH Fairfax
Inova Center for Personalized Health
Fairfax, Virginia

**Frank P. Paloucek, PharmD, FASHP, FAACT,
DPLA, DABAT**

Clinical Professor and Director PGY1 Residency Program
University of Illinois at Chicago
Chicago, Illinois

Brent N. Reed, PharmD, BCPS, BCCP, FCCP

Associate Professor, Pharmacy Practice and Science
University of Maryland School of Pharmacy
Baltimore, Maryland

Carrie A. Sincak, PharmD, BCPS, FASHP

Associate Dean for Clinical Affairs
Professor of Pharmacy Practice
Midwestern University Chicago College of Pharmacy
Downers Grove, Illinois

Jim Thigpen, PharmD, BCPS

Associate Professor, Pharmacy Practice
Bill Gatton College of Pharmacy
East Tennessee State University
Johnson City, Tennessee

Noreen H. Chan Tompkins, PharmD, BCPS-AQ ID

Clinical Pharmacy Specialist, Pediatric Infectious Disease
Professor, Department of Pharmacy Practice
Loma Linda University Children's Hospital and
School of Pharmacy
Loma Linda, California

Tamara L. Trienski, PharmD, BCIDP

Clinical Pharmacy Specialist, Infectious Diseases
Allegheny General Hospital/Allegheny Health Network
Pittsburgh, Pennsylvania

CLINICAL PROOFREADERS

Jared Cavanaugh, PharmD

Assistant Professor, Clinical and Administrative Sciences
California Northstate University College of Pharmacy
Elk Grove, California

S. Dee Melnyk Evans, PharmD, MHS

Consultant
Burlington, North Carolina

Mort Goldman, PharmD, FCCP, BCPS

Senior Consultant
Pharmacy Consulting International
Cleveland, Ohio

Lauren M. Hynicka, PharmD

Associate Professor
University of Maryland
School of Pharmacy
Baltimore, Maryland

Allison King, PharmD

Investigational Drug Pharmacist, Residency Coordinator
Children's Mercy Hospital
Kansas City, Missouri

Colleen Lauster, PharmD, BCPS, CDE

Clinical Pharmacy Specialist, Ambulatory Care
Beaumont Hospital – Royal Oak
Royal Oak, Michigan

Cindy Powers Magrini, PharmD, AAHIVP

Clinical Pharmacy Specialist, Positive Health Clinic
Allegheny General Hospital
Pittsburgh, Pennsylvania

Rickey C. Miller, PharmD, BCOP, BCPS, FASHP

Oncology Clinical Pharmacy Specialist
WVU Medicine – WVU Cancer Institute
Morgantown, West Virginia

Kimberly J. Novak, PharmD, BCPS, BCPPS, FPPA

Advanced Patient Care Pharmacist–Pediatric and
Adult Cystic Fibrosis
Director, PGY2 Pharmacy Residency–Pediatrics
Nationwide Children's Hospital
Department of Pharmacy
Columbus, Ohio

Song Oh, PharmD, BCCCP

Assistant Professor
Department of Clinical & Administrative Sciences
California Northstate University College of Pharmacy
Elk Grove, California

***R. Laney Owings, PharmD, BCPS, BCPP**

Medication Safety Evaluator
U.S. Food and Drug Administration
Chapel Hill, North Carolina

Seon Jo Park, PharmD, BCOP

Hematology Oncology Pharmacy Specialist
Allegheny General Hospital
Pittsburgh, Pennsylvania

Steven Plogsted, BS, PharmD, BCNSP, CNSC, FASPEN

Clinical Pharmacy Specialist (ret.)
Nationwide Children's Hospital
Columbus, Ohio

Tamara Trienski, PharmD, BCIDP

Clinical Pharmacy Specialist, Infectious Diseases
Allegheny General Hospital/Allegheny Health Network
Pittsburgh, Pennsylvania

Raynold Yin, PharmD, APh, BCACP, CDE

Ambulatory Care Pharmacist
Sharp Grossmont Hospital
San Diego, California

Spencer K. Yingling, PharmD, BCOP

Oncology Pharmacy Specialist
WVU Medicine
Morgantown, West Virginia

*Dr. Owings' editorial contributions were done in her personal capacity and do not represent the opinions of the Food and Drug Administration, the Department of Health and Human Services, nor the Federal Government.

ABBREVIATIONS

μm	micrometer	AGPA	allergic granulomatosis with polyangiitis
1,25-DHCC	1,25-dihydroxycholecalciferol	AHA	American Heart Association
17-OHP	17α-hydroxyprogesterone	AIDS	acquired immunodeficiency syndrome
²⁰¹ Tl	thallium-201	ALK	anaplastic lymphoma kinase
2,3 DPG	2,3-diphosphoglycerate	ALL	acute lymphoblastic leukemia
25-HCC	25-hydroxycholecalciferol	ALP	alkaline phosphatase
3SR	self-sustained sequence replication	ALT	alanine aminotransferase
5HT	serotonin	AMA	antimitochondrial antibody
6-AM	6-acetylmorphine	AMI	acute myocardial infarction
6MWT	6-minute walk test	AML	acute myelogenous leukemia
^{99m} Tc	technetium-99m	ANA	antinuclear antibody
²⁰¹ Tl	thallium-201 (radio isotope)	ANCA	antineutrophil cytoplasmic antibody
α ₁ AC	α ₁ -antichymotrypsin	ANF	atrial natriuretic factor
A-G6PD	glucose-6 phosphate dehydrogenase variant	ANP	atrial natriuretic peptide
A1c	glycosylated hemoglobin	anti-HAV IgG IgG	antibody against hepatitis A virus
A2M, α ₂ M	α ₂ -macroglobulin	anti-HAV IgM IgM	antibody against hepatitis A virus
AA	atomic absorption	anti-HBc	antibody to hepatitis B core antigen
AACE	American Association of Clinical Endocrinologists	anti-HbeAg	antibody to hepatitis B extracellular antigen
AAG	α ₁ -acid glycoprotein	anti-HBs	antibody to hepatitis B surface antigen
ABG	arterial blood gas	anti-HCV	antibody against HCV antigen
ABW	average body weight	anti-HD	antibody against hepatitis D
ACA	anticentromere antibody	APC	activated protein C
ACC	American College of Cardiology	APC	antigen-presenting cell
ACCF	American College of Cardiology Foundation	apoB	apolipoprotein B
ACCP	American College of Clinical Pharmacy	APS	antiphospholipid antibody syndrome
ACCP	anticyclic citrullinated peptide	aPTT	activated partial thromboplastin time
ACE	angiotensin-converting enzyme	ARB	angiotensin receptor blocker
ACE-I	angiotensin-converting enzyme inhibitor	ARNI	angiotensin receptor neprilysin inhibitor
ACPA	anticitrullinated protein antibody	ASA	aspirin
ACR	albumin-to-creatinine ratio; American College of Rheumatology	ASCO	American Society of Clinical Oncology
ACS	acute coronary syndrome	ASCVD	atherosclerotic cardiovascular disease
ACT	activated clotting time; α ₁ -coded testing	AST	aspartate aminotransferase
ACTH	adrenocorticotrophic hormone (corticotropin)	AT	antithrombin
ADA	American Diabetes Association	ATP	adenosine triphosphate
ADAM	androgen deficiency in aging males	ATP-K	adenosine triphosphate potassium
ADCC	antibody-dependent cellular cytotoxicity	ATP	Adult Treatment Panel
ADH	antidiuretic hormone	ATP III	Adult Treatment Panel III
ADME	absorption, distribution, metabolism, excretion	ATS	American Thoracic Society
ADP	adenosine diphosphate	AUA	American Urological Association
AEDs	antiepileptic drugs	AUA-SI	American Urological Association Symptom Index
AFB	acid-fast bacilli	AUC	area under the (serum concentration time) curve
AFP	α-fetoprotein	AV	atrioventricular
AG	anion gap	AVP	arginine vasopressin
		B&B	Brown and Brenn
		B2M	β ₂ -microglobulin
		BAL	bronchial alveolar lavage; bronchoalveolar lavage

BAMT	blood assay for <i>Mycobacterium tuberculosis</i>	CF	complement fixation
BBT	basal body temperature	CFTR	cystic fibrosis transmembrane conductance regulator
BCG	Bacillus Calmette-Guérin	CFU, cfu	colony-forming units
bdNA	branched-chain DNA	CFW	calcofluor white
BGMK-hDAF	buffalo green monkey kidney cell line	CGE	capillary gel electrophoresis
	decay accelerating factor	CGM	continuous glucose monitoring
BHI	brain heart infusion	CH ₅₀	complement hemolytic 50%
BHR	bronchial hyper-responsiveness	CHD	coronary heart disease
BID	twice daily	CHF	congestive heart failure
BMI	body mass index	CI	chemical ionization
BMP	basic metabolic panel	CIS	combined intracavernous injection and stimulation
BNP	brain or B-type natriuretic peptide	CK	creatinine kinase
BP	blood pressure	CK-BB	creatinine kinase isoenzyme BB
BPH	benign prostatic hyperplasia	CK-MB	creatinine kinase isoenzyme MB
BPSA	benign form of prostate-specific antigen	CK-MM	creatinine kinase isoenzyme MM
BPT	bronchial provocation testing	CK1	creatinine kinase isoenzyme 1
BRAF	v-Raf murine sarcoma viral oncogene homolog B1	CK2	creatinine kinase isoenzyme 2
BSA	body surface area	CK3	creatinine kinase isoenzyme 3
BSL	biosafety level	CKD	chronic kidney disease
BT	bleeding time	CKD-EPI	Chronic Kidney Disease Epidemiology Collaboration
BTP	β-trace protein	CLIA-88	Clinical Laboratory Improvement Amendments of 1988
BUN	blood urea nitrogen	CLIA	Clinical Laboratory Improvement Amendments
<i>C. difficile</i>	<i>Clostridium difficile</i>	CLL	chronic lymphocytic leukemia
C3	complement protein 3	CLSI	Clinical and Laboratory Standards Institute
C4	complement protein 4	cm	centimeter
CA	cancer antigen	CMA	cornmeal agar
CA	carbonic anhydrase	C _{min}	minimum concentration (of a drug)
CABG	coronary artery bypass graft	CML	chronic myelogenous leukemia
CAC	coronary artery calcium	CMP	comprehensive metabolic panel
CA _{corr}	corrected serum calcium level	CMR	cardiac magnetic resonance
CAD	coronary artery disease	CMV	cytomegalovirus
CAH	congenital adrenal hyperplasia	CNA	colistin-nalidixic acid
CAN2	chromID Candida agar	C _{normalized}	normalized total concentration
cANCA	cytoplasmic antineutrophil cytoplasmic antibody	CNP	c-type natriuretic peptide
CAP	College of Pathologists	CNS	central nervous system
CAP	community-acquired pneumonia	CO	carbon monoxide; cardiac output;
CAT	computerized axial tomography	CO ₂	cyclooxygenase
CA _{uncorr}	uncorrected serum calcium level (or actual measured total serum calcium)	CO-Hgb	carbon dioxide
CBC	complete blood count	COP	carboxyhemoglobin
CCFA	cycloserine cefoxitin fructose agar	COPD	colloid osmotic pressure
CCNA	cell cytotoxicity neutralization assay	CPE	chronic obstructive pulmonary disease
CCP	cyclic citrullinated peptide	CPIC	cytopathic effect
CCR5	chemokine coreceptor 5	CPK	Clinical Pharmacogenetics Implementation Consortium
cCRP	cardiac C-reactive protein	CPPD	creatinine phosphokinase
CCT	cardiac computed tomography	cPSA	calcium pyrophosphate dihydrate
cd	candela	CrCl	complexed PSA
CD	clusters of differentiation	CREST	creatinine clearance
CDC	Centers for Disease Control and Prevention		syndrome characterized by <u>g</u> alcalinosis, <u>R</u> aynaud disease, <u>e</u> sophageal motility disorder, <u>s</u> clerodactyly, and <u>t</u> elangiectasias
CDR	complementarity-determining regions		
CE	capillary electrophoresis		
CEA	carcinoembryonic antigen		
CEDIA	cloned enzyme donor immunoassay		
CETP	cholesteryl ester transfer protein		

CRH	corticotrophin-releasing hormone	ECD	energy coupled dye
CRP	C-reactive protein	ECG	electrocardiogram
CSF	cerebrospinal fluid	ECMO	extracorporeal membrane oxygenation
C _{ss, avg}	average steady-state concentration (of a drug)	ECT	ecarin clotting time
CT	computed tomography	ECW	extracellular water
cTnC	cardiac-specific troponin C	ED	emergency department
cTnI	cardiac-specific troponin I	EDTA	ethylenediaminetetraacetic acid
cTnT	cardiac-specific troponin T	EGFR	epidermal growth factor receptor
CVD	cardiovascular disease	eGFR	estimated glomerular filtration rate
CX	circumflex	EF	ejection fraction
CXCR4	CXC chemokine coreceptor	EI	electron ionization
CYP	cytochrome P450 drug metabolizing enzymes	EIA	enzyme immunoassay
CYP2C19	cytochrome P450 2C19 enzyme	EIB	exercise- or exertion-induced bronchospasm
CYP2D6	cytochrome P450 2D6 enzyme	EKG	electrocardiogram
CYP3A4	cytochrome P450 3A4 enzyme	ELISA	enzyme-linked immunosorbent assay
CYP450	cytochrome P450 enzyme	ELVIS	enzyme-linked virus-inducible system
CYP4F2	cytochrome P450 4F2 enzyme	EM	electron microscopy
CZE	capillary zone electrophoresis	EMB	eosin methylene blue
D&C	dilation and curettage	eMERGE	Electronic Medical Records and Genomics
D5W	5% dextrose in water	EMIT	enzyme-multiplied immunoassay technique
DASH	dietary approaches to stop hypertension	EMR	electronic medical record
DAT	direct agglutination test	EOF	electroosmotic flow
DAT	direct antibody test	EPA	eicosapentaenoic acid
DCCT	Diabetes Control and Complications Trial	EPS	expressed prostatic secretions
DCP	des-gamma-carboxyprothrombin	ER	estrogen receptor
DDAVP	desmopressin	ERS	European Respiratory Society
dTT	dilute thrombin time	ERV	expiratory reserve volume
DDT	dichlorodiphenyltrichloroethane	ESA	erythrocyte-stimulating agent
DEA	desthylamiodarone	ESBL	extended-spectrum β -lactamase
DFA	direct fluorescent antibody	ESC	European Society of Cardiology
DHA	docosahexaenoic acid	ESI	electrospray ionization
DHEA	dehydroepiandrosterone or dehydroepiandrosterone	ESR	erythrocyte sedimentation rate
DHEAS	dehydroepiandrosterone sulfate	ESRD	end-stage renal disease
DI	diabetes insipidus	Etest	epsilometer test
DIC	disseminated intravascular coagulation	ETIB	enzyme-linked immunoelectrotransfer blot
DIM	dermatophyte identification medium	EU	ELISA units
DKA	diabetic ketoacidosis	EUCAST	European Committee on Antimicrobial Susceptibility Testing
dL	deciliter	EULAR	European League Against Rheumatism
DLCO	diffusing capacity of the lung for carbon monoxide	FA	fluorescent antibody
DM	diabetes mellitus	Fab	fraction antigen-binding
DNA	deoxyribonucleic acid	FAB	fast atom bombardment
DNP	dendroaspis natriuretic peptide	FAB	French-American-British
DO ₂	oxygen delivery	FACS	fluorescence-activated cell sorting
DOAC	direct oral anticoagulant	FALS	forward-angle light scattering
DPD	dihydropyrimidine dehydrogenase	FANA	fluorescent antinuclear antibody
DPP-4	dipeptidyl peptidase-4	FBG	fasting blood sugar
dsDNA	double-stranded DNA	FDA	Food and Drug Administration
DST	dexamethasone suppression test	FDP	fibrin degradation product
DTI	direct thrombin inhibitor	FEF ₂₅₋₇₅	forced expiratory flow at 25% to 75% of vital capacity
DTM	dermatophyte test medium	FEF	forced expiratory flow
E2	estradiol	FE _{Na}	fractional excretion of sodium
EBM	esculin base medium	FENO	fractional exhaled nitric oxide
EBV	Epstein-Barr virus		

FEV ₁	forced expiratory volume in 1 second	HAAg	hepatitis A antigen
FiO ₂	fraction of inspired oxygen	HAP	hospital-acquired pneumonia
FISH	fluorescent in situ hybridization	HAV	hepatitis A virus
FITC	fluorescein isothiocyanate	Hb; hgb	hemoglobin
fL	femtoliter	HbA1c	glycated hemoglobin
FM	Fontana-Masson	HBcAg	hepatitis B core antigen
FN	false negative	HBeAg	hepatitis B extracellular antigen
FOB	fecal occult blood	HBsAg	hepatitis B surface antigen
FP	false positive	HBV	hepatitis B virus
FPG	fasting plasma glucose	hCG	human chorionic gonadotropin
FPIA	fluorescence polarization immunoassay	HCO ₃ ⁻	bicarbonate
fPSA	free prostate specific antigen	HCT, Hct	hematocrit
FRC	functional residual capacity	HCV	hepatitis C virus
FSC	forward-scattered light	HDAG	hepatitis D antigen
FSH	follicle-stimulating hormone	HDL	high-density lipoprotein
FTA-ABS	fluorescent treponemal antibody absorption	HDL-C	high-density lipoprotein cholesterol
FVC	forced vital capacity	HDV	hepatitis D virus
FWR	framework regions	HER-1	human epidermal growth factor receptor 1
g	gram	HER-2	human epidermal growth factor receptor 2
G-CSF	granulocyte colony-stimulating factor	HEV	hepatitis E virus
G6PD	glucose-6 phosphate dehydrogenase	HFpEF	heart failure with preserved ejection fraction
GA	gestational age	HFrEF	heart failure with reduced ejection fraction
GAD	glutamic acid decarboxylase	HGA	human granulocytic anaplasmosis
GADA	glutamic acid decarboxylase autoantibodies	Hgb	hemoglobin
GAP	group A streptococcus	HHS	hyperosmolar hyperglycemic state
GAS	group A streptococci	HIPA	heparin-induced platelet activation
GC	gas chromatography	HIT	heparin-induced thrombocytopenia
GC-MS	gas chromatography and mass spectrometry	HIV	human immunodeficiency virus
GDM	gestational diabetes mellitus	HIV-1	human immunodeficiency virus type 1
GERD	gastroesophageal reflux disease	HLA	human leukocyte antigen
GF	Gridley fungus	HLA-B27	human leukocyte antigen B27
GFR	glomerular filtration rate	HLA-DQ	human leukocyte antigen coded DQ genes
GGT, GGTP	gamma-glutamyl transferase; gamma- glutamyl transpeptidase	HLAR	high-level aminoglycoside resistance
GHB	gamma-hydroxybutyrate	HME	human monocytic ehrlichiosis
GI	gastrointestinal	HMG-CoA	3-hydroxy-3-methyl-glutaryl- coenzyme A
GIP	glucose-dependent insulinotropic peptide	HMWK	high-molecular weight kininogen
GLC	gas liquid chromatography	HPA	hypothalamic pituitary axis
GLIM	Global Leadership Initiative on Malnutrition	HPF	high-power field
GLP-1	incretin hormones glucagon-like peptide-1	HPLC	high-performance (or pressure) liquid chromatography
GLUT	glucose transporter	HPV	human papillomavirus
GM-CSF	granulocyte/macrophage colony- stimulating factor	HR	heart rate
GMS	Gomori methenamine silver	hr	hour
GnRH	gonadotropin-releasing hormone	hs-CRP	high-sensitivity C-reactive protein
GOLD	Global Initiative for Chronic Obstructive Lung Disease	HSG	hysterosalpingogram, hysterosalpingography
gp	glycoprotein	hsTnI	high-sensitivity troponin I
GPA	granulomatosis with polyangiitis	hsTnT	high-sensitivity troponin T
GTF	glucose tolerance factor	HSV	herpes simplex virus
H&E	hematoxylin and eosin	Ht	height
<i>H. Pylori</i>	<i>Helicobacter pylori</i>	HTN	hypertension
		I	intermediate

IA	immunoassay	K_{corr}	corrected serum potassium level
IA-2A	insulinoma-associated-2 autoantibodies	KDIGO	Kidney Disease Improving Global Outcomes
IAA	insulin autoantibodies		
IAT	indirect antiglobulin test	kg	kilogram
IBW	ideal body weight	KIMS	kinetic interaction of microparticles in solution
IC	inspiratory capacity		
IC ₅₀	inhibitory concentration 50%	Km	Michaelis constant
IC ₉₀	inhibitory concentration 90%	KOH	potassium hydroxide
ICA	immunochromatographic assay	KRas	V-Ki-ras2 Kirsten rat sarcoma viral oncogene homolog
ICA	islet cell cytoplasmic autoantibodies		
ICD	International Classification of Diseases	K_{uncorr}	uncorrected serum potassium level (or actual measured serum potassium)
ICTV	International Committee on Taxonomy of Viruses	L	liter
ICU	intensive care unit	LA	latex agglutination
ICW	intracellular water	La/SSB	La/Sjögren syndrome B
ID	immunodiffusion	LAD	left anterior descending
IDC	International Diabetes Center	LADA	latent autoimmune disorder
IDL	intermediate-density lipoproteins	LBBB	left bundle branch block
IDMS	isotope dilution mass spectrometry	LBW	lean body weight
IDSA	Infectious Diseases Society of America	LC	liquid chromatography
IEF	isoelectric focusing	LCAT	lecithin cholesterol acyltransferase
IFA	immunofluorescence assay; indirect fluorescent antibody	LCR	ligase chain reaction
		LDH	lactate dehydrogenase
IFE	immunofixation electrophoresis	LDH1	lactate dehydrogenase isoenzyme 1
IFG	impaired fasting glucose	LDH2	lactate dehydrogenase isoenzyme 2
IFN- γ	interferon gamma	LDH3	lactate dehydrogenase isoenzyme 3
IFR	immunofixation electrophoresis	LDH4	lactate dehydrogenase isoenzyme 4
IgA	immunoglobulin A	LDH5	lactate dehydrogenase isoenzyme 5
IgD	immunoglobulin D	LDL	low-density lipoprotein
IgE	immunoglobulin E	LDL-C	low-density lipoprotein cholesterol
IgG	immunoglobulin G	LE	lupus erythematosus
IgM	immunoglobulin M	LFT	liver function test
IGNITE	Implementing GeNomics In PracTice	LH	luteinizing hormone
IGT	impaired glucose tolerance	LHRH	luteinizing hormone–releasing hormone
IHC	immunohistochemistry		
IHD	ischemic heart disease	LIS	laboratory information system
IIEF	International Index of Erectile Function	LMP	last menstrual period
IIM	idiopathic inflammatory myopathy	LMWH	low molecular weight heparin
IMA	inhibitory mold agar	Lp(a)	lipoprotein(a)
IM-ADR	immune-mediated adverse drug reaction	Lp-PLA ₂	lipoprotein-associated phospholipase A ₂
		LPL	lipoprotein lipase
INR	international normalized ratio	LSD	lysergic acid diethylamide
IP	interphalangeal	LTA	light transmittance aggregometry
iPSA	inactive PSA	LUTS	lower urinary tract symptoms
IPSS	International Prostate Symptom Score	LVEF	left ventricular ejection fraction
IQ	inhibitory quotient	m	meter
IRMA	immunoradiometric assay	m ²	meters squared
IRV	inspiratory reserve volume	MAbs	monoclonal antibodies
ISE	ion-selective electrode	Mac	MacConkey
ISI	International Sensitivity Index	MAC	membrane attack complex
ITP	idiopathic thrombocytopenic purpura	MAC	<i>Mycobacterium avium</i> complex
IV	intravenous	MALDI	matrix-assisted laser desorption/ionization
J	joule		
JIA	juvenile idiopathic arthritis	MALDI-TOF	matrix-assisted laser desorption ionization time-of-flight
JRA	juvenile rheumatoid arthritis		
JVP	jugular venous pressure	MAP	mitogen-activated protein
k	constant of proportionality	MAT	microagglutination test
K	kelvin	MBC	minimum bactericidal concentration

MBP	mannose-binding protein	NACB	National Academy of Clinical Biochemistry
mcg	microgram		
MCH	mean corpuscular hemoglobin	NAEPP	National Asthma Education Prevention Program
MCHC	mean corpuscular hemoglobin concentration	NAFLD	nonalcoholic fatty liver disease
MCP	metacarpophalangeal	NASBA	nucleic acid sequence-based amplification
MCT	medium chain triglycerides		
MCTD	mixed connective tissue disease	NASH	nonalcoholic steatohepatitis
MCV	mean corpuscular volume	NCBI	National Center for Biotechnology Information
MDMA	3,4-methylenedioxy-N-methamphetamine (Ecstasy)	NCCB	nondihydropyridine calcium channel blocker
MDR	multidrug resistant		
MDRD	Modification of Diet in Renal Disease	NCEP	National Cholesterol Education Program
MDx	molecular diagnostics		
mEq	milliequivalent	ng	nanogram
mg	milligram	NGS	next-generation sequencing
MHA	Mueller-Hinton agar	NGSP	National Glycohemoglobin Standardization Program
MHA-TP	microhemagglutination <i>Treponema pallidum</i>	NHANES	National Health and Nutrition Examination Survey
MHC	major histocompatibility complex		
MI	myocardial infarction	NHL	Non-Hodgkin lymphoma
MIC	minimum inhibitory concentration	NIH	National Institutes of Health
MIC ₅₀	MIC value representing 50% of a bacterial population	NK	cells natural killer (T) lymphocytes
MIC ₉₀	MIC value representing 90% of a bacterial population	NKDEP	National Kidney Disease Education Program
MIF	microimmunofluorescence	NKF KDOQI	National Kidney Foundation Kidney Disease Outcomes Quality Initiative
min	minute	NLA	National Lipid Association
mL	milliliter	nm	nanometer
mm	millimeter	NMIBC	non-muscle-invasive bladder cancer
mm ³	cubic millimeter	NNRTI	non-nucleoside reverse transcriptase inhibitor
mmol	millimole		
mTOR	mammalian target of rapamycin	NNS	number needed to screen
moAb	monoclonal antibody	NPV	negative predictive value
mo	month	NQO1	NADPH quinone dehydrogenase 1
mol	mole	NQMI	non Q-wave myocardial infarction
mOsm	milliosmole serum osmolality	NRS/CHOL	National Reference System for Cholesterol
MOTT	mycobacteria other than tuberculosis		
MPO	myeloperoxidase	NRTI	nucleoside reverse transcriptase inhibitor
MPV	mean platelet volume	NSAID	nonsteroidal anti-inflammatory drug
MRI	magnetic resonance imaging	NSCLC	non-small-cell lung cancer
mRNA	messenger ribonucleic acid	NSTEMI	non-ST-segment elevation myocardial infarction
MRO	medical review officer		
MRP1	multidrug resistant protein 1	NT-proBNP	N-terminal-proBNP
MRP2	multidrug resistant protein 2	NTM	nontuberculous mycobacteria
MRP3	multidrug resistant protein 3	NUDT15	nudix hydrolase 15
MRSA	methicillin-resistant <i>Staphylococcus aureus</i>	NYHA	New York Heart Association
		OA	osteoarthritis
MS	mass spectrometry	OAT	organic anion transport
MSSA	methicillin-susceptible <i>Staphylococcus aureus</i>	OATP1	organic anion-transporting polypeptide 1
mTOR	mammalian (or mechanistic) target of rapamycin	OATP2	organic anion-transporting polypeptide 2
MTP	metatarsophalangeal	OCT	organic cation transport
N	newton	OGTT	oral glucose tolerance test
NA	nucleic acid	OIR	Office of In Vitro Diagnostics and Radiological Health
NAAT	nucleic acid amplification test		

OSHA	Occupational Safety and Health Administration	PL	phospholipid
$P_1G_1O_1$	one live birth, one pregnancy, no spontaneous or elective abortions	PMA	postmenstrual age
P-gp	P-glycoprotein	PMN	polymorphonuclear leukocyte
Pa	Pascal	PNA	postnatal age
pAB	polyclonal antibody	PNA-FISH	peptide nucleic acid fluorescent in situ hybridization
$PaCO_2$	partial pressure of carbon dioxide, arterial	PO	per os (by mouth)
PAD	peripheral arterial disease	pO_2	partial pressure of oxygen
PAE	postantibiotic effect	POC	point-of-care
PAI1	plasminogen activator inhibitor 1	POCT	point-of-care testing
pANCA	perinuclear antineutrophil cytoplasmic antibody	PPAR	peroxisome proliferator-activated receptor
PaO_2	partial pressure of oxygen, arterial	PPD	purified protein derivative
PAS	periodic acid-Schiff	PPG	postprandial glucose
PBC	primary biliary cirrhosis	PPI	proton pump inhibitor
PBMC	peripheral blood mononuclear cell	PPV	positive predictive value
PBP	penicillin-binding protein	PR	progesterone receptor
$PC_{20}FEV_1$	provocation concentration of the bronchoconstrictor agent that produces a 20% reduction in FEV_1	PR3	proteinase 3
PCA	postconceptional age	PRN	as needed
PCI	percutaneous coronary intervention	PRU	P2Y12 reaction units
pCO_2	partial pressure of carbon dioxide	PSA	prostate specific antigen
PCOS	polycystic ovary syndrome	PSAD	prostate specific antigen density
PCP	phencyclidine	PSADT	prostate specific antigen doubling time
PCR	polymerase chain reaction	PSB	protected specimen brush
PCSK9	proprotein convertase subtilisin/kexin type 9	PSM	patient self-management
PD	pharmacodynamic	PST	patient self-testing
PDA	potato dextrose agar	PT	prothrombin time
PE	phycoerythrin	PTCA	percutaneous transluminal coronary angioplasty
Peak _{steady state}	peak concentration of a drug in serum or plasma at steady state	PTH	parathyroid hormone
PEA	phenylethyl alcohol	q	every
PEFR	peak expiratory flow rate	Q	perfusion
PET	positron emission tomography	QC	quality control
PF3	platelet factor 3	QID	four times daily
PF4	platelet factor 4	qPCR	real-time polymerase chain reaction
PFA	potato flake agar	QRS	electrocardiograph wave; represents ventricular depolarization
PFGE	pulsed-field gel electrophoresis	QwMI	Q-wave myocardial infarction
PFT	pulmonary function test	R	resistant
pg	picogram	R-CVA	right cerebral vascular accident
PG	prostaglandin	RA	rheumatoid arthritis
PG2	prostacyclin	RAAS	renin-angiotensin-aldosterone system
PGx	pharmacogenetic	RADT	rapid antigen detection test
pH	power of hydrogen or hydrogen ion concentration	RAEB	refractory anemia with excess blasts
PHY	phenytoin	RAIU	radioactive iodine uptake test
Ph	Philadelphia	RALS	right-angle light scattering
PI	protease inhibitor	RBC	red blood cell
PICU	pediatric intensive care unit	RBF	renal blood flow
PID	pelvic inflammatory disease	RCA	right coronary artery
PIP	proximal interphalangeal	RDW	red cell distribution width
PK	pharmacokinetic	RF	rheumatoid factor
PKU	phenylketonuria	RhMK	rhesus monkey kidney
		RI	reticulocyte index
		RIA	radioimmunoassay
		RIBA	recombinant immunoblot assay
		RIDTs	rapid influenza diagnostic tests
		RNA	ribonucleic acid

RNP	ribonucleoprotein	STEMI	ST-segment elevation myocardial infarction
Ro/SSA	Ro/Sjögren syndrome A antibody	SV	stroke volume
RPF	renal plasma flow	SVC	slow vital capacity
RPR	rapid plasma reagin	SvO ₂	venous oxygen saturation
RR	respiratory rate	T ₃	triiodothyronine
RSA	rapid sporulation agar	T ₃ RU	triiodothyronine resin uptake
RSAT	rapid streptococcal antigen test	T ₄	thyroxine
RSV	respiratory syncytial virus	TAT	turnaround time
RT	reverse transcriptase; reverse transcription	TB	tuberculosis
RT-PCR	reverse-transcriptase polymerase chain reaction	TBG	thyroxine-binding globulin
RV	residual volume	TBI	total body irradiation
S	susceptible	TBPA	thyroid-binding prealbumin
S	Cys C serum cystatin C	TBW	total body water
S:P ratio	saliva:plasma concentration ratio	TBW	total body weight
SA	sinoatrial	TC	total cholesterol
SaO ₂	arterial oxygen saturation	TCA	tricyclic antidepressant
SAMHSA	Substance Abuse and Mental Health Services Administration	TDM	therapeutic drug monitoring
SAT	serum agglutination test	TEE	transesophageal echocardiography
SBA	sheep blood agar	TF	tissue factor
SBT	serum bactericidal test	TFPI	tissue factor pathway inhibitor
ScL ₇₀	scleroderma-70 or DNA topoisomerase I antibody	TG	triglyceride
SCr	serum creatinine	THC	total hemolytic complement
ScvO ₂	central venous oxygen saturation	TIA	transient ischemic attack
SD	standard deviation	TIBC	total iron-binding capacity
SDA	Sabouraud dextrose agar	TID	three times daily
SDA	strand displacement amplification	TJC	The Joint Commission
sec	second	TK	tyrosine kinase
SEGA	subependymal giant cell astrocytoma	TKI	tyrosine kinase inhibitor
SGE	spiral gradient endpoint	TLA	total laboratory automation
SGLT	sodium glucose cotransporters	TLC	therapeutic lifestyle changes
SHBG	sex hormone-binding globulin	TLC	thin layer chromatography
SI	International System of Units	TLC	total lung capacity
SIADH	syndrome of inappropriate antidiuretic hormone	TMA	transcription mediated amplification
SID	strong ion difference	TN	true negative
SIG	strong ion gap	TnC	troponin C
SIHD	stable ischemic heart disease	TnI	troponin I
SLE	systemic lupus erythematosus	TnT	troponin T
Sm	Smith antibody	TP	true positive; tube precipitin
SMBG	self-monitoring blood glucose	tPA	tissue plasminogen activator
SNP	single nucleotide polymorphism	TPMT	thiopurine methyltransferase
SNRI	serotonin–norepinephrine reuptake inhibitor	TPN	total parenteral nutrition
SnRNP	small nuclear ribonucleoprotein particle	TR	therapeutic range
SPECT	single-photon emission computed tomography	TRH	thyrotropin-releasing hormone
SPEP	serum protein electrophoresis	TRUS	transrectal ultrasound of the prostate
SRA	C-serotonin release assay	TSB	trypticase soy broth
SSC	side-scattered light	TSH	thyroid-stimulating hormone
ssDNA	single-stranded DNA	TST	tuberculin skin test
SSRI	selective serotonin reuptake inhibitor	TT	thrombin time
STD	sexually transmitted disease	TTE	transthoracic echocardiography
		TTKG	transtubular potassium gradient
		TTP	thrombotic thrombocytopenic purpura;
			total testing process
		TTR	time in therapeutic range
		TV	tidal volume

T_xA_2	thromboxane A_2	Vd	volume of distribution
type 1 DM	type 1 diabetes mellitus	VDRL	Venereal Disease Research Laboratory
type 2 DM	type 2 diabetes mellitus	VISA	vancomycin-intermediate <i>Staphylococcus aureus</i>
U	urinary creatinine concentration	VKOR	vitamin K epoxide reductase
U_1 RNP	uridine-rich ribonuclear protein	VKORC1	vitamin K epoxide reductase complex subunit 1
UA	unstable angina	VLDL	very low-density lipoprotein
UCr	urine creatinine	V_{max}	maximum rate of metabolism
UFC	urine-free cortisol	VPA	valproic acid
UFH	unfractionated heparin	VO_2	oxygen consumption
UGT1A1	uridine diphosphate glucuronyl transferase	VRE	vancomycin-resistant enterococci
UKPDS	United Kingdom Prospective Diabetes Study	VTE	venous thromboembolism
ULN	upper limit of normal	vWF	von Willebrand factor
uNGAL	urine neutrophil gelatinase associated lipocalin	VZV	varicella zoster virus
uPA	urokinase plasminogen activator	W	watt
U-PGx	Ubiquitous Pharmacogenetics Consortium	WB	western blot
UTI	urinary tract infection	WBC	white blood cell
UUN	urinary urea nitrogen	WHO	World Health Organization
UV	ultraviolet	wk	week
V	total urine volume collected; ventilation; volt	WNL	within normal limits
VAP	ventilator-associated pneumonia	Wt	weight
VC	vital capacity	WT	wild type
		xPOCT	multiplexed point-of-care testing
		yr	year

