HEALTHCARE INFORMATION TECHNOLOGY EXAM GUIDE FOR CHTS AND CAHIMS CERTIFICATIONS

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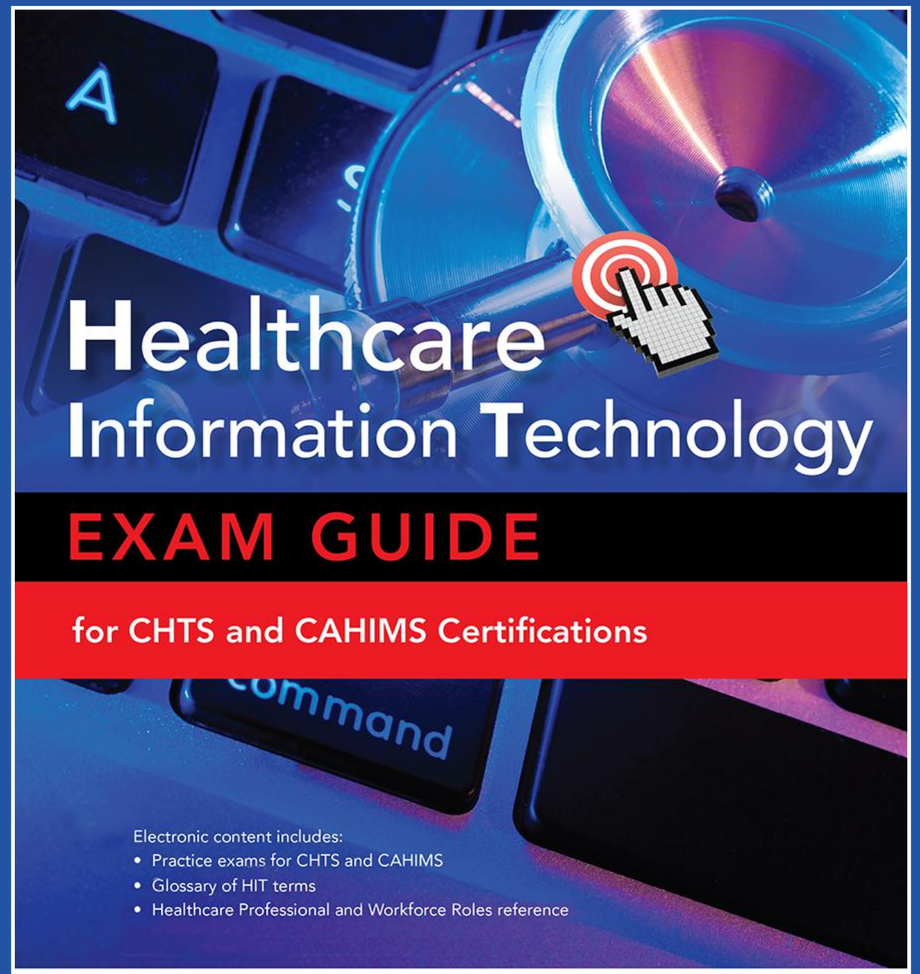

KATHLEEN A. McCORMICK, PhD
BRIAN GUGERTY, DNS, RN
JOHN E. MATTISON, MD

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Kathleen A. McCormick, Ph.D.
Brian Gugerty, DNS, R.N.
John E. Mattison, M.D.

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This book is dedicated to our families, since books are "family affairs." We express gratitude for our family members' support, encouragement, and patience while we took evenings and weekends away from them to write the book and coordinate the chapters.

The growing McCormick Family now includes a Kate, Anina, Prunella, and Christine, in addition to Francis, Sr., Francis, Jr., Ellen, Simon, and Christopher. I am forever grateful to this family throughout the years that were spent on developing this book.

Brian Gugerty dedicates the book to Kathleen Bartley, his wife, Sean, Ryan, and Dylan, his sons, and to the memory of Helen M. Gugerty, R.N., and Leo J. Gugerty.

John dedicates the book to Mindy, his wife, Shawn, Michelle, and Heidi, his children, and his parents Jim and Joanne, who inspired us all toward kindness and service to others.

The book is also dedicated to the HIT professionals, clinical informaticians, and STEM professionals in healthcare organizations, HIT-focused companies, government agencies, and professional associations that the authors have been privileged to work with, learn from, and be inspired by.

ABOUT THE LEAD AUTHORS

Kathleen A. McCormick, Ph.D., R.N., FACMI, FAAN, FHIMSS, is an author, senior practitioner, and consultant in healthcare informatics, genomics, and bioinformatics. She has authored or co-authored more than eight books and hundreds of publications, including the McGraw-Hill title *Essentials of Nursing Informatics*, now in its sixth edition. Dr. McCormick has a B.S. and M.S. in nursing and an M.S. and Ph.D. in physiology, and has been involved in informatics since 1978. As a tenured scientist at the National Institutes of Health, Dr. McCormick retired as a 06 Captain in the U.S. Public Health Service. Following her retirement, she worked for 16 years in the healthcare IT industry as a vice president and chief senior scientist/executive contractor for SRA (now CSRA), SAIC, and Leidos. Since 2013, Dr. McCormick has been a lecturer, author, and consultant. Her fellowships in informatics include the College of Medical Informatics through AMIA, the American Academy of Nursing, and the Healthcare Information and Management Systems Society (HIMSS). Dr. McCormick is an elected fellow of the prestigious National Academy of Sciences, National Academy of Medicine (formerly the Institute of Medicine).

Brian Gugerty, DNS, R.N., is a Senior Service Fellow at the CDC's National Center for Health Statistics/Division of Health Care Statistics, where he advises Center leadership on healthcare data standards and policy issues regarding interoperability. As the founder and former CEO of GiC Informatics, he developed innovative approaches to assist physicians and clinicians to effectively and efficiently use EHRs during the critical EHR "go-live" period and then optimize EHR use on an ongoing basis. Dr. Gugerty has been in the clinical informatics field for 27 years. His experience includes teaching, clinical informatics research, clinical software development, and consulting to healthcare organizations. Dr. Gugerty has authored or co-authored more than 40 articles and book chapters on the theory, practice, and future of clinical informatics and is a frequent presenter of these topics.

John E. Mattison, M.D., is Chief Medical Information Officer and Assistant Medical Director for Kaiser Permanente, SCAL. Dr. Mattison focuses on transforming care delivery with information technology, through convergence of exponential technologies and data liquidity. He led the design and implementation of the largest integrated electronic health record in the United States, and is the founder of the international XML standard for health record interoperability known as CDA, CCD, and CCDA. He has led various national innovation programs including virtual care, sponsored or led numerous digital health projects implemented at scale, is senior advisor to the Tricorder X-Prize, and mentors many digital health startups. Dr. Mattison chairs the eHealth Workgroup of the Global Alliance for Genomics and Health (GA4GH) and

is a board member of Open mHealth, the NIH-funded "Policy and Ethics in Precision Medicine," the Simms-Mann Foundation, BioCOM, Big Data Advisory Board, and IOT Advisory Board. He teaches at multiple universities, including Exponential Medicine at Singularity University, UCSD, Stanford, USC, and UCLA. Dr. Mattison has published widely on IOT, global genomics, policy, privacy, security, international research collaboration models, interoperability, mobile health, community health, mindfulness and resilience, and healthcare transformation. He has published in *Nature*, *JAMIA*, and *JAMA*, has been quoted in *Wall Street Journal*, *Forbes*, *Fast Company*, *Modern Healthcare*, *Modern Physician*, *Mobile Health News*, and *Sloan Management Review*, and has authored chapters for four books. Dr. Mattison keynotes and hosts many national and international conferences and frequently consults globally. He is an active participant on several global initiatives to bring Internet services to underserved communities to provide access to both jobs and healthcare. His contributions to healthcare have been recognized by various national awards. His current work focuses on leveraging a Motivational Formulary®™ with motivicons®™ across the Healthcare Plecosystem®™ to restore ancient wisdom, mindfulness, and resilience while creating a "Behavioral Symphony of Wellness."®™

A recent keynote video featuring Dr. Mattison is available for viewing at https://exponential.singularityu.org/medicine/innovation-at-scale-virtues-of-plecosystem-approach-with-john-mattison/.

About the Foreword Author

John D. Halamka, M.D., M.S., is the International Healthcare Innovation Professor at Harvard Medical School, Chief Information Officer of the Beth Israel Deaconess System, and a practicing emergency physician. He strives to improve healthcare quality, safety, and efficiency for patients, providers, and payers throughout the world using information technology. He has written five books, several hundred articles, and the popular Geekdoctor blog. He is also an organic farmer in Sherborn, Massachusetts, overseeing 15 acres of agriculture, animals, and cider/mead making.

About the Section Editors

Part I: Healthcare and Information Technology in the United States

J. Marc Overhage, M.D., Ph.D., is a general internist who earned a doctorate in biophysics and completed a fellowship in medical informatics. During his 25-year tenure at Regenstrief Institute and Indiana University, Dr. Overhage practiced medicine, served as the Sam Regenstrief Professor of Medical Informatics, and studied a variety of informatics topics including clinical decision support, the impact of healthcare IT on providers, and health information exchange. During that time, along with his colleagues, he developed the Indiana Network for Patient Care and studied the role of health information exchange on public and population health. Subsequently, he founded and served as CEO of the Indiana Health Information Exchange before becoming the Chief Medical

Informatics Officer for Siemens Healthcare and now Cerner Corporation. Dr. Overhage is a Master of the American College of Physicians, a fellow of the American College of Medical Informatics, and a fellow of the National Academy of Medicine.

Part II: Fundamentals of Healthcare Information Science

Andre Kushniruk, M.Sc., Ph.D., is a professor in health informatics and Director of the School of Health Information Science at the University of Victoria in Canada. He is also an adjunct professor at Aalborg University in Denmark and an honorary professor at the University of Hong Kong. He is a fellow of the American College of Medical Informatics and a fellow of the Canadian Academy of Health Sciences. Dr. Kushniruk conducts research in a number of areas including usability engineering, electronic health records, evaluation of the effects of information technology, human-computer interaction in healthcare and other domains, and cognitive science. He has published widely in the area of health informatics, with over 200 peer-reviewed publications, and his work is known internationally. Dr. Kushniruk has advised on a variety of key national and international committees and projects. He focuses on developing new methods for the evaluation of healthcare IT and studying human-computer interaction in healthcare. Dr. Kushniruk holds undergraduate degrees in psychology and biology, as well as an M.Sc. in computer science and a Ph.D. in cognitive psychology from McGill University.

Part III: Healthcare Information Standards and Regulation

Donald T. Mon, Ph.D., is a senior director in the Digital Health Policy and Standards (DHPS) department at Research Triangle Institute (RTI), where he leads the standards and interoperability practice. In this capacity, he represents RTI in key national and international standards development activities and directs RTI's business development and project implementation related to data, functional, and interoperability standards. Dr. Mon has served as board chair of Health Level Seven International (HL7), co-chair of the HL7 EHR Work Group, president of the Public Health Data Standards Consortium, and subject-matter expert in the U.S. Technical Advisory Group (the U.S. representative to ISO Technical Committee 215–Health Informatics). Dr. Mon has more than 35 years of experience in health information management (HIM), healthcare IT, and informatics. Prior to joining RTI, Dr. Mon was vice president of practice leadership at the American Health Information Management Association (AHIMA), where he led the implementation of AHIMA's top strategic national and international initiatives. He has developed IT strategic and business process reengineering plans, and helped design, develop, and maintain large-scale databases and information systems for the Biological Sciences Division/Pritzker School of Medicine at the University of Chicago, Catholic Healthcare West, University of Illinois at Chicago, Premier, Inc., Oracle Corporation, Rush University Medical Center, and Schwab Rehabilitation Hospital.

Part IV: Implementing, Managing, and Maintaining Healthcare IT

Michael J. Beller, M.D., M.M.M., is a vice president and physician executive working in Cerner Corporation's Investor Owned/Federal Organization. He currently serves as

the lead physician for the Cerner/Leidos partnership implementing a new electronic health record for the Military Health System. Prior to joining Cerner in 2001, Dr. Beller was a Family Medicine Residency Director for Intermountain Healthcare in Provo, Utah. He has published articles on computerized physician order entry, quality improvement, and management and has presented to audiences around the country on CPOE and quality of care. He received his medical degree from Creighton University and a master's in medical management from Tulane University.

Part V: Optimizing Healthcare IT

Lead author **John E. Mattison**, M.D., CMIO.

Part VI: Making It All Secure: Healthcare IT Privacy, Security, and Confidentiality

Lori Reed-Fourquet, M.C.S., is a principal at e-HealthSign, LLC, consulting in health informatics. She is the convener for ISO TC215, WG4 on Health Information Security, Privacy, and Patient Safety. She is also a member of the IT Infrastructure Planning and Technical committees; IHE Quality, Research, and Public Health Planning and Technical committees; and the HL7 Security and HL7 Public Health and Emergency Response committees. Ms. Reed-Fourquet has been working in medical and health informatics for more than 20 years, serving in numerous leadership capacities creating successful collaborations involving diverse healthcare communities in competing markets. She was part of the contracting teams to the Office of the National Coordinator for Health Information Technology (ONC) and the Security and Privacy and the Standards Harmonization initiatives as part of the U.S. efforts to advance nationwide interoperable healthcare IT. She serves as a technical assessor for the American National Standards Institute (ANSI), the ONC Approved Accreditor for the Permanent Certification Program for Health Information Technology (HIT). She holds a master's of computer science degree from Rensselaer Polytechnic Institute.

About the Contributors

Chris Apgar, CISSP, CEO, and president of Apgar & Associates, LLC, is a nationally recognized information security, privacy, HIPAA, and electronic health information exchange expert. He has more than 17 years of experience assisting healthcare organizations comply with HIPAA, HITECH, and other privacy and security regulations. Mr. Apgar also has assisted healthcare, utilities, and financial organizations implement privacy and security safeguards to protect against organizational harm and harm to consumers. Mr. Apgar is also a nationally known speaker and author. Mr. Apgar has been a Certified Information Systems Security Professional since 2002 and he is a senior member of the Information Systems Security Association. His education includes a bachelor of science degree in psychology and an associate of science degree in accounting. Mr. Apgar served on the Work Group for Electronic Data Interchange board of directors for eight years and is the chair of the Oregon Prescription Drug Monitoring Program Advisory Commission.

Dixie B. Baker, Ph.D., M.S., M.S., FHIMSS, is a Senior Partner at healthcare consulting firm Martin, Blanck & Associates, where she provides consulting services in the areas of healthcare IT, EHR technology, privacy and security technology, and the sharing and protection of genomic and clinical data. Dr. Baker was one of the original members of the Health IT Standards Committee (HITSC) when it was formed in 2009, and served the full two terms allowed by law. Dr. Baker chaired the HITSC Security Workgroup throughout her tenure, and led the Nationwide Health Information Network (NwHIN) Power Team that developed metrics for assessing the readiness of technology specifications to become national standards. Dr. Baker co-chairs the Security Working Group of the Global Alliance for Genomics and Health, a worldwide coalition to facilitate the sharing of genomic and clinical data to accelerate the discovery and translation of biomedical knowledge. She is a member of the Advisory Council for Health Level Seven International (HL7), and the Academy of Medicine's DIGITizE Action Collaborative, which is developing standards for integrating genomic data into EHRs. She also serves on the Scientific Advisory Board of the European Genome-Phenome Archive (EGA) of the European Bioinformatics Institute (EBI), and on the Institutional Review Board for Genetic Alliance. Dr. Baker is a fellow of the Healthcare Information and Management Systems Society (HIMSS). In 2013, HealthcareInfoSecurity.com named Dr. Baker one of its inaugural "Top 10 Influencers in Health Information Security" and in 2017, Health Data Management named her one of the top 75 Most Powerful Women in Healthcare IT. Dr. Baker holds a Ph.D. in special education and an M.S. in computer science from the University of Southern California, as well as M.S. and B.S. degrees from Florida State University and The Ohio State University, respectively.

Kimberly Baldwin-Stried Reich, M.B.S., M.J., PBCI, RHIA, CPHQ, FAHIMA, is a credentialed healthcare information management, quality management, case management, and healthcare compliance professional with more than 25 years of experience in a variety of healthcare settings. Ms. Baldwin-Stried Reich holds a master's of business from the Lake Forest Graduate School of management, a master's of jurisprudence in health law and policy from the Loyola School of Law-Beazley Institute for Health Law and Policy in Chicago, and a post-baccalaureate certificate in clinical informatics (PBCI) from the Johns Hopkins School of Medicine. Ms. Baldwin-Stried Reich is the first Registered Health Information Administrator (RHIA) to successfully complete the Johns Hopkins program and is a 2011 recipient of the AHIMA e-HIM Triumph Award. Ms. Baldwin-Stried Reich is currently employed as a compliance and case management professional for Lake County Physicians' Association in Waukegan, Illinois. She is the lead author of *E-Discovery and Electronic Records* (AHIMA Press).

Elizabeth Borycki, R.N., HBScN, M.N., Ph.D., is the Director of the Social Dimensions of Health program and the Director of the Health and Society program in the Office of Interdisciplinary Studies at the University of Victoria in Victoria, British Columbia, Canada. She is a professor in the School of Health Information Science at the University of Victoria. Her research interests include clinical informatics, health information systems safety, patient safety, human factors, and educating health professionals about EHRs and

health services research. Dr. Borycki has authored or co-authored over 150 articles, book chapters, and books. She has served as Academic Representative for Canada for Canada's Health Informatics Association (2007–2013) and as Vice President representing North America on the board of directors for the International Medical Informatics Association (IMIA; 2010–2013). Dr. Borycki founded the IMIA working group focusing on health informatics for patient safety and is currently the Scientific Program Committee Co-Chair for Medinfo 2017. Dr. Borycki returned to the board of directors of IMIA in August 2016 as Vice President, Special Affairs. She received her Ph.D. from the Department of Health Policy, Management, and Evaluation at the University of Toronto, a master's degree in geriatrics and community health nursing from the University of Manitoba, and an honors bachelor's of science in nursing degree from Lakehead University.

Jane Brokel, Ph.D., R.N., FNI, is currently an adjunct assistant professor for the University of Iowa College of Nursing and a nurse for Heartland Home Care, Inc. She has taught nursing, research, and informatics courses the past six years. She serves on the executive committee and advisory council for the state of Iowa Health Information Network to represent nursing's perspective in developing health information exchange. Dr. Brokel is the current president of NANDA International, Inc., an international nursing organization defining nursing knowledge, and has published on the experiences and findings with patient-centered workflows, clinical decision support knowledge development, and measuring patient-desired outcomes. She has more than 35 years of experience in various nursing roles, which includes 20 years using databases and healthcare information technologies.

Brian Dixon, Ph.D., M.P.A., FHIMSS, is an associate professor at the Indiana University Richard M. Fairbanks School of Public Health and a research scientist at the Regenstrief Institute Center for Biomedical Informatics in Indianapolis, Indiana. Dr. Dixon's research focuses on applying informatics methods and tools to improve population health in clinical and public health organizations. His work leverages clinical and administrative data in electronic health records to improve population outcomes, better understand threats to public health as well as care delivery processes, examine public health business processes, and make population surveillance more efficient. Dr. Dixon's research also involves the design, implementation, and evaluation of information infrastructures as well as data quality in support of continuous use of electronic data. Dr. Dixon also teaches courses on informatics and health information exchange to future leaders in clinical and public health. Before joining the faculty at Indiana University, Dr. Dixon managed informatics research and development projects for Regenstrief and the Indiana Health Information Exchange.

Floyd P. Eisenberg, M.D., M.P.H., FACP, is president of iParsimony, LLC, serving organizations and clinical system vendors interested in repurposing data for measurement, clinical decision support, reporting, and research. Dr. Eisenberg received his M.D. degree from Penn State University, followed by a residency in internal medicine at Abington Memorial Hospital in Abington, Pennsylvania, and a fellowship in infectious diseases at Temple University.

His experience includes ten years of clinical practice in Norristown, Pennsylvania; network quality improvement activities at Independence Blue Cross; and EHR development at Siemens Medical Solutions Health Services. He led the initial efforts to develop healthcare standards to express quality measurement directly from EHRs at National Quality Forum and subsequently as an independent consultant. Dr. Eisenberg is currently working on harmonization standards for clinical decision support and measurement as well as collaborating with the HIMSS Immunization Integration Program for EHRs. He is a member of the Health IT Standards Committee (HITSC) of the Office of the National Coordinator for Health Information Technology (ONC), and a co-chair of the HL7 Clinical Quality Information Workgroup.

Alistair Erskine, M.D., is Chief Informatics Officer at the Geisinger Health System. He is responsible for sequencing innovative technologies, harmonizing data across the enterprise, and aligning healthcare systems to optimize patient experience. Dr. Erskine heads the Division of Informatics, which engages staff in the design and configuration of Geisinger's clinical information systems and evolves Geisinger's facilities to take advantage of ultramodern technologies. Dr. Erskine oversees Geisinger's Unified Data Architecture, a hedged data management environment powered by big data and traditional relational database systems to ensure that data collected as a byproduct of clinical and research investigation are accessible for new discovery and appropriate secondary use. Dr Erskine is the Program Director of Geisinger's ACGME-accredited Clinical Informatics Fellowship program and participates on several clinical informatics research grants (e.g., PCORI, NIH). Prior to Geisinger, Dr. Erskine was appointed Associate Dean of Medical Informatics at Virginia Commonwealth University and was a member of the board for the 650-physician Medical College of Physicians practice plan. Dr. Erskine trained at Brown University and Virginia Commonwealth University Health System and is triple board-certified in internal medicine, clinical informatics, and pediatrics. He is currently engaged in a two-year program with MIT Sloan School of Management and is on faculty at The Ohio State University in the department of biomedical informatics.

Cheryl A. Fisher, Ed.D., R.N.–BC, is currently the program director for Professional Development for Nursing and Patient Care Services at the National Institutes of Health Clinical Center, in Bethesda, Maryland. She received her doctorate in instructional technology from Towson University and has a postgraduate certificate in nursing informatics from the University of Maryland and a postgraduate certificate in nursing education. Dr. Fisher is responsible for all the central nursing education at the NIH Clinical Center and is actively working to reconceptualize courses utilizing technology to increase accessibility of all educational offerings. She is an adjunct professor for the University of Maryland and teaches graduate courses in nursing informatics. Dr. Fisher is also board certified in nursing informatics.

Amy Lorraine Flick, PMP, is a Principal Owner and Project Leadership Practice Lead at DPT. DPT stands for "Driving Performance Together" and is a business performance consulting firm based in Grand Rapids, Michigan, specializing

in customer relationship management (CRM), business process management, and project leadership. Ms. Flick is a graduate of the University of Notre Dame, receiving a bachelor's of business administration with a marketing concentration. Her career in healthcare began in 1992 at Parke-Davis Pharmaceutical in field sales for Michigan and Northern Indiana providers, pharmacies, and hospitals. Building upon her sales experiences in primary care, hospitals, and neurology, Ms. Flick performed key training, project, technology, and leadership roles in pharmaceuticals, healthcare benefits, and for a nationally recognized not-for-profit health system in Michigan. Ms. Flick earned the Project Management Professional (PMP) certification in 2005. In 2008, she joined DPT as a Senior Consultant, and her focus became working with senior leaders in for-profit and not-for-profit organizations to create, grow, improve, and innovate business performance. Ms. Flick became a Principal Owner of DPT in 2011, achieving a longtime personal goal for entrepreneurship. Amy specializes in the design and organization of work to align with strategic plan objectives, governance model design, vendor partner relationship management advisory, project portfolio design and implementation, and operational area assessment and advisory supporting due diligence work for mergers and acquisitions.

Lisa A. Gallagher, BSEE, CISM, CPHIMS, FHIMSS, has over 30 years of professional experience in systems engineering, hardware design, and software development, as well as healthcare privacy, security, and public policy. Ms. Gallagher is currently Managing Director in PwC's Healthcare Industries Advisory Cybersecurity and Privacy practice. She most recently served as Vice President, Technology Solutions for the Healthcare Information and Management Systems Society (HIMSS). Ms. Gallagher is currently a co-chair of the ONC Health IT Standards Committee (HITSC) to the HHS Office of the National Coordinator for Health IT (ONC) in a data security expert role.

Diane Hibbs, D.O., FACOOG, is a physician executive with Cerner Corporation. In this role, she is responsible for improving physician satisfaction with and usage of technologies to influence and enhance patient care. Prior to her current role, she served as a physician informaticist with Banner Health. Clinically trained as an OB/GYN, she continues to be an end user of an EMR as a part-time OB hospitalist.

Julie Hollberg, M.D., is the Chief Medical Information Officer for Emory Healthcare and Assistant Professor, Division of Hospital Medicine, Department of Medicine at Emory University School of Medicine. In her current role, Dr. Hollberg is responsible for providing medical direction and governance for the system's electronic medical record and related clinical applications. Her focus is on increasing the usability of EMR systems for clinicians and using information technology to improve the quality and safety of patient care.

Liz Johnson, M.S.N, FAAN, FCHIME, FHIMSS, CHCIO, R.N.–BC, is the nationally recognized and award-winning Chief Information Officer, Acute Care Hospitals & Applied Clinical Informatics for Tenet Healthcare. Ms. Johnson provides the strategic vision and tactical planning for all clinical, patient management, imaging, productivity, and supply chain

systems used across Tenet's acute-care hospitals nationwide. As a pioneer in nursing and nurse informatics, Ms. Johnson led the most aggressive and successful EHR implementation effort in the nation. Due to her leadership, Tenet Healthcare is now a national model of healthcare reform, using quantifiable data to transform clinical practice to enhance care delivery and improve patient outcomes through the use of EHR systems. Ms. Johnson is also honored to serve in various elected, assigned, and philanthropic positions at the national level, including appointment to the Health IT Standards Committee (HITSC) of the Office of the National Coordinator (ONC); appointment to the Health Level 7 International (HL7) board of directors; and election by the College of Health Information Management Executives (CHIME) to the board of directors and as CHIME Board Chair. Ms. Johnson has been recognized in the industry as one of "The Most Powerful Women in Healthcare IT" and as one of "50 Top Healthcare Information Technology Experts" for being a guiding light in the industry and advancing the important work of healthcare IT.

Bipin Karunakaran, M.S., M.B.A., is the Vice President of Enterprise Data Management at Geisinger Health Systems. He is responsible for the build and implementation of major data processing, aggregation, and reporting systems, including the big data system at Geisinger. He is also responsible for advanced analytics systems used to process millions of clinical notes to extract key diagnosis using Natural Language Processing (NLP) and predictive modeling, helping providers make better informed care decisions. Mr. Karunakaran was the principal developer for Microsoft's first version of the digital media encoder on the Web. He led the team at the Walt Disney Company responsible for the first companywide implementation of big data. Mr. Karunakaran has held board seats as a technical advisor for two major startups. He received his M.S. in computer science and engineering from University of Washington, Seattle, and his M.B.A. from the UCLA Anderson School of Business, Los Angeles.

J. Michael Kramer, M.D., M.B.A., is a senior vice president and the chief quality officer with Spectrum Health. As chief quality officer, Dr. Kramer is the leader for Spectrum Health's Quality Outcomes and Electronic Medical Records teams. He is actively engaged in advancing the quality, safety, and analytics strategy of all Spectrum Health's inpatient, outpatient, and insurance businesses. In his CMIO roles, Dr. Kramer has been a national leader in designing methodologies for implementing and optimizing systems that assist clinicians in achieving high-quality care and evidence-based outcomes. Dr. Kramer brings to his role as CQO more than 20 years of information systems experience. He previously taught applied clinical informatics at the University of Michigan. Dr. Kramer is currently highly engaged in implementing MACRA and supporting the integrated care model across Spectrum Health's 180 practice locations and 9 hospitals using five different electronic medical records.

Philip J. Kroth, M.D., M.S., is an associate professor at the University of New Mexico (UNM) School of Medicine. He is also the director of the Biomedical Informatics Research, Training and Scholarship unit at the UNM Health Sciences Library

and Informatics Center and Section Chief of Clinical Informatics in the UNM Department of Internal Medicine. Before joining UNM in 2004, Dr. Kroth received his B.S. in computer engineering from the Rochester Institute of Technology in 1987, his M.D. degree from the Medical College of Ohio in 1995, and completed his residency in internal medicine at the State University of New York at Buffalo in 1999. He completed a research fellowship in biomedical informatics at the Regenstrief Institute at the Indiana University Medical Center, where he also earned an M.S. in clinical research in 2003. At UNM, in addition to practicing as a general internist, Dr. Kroth directs a post-doctoral research fellowship in biomedical informatics as well as the new clinical informatics fellowship for physicians. Dr. Kroth is board certified in both internal medicine and clinical informatics.

Roman Mateyko has worked in the telecommunications industry in both management and engineering roles in the private and public sector. After moving to Victoria in 1988, he joined the Government of British Columbia where he worked in engineering, service management, contract management, planning, and strategy. During his tenure as a Network Planning Manager, he was responsible for the planning and engineering of the Provincial Learning Network, which connected 2,000 schools to SPAN/BC, the province's data network. He is currently Executive Director, Architecture and Planning Administrator's Office of the CIO in the Ministry of Labour, Citizens' Services. Before joining government, Mr. Mateyko worked in the cellular industry and for a common carrier. His experience includes negotiations, contract management, service management, engineering, planning, implementation, and operations of large-scale physical and logical networks. Mr. Mateyko has a bachelor of applied science in electrical engineering from the University of Toronto, is a professional engineer, a member of the IEEE, and is currently an adjunct assistant professor at the University of Victoria.

Mac McMillan is co-founder and CEO of CynergisTek, Inc., a top-ranked information security and privacy consulting firm focused on the healthcare IT industry. He is a member of CHIME's AEHIS Advisory Board, recognized as a HIMSS fellow, and former chair of the HIMSS Privacy & Security Policy Task Force. Mr. McMillan brings nearly 40 years of combined intelligence, security countermeasures, and consulting experience from positions within the government and private sector and has worked in the healthcare industry since his retirement from the federal government in 2000. Mr. McMillan is a thought leader in compliance, security, and privacy issues in healthcare, contributing to several industry trade publications and blogs. He was recognized in *Becker's Hospital Review*'s lists of influential healthcare IT leaders by both its writers and readers in 2015, and was named one of the top 10 health information security influencers of 2013 by *HealthInfoSecurity*. Mr. McMillan served as Director of Security for two separate defense agencies, and sat on numerous interagency intelligence and security countermeasures committees while serving in the U.S. government. He holds a master of arts degree in national security and strategic studies from the U.S. Naval War College and a bachelor of science degree in education from Texas A&M University. He is a graduate of the Senior Officials in National Security program at the John F.

Kennedy School of Government at Harvard University and a 1993/4 Excellence in Government Fellow.

John Moehrke is a standards architect focused on healthcare information exchange interoperability, security, and privacy. He is co-chair of the HL7 Security Workgroup, a member of the FHIR Management Group, and part of the core founding members of HL7 FHIR. Mr. Moehrke is an active member in the United States' national initiatives to create a Nationwide Healthcare Information Network for both the Exchange architecture and the Direct Project. He participates in DICOM, HL7, ISO, and IHE. He has been active in healthcare standardization since 1999, during which time he has authored various standards, profiles, and white papers. Mr. Moehrke has become a well-known security and privacy expert in the standards organizations and government regulations. Mr. Moehrke graduated from the Milwaukee School of Engineering with a bachelor of science degree in computer science and engineering. Mr. Moehrke has an internationally read blog at https://healthcaresecprivacy.blogspot.com/.

Alex Mu-Hsing Kuo, Ph.D., is a full-time associate professor at the School of Health Information Science at the University of Victoria in British Columbia, Canada. He has been a visiting scholar at the Electronic Commerce Resource Centre (ECRC) at Georgia Tech, and at the Center for Expanded Data Annotation and Retrieval (CEDAR) at the Stanford University School of Medicine. Dr. Kuo is the chair of the IEEE Big Data Education Track as well as the study group leader of Metadata Standard for Big Data Management at the IEEE Big Data Initiative (BDI). With over 20 years of programming and data analysis practical and research experience, Dr. Kuo has written over 150 peer-reviewed publications. His research interests include cloud computing and big data application to healthcare, health data interoperability, health database and data warehousing, data mining application in healthcare, e-health, and clinical decision support systems.

Sean Murphy, FACHE, CPHIMS, CISSP-ISSMP, CIPT, HCISP, is a vice president and Chief Information Security Officer at Premera Blue Cross, Seattle, Washington. As a healthcare information security expert with over 20 years of experience, Mr. Murphy has had success at all levels of healthcare. Prior to his current career in healthcare information security, Mr. Murphy was a lieutenant colonel in the U.S. Air Force Medical Service Corps. His proudest professional military accomplishment was his service as senior mentor to the Afghan National Police Surgeon General's Office in support of Operation Enduring Freedom. He has master's degrees in business administration (advanced IT concentration) from the University of South Florida and in health services administration from Central Michigan University. He is also an adjunct professor at Saint Leo University, a fellow of the American College of Healthcare Executives, and is board-certified by the Healthcare Information Management Systems Society. Mr. Murphy is also a Certified Information Systems Security Professional and Information Systems Security Management Professional.

Donald Nichols, Ph.D., is a principal scientist in the Research on Healthcare Value, Equity, and the Lifespan (REHVEAL)

program at RTI International in Washington, DC, and the program director for RTI's Health Equity Analytics and Solutions Program. Throughout his 15 years as an academic and social policy researcher, Dr. Nichols has gained experience working on projects involving program evaluations, demonstration designs, payment methodologies, performance measures, and economic modeling. His research includes evaluations of the Maryland Multi-payer Patient Centered Medical Home (PCMH) demonstration and the Centers for Medicare and Medicaid Services' implementation of the Multi-Payer Advanced Primary Care Practice (MAPCP) demonstration. Dr. Nichols was previously on the faculty of Washington University in the Department of Economics where he taught courses in health economics and econometrics. He completed his doctoral work in economics at Stanford University where he was the recipient of the National Science Foundation and Ford Foundation fellowships.

Sheila A. Ochylski, DNP, R.N., is the Chief Nursing Informatics Officer for the Veterans Health Administration, where she provides leadership and strategic direction to enhance care and improve health outcomes for veterans through the use of Health Information Technology. Dr. Ochylski brings with her over 30 years of executive-level experience. Her background includes emergency room and intensive care nursing followed by 20 years as a business owner/nurse entrepreneur operating a large private duty staffing company. Recently Dr. Ochylski served as a nurse leader/executive director of transformation of one of the nation's largest Catholic health systems. As Executive Director of Transformation, Dr. Ochylski led a team tasked with coordinating the implementation of new Electronic Health Record systems to over 90 hospitals across five different platforms.

Gila Pyke, BCompSc software engineering, is the president of Cognaissance and senior consultant specializing in privacy, security, and risk management, as well as interoperability standards in the healthcare IT domain. She has been working in IT since 1994, and fell in love with healthcare IT in 1999 and has never looked back. She has been instrumental in the successful implementation and management of risks in healthcare IT projects in the United States, Canada, France, Belgium, Austria, and Saudi Arabia. In all of her work as an implementer, consultant, and chair of standards development committees such as IHE ITI, Ms. Pyke insists that a high-communication, personalized approach to helping stakeholders manage risk is always the most successful.

Joyce Sensmeier, M.S., R.N.–BC, CPHIMS, FHIMSS, FAAN, is the vice president of informatics at HIMSS. In her current role, she is responsible for the areas of clinical informatics, standards, interoperability, privacy, and security. Ms. Sensmeier became board certified in Nursing Informatics in 1996, earned the Certified Professional in Healthcare Information and Management Systems in 2002, and achieved HIMSS fellowship status in 2005. Ms. Sensmeier is president of IHE USA and previously served as the standards implementation technical manager for the Healthcare Information Technology Standards Panel (HITSP). Ms. Sensmeier was recognized in 2010 as a fellow of the American Academy of Nursing, the highest honor in the field of nursing. She is also co-founder and

ex-officio chair of the Alliance for Nursing Informatics.

Dennis M. Seymour, CISSP, HCISPP, ITILv3, is a consultant for Blue Cross Blue Shield of Michigan leading the information security training and awareness program. Prior to his current role, he was the chief security architect for Ellumen, Inc. He has more than 22 years of healthcare-specific security experience, including 15 years of experience at the enterprise level for the Department of Veterans Affairs, Veterans Health Administration, in the positions of technical security advisor and information security officer, with the responsibilities of policy development, system controls assessment and certification, and medical device security policy development and compliance with HIPAA, NIST, FISMA, and other requirements. Mr. Seymour has served as the chairperson of the Healthcare Information and Management Systems Society (HIMSS) Privacy and Security Steering Committee and has been a member of the HIMSS Medical Device Security Task Force, Mobile Security Work Group, and Risk Assessment Work Group. In 2010 Mr. Seymour was a finalist for the International Information Systems Security Certification Consortium [$(ISC)^2$] U.S. Government Information Security Leadership Award (GISLA) in the contractor division.

Omid Shabestari is a medical doctor and Ph.D. in health informatics. He received his medical degree from Tehran University of Medical Sciences in 1999 and his Ph.D. in health informatics from City University of London in 2010. Since 1994, Dr. Shabestari has served as a digital health consultant with executive responsibilities for both public and private sectors in several countries. His experience includes eight years as CMIO and also supporting a variety of digital health initiatives at organizations such as the National Health Service (NHS), Pfizer, and Cancer Care Ontario. In addition, he has held academic positions as assistant professor of health informatics at the University of Victoria and the University of Toronto in Canada teaching relevant courses and supervising graduate students since 2012. Dr. Shabestari collaborates with several scientific journals and granting agencies as a scientific reviewer. He is very passionate about converting health data into meaningful information by different diagnostic and predictive analytics models and using them at the point of care to improve healthcare delivery. He currently serves as the director of healthcare analytics at Carilion Clinic and is a member of the Health Management Academy in the United States.

Allison Viola, M.B.A., RHIA, is a Director, Health IT with Kaiser Permanente, where she identifies, develops, and recommends strategic policy positions on healthcare IT issues and advises senior executives across all the regions, functions, programs, and entities on the adoption and implementation of positions related to standards, architecture, clinical models, information privacy, and information exchange. She reviews and assesses new healthcare IT standards and technologies, and new applications of technologies in healthcare for possible use, development, and/or influence by Kaiser. Prior to Kaiser Permanente, Ms. Viola has worked in managing large healthcare IT system life-cycle implementations, data mapping, and support; policy and strategy; and security solutions such as biometrics and public key infrastructure analysis. She also currently serves on DC's

Health Information Exchange Finance Sustainability Subcommittee. Ms. Viola holds an M.B.A. in finance from George Washington University, a B.S. in health information management with certification as a Registered Health Information Administrator from Temple University, and a B.S. in business administration with a marketing concentration from Bloomsburg University.

Axel Wirth, CPHIMS, CISSP, HCISPP, is a Healthcare Solutions Architect providing strategic vision and technical leadership within Symantec's Healthcare Vertical, serving in a consultative role to healthcare providers, industry partners, and healthcare technology professionals. Drawing from over 30 years of international experience in the medical device, healthcare IT, and cybersecurity industries, Mr. Wirth supports healthcare organizations in their efforts to solve critical compliance, security, and privacy challenges. Mr. Wirth actively contributes to industry organizations and is a frequent speaker at conferences, forums, and webcasts. He is leading the IHE PCD Cybersecurity working group and is an active participant in the Medical Device Innovation, Safety and Security Consortium (MDISS). In addition, he supports several government healthcare security initiatives and collaborates with security thought leaders across the industry. Mr. Wirth holds a B.S. in electrical engineering from the University of Applied Sciences in Düsseldorf, Germany, and an M.S. in engineering management from The Gordon Institute of Tufts University.

About the Instructor Resource Contributors

Juliana J. Brixey, Ph.D., M.P.H., R.N., earned her doctoral degree from The University of Texas Health Science Center at Houston, School of Health Information Sciences (School of Biomedical Informatics, SBMI) in 2006. Dr. Brixey is an associate professor at the University of Texas Health Science Center at Houston. She holds a joint appoint with SBMI and School of Nursing. Dr. Brixey is Director of the UTHealth Center for Interprofessional Collaboration. Her research interests include interruptions in workflow, patient safety, user-centered design, and the use of social media for online education. She has a strong commitment to excellence in education. This is demonstrated by her contributions to the development of educational materials in health informatics. Dr. Brixey is an active leader in professional informatics and nursing organizations.

Jack E. Brixey holds an M.S. in biomedical informatics as well as B.S. degrees in Biology and Medical Technology. He is certified by the American Society of Medical Technology (MTASCP). Following retirement as a researcher in the chemical industry, Mr. Brixey began a third career as a health informatics consultant. In this role, he has co-authored two teaching guides for health informatics textbooks. He volunteers his time for special projects identified by the American Medical Informatics Pioneers in Nursing Informatics History Project.

Prior to retirement, Mr. Brixey worked more than 35 years in chemical research, engineering, and medical laboratory science. Projects spanned from the production of ultra-high purity chemicals for the Atomic Energy Commission to the development of high-capacity energy sources for

aerospace use. In healthcare, Mr. Brixey has extensive experience working in medical laboratories for the military, veterans', and civilian hospitals.

Vanessa Buckley holds an M.Ed. and M.S. in biomedical informatics from UTHealth School of Biomedical Informatics (SBMI). Currently an instructor at UTHealth School of Nursing, Ms. Buckley has over 20 years' experience assisting in grant-funded research projects and running complex data analysis for imaging studies in the field of neuropsychology. This research focuses on patients diagnosed with schizophrenia, behavioral disorders, and addictions, and veterans with mild traumatic brain injuries. Ms. Buckley's additional professional experience includes serving as a teaching assistant at the University of St. Thomas, a graduate assistant at Texas Woman's University, and a tutor at Ross Elementary to students with intellectual disabilities.

CONTENTS AT A GLANCE

CONTENTS

FOREWORD

Every year, I travel a few hundred thousand miles helping governments craft healthcare IT strategy. The culture in each country is different but the problems are the same all over the world. This book is an invaluable reference for understanding what has come before and what trends are likely to shape the future.

The authors are a who's who of the advisors and consultants who shaped thousands of pages of federal regulations across the past two U.S. presidential administrations. As the chair of the Bush-era Healthcare Information Technology Standards Panel and the co-chair of the Obama-era Healthcare Information Technology Standards Committee, I worked side by side with these authors and I can say with confidence that they have an inside view of the "sausage being made."

Part I of this book covers healthcare information technology in the United States, but the concepts it relates from the past two decades of policy apply globally. The United States spends 17 percent of its gross domestic product on healthcare and yet does not lead the world in quality, safety, or efficiency. The United States must move from a fee-for-service reimbursement to value-based purchasing—paying for outcomes and quality—if it is to bend the cost curve. The IT tools necessary to keep people healthy are quite different from those needed to document episodes of care when they are sick. Part I provides valuable insights into the care coordination tools needed in the future to reduce cost and improve quality. Although the Obama administration's Meaningful Use program has had mixed results, public health reporting of immunizations, syndromic surveillance, and reportable lab results has been implemented successfully at a national scale. You'll learn how that was achieved in Chapters 1–4.

In Part II, you'll learn about the major issues shaping health information science. Today's hot trends include team-based communication, mobile computing, analytics, and cloud computing. In 2017 and beyond, I believe that the role of IT leaders will fundamentally change from choosing and integrating the best technology to managing complex projects successfully and ensuring a highly usable result. All of these issues are discussed in Chapters 5–12.

Part III focuses on standards and regulation. An old joke notes "the great thing about healthcare IT standards is that there are so many of them." Creating standards is complex and involves harmonization of multiple stakeholders with a near infinite number of use cases. What is the difference between harmonization and compromise? Harmony means that everyone is happy with the consensus. Compromise means that everyone is equally unhappy with the consensus. Since standards are adopted by consensus, achieving harmony means that standards include a little bit of everyone's wish list. The danger is that a consensus approach to designing a duck could produce a platypus—it's supposed to be a bird with feathers but turns out to be a mammal with hair. You'll hear from experts about the Meaningful Use standards and how we attempted to balance the needs of the many with a relatively low burden for developers, then wrote it into regulation.

Part IV focuses on the day-to-day operations of healthcare IT organizations. I've been a CIO for 20 years, and during that time, we've evolved from products that had to be self-developed to highly reliable commodity services available at reasonable cost. Keeping IT running flawlessly while also introducing continuous improvement/change takes hands-on management and a thick skin. You'll hear from leaders in the trenches in Chapters 18–22.

Part V focuses on innovation. I sometimes describe introducing new technologies into mission-critical production systems as changing the wings on a 747 while it's flying. The world of big data, precision medicine, genomics, and telehealth requires us to break old paradigms of architecture and functionality while not interrupting existing care processes and revenue cycles. There are risks, but risks can be mitigated with appropriate planning. You'll learn how in Chapters 23 and 24.

Part VI focuses on security. Today, as CIO, I spend 25 percent of my time on security-related matters. The new threats are no longer bored college students. We're dealing with state-sponsored cyberterrorism, hacktivism, and organized crime. I describe healthcare IT security as a cold war. The faster the good guys innovate, the faster the bad guys innovate. We're asked to share more data with more stakeholders for more purposes but never spill a single byte. It's an impossible task. You'll hear from the experts who created many of the regulations and best practices we're using today to keep information private.

I hope you enjoy this book as much as I have and that it finds a place of importance on your bookshelf. Regardless of the political and economic divisiveness we'll encounter in the world over the next few years, we know that healthcare IT automation is a universal priority in every society to optimize existing resources and keep our aging societies as healthy as possible. Be well!

John Halamka, M.D., M.S.
International Healthcare Innovation Professor at Harvard Medical School
Chief Information Officer of the Beth Israel Deaconess System
and a practicing emergency physician

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The first acknowledgment goes to a welcomed coauthor, Dr. John E. Mattison, who guided us in the outline for the book, recommended new authors, and joined us authoring chapters. The next acknowledgment goes to the section editors of this book, who worked on the chapters while also leading healthcare informatics projects nationally, developing national policies, leading industries, serving as Chief Medical Informatics Officers (CMIOs), and working in academic institutions. Dr. Marc Overhage, Dr. Andre Kushniruk, Dr. Don Mon, Dr. Michael Beller, Dr. John E. Mattison, and Lori Reed-Fourquet spent time shaping the outlines and the chapters to ensure that they responded to the vision of providing one healthcare information technology book that you can use not only to prepare for the CAHIMS and CHTS exams but also as a valuable reference in your IT career. The next round of thanks goes to the contributors, who were equally stressed during this very intensive time in healthcare IT to work over and above their work schedules to get this book delivered and out to the community.

Behind all of us was a team from McGraw-Hill Education that is matched by no other in the dedication and commitment to pursuing what the healthcare information technology domain requires at this time. This team includes the leadership of Tim Green, executive editor, International and Professional Group; Claire Yee, editorial coordinator; and the legal department, which we challenged with dozens of individual contracts. Tim provided special leadership in creating a book that provides a vision in a creative way that is responsive to the CAHIMS and CHTS exams.

When production started, we were joined by a team of specialists: Howie Severson, project manager for copyediting and page proofs; Bill McManus, copy editor; Janet Walden, editorial supervisor from McGraw-Hill Education; and Paul Tyler, references editor and proofreader. What a dedicated team to maintaining quality, readability, and format.

Finally, the book's online learning center can be attributed to the dedicated team working with Amy Stonebraker, acquisitions editor, and Claire Yee. Joining that team were Juliana Brixey, Jack Brixey, and Vanessa Buckley, who developed the online teaching outlines, test bank of questions, and PowerPoint slides.

Additional Resources for Instructors

Whether used as a self-study guide or a classroom text, this book is designed to prepare readers for the AHIMA CHTS and HIMSS CAHIMS, as well as the field of healthcare information technology.

For those using this book in a classroom, please visit this book's Online Learning Center:

http://highered.mheducation.com/sites/1259836975/

The Online Learning Center provides instructor support materials in a format that follows the organization of this book. On this site you will find the following:

- An instructors' manual that contains learning objectives, classroom preparation notes, instructor tips, and a lecture outline for each chapter
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PART I

Healthcare and Information Technology in the United States

CHAPTER 1

Healthcare Information Technology: Definitions, Stakeholders, and Major Themes

Kathleen A. McCormick, J. Marc Overhage, John E. Mattison, Brian Gugerty

In this chapter, you will learn how to

- Define the complex evolution of the computer network environment in healthcare information technology (HIT)
- Explain the fast uptake of HIT in the continuum of healthcare
- Describe how the increase in volume of HIT has expanded the capabilities to measure the value of healthcare
- Describe the need to prepare an adequate workforce aware of the unique HIT environment
- Define the roles of HIMSS and AHIMA in support of HIT credentialing, education, and training

This chapter provides an overview of some of the updated content in this second edition as well as new content pertaining to the rapid advances in healthcare information technology (HIT). These rapid advances will be briefly mentioned in this introductory chapter and further defined in later chapters. The evolution of HIT has occurred from simple systems to much more complex computer network environments.[1] With this expansion, the technology has become a component of the entire continuum of care, which results in silos of information and data on individuals and communities of people. The need for integrated networks, standards, and security/cybersecurity has intensified as these systems are more commonly being used to increase the volume of HIT and monitor the value of healthcare.

The new generation of healthcare IT personnel must have adequate knowledge and skills to participate in the workforce delivering services and technology. Achieving certification is the best way for these technology and healthcare professionals to demonstrate proficiency with a standard body of knowledge endorsed by professional healthcare organizations. Two types of certification are the focus of this second edition. The first, Certified Associate in Healthcare Information and Management Systems (CAHIMS), is awarded by the Healthcare Information Management Systems Society (HIMSS). CAHIMS is a professional certification for emerging professionals who may not have a lot of experience in healthcare IT but seek a career in the field. The other is the Certified Healthcare Technology Specialist (CHTS) series from the American Health Information Management Association (AHIMA). This series originated with the Office of the National Coordinator for Health Information Technology (ONC) HIT Pro categories of exams and covers six IT roles for people in health information management. Both certifications will be described in more detail later in this chapter.

The Explosion of Healthcare Information Technology

During the past decade, the following factors have contributed to massive expansion in healthcare IT:

- A huge increase in the number of connected networks and network-enabled devices (commonly called the Internet of things [IoT])
- Access to healthcare through mobile devices, patient portals, and cloud services
- Critical cybersecurity threats
- Integration of healthcare networks
- The volume of genomics data
- The need to analyze big data

With this expansion in HIT, the healthcare informatics community has also come to realize that data standards are required to truly achieve interoperability and to mine the data for quality, efficiencies, effectiveness, and cost. In addition, the consumer has embraced direct-to-consumer genomics, mobile devices, portals, and the Internet. Consumers now demand secure and easy access to their healthcare information via healthcare apps on their mobile devices and via the Web on their home computers. When the authors defined the necessary components to understand healthcare IT in the first edition of this book, the enterprise architecture was fairly simple, consisting of a boundary, a network, a data center containing servers located in a defined, secure area, and desktop computers within a closed network. Contrast that to the time of writing of this second edition, and the architecture now contains mobile devices connected from any