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SIXTH EDITION

COMPREHENSIVE NEONATAL NURSING CARE



A decorative graphic at the top of the page features a central horizontal line from which various blue, leaf-like shapes and small dots radiate outwards, creating a symmetrical, floral or branch-like pattern. The colors range from light sky blue to a slightly darker, muted blue.

Comprehensive Neonatal Nursing Care



Carole Kenner, PhD, RN, FAAN, FNAP, ANEF, is the Carol Kuser Loser Dean/Professor of the School of Nursing, Health, and Exercise Science at The College of New Jersey. Dr. Kenner received a bachelor's of science in nursing from the University of Cincinnati and her master's and doctorate in nursing from Indiana University. She specialized in neonatal/perinatal nursing for her master's and obtained a minor in higher education for her doctorate. She has authored more than 100 journal articles and 30 textbooks.

Her career is dedicated to nursing education and to the health of neonates and their families, as well as educational and professional development of healthcare practices in neonatology. Her dedication includes providing a healthcare standard for educating neonatal nurses nationally and internationally. Her passion led her to begin the journal *Newborn and Infant Nursing Reviews*, in which she served as editor and then associate editor. She worked with the National Coalition on Health Professional Education in Genetics (NCHPEG) and the American Nurses Association to develop genetic competencies. She helped develop the End-of-Life Nursing Education Consortium (ELNEC) Neonatal/Pediatric modules. She served as the co-chair of the Oklahoma Attorney General's Task Force on End of Life/Palliative Care. She also helped develop program recommendations for perinatal/neonatal palliative care as part of a family-centered/developmental care project sponsored by the National Perinatal Association. She serves on the Consensus Committee of Neonatal Intensive Care Design Standards, which sets recommendations for Neonatal Intensive Care Unit designs, and serves on the March of Dimes Nursing Advisory Committee. She is a fellow of the American Academy of Nursing (FAAN), a fellow in the National Academies of Practice, a fellow in the Academy of Nursing Education, past president of the National Association of Neonatal Nurses (NANN), and founding president of the Council of International Neonatal Nurses (COINN), the first international organization representing neonatal nursing-setting standards globally. She is the 2011 recipient of the Audrey Hepburn Award for Contributions to the Health and Welfare of Children Internationally.



Leslie B. Altimier, DNP, RNC, MSN, NE-BC, is the director for clinical innovation and research for Phillips HealthTech, where she is responsible for developing clinical analytic support algorithms and research tools for future NICU technology. She received her BSN from Kent State University, MSN from the University of North Carolina, DNP from Northeastern University in Boston, and she completed a postdoctoral fellowship in compassionate healthcare through the Northeastern University in collaboration with the Schwartz Center for Compassionate Healthcare and the Jonas Center for Nursing and Veterans Healthcare. In her 30-year nursing career, she has worked in a variety of neonatal, pediatric, and adult intensive care units, and has been a clinical director of nursing for a hospital network consisting of a 50-bed level III NICU and multiple level II NICUs.

Dr. Altimier is a renowned clinician who lectures internationally and has published over 100 articles, chapters, and books on topics related to the care of neonates and families, NICU design, and organizational leadership. She was the editor-in-chief of *Newborn and Infant Nursing Reviews (NAINR)* journal and most recently is the editor-in-chief of the *Journal of Neonatal Nursing (JNN)*, the official journal of the Neonatal Nurses Association (NNA). She is a member of NANN (the National Association of Neonatal Nurses), COINN (Council of International Neonatal Nurses, Inc.), and INANE (the International Academy of Nurse Editors). She also holds a nursing executive certification by the AANC (American Nurses Credentialing Center).

Dr. Altimier has contributed to nursing through practice, education, leadership, research, and publications. She is passionate about neuroprotective developmental care, family-integrated care, and compassionate care and has earned the Neonatal Developmental Care Specialist Designation from NANN. Her goal is to create a culture of change in healthcare worldwide.



Marina V. Boykova, PhD, RN, is an assistant professor of nursing in the School of Nursing and Allied Health Professions, Holy Family University, Philadelphia, Pennsylvania. Dr. Boykova received her Diploma in Nursing Practice from the School of Nursing #3, Saint Petersburg, Russia; a Certificate in Theory and Practice of Nurse Education, Medical College #1, Saint Petersburg, Russia; a Certificate in Theory and Practice of Nurse Education, Chester, United Kingdom; Bachelor of Science with Honours in Professional Practice (Nursing), University of Liverpool, Chester, United Kingdom; Diploma of Higher Education in Nursing, Novgorod University of Y. Mudrogo, Novgorod, Russia; Master of Science in Health Promotion (Distinction), University of Liverpool, Chester, United Kingdom; and Doctor of Philosophy in Nursing, University of Oklahoma, Oklahoma City, Oklahoma. She is a member of Sigma Theta Tau International. She serves as a nonexecutive director for the Council of International Neonatal Nurses, Inc. (COINN). Dr. Boykova's clinical background is neonatal intensive care nursing. Her research interests center on transition from hospital to home and to primary care for parents of preterm infants.

She has published in this area as well as neonatal care topics. She coauthored a policy brief on Reducing Preterm Births for the American Academy of Nursing.

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Sixth Edition

Carole Kenner, PhD, RN, FAAN, FNAP, ANEF

Leslie B. Altimier, DNP, RNC, MSN, NE-BC

Marina V. Boykova, PhD, RN

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Carole Kenner: <https://orcid.org/0000-0002-1573-5240>
Leslie B. Altimier: <https://orcid.org/0000-0001-8558-3011>
Marina V. Boykova: <https://orcid.org/0000-0002-9065-3704>

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I wish to first express my appreciation, love, and support for my dad, who died in 2017 at the age of 105½. He always got excited when a new edition published.

—Carole

I would like to thank my children, Jen, Julie, and Kevin, for their love, support, and encouragement for me as a mom and as a professional.

—Leslie

For my mom, whose love and support were endless.

—Marina

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—Carole Kenner, Leslie Altimier, and Marina Boykova



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Contributors

Leslie B. Altimier, DNP, RNC, NE-BC
Director of Clinical Innovation and Research
Phillips Research and Development
Cambridge, Massachusetts

Diane M. Anderson, PhD, RD
Associate Professor
Department of Pediatrics, Section of Neonatology
Baylor College of Medicine
Houston, Texas

Shreyas Arya, MD, MBBS
Clinical Fellow
Division of Neonatology and Pulmonary Biology
Cincinnati Children's Hospital Medical Center
Cincinnati, Ohio

Gail A. Bagwell, DNP, APRN, CNS
Clinical Nurse Specialist—Perinatal Outreach
Nationwide Children's Hospital
Columbus, Ohio

Susan Tucker Blackburn, PhD, RN, FAAN
Professor Emeritus
Department of Family and Child Nursing,
School of Nursing
University of Washington
Seattle, Washington

Mary Beth Bodin, DNP, CRNP, NNP-BC
Neonatal Consultant
Tuscaloosa, Alabama

Marina V. Boykova, PhD, RN
Assistant Professor
School of Nursing and Allied Health
Holy Family University, School of Nursing
and Allied Health
Philadelphia, Pennsylvania

Caitlin Bradley, MS, NNP-BC, RN
Neonatal Nurse Practitioner
Boston Children's Hospital
Boston, Massachusetts

Ashlea D. Cardin, OTD, OTR/L, BCP
Assistant Professor of Occupational Therapy
Missouri State University
Springfield, Missouri

Waldemar A. Carlo, MD
Edwin M. Dixon Professor of Pediatrics
Division Director, Neonatology
UAB Division of Neonatology
University of Alabama at Birmingham
Birmingham, Alabama

Terri A. Cavaliere, DNP, NNP-BC, RN
Clinical Associate Professor
Stony Brook University
Stony Brook, New York
Neonatal NNP Cohen Children's Hospital at North Shore
Manhasset, New York

Robin Dawn Clark, MD
Professor of Pediatrics in Medical Genetics
Loma Linda University Health
Loma Linda, California

Amy D'Agata, PhD, MS, RN
Assistant Professor, College of Nursing
University of Rhode Island
Kingston, Rhode Island
Adjunct Assistant Professor, Department of Pediatrics
Brown University
Providence, Rhode Island

Deborah A. Discenza, MA
Founder, President
PremieWorld, LLC
Springfield, Virginia

Georgia R. Ditzenberger, PhD, NNP-BC, APNP
Assistant Professor, CHS
Neonatology Division, Department of Pediatrics, University
of Wisconsin, School of Medicine and Public Health
Madison, Wisconsin

Jenna L. Dobry, BSc (Hon)
Clinical Research Coordinator
Section of Neonatology, Department of Pediatrics
Cummings School of Medicine
University of Calgary
Calgary, Alberta, Canada

Dolores R. Dzuby, PhD, MSN, RNC-OB
Assistant Professor, Department of Nursing
School of Nursing, Health, and Exercise Science
The College of New Jersey
Ewing, New Jersey

Taryn M. Edwards, MSN, CRNP, NNP-BC
Neonatal Nurse Practitioner
Division of General, Thoracic, and Fetal Surgery
Children's Hospital of Philadelphia (CHOP)
Philadelphia, Pennsylvania

Kelly Benham French
Parent and Professor of Practice in Journalism
The Media School
Indiana University
Bloomington, Indiana

Samuel Gentle, MD
Assistant Professor
Division of Neonatology
University of Alabama at Birmingham
Birmingham, Alabama

Donna A. Goff, MD, MS
Assistant Professor of Pediatrics
Attending Physician in Pediatric Cardiology
Loma Linda University Children's Hospital
Loma Linda, California

Kathleen Haubrich, PhD, RN
Associate Professor, Department of Nursing
Miami University
Hamilton, Ohio

Stephanie Hoe, BSN, RN
Neonatal Staff Nurse
Kapiolani Medical Center for Women & Children
Caring for Hawai'i Neonates,
Honolulu, Hawaii

Jacqueline Hoffman, DNP, APRN, NNP-BC
Assistant Professor, Department of Nursing
Department of Women, Children and Family Nursing
College of Nursing
Rush University
Chicago, Illinois

Diane Holditch-Davis, PhD, RN, FAAN
Associate Dean for Research Affairs
Duke University School of Nursing
Durham, North Carolina

Kathleen P. Juco-Purdy, BSN, RN, CNOR
Lead of Transplant Service
Seattle Children's Hospital
Seattle, Washington

Susan Kau, BSN, RNC-NIC
Neonatal Staff Nurse
Kapiolani Medical Center for Women & Children
Caring for Hawai'i Neonates
Honolulu, Hawaii

Carole Kenner, PhD, RN, FAAN, FNAP, ANEF
Carol Kuser Loser Dean/Professor
School of Nursing, Health, and Exercise Science
The College of New Jersey
Ewing, New Jersey
Founding President
Council of International Neonatal Nurses, Inc. (COINN)
Yardley, Pennsylvania

Joanne McManus Kuller, RN, MS
Neonatal Clinical Nurse Specialist
University of California at San Francisco Benioff
Children's Hospital Oakland
Oakland, California

Abhay Lodha, DM, MD, MBBS, MSC
Associate Professor
Department of Pediatrics
Cumming School of Medicine,
University of Calgary
Calgary, Alberta, Canada

Carolyn Houska Lund, MS, RN, FAAN
Neonatal Clinical Nurse Specialist
University of California at San Francisco Benioff
Children's Hospital Oakland
Associate Professor
University of California at San Francisco
School of Nursing
Oakland, California

Christina Mahoney, BSN, RN
Staff Nurse
Neonatal Intensive Care Unit
Boston Children's Hospital
Boston, Massachusetts

Maureen F. McCourt, MS, RN, NNP-BC, PNP
Instructor, NNP Program
Northeastern University
Boston, Massachusetts
Neonatal Nurse Practitioner Supervisor
Women and Infants Hospital
Providence, Rhode Island

Jacqueline M. McGrath, PhD, RN, FNAP, FAAN
 Vice Dean for Faculty Excellence
 School of Nursing
 University of Texas at San Antonio
 San Antonio, Texas

Kathryn R. McLean, MSN, RN, NNP-BC
 Neonatal Nurse Practitioner
 Women and Infants Hospital
 Providence, Rhode Island

Mary E. Coughlin McNeil, MS, NNP, RNC-E
 President and Founder
 Caring Essentials Collaborative, LLC
 Boston, Massachusetts

Tamara M. Meeker, MSN, CRNP, NNP-BC
 Neonatal Surgical Nurse Practitioner
 Division of General, Thoracic, and Fetal Surgery
 Children's Hospital of Philadelphia (CHOP) NICU
 Philadelphia, Pennsylvania

Samual Mooneyham, MSN, RN
 Clinical Nurse Manager
 Brookline Pediatrics
 Brookline, Massachusetts

Merry-K. Moos, BSN, FNP, FAAN
 Research Professor (retired)
 Department of Obstetrics and Gynecology
 University of North Carolina at Chapel Hill,
 School of Medicine
 Consultant, Center for Maternal and Infant Health
 Lead Nurse Planner, National March of Dimes
 President, MK Moos, Inc.
 Chapel Hill, North Carolina

Dorothy M. Mullaney, DNP, MHSc, ANPRN, NNP-BC, RN
 Director, Associate Providers
 Dartmouth Hitchcock Medical Center
 Assistant Professor of Pediatrics
 Geisel School of Medicine at Dartmouth
 Hanover, New Hampshire

Vivek Narendran, MD, MBA, MRCP
 Medical Director University of Cincinnati Medical Center NICU
 Medical Director, Cincinnati Perinatal Outreach Project
 Department of Pediatrics
 University of Cincinnati
 Cincinnati Children's Hospital Medical Center
 Cincinnati, Ohio

Susan K. Newbold, PhD, RN-BC, FAAN, FHIMSS
 Director, Nursing Informatics Boot Camp
 Franklin, Tennessee

Khiet D. Ngo, DO, MS
 Assistant Professor of Basic Sciences & Clinical Medicine
 Department of Medical Education & Pediatrics
 Loma Linda University School of Medicine
 Loma Linda University Children's Hospital
 Loma Linda, California

Debra M. Parker, MSN, APRN-NP
 Lead Neonatal Nurse Practitioner
 Methodist Women's Hospital
 Omaha, Nebraska

Leslie A. Parker, PhD, NNP-BC, FAAN
 Associate Professor
 University of Florida
 Gainesville, Florida

Raylene M. Phillips, MD, FAAP, FABM, IBCLC
 Neonatologist
 Loma Linda University Children's Hospital
 Loma Linda, California

Lyn S. Prater, PhD, RN
 Senior Lecturer and Undergraduate Clinical Coordinator
 Baylor University, School of Nursing
 Dallas, Texas

Shahirose S. Premji, PhD, MScN, BSc, BScN, RN, FAAN
 Director and Professor
 School of Nursing, Faculty of Health
 York University
 Toronto, Ontario, Canada

Jana L. Pressler, PhD, RN
 Assistant Dean and Professor
 University of Nebraska Medical Center College of Nursing
 Lincoln Division
 Lincoln, Nebraska

Geralyn Sue Prullage, DNP, APN, NNP/PNP-BC
 Neonatal and Pediatric Nurse Practitioner
 Optimus Hospitalist and Pediatric Subspecialists, Ltd.
 Chicago, Illinois

Cheryl Riley, DNP, RN, NNP-BC
 Clinical Associate Professor and NNP Program Coordinator
 Baylor University, School of Nursing
 Dallas, Texas

Lori Baas Rubarth, PhD, APRN, NNP-BC
 Associate Professor and NNP Program Coordinator
 Creighton University School of Nursing
 Omaha, Nebraska

Donna J. Ryan, DNP, RN, CNE
 Assistant Professor, Nurse Educator
 Elmira College
 Elmira, New York

Manoj Shah, MD, FAAP
 Chief Pediatric Gastroenterology & Nutrition
 Loma Linda University School of Medicine
 Loma Linda, California

Elizabeth L. Sharpe, DNP, ARNP, NNP-BC, VA-BC, FAANP
Associate Professor of Clinical Nursing
Neonatal Nurse Practitioner Program Specialty
Track Director
The Ohio State University
Columbus, Ohio

Beth Shields, PharmD
Associate Director of Operations
Pediatric Clinical Specialist
Rush University Medical Center
Chicago, Illinois

Kaye Spence, AM, RN, MN
Adjunct Associate Professor
Clinical Nurse Consultant—Neonatology
Grace Centre for Newborn Care
The Children's Hospital at Westmead
Westmead, Australia

Becky Spencer, PhD, RN, IBCLC
Assistant Professor
Texas Woman's University
College of Nursing
Denton, Texas

Carol Turnage Spruill, MSN, APRN-CNS, CPHQ, NTMNC
Clinical Nurse Specialist
Department of Women, Infants and Children
University of Texas Medical Branch
Galveston, Texas

Deborah K. Steward, PhD, RN
Faculty Emeritus
Ohio State University
College of Nursing
Columbus, OH

Valerie Boebel Toly, PhD, RN, CPNP
Assistant Professor
Frances Payne Bolton School of Nursing
Case Western Reserve University
Cleveland, Ohio

Colm Travers, MD
Neonatologist
Division of Neonatology
University of Alabama at Birmingham
Birmingham, Alabama

Dorothy Vittner, PhD, RN, CHPE
Director, Senior NIDCAP Trainer
Carolina NIDCAP Training Center
Infant and Family Specialist
WakeMed Hospital and Health Systems
Raleigh, North Carolina

Marlene Walden, PhD, RN, NNP-BC, CCNS, FAAN
Nurse Scientist Manager
Arkansas Children's Hospital
Adjunct Associate Professor
University of Arkansas for Medical Sciences
Little Rock, Arkansas

Karen Walker, PhD, RN
Clinical Associate Professor, University of Sydney
Research Manager, Grace Centre for Newborn Care
Senior Research Fellow, IMPACT for Cerebral Palsy
President, Australia College of Neonatal Nurses
Vice President, Council of International Neonatal Nurses,
Inc. (COINN)
Westmead, Australia

Tami Wallace, DNP, APRN, NNP-BC
Neonatal Nurse Practitioner and Educator Nationwide
Children's Hospital
Columbus, Ohio

Robert D. White, MD
Director, Regional Newborn Program
Pediatrix Medical Group
Beacon Children's Hospital
South Bend, Indiana

Parent Voices Contributors

Amy Blanchard
Graham's Foundation
Perrysburg, Ohio

Jennifer Canvasser, MSW
NEC Society
Davis, California

Katie Reginato Cascamo, MA
Courageous Steps
Stillwater, Maine

Jennifer Degl
Mahopac Falls, New York

Deborah A. Discenza
PremieWorld, LLC
Springfield, Virginia

Jennifer M. Driscoll
Lily's Hope Foundation
Allentown, Pennsylvania

Crystal Duffy
Twin to Twin
Houston, Texas

Ali Dunn
MeTwo Books
Indianapolis, Indiana

Jimena Guild
Graham's Foundation
Perrysburg, Ohio

Yamile Jackson, PhD, PE, PMP
The Zaky—Nurtured by Design
Sugar Land, Texas

Laural Kapferer, MS
Team Grayson
Boston, Massachusetts

Gigi R. Khonyongwa-Fernandez
Families Blossoming, LLC
Vienna, Virginia

Jenny R. McCormick
PremieWorld, LLC
Springfield, Virginia

Heather McKinnis
Graham's Foundation
Perrysburg, Ohio

Rosie Moore, DNP, RN
The Gift of Life
Boca Raton, Florida

Farrin Moreano
The University of Texas at San Antonio
San Antonio, Texas

Tracy Pella
Connected Forever
Tecumseh, Nebraska

Keira Sorrells
Premie Parent Alliance
Madison, Mississippi

Heather Tanner
Sister Friend Up
USA



Past Contributors to the Fifth Edition

Jennifer Arnold, MD, MSc, FAAP

Assistant Professor
Division of Neonatology
Baylor College of Medicine
Houston, Texas

Beverly Bowers, PhD, APRN-CNS, ANEF

Assistant Dean for the Center for Educational Excellence
and Associate Professor
University of Oklahoma College of Nursing
Oklahoma City, Oklahoma

Joyce M. Butler, MSN, NNP-BC

Instructor
Department of Pediatrics
University of Mississippi Medical Center
Jackson, Mississippi

Tony C. Carnes, PhD

Senior Technical Fellow, Integrated Patient Intelligence Group
Respiratory and Monitoring Solutions
Covidien
Mansfield, Massachusetts

Sergio DeMarini, MD

Neonatologist
IRCCS Burlo Garofolo
Trieste, Italy

Willa H. Drummond, MD, MS (Medical Informatics)

Professor of Pediatrics, Physiology and Large Animal
Clinical Sciences
University of Florida
Gainesville, Florida

Wakako Eklund, MS, NNP, RN

Neonatal Nurse Practitioner
Pediatrix Medical Group, Inc.
Nashville, Tennessee

Susan Ellerbee, PhD, RNC-OB

Associate Professor
University of Oklahoma, College of Nursing
Oklahoma City, Oklahoma

Jody A. Farrell, MSN, RN

Director, Fetal Treatment Center
University of California at San Francisco Benioff
Children's Hospital
San Francisco, California

Linda MacKenna Ikuta, MN, RN, CCNS, PHN

Neonatal Clinical Nurse Specialist
Packard Children's Hospital
Palo Alto, California

Jamieson E. Jones, MD

Staff Neonatologist
Desert Regional Medical Center Hospital
San Diego, California

Nadine A. Kassity-Krich, MBA, BSN, RN

Adjunct Professor
University of San Diego
San Diego, California

Judith A. Lewis, PhD, RN, WHNP-BC, FAAN

Professor Emerita
Virginia Commonwealth University, School of Nursing
Richmond, Virginia

Cindy M. Little, PhD, WHNP-BC, CNS

Assistant Clinical Professor
Drexel University
Philadelphia, Pennsylvania

Judy Wright Lott, PhD, NNP-BC, FAAN

Dean of Nursing
Wesleyan College
Macon, Georgia

Sheryl J. Montrowl, MSN, NNP-BC
Clinical Coordinator Pediatrics, Neonatal Nurse Practitioner
Division of Neonatology, Department of Pediatrics
University of Florida
Gainesville, Florida

Beth Mullins, MSN, NNP-BC
Neonatal Nurse Practitioner
Instructor, Department of Pediatrics
University of Mississippi Medical Center
Jackson, Mississippi

Linda L. Rath, PhD, RN, NNP-BC
Associate Professor
University of Texas at Tyler
Tyler, Texas

Rachel Ritter, BSN, RN
Staff Nurse
Neonatal Intensive Care Unit
Children's Hospital Boston
Boston, Massachusetts

Debra A. Sansoucie, EdD, ARNP, NNP-BC
Vice President
Advanced Practitioner Program
Pediatrix Medical Group
Sunrise, Florida

Thomas D. Soltau, MD
Assistant Professor
University of Alabama at Birmingham
Birmingham, Alabama

Kathleen R. Stevens, EdD, RN, ANEF, FAAN
Professor and Director
Academic Center for Evidence-Based Practice—
www.ACESTAR.uthscsa.edu and
Improvement Science Research Network—www.ISRN.net
University of Texas Health Science Center at San Antonio
San Antonio, Texas

Laura A. Stokowski, MS, RNC
Staff Nurse
Inova Fairfax Hospital for Children
Falls Church, Virginia

Tanya Sudia-Robinson, PhD, RN
Professor
Georgia Baptist College of Nursing of Mercer University
Atlanta, Georgia

Lynda Law Wilson, PhD, RN, FAAN
Professor and Assistant Dean for International Affairs
The University of Alabama at Birmingham School of Nursing
Birmingham, Alabama



Foreword

Comprehensive Neonatal Nursing Care has been the go-to resource for evidence-based and practical guidance for novice and expert neonatal nurses in classroom and clinical settings since 1993. As we have come to expect and rely upon, the new *sixth edition* includes the latest information on neonatal embryology, physiology, medical and surgical management, psychosocial care, emerging infections, neuroprotection, pain control, care of the late preterm infant, and much more. The textbook is organized with a focus on integrative management of the newborn and family. There is extensive use of research findings in each of the chapters to provide evidence to support practice strategies and clinical decision-making. Complete references are found at the end of each chapter.

In the new *sixth edition*, the chapters have been thoroughly updated and refreshed with the latest research and practice tips, written by authors who are recognized experts in their fields. New features include callouts highlighting parent perspectives, quality and safety practice points, and emergency alerts. There are new chapters on trauma-informed care, neonatal abstinence, and support for families. Uniquely among neonatal textbooks, the *sixth edition* of *Comprehensive Neonatal Nursing Care* includes a focus on the neonatal care ecosystem, with chapters on emerging trends in research and care delivery, genetics and genomics, and

competency-based education and support for neonatal unit managers and directors.

In today's world, neonatal nurses are faced with the constant threat of information overload and ever-present concerns about the accuracy and relevance of what appears in print, online, and in videos, blogs, podcasts, or instant messages. It is therefore reassuring—and indeed essential—to have the well-written, accessible, thoroughly researched and accurate *Comprehensive Neonatal Nursing Care* as our constant and trustworthy companion as we strive to provide high-quality care to all newborns and their families. The editors and authors are to be congratulated for maintaining such a high standard of excellence and practical application. Your dedication enables neonatal nurses everywhere to provide essential care to the more than 30 million sick and premature newborns and their families who depend on nurses to survive and thrive.

Thank you!

Linda S. Franck, PhD, RN, FRCPCH, FAAN
Professor and Jack & Elaine Koehn Endowed
Chair in Pediatric Nursing
Department of Family Health Care Nursing
University of California, San Francisco



Preface

One of the most complex issues in healthcare is the care of sick or premature infants and those with multiple, severe congenital anomalies. Despite advanced technology and knowledge, preterm delivery continues to be a significant problem in the United States. Maternal risk factors have changed over the past decade. For example, more women with congenital heart anomalies and chronic illnesses, such as diabetes or sickle cell anemia, are giving birth to infants with consequent health problems. The rise of in vitro fertilization has resulted in increased multiple births and prematurity. Many infants in neonatal intensive care units (NICUs) have been exposed to substances or are born to mothers with other risk factors such as delayed childbearing or childhood cancers.

The care of these at-risk infants requires the use of more and more complex technology. Surfactant administration, nitric oxide administration, high-frequency jet ventilators, neurally adjusted ventilatory assist (NAVA; Stein & Firestone, 2014), and new hybrid ventilators providing high-frequency and conventional modes of ventilation are being used in Europe and are likely to be brought to the United States for Food and Drug Administration (FDA) approval. New technologies now can provide continuous, noninvasive monitoring of endotracheal tube position and obstruction (Hütten et al., 2015). Servo-controlled oxygen administration, which leads to greater compliance with targeted oxygen saturation ranges, is being developed (Claure & Bancalari, 2015). Near-infrared spectroscopy (NIRS), amplitude-integrated EEGs (aEEGs), dialysis, organ transplantation, and other extraordinary measures are becoming commonplace. Better integration of technologies (both electronic medical records [EMRs] and medical devices) will be the basis for decision support and predictive analytics. However, in the midst of these high-tech interventions, neuroprotective developmentally supportive care interventions such as olfactory and gustatory support, using visible rather than audible alarms, music therapy, cycling lights, using more physiologically and developmentally appropriate positioning, and skin-to-skin contact are being recognized as evidence-based neuroprotective interventions, due to increasing evidence regarding the importance of maintaining a developmentally supportive NICU environment for improved long-term infant/child and family outcomes. Some consequences of prematurity are caused by early parent–infant separation and a lack of parents' participation in the care of their

infant during traditional neonatal intensive care. The family is an essential partner in decision-making and care for their infant, and family-centered care is being expanded to family-integrated care, a paradigm shift from nurse caring to nurse coaching for parents providing the care.

Providers of neonatal care need up-to-date accurate and comprehensive information as a basis for providing care to newborns. A thorough understanding of normal physiology as well as the pathophysiology of disease processes is necessary for well-designed care practices. Knowledge about associated risk factors, genetics, critical periods of development, principles of nutrition and pharmacology, and current neonatal research findings are all essential in providing optimal care for neonates. A newer concept called de-implementation refers to the science of abandoning and unlearning practices built on the scaffolding of habit. Practices that are novel but yet not fully tested, unproven practices (those that lack supporting evidence), and practices of habit (practices that continue despite contradictory evidence) should go through the process of de-implementation. Care practices need to be based on best evidence-based practices available, rather than on tradition and habits.

A multidisciplinary approach has been replaced by an integrated interprofessional approach to care. All these elements form the foundation for assessment, planning, implementation, and evaluation of the effectiveness of neonatal care. The nurse plays a vital role in the provision of integrated healthcare to newborns. During the past decade, the nurse's role has included added responsibilities, which are recognized at both the staff and advanced practice levels. For the purposes of this book, we define the roles of the neonatal staff nurse, clinical nurse specialist (CNS), and neonatal nurse practitioner (NNP).

NEONATAL STAFF NURSE

The neonatal staff nurse role requires accurate and thorough assessment skills, excellent ability to communicate with other health professionals and patients' families, and a broad understanding of physiology and pathophysiology on which to base management decisions. It requires highly developed technical skills as well as critical decision-making skills. With healthcare delivery changes, the role also requires supervision of ancillary