Adaptive Health Management Information Systems

Concepts, Cases, and Practical Applications

Third Edition

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New to This Edition

Adaptive Health Management Information Systems, Third Edition, is for instructors who want to keep pace with rapid changes in the field of healthcare management information systems (HMIS) and health informatics (HI). This new edition is not simply an update of the second edition—it is a completely reorganized, expanded, and rewritten text containing all new contributions, special sections, and streamlined discussions of more established as well as hot current topics. These are spiced with motivating scenarios; real-world examples; mini-cases; stimulating chapter questions; illustrative graphics, tables, and exhibits; and additional readings. Significant updates and complete revisions have been integrated throughout the text—so much so that readers familiar with the previous edition would not recognize this work as a derivative of the other.

Specific updates

- *Content.* Rich, comprehensive topics covered range from HMIS history; chief executive officer/chief information officer roles and responsibilities; health IT and Internet use; HMIS enterprise software; virtual communities and networks; patient-centric management systems; HMIS interoperability; HMIS strategic planning; HMIS developments; HMIS project management; HMIS standards, governance, and international perspectives; and HMIS innovation.
- *Scenarios.* Realistic and real-world scenarios set the stage for topic discussion and to motivate the student readers; a short reflection is also given at the end of each scenario.
- *Technology Briefs.* Concise briefs cover specific HMIS knowledge domains such as the Internet and associated technologies; hardware, software, and user interfaces; network technologies; database concepts; and data mining and data warehousing.
- *Research Brief.* Brief extends reading and provides supplementary research data.
- *Policy Brief.* Brief covers key policy issues relating to the Health Insurance Portability and Accountability Act (HIPAA), privacy, confidentiality, and security issues.
- *Mini-Cases.* Short cases illustrate concepts, and related mini-case questions promote class discussions among students.
- *Chapter Questions.* Long- and short-answered questions stimulate classroom discussions and promote learning of various topics and examples discussed in the text.

- *Editor's Notes.* Appended to chapters contributed by various authors, these notes bridge the chapter contents with the other chapters and parts of the text, thereby providing readers with an overview of the intended organization of the text.
- *Major Cases.* Part V provides a selection of major cases to enhance understanding of teaching materials and promote further interactions between students and instructors.

Dedication

To the memory of my parents, who brought me into this world;
to my students and colleagues, who have enjoyed my work and benefited
from my 20-year career of teaching and research in the fields of healthcare services
and administration, business information systems, and healthcare informatics;
and to my immediate family members, who have helped in every way
to mature my academic publishing and writing career.

—Joseph Tan

Acknowledgments

Above and beyond those to whom I am indebted while putting together the earlier editions of this text, I would like to thank those newly added academic and professional contributors, including those who were brought on board by co-editor, Dr. Fay Cobb Payton. Dr. Payton has personally shared in parts of the writing of this revised edition and Mr. Joshia Tan helped make this revised edition not only a completely different kind of text, but one much more appealing and valuable for instructors and students alike. Aside from contributing his very own case as a closure to the text and spearheading the writing of several briefs and chapters, Mr. Tan has contributed to the repackaging of the materials in this text in such a way as to help student readers better digest those more complex and highly technical parts of the previous editions by rearranging and rewriting key portions of previously published materials for lighter and easier reading.

There are two other individuals whom I must especially thank: Dr. Kai Zheng, a professor at the University of Michigan School of Public Health and School of Information, and Mr. Jonathan Dunford, a graduate student studying in the joint MBA–Masters in Health Services and Administration program at the University of Michigan. Dr. Zheng has kindly—and meticulously—reviewed some of the more critical chapters of this revised edition, especially Chapter 1, while Mr. Dunford has generously assisted in summarizing several of the motivating scenarios appearing at the beginning of the chapters. I am also indebted to numerous Wayne State University students, whose names would fill countless pages if I were to list them one by one; I will choose to keep this simple for fear of missing anyone important. To date, these students have contributed to many repeated discussions, year after year, about where they felt changes would have made previous editions of this text more valuable in classroom teaching and during online discussion sessions. A good number of these students have enjoyed and greatly benefited from my teaching and have also encouraged me to elaborate on new and emerging topics, most of which, unfortunately, I can only incorporate briefly and sparingly due to space limitation; otherwise, we would have ended up with a four-volume introductory text if all of the research gathered by myself, my assistants, and my students were to be incorporated, in one way or another, as different chapters, briefs, and cases. Indeed, I have also taken this opportunity, with the help of Mr. Joshia Tan, to substantially reduce the volume of words to convey the same key

messages contained in the previous editions through the innovative use of *Technology*, *Research*, and *Policy Briefs*. In so doing, we have eliminated most of the dated materials.

I am grateful to all who have contributed, especially for their collaborative spirit and willingness for me to revise and edit freely their submitted pieces throughout the lengthy duration of this project. Their willingness for me to redirect their contributions to a common theme, to conform to a set format or a particular layout, to confine and revise the writing to a particular topic or area of research, to eliminate much of the overlapping information in earlier drafts, and to make substantive changes when necessary—without the need to consult with them over and over again—is highly admired because it has helped merge the different contributed pieces into a unified whole. More importantly, a special acknowledgment is due to the generosity of the publisher to extend the deadline for me to complete all of the revisions I wanted to see going into this latest edition at a time when I was swamped with the parallel production of several other major works. I would also like to take this opportunity to thank the three anonymous reviewers engaged by the publisher for going over the submitted drafts, pointing out any errors, and providing various suggestions to improve the appeal of the different chapter layouts and contents. Without the patience shown to me by key personnel at Jones & Bartlett Publishers, I know the end product of this revised edition would have been vastly limited. I am also indebted to Dean Homer Schmitz of St. Louis University, who kindly agreed to pen the Foreword for this latest edition swiftly on a very tight time constraint. His mentorship and advice for advancing my academic career has always been one that I truly admire and enjoy.

All in all, I greatly appreciate and thankfully acknowledge all of the assistance, encouragement, and understanding from each and every person who participated in any way, shape, or form, in the various stages and processes involved in the production of this work, from beginning to end. Once again, I am particularly grateful to my son, Joshia Tan, who took precious time out of his extremely busy summer 2008 work schedule to help me prepare this third edition for publication. And I must certainly acknowledge the unceasing support, encouragement, and understanding of my wife, Leonie Tan, throughout the duration of this project.

To all of these individuals and to my family members, friends, students, and relatives, I offer my many thanks for the support provided to me. Much of the value of this work is due to their contributions and assistance.

—Joseph Tan

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and Joseph Tan*
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About the Editors

Primary author and editor **Joseph Tan**, PhD, is a professor of business information systems/information technologies (IS/IT) and healthcare informatics. He is the editor-in-chief of *International Journal of Healthcare Information Systems & Informatics* (IJHISI). He has served as acting director for the master's of health administration program at the Faculty of Medicine, University of British Columbia; as chair of the Information Systems and Manufacturing Department of Wayne State University's School of Business Administration; as consultant to the Ontario Council of Graduate Studies; as well as a research fellow and advisor to various professional research institutes and nonprofit and for-profit organizations. His professional background spans a broad spectrum of disciplinary expertise and research interests, with a demonstrated ability to serve in both academia and industry. He is the lead investigator in redefining the frontiers of interdisciplinary and translational business and health IT knowledge development and expansion, including active involvement in collaborative research and multidisciplinary joint-grant submissions. He has achieved recognized scholarship in teaching and learning with students' nominations for teaching excellence awards, and he networks widely with key decision and policy makers as well as academic scholars and practitioners at local, provincial/state, national, and international levels, including private, public, and nongovernmental organizations and universities.

Dr. Tan has been asked to provide keynote speeches at doctoral seminars and conferences and has been invited to conduct research seminars and/or make appearances at numerous major universities around the world. His work is widely cited, and he has more than 100 academic publications, including a four-volume encyclopedia and numerous research monographs and teaching textbooks. He has taken leadership roles in team-based research, curriculum and program development and accreditation, peer-reviewed journal publications and book reviews, online education and programming, planning and organization of symposiums and conferences, development of book series, special issue journals, and federal grant proposals. His past 20-year academic experience includes full-time employment in academia, private and nonprofit

sector organizations, as well as consulting and engaging in executive program development activities catering to executives and foreign delegation. His overall career focus is on reshaping the landscape of IS/IT applications and promotion in e-healthcare informatics through cross-disciplinary thinking/project partnering with diverse practitioners, clinicians, researchers, and a variety of user communities.

Co-editor **Fay Cobb Payton**, PhD, is an associate professor of IS/IT at North Carolina State University (NCSU), where she serves as the IS area coordinator. She is the vice chair of the AIS SIG-Health International group and is an active member of the Institute of Electrical and Electronics Engineers (IEEE) medical technology policy group. She is currently serving as a member of the NCSU Advisory Board for the Women in Science and Engineering Program. She has worked on consulting and/or research projects with Ernst & Young/CAP Gemini Health Care IT Practice, IBM, Blue Cross Blue Shield of Ohio and North Carolina, Duke Medical Center, the North Carolina Medical Society, Quintiles Transnational, and Time-Warner. Her research interests include healthcare informatics (AIDS/HIV among African American and sub-Saharan African populations; health disparities), data management (data analytics and quality), and social exclusion (including the digital divide/equity and STEM [Science, Technology, Engineering, and Mathematics] pathways). She has published in many peer-reviewed publications, including *Journal of the AIS*; *The Information Society*; *Journal of Organizational Computing and EC*; *IEEE Transactions*; *Communications of the ACM*; *Health Care Management Review*; *Computer Personnel, Information and Management*; *Decision Sciences Journal on Innovative Education*; *Computers and Society*; and *International Journal of Technology Management*.

Dr. Payton served on the editorial board of *ITProfessional*—an IEEE computer society journal—for four years and is the co-editor of the Health Care section for the National Science Foundation (NSF)-sponsored *African Journal of Information Systems*. She is also the co-editor of a *Journal of the AIS* special issue—"Healthcare: People and Processes." She is part of a research team that received an NSF ADVANCE grant. She has actively served in an advisory role for The PhD Project and the project's IS Doctoral Student Association.

Editorial assistant **Joshia Tan** is a sophomore (and on the Dean's List) at the Olin Business School, Washington University, in St. Louis, Missouri. Even at an early age, Mr. Tan displayed an affection for and interest in a vast range of pursuits, so it comes as no surprise that, years later, he is involved in an incredible variety of activities. He serves as a college council representative, writes and distributes for *Eleven Music Magazine*, and works at the WashU Law School. A National Merit Scholar and Washington University in St. Louis Book Award recipient, Mr. Tan has also received numerous other awards, including graduating cum laude, the AP Scholar with Distinction award, Cranbrook Prize Papers, Michigan Math Prize Competition Finalist, and Brook Film Festival's 3rd place award as lead actor and co-director of *The Broken Silence*. In addition, one of Mr. Tan's most recognized film productions, *Tao Te Cranbrook*, has been presented at a number of classes and seminars in the Business Department, School of Business Administration, Wayne State University, Michigan. He has also brought his activities to new levels by sharing them with others; for example, he volunteered for two years as a snowboarding

counselor for Bloomfield Hills Ski & Snowboard club in Michigan. He also played violin with various schools' orchestras and served as assembly pianist for one his schools.

The literary world plays a large role in Mr. Tan's life, as he has co-authored "The Oliver Home Case" (with J. Tan/G. Demiris) and "CyberAngel: The Robin Hood Case" (with J. Tan), both appearing in J. Tan (Ed.) *E-Health Care Information Systems: An Introduction for Students & Professionals* (San Francisco: Jossey-Bass, 2005): 52–55 and 290–294, respectively. In 2008, Mr. Tan self-published *The Apprentice Bistro: A Feast for Amateur Writers*, an adaptation of his 2007 Davidson Fellows entry—for which he received an honorable mention. More recently, he has completed another major work, *Concord in Calamity: Taming the Awakening Armageddon*. Mr. Tan is also an avid traveler with numerous countries under his belt; he keeps a steadfast hold on his life dream of seeing the world—and changing it for the better. True to this vision, he has studied various languages, including English, French, and two different dialects of Chinese. Moreover, to better appreciate the Chinese language and culture, he spent an entire semester fulfilling the challenge of his dream by accepting an invitation to work as an intern in Shanghai, China. Furthermore, he incorporates this dream into his hobbies, such as drawing from international influences for his dabbles in the musical and culinary arts. Ultimately, it is this vision that continues to drive him; it is this dream that he works toward; and it is this dream that may, years later, very well become reality.

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Dr. William Greer is currently a senior clinical planner in health statistics at Sidra Medical and Research Center in Qatar. Originally a physicist, he obtained his PhD in bioengineering in 1978 from Strathclyde University in Scotland, where he developed an integrated mathematical model of the neural and chemical control of breathing in humans. His postdoctoral research was divided between an epidemiological study of musculoskeletal injuries in Mt. Isa Mines, Australia, and the application of control systems techniques to the analysis of totally closed breathing circuits at Manchester University, England. In 1980, he joined the National Institute for Medical Research in London, where he initially commissioned its new mainframe computer system prior to spending several years collaborating with biologists in computational and mathematical aspects of developmental biology and neurobiology, including the development of the first computerized mapping system for biological electron microscopy. While at the National Institute, he also developed one of the first bioinformatics software packages (MGS), which was later adopted by a number of U.K. research institutions and universities. In 1986, he moved to the King Faisal Specialist Hospital and Research Centre in Riyadh, Kingdom of Saudi Arabia, where he carried out biocomputing, epidemiological, biostatistical, and bioinformatics research for the next 10 years.

In 1995, Dr. Greer relocated to Edinburgh as an independent research consultant in biostatistics and pharmacogenomics. During this period, he became responsible for the data management and analysis of one of the largest collections of normative bone mineral density measurements in women, at the Bone Densitometry Unit in the Nuffield Hospital, Oxford. In 1998, he returned to King Faisal Specialist Hospital and Research Centre to develop a new Scientific Computing Research Unit, focusing on clinical image analysis, biological simulation, geographical information systems (GIS), and bioinformatics. In 2005, he assumed a faculty position in public health at the Weill Cornell Medical School in Qatar, where—in addition to developing research on diabetes in Qatar—he was responsible for teaching biostatistics, epidemiology, and evidence-based medicine. His current research interests include diagnostic aspects of postmenopausal osteoporosis, epidemiological applications of GIS, biological and physiological modeling, and the computational analysis of promoter regions of DNA.

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For more than 15 years, Dr. Kohli has worked or consulted with IBM Global Services, SAS Corporation, United Parcel Service, AM General, MCI Telecommunications, Westinghouse Electronics, Wipro Corporation, and Godrej Industries (India), in addition to several healthcare organizations. Prior to joining full-time academia in 2001, he was a project leader in decision support services at Trinity Health. Dr. Kohli has held positions at the City University of Hong Kong, China; University of Canterbury, New Zealand; Sloan School of Management, Massachusetts Institute of Technology, Cambridge, Massachusetts; and the University of Cambridge, United Kingdom.

Academic studies have ranked Dr. Kohli among the top 20 MIS researchers worldwide. Dr. Kohli's research is published in *MIS Quarterly*, *Management Science*, *Information Systems Research*, *Journal of Management Information Systems*, and *Communications of the ACM*, among other journals. He is a co-author of *IT Payoff: Measuring Business Value of Information Technology Investment*, published by Financial Times Prentice-Hall. Dr. Kohli has been a recipient of several grants in information systems research.

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Professor Mbarika has more than 90 published works, including three books; five book chapters; 31 peer-reviewed journal papers in premier outlets such as *IEEE Transactions*, *CACM*, *JAIS*, *ISJ*, *The Information Society*, and *Journal of the American Society for Information Sciences*; and more

than 45 papers at premier conferences such as IFIP, ICIS, DSI, AMCIS, and HICSS. He has chaired several mini-tracks/workshops at DSI and AMCIS, where he introduced the first mini-track on ICT in developing countries. His publication outlets clearly reflect the impact he is having on the information systems, computer science, information science, and engineering communities.

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Dr. Musa has served on special assignments related to PhD programs to other universities around the world. In addition to serving on the editorial boards of several academic and practitioner journals, Dr. Musa has presented at and published in dozens of proceedings of national and international information systems conferences such as America's Conference on Information Systems, the International Federation for Information Processing, Information Resource Management Association, Global Information Technology Management, and Decision Sciences Institute, among others. He has also served as chair or on program committees of many of the professional conferences and dissertation committees. Dr. Musa is an academic professional member of APICS, senior member of the Institute of Electrical and Electronics Engineers (IEEE), member of the Association of Information Systems (AIS), and a lifetime member of Phi Kappa Phi. He is a licensed professional engineer (PE) with backgrounds in electrical engineering and the semiconductor industry. He is also a certified supply chain professional (CSCP).

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Dr. O'Neill's primary research interests are in healthcare operations and information systems, including hospital efficiency analysis, hospital marketing, technology diffusion, and managerial benchmarking using data envelopment analysis. He has published more than 20 articles and book chapters in scholarly journals, such as *Health Care Management Science*, *Management Science*, *Medical Care Research and Review*, *Neurology*, *Anesthesia and Analgesia*, *Naval Research Logistics*, and *Socio-Economic Planning Sciences*. In addition, his research has received awards from the Production and Management Society and the Western Decision Sciences Institute. He is on the editorial board of *Health Care Management Science* and *International Journal of Healthcare Information Systems and Informatics* and is past-president of the Health Care Applications Section of Institute for Operations Research and Management Science (INFORMS).

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Foreword

When I joined the health information world many years ago disc drives storing 5 to 10 megabytes of information and costing upward of $200,000 were the standard; central processing units with memories of 512K to 1024K and costing many thousands of dollars were the rule; elaborate climate-controlled environments costing tens of thousands of dollars were mandatory; elaborately trained operators were required to be present at all times that the technology was being used; and an online, real-time order entry system was rare and very expensive. At that time there were less than a dozen such systems in the United States that were actually working as true real-time order entry and data collection systems. Their computing power was probably less than what we carry around on our belts today. We talked about how healthcare organizations had more data than they knew what to do with but that very few had more information than they could use.

The distinction between data and information is subtle but important. The technology has changed enormously with regard to price and performance but the problem has not changed. We still wrestle with the question of how we can better provide the information that a decision-maker needs in a timely, accurate, and cost-effective manner. In addition to the enormous changes in technology, the explosive increase in information availability seriously complicates the problems of information management. In today's world of the Internet and Web services, there is the additional problem of discriminating between reliable and accurate information and unreliable information while at the same time protecting the privacy and confidentiality of healthcare consumers who are seeking help in understanding their specific situation.

Against this backdrop of complicating factors and profound change Joseph Tan with Fay Cobb Payton and colleagues deliver a richly informative and well-organized text that addresses many of the issues facing health information users seeking answers in this more complex and rapidly changing world. They examine the dynamics of merging healthcare organizations with health information systems. They scrutinize the tools and methodologies that are available to the information seeker from traditional sources to the Internet and related technologies. They

investigate new social groupings for health information dissemination such as community networking and building virtual communities. All of this is accomplished while also providing an excellent coverage and insight into current management and technology issues related to building effective information systems in healthcare organizations. The task of building and managing these enormously complex systems in an environment that is changing so rapidly is daunting. Joseph Tan with Fay Cobb Payton and colleagues have done an excellent job of describing not only the technology and information needs of this dynamic time but also have done an extraordinary job of investigating those influential forces or critical success factors that have an impact on current and future-oriented health information management systems and their use to support a growing network of multi-provider healthcare delivery services in an age of globalization, continuing knowledge explosion, and technological innovation diffusion.

I would be remiss if I did not acknowledge the many insightful contributions that Joseph Tan has made to the field of health information systems over the years. These contributions have been pragmatic as well as scholarly and have impacted enormously the way health information systems are viewed and used. This book will only add to that legacy.

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Preface

Adaptive Health Management Information Systems, Third Edition, is a gift especially designed for the professional readers and instructors who want their students to keep pace with rapid changes in the evolving field and knowledge domains of healthcare management information systems (HMIS) and health informatics (HI). This new edition is not simply an update of the second edition—it is, in fact, a completely reorganized, expanded, and thoroughly revised manuscript containing new and logically ordered contributions partitioned into five major themes connecting the 14-chapter series. It is supplemented with *Research*, *Technology*, and *Policy Briefs*, plus five major cases. Simply stated, significant updates and complete revisions to every part of the previous edition have been meticulously generated throughout the text—so much so that readers who may be familiar with the previous edition would not have recognized this work as a derivative of the other. It is analogous to producing a new hybrid vehicle but doing away with most of the parts empowering the old model design that is purely gasoline-based.

As we moved across and beyond the 21st century, the active cross-pollination of ideas and fresh knowledge from multiple disciplines—including advances in information science and pervasive technology, management theories and information systems practices, the marriage of the health sciences with ubiquitous computing technologies, and the ever-increasing volumes of healthcare informatics and telematics publications—are beginning to influence the growth and knowledge explosion of the HMIS field. To this end, this newly minted HMIS text contains streamlined discussions of more established, state-of-the-art as well as hot emerging topics ordered under each of the five major themes discussed later, spiced with motivating scenarios; real-world examples; mini-cases; stimulating chapter questions; illustrative graphics, tables, and exhibits; and notes and supplementary and additional readings.

One advantage, as evidenced both on the book cover and throughout the different parts of the book, is the wide spectrum of topics covered in a variety of forms by the different contributing authors as shown in the Table of Contents. In this new edition, the five-part clusters used in previous editions have been completely reconstituted along the following themes:

Part I, which encompasses Chapters 1 through 3, lays the foundation for HMIS conceptualization. Part II, covering Chapters 4 through 7, concentrates on HMIS technology and applications, whereas Part III, including Chapters 8 through 11, shifts focus to HMIS planning and management. Part IV, comprising Chapters 12 through 14, addresses HMIS standards, governance, policy, globalization, and future. Finally, five major cases highlighting HMIS practices and implementation lessons are presented in Part V. Each of these major themes progressively flows into one another to unveil different aspects of the hidden HMIS gem.

More particularly, Part I offers the readers an overview of HMIS foundational concepts and attempts to showcase the significance of having an education in the discipline. Chapter 1 starts off with the historical development of the HMIS field, traces a roadmap to guide readers in navigating through the different parts and chapters of the text, details the basic HMIS components and functions, and reflects upon HMIS cultures. Chapter 2 focuses on key roles and responsibilities of senior executives in healthcare services organizations vis-à-vis taking the HMIS leadership through a process comprising vision, strategy, and intelligent execution. To succeed, these executives must show characteristics of being trustworthy, inspirational, and ready to motivate others, as well as learning to be effective communicators. An accompanying *Research Brief* offers insight into how HMIS devices as simple as a PDA can be used to cut down on wait time in an emergency department. Chapter 3 redirects the attention of the readers to online health information seeking behaviors among Internet versus non-Internet users and touches on access and digital equity considerations. An interesting question raised here is: can the Internet and associated technologies be used to provide emotional support and empowerment to online health information seekers? *Technology Brief I*, which presents a refresher course on the fundamentals of Internet and associated technologies for healthcare services organizations, complements the chapter reading. Altogether, the significance of HMIS influence can be seen throughout history (Chapter 1); on individuals, groups, and organizations (Chapter 2); as well as on society at large (Chapter 3). The key message conveyed in Part I is that of the increasing significance of HMIS proliferating through every aspect of both our personal and organizational life and addresses, in large part, the "whys" of educating health informatics, management, and professional students in the HMIS discipline.

Part II challenges the readers to examine the HMIS technology and applications theme. Isolated legacy systems such as hospital information systems; financial, budgeting, and payroll systems; nurse scheduling systems; admission-discharge-transfer systems; purchasing and inventory control systems; facility planning systems; and basic clinical workflow systems used for decades in healthcare facilities will soon give way to emerging enterprisewide systems—namely, supply chain management (SCM), customer relationship management (CRM), and enterprise resource planning (ERP). Chapter 4, therefore, begins a discussion on these three systems, SCM, CRM, and ERP—enterprisewide systems believed to be emerging as the next-generation HMIS administrative applications that will significantly affect the future quality of healthcare services delivery. *Technology Brief II* features hardware, software, and computer-user interface design and supplements the chapter reading. Chapter 5 continues this same line of thought by highlighting network-based HMIS technology and applications, specifically, community health information networks (CHIN) and regional health information organizations (RHIO). *Technology Brief III*

summarizes health organization merger arrangements vis-à-vis the telecommunications and network infrastructures that are appropriate for these arrangements and is offered as supplementary reading. The central message here is the wide-ranging applications of HMIS technologies for bringing community organizations together as partners for healthcare services delivery.

Representing a natural expansion of concepts discussed in HMIS administrative applications and technologies (Chapter 4) as well as CHIN and RHIO (Chapter 5) is the concept of patient-centric management systems and integrated HMIS systems discussed in Chapters 6 and 7, respectively. Among the most popular HMIS applications and technologies employed in today's healthcare services organizations are electronic health records (EHR), computerized physician order entry (CPOE), and clinical decision support systems (CDSS), which are the subjects of Chapter 6. As noted in the chapter title, these applications represent a movement toward patient-centric management systems because the technology is ultimately designed to elevate patient care by providing the caregivers with relevant, current, accurate, reliable, available, and accessible health information. Therefore, the significance of these systems for benchmarking both administrative and clinical performance across healthcare services organizations cannot be overly emphasized. *Technology Brief IV*, focusing on database, data-mining, and data-warehousing concepts for healthcare services organizations, has been appended to this chapter to augment the readers' understanding not only of the internal structure, content, and functionalities of these systems, but also to provide insights into the enabling and empowering nature of these systems for the end-users. Finally, the benefits and challenges of these patient-centric management systems are also discussed in the context of electronic health records, which is the HMIS cornerstone of both the U.S. and Canadian healthcare services delivery systems.

Finally, Chapter 7, which focuses on the topic of HMIS integration, concludes the Part II discussion of HMIS technology and applications. Apparently, maintaining legacy systems in healthcare services organizations can be both costly and increasingly cumbersome due to the lack of interoperability among disparate applications. Indeed, these isolated systems will eventually result in unsatisfactory delays to patient care and will continue to take a toll on both clinicians' and employees' time and productivity. The application of Web services as a way to transform healthcare organizational HMIS into seamless integrated systems is certainly a major step that promises to benefit the healthcare services organizations in the longer term, not just temporarily. Therefore, the technology discussed in Chapter 7 is extremely innovative. Not only would this technology help ready readers to move away from islands of legacy systems in light of the rapid advances in HMIS technology and applications, but the message conveyed could also help the readers adopt new HMIS thinking as well as assist them to take the next steps toward achieving a higher and wider HMIS perspective. Altogether, the knowledge acquired in Part II offers the readers a wide-ranging survey of the "whats" of HMIS technology and applications.

This brings us to Part III, which focuses on HMIS planning and management. Chapter 8 concentrates on HMIS strategic planning and information requirements because these are two of the early, but critical, steps in the administration of HMIS planning and management for healthcare services organizations. This chapter therefore lays the groundwork for the "hows" of realizing HMIS initiatives in practice (Part III), not just the "whys" (Part I) and "whats" (Part II). Beyond instructing students, practitioners, and administrators on how to align HMIS goals

and objectives with corporate goals and objectives and how to go about deciding on the best alternative means of developing the system that would fit well with organizational information requirements and culture (Chapter 8), the next steps will have to include a thorough familiarity with HMIS analysis and development methodologies (Chapter 9); followed by practical advice on HMIS design, implementation, and evaluation through a focus on data stewardship (Chapter 10); and the proper managing of pre-implementation preparation, implementation processes, and post-implementation upkeep, as well as ongoing IT service management (Chapter 11). Part III, therefore, bridges HMIS technology and applications (Part II) on the one hand and HMIS standards, governance, policy, and international perspectives (Part IV) on the other. This then takes us to Part IV.

Part IV acquaints the readers with HMIS standards, governance, policy, globalization, and future. It begins with Chapter 12, featuring a comprehensive review of HMIS standards—a topic of increasing significance for HMIS students, practitioners, and researchers. Major standards relating to data coding (vocabulary), data schema (structure and content), data exchange (messaging), and Web standards are formulated by groups of enthusiastic standards developers through standards development organizations to evolve a common language for sharing health information electronically among care providers. This chapter also links the readers back to the earlier parts of the text regarding HMIS foundational conceptualization and the use of data for managerial decision making and online health data searches (Part I). Again, the concepts of standards link the readers back also to the significance of sharing information among community health networks and the challenge of overcoming interoperability among disparate systems by integrating HMIS technology and applications via Web services (Part II). A *Policy Brief* on the Health Insurance Portability and Accountability Act (HIPAA), privacy, and security issues complements the reading for Chapter 12.

Beyond HMIS standards, Chapter 13 attempts to widen the readers' perspectives on HMIS by moving into the topic of HMIS globalization and e-health. Apparently, the application of e-health conceptualization demonstrates to whom the concepts of information and communication technologies (ICT) in health care, as well as HMIS in healthcare services organizations, relate to most in everyday life: humankind. Accordingly, HMIS used in the context of Chapters 1 through 12 of this text are now expanded to an e-health perspective used specifically in the globalization context of Chapter 13. In this sense, both e-health and HMIS may be conceived as umbrella terms encompassing all ICT and related e-technologies applied in a global healthcare services context. Hence, there is a true parallelism in terms of the need for ICT governance, policies, and sharing of ICT innovations among developed, developing, and underdeveloped countries for both HMIS and e-health. In light of this, the term *HMIS* has been inserted throughout Part IV, where appropriate, to sound the underlying message of the similar challenges facing designers and administrators of healthcare systems—whether it is to be deployed as an isolated system for healthcare providers (health informatics), an integrated system for healthcare services organizations (HMIS), or an Internet-based system for entire populations (e-health).

Up to this point, the readers should not be surprised by the inclusion of a chapter on innovation diffusion, Chapter 14, constitutes the final chapter of this *adaptive* HMIS text and

brings closure to Part IV—or to the entire text. It does this by highlighting the barriers to HMIS implementation and innovation diffusion and by providing key theoretical concepts for HMIS innovation management. Evidently, the benefits of HMIS should extend beyond just individuals, even beyond healthcare provider groups and healthcare services organizations. HMIS must be *adaptive* to change, to innovations, and to everyone's business. Before HMIS can diffuse so as to raise the quality of healthcare services, not only in the United States and Canada, but also all over the world, HMIS developers must learn to *integrate*, *adapt*, and *innovate* the technology. As with the management of any innovation, HMIS innovation diffusion management is definitely not going to be an easy, static process. Instead, it is a very *dynamic* and *adaptive* one, depending on how the healthcare services delivery system changes vis-à-vis the organizational changes affected by movements in the larger political, technological, social, and cultural environments in which any HMIS innovation is to be deployed. Put together, Part IV has to do with addressing the "whos" of HMIS effects.

Finally, the five major case studies in Part V cluster largely around the notion of HMIS implementations in diverse organizational environments, whether these be in the past (Cases 1 and 4), the present (Cases 2 and 3), or in the future (Case 5). These cases combine the elements of the HMIS conceptualization (Part I); the HMIS technology and applications (Part II); the HMIS planning and management (Part III); and the HMIS standards, governance, policy, and future (Part IV).

—Joseph Tan with Fay Cobb Payton