

Medical Quality Management

Angelo P. Giardino
Lee Ann Riesenberg • Prathibha Varkey
Editors

Medical Quality Management

Theory and Practice

Third Edition



Springer

— AMERICAN COLLEGE OF —
Medical  Quality

Editors

Angelo P. Giardino
Department of Pediatrics
University of Utah School of Medicine
Salt Lake City, UT, USA

Lee Ann Riesenberg
Department of Anesthesiology
and Perioperative Medicine
University of Alabama at Birmingham
Birmingham, AL, USA

Prathibha Varkey
Northeast Medical Group
Yale New Haven Health
Stratford, CT, USA

ISBN 978-3-030-48079-0

ISBN 978-3-030-48080-6 (eBook)

<https://doi.org/10.1007/978-3-030-48080-6>

© American College of Medical Quality (ACMQ) 2005, 2009, 2021

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors, and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

My work on this book is dedicate to Dr. Richard J. Baron, President and CEO of the American Board of Internal Medicine Foundation, who in the early 1990s, while we were both at Health Partners of Philadelphia, introduced me to the transformational work of Dr. Avedis Donabedian. Dr. Baron's encouragement and outstanding mentorship allowed me to build a strong foundation in Quality Improvement and he modeled how to strike a balance among a commitment to clinical care, the heart of a medical educator, and the stewardship of a healthcare administrator.

Angelo P. Giardino, MD, PhD, MPH, CMQ

I dedicate my work on this book to Dr. Donald M. Berwick, a passionate and tireless advocate for healthcare system improvement. Of his many accomplishments, I am particularly grateful for his leadership and innovation in launching the IHI Open School for Health Professions in 2008, which has provided a rich Quality and Patient Safety educational resource for countless healthcare students and professionals.

Lee Ann Riesenberg, PhD, MS, RN

I dedicate my work on this third edition of Medical Quality Management: Theory and Practice to all healthcare professionals who have committed to making positive change in improving healthcare and our systems.

Prathibha Varkey, MBBS, MPH, MHPE, MBA

Foreword

I have never been convinced that competition by itself will improve the efficiency or the effectiveness of care or even that it will reduce the cost of care....Health care is a sacred mission. It is a moral enterprise and a scientific enterprise, but not fundamentally a commercial one... Doctors and nurses are stewards of something precious. Their work is a kind of vocation rather than simply a job; commercial values don't really capture what they do for patients and for society as a whole.

—Avedis Donabedian, MD, MPH

The American College of Medical Quality continues to be a national leader in educating the medical community about both the science and the practice of medical quality management. The third edition of *Medical Quality Management: Theory and Practice* underscores the College's commitment to the shared vision of a safer, responsive healthcare system and provides many resources to readers to guide our collective journey. While much of the basics of medical quality management remain constant, it is essential that new and revised information be provided. Changes within the culture of medicine, technology, and new innovations in care management require that we acknowledge, inform, and educate healthcare professionals on the changing tide of medical quality management.

This third edition of the American College of Medical Quality's textbook is revised to include the latest information on quality improvement, measurement, and the many facets of medical quality that prove essential to the ever-evolving field of healthcare. Every chapter has been updated to impart the latest information on the specific areas that comprise the creation, improvement, and management of medical quality in every healthcare arena. "Data Analytics for the Improvement of Health Care Quality" and "Ethics and Quality Improvement" are new chapters in the third edition. The topic of ethics was previously covered in the chapter on quality improvement and the law; however, technological innovation and the use of electronic health records demands attention to potential ethical dilemmas afforded by the adoption and use of these means. With an expanded view of ethical considerations related to quality and patient safety, in addition to a thorough overview of the four pillars of ethics, this chapter seeks to uncover a myriad of evolving ethical issues.

Unfortunately, up-and-coming medical professionals do not always consider quality and quality improvement to be of great concern when first starting out on their career. I urge everyone, however, to make medical quality, safety, and quality improvement the foundation of your experience and “sacred mission” as a health-care professional. I heartily encourage all healthcare professionals to read this book and utilize the concepts provided by the outstanding contributors who gave so generously of themselves to create this edition.

Paula J. Santrach, MD

Associate Professor, Laboratory Medicine and Pathology

Former Chief Quality Officer

Mayo Clinic

Book Abstract

This comprehensive medical textbook, *Medical Quality Management: Theory and Practice, Third Edition* is a compendium of the latest information on healthcare quality. This text provides knowledge about the theory and practical applications for each of the core areas that comprise the field of medical quality management as well as insight and essential briefings on the impact of new healthcare technologies and innovations on medical quality and improvement. The third edition provides significant new content related to medical quality management and quality improvement, a user-friendly format, and updated learning objectives.

Preface

I have looked in many places for the source of the commitment that would bring about such dedication to quality. I have seen it in professional values and traditions. It is implicit in the contract between the professions and society – a contract that confers privileges on the former in return for responsibilities toward the latter. I have wished to see it in each practitioner’s need for the respect of colleagues and the gratitude of patients; in the quest for acceptance, for success, for the joy in virtuosity. Often, I have cast the commitment to quality in moral terms, preferring to see it as the ethical imperative that must govern the conduct of all caregivers.

—Avedis Donabedian, MD

The publication of the third edition of this textbook is a milestone for The American College of Medical Quality (ACMQ) as a leading organization in the training and skill building of quality improvement and patient safety professionals. ACMQ is a national organization of healthcare professionals who are interested in the advancement of medical quality and patient safety as a field of study and practice. Origins of ACMQ date back to 1973, when it was first called the American College of Utilization Review Physicians (ACURP). It is formally recognized by the American Medical Association and holds a seat in its House of Delegates.

A brief look back at the book’s history is in order. In 2005, with a sizeable grant of \$100,000 from Merck & Company, ACMQ produced the first edition titled *A Core Curriculum for Medical Quality Management*, edited by James Ziegenfuss, Jr., PhD, and Mark Lyles, MD, MBA. In 2009, a revised and updated second edition was edited by Prathibha Varkey, MBBS, MPH, MHPE, MBA, and was re-titled *Medical Quality Management: Theory and Practice*. And now, a revised and updated third edition with Dr. Varkey as Senior Editor joined by two additional ACMQ members as co-editors has been written.

In the Foreword to the second edition, Carolyn M. Clancy, MD, then the Director of the federal Agency for Healthcare Research and Quality, commended ACMQ and *Medical Quality Management: Theory and Practice* as follows:

The American College of Medical Quality continues to be a national leader in educating the medical community about both the science and the practice of medical quality management. The new edition of this book underscores the College’s commitment to our shared vision of a safer health care system and provides many resources to readers that will guide our journey.

The opening quote by the medical quality management icon, Avedis Donabedian, MD, casts the pursuit of quality and safety in healthcare as rooted in the values and traditions of the healthcare profession, the privileges enjoyed by those professionals that emanate from the responsibilities to the patient, and ultimately, as a moral imperative to do one's best for the patients whom we serve. ACMQ embraces these pursuits and offers a robust approach to learning the content at the foundation of medical quality management that its members adhere to — the values and traditions of which Donabedian speaks. This book, in its third edition, seeks to assist in that training and educational process.

We would like to acknowledge contributors from the second edition who made an indelible impression on the material presented herein and who were unable to participate in this third edition:

Harry Pigman, MD, MSHP
Quality Measurement

Lakshmi P. Chelluri, MD, MPH, CMQ
Patient Safety

Sharon Wilson, RN, BS, PMP
Patient Safety

Louis H. Diamond, MB, ChB, FACP
Health Informatics

Stephen T. Lawless, MD, MBA
Health Informatics

Arthur L. Pelberg, MD, MPA
Utilization Management

Thomas Biancaniello, MD, FACC
Organization Design and Management

James T. Ziegenfuss, Jr., PhD
Organization Design and Management

Mano S. Selvan, PhD
The Interface Between Quality Improvement, Law, and Medical Ethics

Jeffrey M. Zale, MD, MPH, CMQ
The Interface Between Quality Improvement, Law, and Medical Ethics

Salt Lake City, UT, USA
Birmingham, AL, USA
Stratford, CT, USA

Angelo P. Giardino
Lee Ann Riesenberg
Prathibha Varkey

About the Book

Medical Quality Management: Theory and Practice, Third Edition is written as a basic text to describe the key components of medical quality management (MQM). As such, this text has applicability for novices, committed students, and seasoned practitioners within the field. Each chapter has been designed for a review of the essential background, precepts, and exemplary practices within the topical area. A common format is followed within the chapters to provide structure to the authors' comments, including useful learning objectives, case studies, inter-chapter cross-references, and scholarly references. Each chapter seeks to reliably capture the essential elements that will allow a diligent reader to establish a practical fluency in the topic. As the editors, we are appreciative of the chapter authors who are all highly trained experts in their topical areas and who have summarized their extensive knowledge and experiences into exceptionally well-researched and written text. Individual chapters focus on the following core curriculum essentials.

Chapter 1 is a short introduction to the concept of medical quality management and its core components and objectives. It outlines the essential elements of a curriculum for teaching MQM and highlights the historical calls to integrate MQM training and implementation into the healthcare system.

Chapter 2 sets the tone and foundation for the book by highlighting the basic historical drivers of medical quality assurance and quality improvement by reviewing the major concepts and common applications of quality improvement (QI) methods and strategies, and by outlining the challenges and opportunities within the rapidly evolving field of medical quality management. The chapter opens the door to a sometimes complex field of quality measurement methods and systems, operational processes, and strategies.

Chapter 3 focuses on the history, types, characteristics, processes, and interpretations of quality measurements. This chapter provides a framework for understanding the basic components of quality measurement within direct care and policy-making settings, exemplified by illustrative case studies, and provides new information on the criteria for successful process measures, bundled measures, and balancing measures. The author effectively correlates the critical interface of quality measurement strategies and methods to areas highlighted in other chapters,

especially medical informatics, utilization and quality management, patient safety, and health policy development.

Chapter 4 provides a detailed overview of the major patient safety concepts; specific, high profile medication errors and failures; and causal factors, including analysis methodologies and root cause analysis strategies. The chapter discusses perioperative complications and iatrogenic injuries, care transitions, bundles and patient safety collaboratives, techniques and tools for systematic patient safety enhancement (PSE), and future trends in patient safety measures. The authors also focus on attributes of high-reliability organizations and operational interventions for PSE and the national momentum towards substantive investments in patient safety promotion tracking and educational systems, representing a true megatrend in healthcare and a core area of focus in MQM.

Chapter 5 addresses updated developments and challenges within health informatics, a central component of MQM that has become a pivotal aspect of healthcare in the twenty-first century. The author concretely summarizes the major developments of medical informatics infrastructures, including health information exchange, data warehousing, coding classification systems, clinical decision support, data integrity, transparency, quality control and innovation, and analysis. A discussion of documentation modalities and updates to EHR information is also presented, in addition to a brief history of health informatics in the USA and current trends.

Chapter 6 is a new chapter produced for the third edition which addresses the growing sophistication of data analytics and its role in improving patient outcomes. This chapter summarizes the importance of mining big data and converting it to a useable form that coalesces technology and expertise in a manner that can be effectively applied to clinical and population health settings. The authors present timely information on the benefits of data analytics to healthcare systems and how accurate, precise data serve to measure healthcare value, discover areas in which quality improvement strategies could have a measurable impact, advance analytic maturity within an organization, and improve health outcomes.

Chapter 7 describes the essential processes, tasks, and common systems of utilization management (UM) and care coordination (CC). UM focuses upon prior authorization and concurrent and retrospective forms of utilization review to establish *medical necessity* of care. Medical necessity criteria, processes for determining the effectiveness and value of UM procedures (e.g., over- and underutilization markers), common organizational structures for UM activities, and accreditation standards and programs are also detailed. New sections in this chapter include a discussion of the role of UM in disease management, pay-for-performance programs, and models of care. This section is particularly important due to the current focus on the coordination of care models to make improvements in cost and quality. Care coordination focuses on the deliberate integration of personnel, providers, information, and resources to facilitate required patient care activities and the efficient delivery of healthcare services both within and across systems.

Chapter 8 focuses on organizational design and leadership in quality management. Most of the publications in these areas tend to be theoretical and descriptive rather than framed by the numbers and facts with which most health professionals

are familiar. The discussions on quality management leadership, collaboration, strategic and operational planning, implementation, data analysis, and feedback are all presented clearly and—like all of the chapters—with an abundance of relevant references.

Chapter 9 presents the subject of economics and finance in relation to MQM and quality improvement with a detailed approach. They elaborate on major economic and business principles relevant to the future practice of MQM, including those related to accounting and finance, value and compensation in healthcare, organizational planning and psychology, project management, the development of business plans and financial statements, and sensitivity analyses. MQM professionals will need to make the business case for clinical services, framed by quality management objectives and outcomes metrics. The authors elegantly frame the lessons in this chapter, including several instructive case studies.

Chapter 10 focuses on key external QI activities, including accreditation, professional certification, and quality improvement education. It highlights major healthcare standards-setting and accreditation organizations, including medical specialty board certification, state professional licensing, and prominent national accreditation organizations such as the National Committee for Quality Assurance, Utilization Review Accreditation Commission, and the Joint Commission. The chapter discusses the Centers for Medicare and Medicaid Services' Center for Clinical Standards & Quality, the new Quality Payment Program, the CMS Five-Star Quality Rating System, and Accountable Care Organizations, and includes statistics from the 2016 Leapfrog Group Hospital Report. External QI resources serve to integrate the diverse number of utilization, quality, and risk management activities that frame clinical systems of care. The chapter includes a new focus on the importance of QI education for medical students and practicing physicians.

Chapter 11 addresses legal requirements, and the authors review several current, major national legal mechanisms for quality promotion such as the National Practitioner Data Bank, accreditation activities, peer review protections, the tort system, clinical practice guidelines, institutional review boards, and medical ethics programs. The chapter also provides thoughtful commentary about evolving trends aimed at improving the quality of healthcare service and delivery. Notable current movements that are evolving include how to handle apologies when a medical error has occurred, patient safety activities, and pay-for-performance initiatives.

Finally, Chapter 12 is also a new chapter for the third edition which provides an in-depth look at the prevailing values that affect quality ethics and the related clinical frameworks that guide decision-making and best practice in terms of patient safety and quality improvement efforts. The chapter also delves into ethics in research and describes effective, ethical, systematic investigation and, additionally, how research and quality improvement overlap in practice. Chapter themes also include a discussion of the Institutional Review Board and their review of quality improvement projects, as well as the foundational principles that guide the review and discussion of clinical dilemmas.

Contents

1	Introduction	1
	Angelo P. Giardino, Lee Ann Riesenberg, and Prathibha Varkey	
2	Basics of Quality Improvement	5
	Julia Caldwell and Prathibha Varkey	
3	Quality Measurement	33
	Linda Harrington	
4	Patient Safety	53
	Philip J. Fracica and Elizabeth A. Fracica	
5	Health Informatics	91
	David W. West	
6	Data Analytics for the Improvement of Healthcare Quality	121
	Charles G. Macias and Kathleen E. Carberry	
7	Utilization Management, Case Management, and Care Coordination	139
	Angelo P. Giardino and Michelle A. Lyn	
8	Organization Design and Management	177
	Robert McLean, Jennifer Hooks, and Carrie Guttman	
9	Economics and Finance in Medical Quality Management	197
	Donald Fetterolf and Rahul K. Shah	
10	External Quality Improvement: Accreditation, Certification, and Education	245
	Antoine Kfuri, Nancy L. Davis, and Angelo P. Giardino	

11 The Interface Between Quality Improvement and Law	283
Angelo P. Giardino and Marc T. Edwards	
12 Ethics and Quality Improvement	317
Perry Ann Reed, Eileen R. Giardino, and Angelo P. Giardino	
Index.	355

About the Editors

Angelo P. Giardino MD, PhD, MPH, CMQ, is the Wilma T. Gibson Presidential Professor and Chair of the Department of Pediatrics at the University of Utah School of Medicine. He also serves as the Chief Medical Officer at Intermountain Primary Children's Hospital in Salt Lake City, UT. Prior to arriving in Utah, Dr. Giardino served as Senior Vice President/Chief Quality Office at Texas Children's Hospital and was Professor of Pediatrics and Section Chief of Academic General Pediatrics at Baylor College of Medicine (BCM). He received his medical degree and doctorate in education from the University of Pennsylvania; completed his residency and fellowship training at The Children's Hospital of Philadelphia (CHOP); earned a Master's in Public Health from the University of Massachusetts, a Master's in Theology from Catholic Distance University (CDU), and a Master's in Public Affairs from the University of Texas Rio Grande Valley; and is a Certified Physician Executive (CPE) within the American Association for Physician Leadership. He completed the Patient Safety Certificate Program from the Quality Colloquium, is certified in medical quality (CMQ) as designated by the American Board of Medical Quality, and is a Distinguished Fellow of the American College of Medical Quality. He holds subspecialty certifications in Pediatrics and Child Abuse Pediatrics by the American Board of Pediatrics. He is a recipient of the Fulbright & Jaworski L. L. P. Faculty Excellence Award at BCM. Dr. Giardino serves as an Associate Editor for the 23rd edition of the classic *Rudolph's Textbook of Pediatrics*, is Co-Editor of the 4th edition of the *Medical Evaluation of Child Sexual Abuse* published by the American Academy of Pediatrics, and serves as the Co-Editor-in-Chief of the *Journal of Family Strengths*. Dr. Giardino serves on the Board of Directors of Prevent Child Abuse America, CDU, US Center for Safe Sport, and Intermountain Community Care Foundation.

Lee Ann Riesenberg PhD, MS, RN, CMQ, is Professor and Associate Director of Education, Anesthesiology, and Perioperative Medicine at the University of Alabama at Birmingham. Dr. Riesenber works as a medical educator and conducts medical education and quality and patient safety outcomes research. Dr. Riesenber has worked in medical education for 25 years, received numerous recognition

awards for her dedication to medical education and quality improvement in graduate medical education, and serves on the editorial board of the American Journal of Medical Quality.

Prathibha Varkey MBBS, MPH, MHPE, MBA, is the CEO and President of the Yale New Haven Health Northeast Medical Group, home of about 1000 clinicians in CT, RI, and NYC. Dr. Varkey is a Professor of Medicine at the Yale School of Medicine and a Professor of Health Policy and Management at the Yale School of Public Health. Dr. Varkey is a past president of the American College of Medical Quality. Previously, Dr. Varkey served as the turnaround CEO of the Seton Clinical Enterprise in Austin, TX, and in various leadership roles at Mayo Clinic Rochester: Associate Chair of the Department of Medicine, Program Director of the Preventive Medicine Fellowship, Director of Quality at the Division of Preventive and Occupational Medicine, and Director of Quality at Mayo School of Graduate Medical Education and Mayo School of Continuing Medical Education.

Contributors

Julia Caldwell MD, MHA, CMQ, is an Assistant Professor of Anesthesiology, Pain, and Perioperative Medicine. She is board certified in anesthesiology, pain medicine, and medical quality. She is deeply passionate about resident education, pain medicine, and medical quality. Dr. Caldwell is an active leader on the educational and abstract committees within the American Medical College of Quality. She enjoys research as well as providing safe and quality care to her patients and the community.

Kathleen E. Carberry RN, MPH, is the Outcomes Program Officer at the Value Institute for Health and Care at the University of Texas at Austin's Dell Medical School and McCombs School of Business where she teaches outcome measurement. She also engages with healthcare teams to implement outcome measurement strategies that drive the creation of high-value healthcare services. She is passionate about measuring the outcomes that matter most to patients and partnering with healthcare teams to create measurement systems that readily demonstrate improved outcomes for patients.

Nancy L. Davis PhD, is a Professor and Associate Dean of Faculty Development at the University of Kansas School of Medicine. She previously served as Director, Practice-Based Learning and Improvement, Association of American Medical Colleges; Executive Director, National Institute for Quality Improvement and Education; and Director, CME, American Academy of Family Physicians. She helped design the CME credit designation for clinical performance improvement. Dr. Davis earned a PhD in Adult and Continuing Education. She serves on the Editorial Board of the *American Journal of Medical Quality*, teaches, presents in national forums, and is widely published. She has been credentialed as a Certified Diabetes Educator, a Certified CME Professional, and a Certified Professional in Healthcare Quality.

Marc T. Edwards MD, MBA, has more than 30 years of healthcare management and consulting experience, including service as the senior physician executive in both teaching and community hospitals. He operated a federally listed and Connecticut-authorized Patient Safety Organization from 2010 to 2019. A native of Seattle, he graduated from the University of Washington. He earned his MD degree from the University of Colorado, trained in Family Medicine at Thomas Jefferson University Hospital, and completed an MBA at the University of Connecticut. He is a member of Phi Beta Kappa and maintains board certification in Family Medicine. He is an authority on best practices in clinical peer review having conducted four national studies and published 11 related scientific manuscripts. He relocated to Chapel Hill, NC, from Connecticut in 2017 and contributes to University of North Carolina School of Medicine as adjunct faculty.

Donald Fetterolf MD, MBA, FACP, is currently the Chief Medical Officer of MiMedx Group, Inc. Prior roles include EVP of Health Intelligence at Alere, Inc.; EVP of Matria Healthcare; Chief Medical Officer of Highmark, Inc.; and president of a multi-physician medical group practice. Dr. Fetterolf received undergraduate and medical degrees from the University of Pennsylvania and completed internal medicine training at the University of Pittsburgh, where he also received an MBA degree. He is Past President and a Distinguished Fellow of the American College of Medical Quality, and is Past Chairman of the American Board of Medical Quality. Dr. Fetterolf was the first recipient of the Brian Hayes Award of the Blue Cross Blue Shield Association and was awarded the 2006 Annual Disease Management Association of America Award for Outstanding Individual Leadership. He is a Fellow of the American College of Physicians and of the College of Physicians of Philadelphia.

Elizabeth A. Fracica MD, MPH, is in her first year of residency training at Johns Hopkins Hospital and completed her medical training at the Mayo Clinic School of Medicine. She has already contributed to federal and state-level healthcare delivery reform efforts through her work on the Maryland All Payer Model. She looks forward to pursuing a career in academic Neurology and healthcare reform.

Philip J. Fracica MD, MBA, FACP, is Chief Medical Officer at Bothwell Regional Health Center in Sedalia, Missouri. He also serves as Medical Director for Hospitalist Services. Dr. Fracica's experience includes 25 years as a Medical ICU Director at tertiary care academic medical centers. For the last 10 years he has served as Chief Medical Officer at institutions in Missouri, Texas, and Arizona.

Eileen R. Giardino PhD, RN, APRN, is an Associate Professor for the Department of Adult Health and Gerontological Nursing at Rush University College of Nursing and Adjunct Associate Professor in the Division of Health Systems and Community Based Care at the University of Utah College of Nursing. She earned a Bachelor of Science and PhD in Education from the University of Pennsylvania, and is certified as a family and adult nurse practitioner. Dr. Giardino teaches courses in quality

improvement in the Doctor of Nursing Practice (DNP) program and works with doctoral students on their DNP scholarly projects, many of which are quality improvement initiatives at the clinical affiliates of DNP program.

Carrie Guttman MSN, BA, BS, RN, is the Nursing Lead and Quality Manager at Northeast Medical Group (NEMG) in Connecticut. She currently has oversight of nursing function at NEMG, quality improvement for all community-based sites, and clinical performance reporting. Her background includes gynecology oncology, hospital patient safety, and ambulatory clinical quality. Responsibilities include leading a quality collaborative that engages 30+ sites, managing a team of business analysts, and optimizing nursing practice across an organization that spans three states.

Linda Harrington PhD, DNP, RN-BC, CNS, CPHQ, CENP, UXC, CPHIMS, FHIMSS, is a Professor at Baylor College of Medicine where she teaches quality outcomes management, statistics, and informatics. She holds a DNP and post-master's certificate in informatics from Duke University, a PhD from Texas Woman's University, and is certified in healthcare quality and informatics. Linda serves as the Technology Today column editor for the American Association of Critical-Care Nurses' *Advanced Critical Care* and lead author of *Usability Evaluation Handbook for Electronic Health Records*.

Jennifer Hooks MBA, is Manager of Performance Improvement at the Medical University of South Carolina, where she is responsible for the deployment of Lean Six Sigma throughout the organization. She is an adjunct faculty member in MUSC College of Health Professions and College of Nursing where she teaches Lean Six Sigma methodology. Ms. Hooks is a retired Air Force Chief Master Sergeant and a certified Six Sigma Master Black Belt and also holds a LEAN Sensei Certification from Villanova University.

Antoine Kfuri MD, MPH, FACOG, currently serves as a senior medical director in the Clinical Analytics department at Inovalon. Dr. Kfuri is extensively involved in the clinical design, implementation, and improvement of Inovalon's portfolio of healthcare data analytics solutions, clinical data review tools, and clinical data integrity and quality oversight programs. Dr. Kfuri's medical expertise, coupled with his clinical experience and successful quality improvement programs and data analytics, foster effective patient-provider engagement and contribute to successful outcomes in areas of patient quality, utilization and cost management, and reporting. Prior experience includes clinical practice for more than 20 years and time as a consultant in Healthcare Management, leading to performance excellence awards. Dr. Kfuri is board certified by the American Board of Obstetrics & Gynecology. He is certified in both Health Policy and Health Finance & Management by the Johns Hopkins School of Public Health and holds an MPH in Health Management & Leadership from the Johns Hopkins School of Public Health. Dr. Kfuri is also a Senior Alumni Examiner and Team Leader for the prestigious Baldrige National

Performance Excellence Program (BPEP) and is a Senior Examiner and a Team Leader for the State of Maryland Performance Excellence Award Program (MPEA). He is also a senior fellow and Quality Judge in the Healthcare Division of the American Society of Quality (ASQ).

Michelle A. Lyn MD, FAAP, is an Associate Professor of Pediatrics at Baylor College of Medicine and the Medical Director of Care Management/Patient Flow at Texas Children's Hospital in Houston. She received her medical degree from the State University of New York at Buffalo School of Medicine and completed her residency in Pediatrics at Albert Einstein College of Medicine-Montefiore Medical Center in Bronx, New York. After serving an additional year as Chief Resident, she moved to Texas to complete her postgraduate fellowship in Pediatric Emergency Medicine at Baylor College of Medicine. Dr. Lyn holds board certifications in Pediatrics, Pediatric Emergency Medicine, and Child Abuse Pediatrics. Dr. Lyn is an administrator, educator, and clinician. She previously served as the Chief of Child Protection in the Section of Emergency Medicine. Dr. Lyn is the recipient of the Baylor College of Medicine Department of Pediatrics Award of General Excellence in Teaching and the Baylor College of Medicine Fulbright and Jaworski Excellence in Teaching Award. She is also the recipient of several Houston community awards including the Breakthrough Women Award from Texas Executive Women and The Houston Chronicle and the Unstoppable Leader Award from the Greater Houston Women Chamber of Commerce.

Charles G. Macias MD, MPH, is an Associate Professor of Pediatrics at Case Western Reserve University and serves as Vice Chair and Chief Quality Officer for University Hospitals Rainbow Babies and Children's Hospital. He is executive director of the national EMS for Children Innovation and Improvement Center, utilizing improvement science to help drive improved outcomes for ill or injured children in 58 states and territories. He chairs or co-chairs a number of quality improvement collaboratives, including the Improving Pediatric Sepsis Outcomes quality collaborative dedicated to decreasing mortality and morbidity from sepsis in greater than 50 hospitals. He was named HealthData Management's Clinical Visionary of the Year in 2014.

Robert McLean MD, MACP, is currently an Associate Clinical Professor of Medicine at the Yale School of Medicine. He has practiced internal medicine and rheumatology in New Haven since 1994. In 2013, he became chair of the Clinical Integration Steering Committee for Yale New Haven Health System and chair of the Quality & Performance Improvement Committee for Northeast Medical Group. In 2016, he became Medical Director for Clinical Quality at Northeast Medical Group. He served on the American College of Physicians' Medical Practice & Quality Committee from 2013 to 2017, and as Chairman from 2015 to 2017.

Perry Ann Reed MBA, MS, FACHE, is Executive Director of WakeMed Children's Hospital, where she oversees strategy formulation and execution, finan-

cial performance, and operational management. Previously, as Director of Ethics and Palliative Care at Texas Children's Hospital, she launched and led these two service lines. She holds an MBA in healthcare management from the University of Texas and an MS in Bioethics from Columbia University. Recent published chapters include "Law, Ethics and Clinical Judgment" in *Rudolf's Pediatrics* 23rd Edition. She and her husband John have four children.

Rahul K. Shah MD, MBA, FACS, FAAP, obtained a combined BA/MD from Boston University School of Medicine and completed his Otolaryngology residency at Tufts University, followed by a fellowship in Pediatric Otolaryngology at Children's Hospital Boston at Harvard University. After fellowship, he joined the faculty of Children's National Hospital, rising to the rank of Professor. He is recognized as a leader in patient safety and quality improvement and has chaired and serves on several national committees related to patient safety and quality improvement. He was the Executive Director of an international not-for-profit quality improvement initiative, the Global Tracheostomy Collaborative. He was the inaugural Associate Surgeon-in-Chief (Chief, Perioperative Services) within the Joseph E. Robert, Jr. Center for Surgical Care at Children's National Hospital and the Medical Director of Perioperative Services from 2011 to 2014. He served as President of the Medical Staff at Children's National Hospital from 2012 to 2014. In 2014, he was appointed the inaugural Vice-President, Chief Quality and Safety Officer for Children's National Health System. Under his leadership, Children's National has received numerous safety and quality distinctions and is a recognized leader in pediatric safety and quality.

David W. West MD, MMI, completed his pediatric residence at University of Virginia and then completed a fellowship in General Academic Pediatrics at Johns Hopkins University. He came to Nemours in 1989 and practiced as a primary care physician, consultative physician, and hospitalist. He subsequently served as the Medical Director of Primary Care for Nemours Children's Clinic in Delaware. In 1996, he was appointed Chief of Medical Informatics. In this role, he has overseen the deployment of a single integrated electronic health record for over 700 Nemours physicians practicing at two tertiary care children's hospitals and dozens of ambulatory locations across four states. He was board certified in medical informatics in 2016 after receiving his Master's degree in Medical Informatics from Northwestern University. He currently leads initiatives in precision medicine, patient engagement, and interoperability with external healthcare systems. Under his leadership, Nemours has successfully achieved Meaningful Use for both its Eligible Providers and Eligible Hospitals resulting in awards in excess of \$20 million. In 2010 under Dr. West's guidance, Nemours earned the HIMSS Davies Organizational Award honoring Excellence in Health Information Technology. Both children's hospitals in the Nemours network, Alfred I DuPont Hospital for Children (Wilmington, DE) and Nemours Children's Hospital (Orlando, FL), have achieved Health Level 7 certification by HIMSS, indicating the highest level of health information technology integration for promoting improved healthcare quality and outcomes.