Essentials of Health Information Systems and Technology

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Dedication

This book is dedicated to the information technology professionals working day after day in and on behalf of healthcare organizations across the country without whose work, nothing described in this book would be possible.

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Preface

We simply have to look around at our immediate surroundings to see how our world is evolving due to the introduction of disruptive technologies, practically before our very eyes. Health care, the practice of medicine, public health, and health in the lives of individuals are no different—and information technologies (IT) have a lot to do with these changes. This text addresses health information systems (HIS) and technology, and it is intended to take the mystery out of this subject, which can be daunting to even the most knowledgeable and talented around us—healthcare experts, physicians, nurses, and public health professionals alike. Why? Because unless something that appears foreign or complex or unusual has been carefully and simply explained to us, it remains a mystery, and we tend to avoid the subject, which prompts us to sidestep taking the dive into the world of health information systems and technology.

But what a loss, to avoid one of the most interesting, creative, ever-changing topics on the planet! No healthcare professional in any discipline can do her or his work without health information systems and technology. In this text, we dig in and explore together the simple truths and principles about this technical and disruptive subject. When we break it down into basics and principles that apply to any technology or any situation, suddenly what can be an intimidating, seemingly complex subject becomes much clearer.

What qualifies me to write about this topic? I have spent my career in the fields of health care, medical records science, health information systems and technology, innovation, and public health. As a chief information officer (CIO) for 20 years in two large, complex health systems, I learned tough lessons about health information technology, planning and managing systems, people, and change, and introducing disruptive technologies into healthcare organizations in a variety of markets across the United States. I learned how to develop HIS strategic plans, negotiate with and manage IT vendors, and implement new systems. In pursuing my PhD, I have learned the art and science of research; as an educator for the past 7 years, I have learned to teach graduate students pursuing their master of public health (MPH), master of science (MS), or PhD in health policy and management degrees. A good deal of my career has been spent explaining health information systems and technology to healthcare professionals, people, and students—those proficient in elements of technology as well as those completely unfamiliar with HIS and technology but expert in their chosen domain of health care such as nursing, medicine, management, quality, laboratory science, finance, or other disciplines.

My favorite discipline has always been the clinical side of health care, because, well, that is what health care is all about—caring for people who at a point in their lives find themselves vulnerable and in need of support, care, therapy, and maybe a little education about how to better take care of themselves. This is my bias. As my dear mentor, Dr. Paul Torrens, taught us at UCLA in the introductory course on the U.S. healthcare system, everyone has a bias, and it is important to state what that is at the outset of a conversation, writing, or lecture, so that people can take that perspective into consideration. The clinical side of health care is why healthcare organizations exist; the prevention

of disease and harm is the mission of public health. Such organizations do not exist to provide fabulous billing services to the world or terrific strategic plans as a product. These functions in healthcare organizations are important, but they are support roles, intrinsic to success but ancillary to the real purpose of healthcare organizations and public health—namely, to provide high-quality health care to patients in the practice of medicine as well as public health services to citizens and populations in the pursuit of health.

This text, then, is about HIS and technology for health care and public health. It is also about making this complex, potentially overwhelming topic simple. Because curricula in universities and training programs for the health sciences, medicine, nursing, computer science, and other disciplines that lead to careers in health care, medicine, and public health have not included information technology courses until very recently, most people working in healthcare organizations and public health institutions today had absolutely no education or formal training in HIS. And yet, these are exactly the same people who are being asked to make the transformative change using HIS—to take the big leap into implementing disruptive technologies into their clinical and business environments, all while taking care of sick and injured people. This is a tall order, and it can be very stress inducing without proper support and clarification along the way of "what we are doing and why we are doing it." In fact, computerization of healthcare organizations and public health entities does not need to be a mystery, nor does it need to be as high risk as is it when those entering the process do so without education in the fundamentals of planning, selecting, implementing, using, and reaping the benefits of HIS and the data, information, and knowledge it can produce. My goal in this text is to give you a fundamentals playbook, thereby making HIS and technology more than the "black box" that it seems to so many otherwise highly qualified healthcare professionals or students whose goal it is to understand and work in health care, health policy and management, and public health someday.

This text is also intended for those new students who are just preparing for their careers, as they launch into whatever orbits their professional life takes them. Younger students, of course, have the advantage of having grown up with technology as part of their everyday existence, which definitely gives them a leg up in learning about it. But readers should not think that just because smart phones or laptop computers are easy and intuitive for them to use, they do not need to learn the fundamentals of planning, selecting, implementing, managing, and using the large HIS that guide organizations small and large. The disciplines of HIS, informatics, and data management are essentials of healthcare management, the new practice of medicine, and public health initiatives, and these are quite different from using personal computing devices whose applications and functions are integrated at the factory. We are counting on you! Young people starting out in their careers—along with experienced professionals broadening their perspectives, knowledge, and marketability—can carry the day into a better, more cost-effective healthcare and public health future. This future will be enabled by innovative uses of HIS and emerging health technologies that can help us take care of patients more effectively in our hospitals, clinics, and physician practices, and help people stay healthier and safer in their daily lives.

Industry by industry, segment by segment, and organization by organization, the key principles of HIS strategy, planning, management, and implementation (and key principles for computer systems) are very nearly the same, no matter which types of systems or technologies or organizations are involved. By focusing on fundamentals, guiding principles, management issues, and proven methods, you will be well equipped to deal with HIS selection and implementation projects in your department or organization. My goal is for you to feel confident with your grasp of this subject—HIS—and the health information systems and technology aspects of your professional role. Whether HIS is your primary focus or is secondary to your role, you will need it to do *any* job in health care and public health. The firmer your command of the basics of HIS and technology, the more qualified you will be for any new job or opportunity in which you find yourself and that ignites your professional passion. This is true regardless of the specialty, domain, department, function, or type of healthcare organization in which you work.

The truth is that no matter which area of healthcare practice you enter—such as project management, nursing, medicine, finance, operations, public health programs and outreach, health education and health promotion, policy, or another role—*your job will include health information systems–based and technology-related responsibilities*. It will be incumbent upon you to implement systems in your department, function, or organization throughout your career. It is much better to have a handle on the basics and key principles of HIS, so that you will be confident and proficient in those duties. By knowing these principles, you will be able to volunteer for the next HIS implementation project in your organization with conviction—and know that by understanding the basics of technology, you will be able to quickly pick up the technology specifics relevant to each new project.

Some readers may become so enamored with HIS at this level that they are spurred to go further and specialize in this area. I am here to share a simple message: You can do it! With emerging education and training programs in IT and a growing number of programs specializing in HIS, plus growing numbers and types of professional and entrepreneurial opportunities, you can make this your career if you so choose. The sky is the limit. Opportunities abound for productive, exciting, and well-paying careers in HIS for the long haul. In whatever area you choose to invest your education and training, HIS and technology will simply make you more proficient in that discipline, better able to innovate compete and reinvent yourself, more valuable to the organization, and more qualified for a wider range of opportunities and responsibilities. The more you know about HIS and technology, the better.

Now that you've had this heartfelt pep-talk, we will move on to a quick review of the key topics of *Essentials of Health Information Systems and Technology.*

ORGANIZATION OF THIS TEXT

This text is organized into sections that follow the HIS model presented in the *HIS Scope, Definition, and Conceptual Model* chapter and used throughout the text as a conceptual model for framing and organizing the materials and principles introduced. With a picture in your mind of how the various pieces and principles fit together, you will gain confidence in your overall understanding of the many facets of HIS and technology, which in turn will make a lifetime of learning about this area much easier for you from this point forward. I guarantee you will understand something that the majority of people in your organization do not, which provides you with a tremendous opportunity to be a leader in your healthcare career no matter where it takes you.

The first section, *Understanding Health Information Systems and Technology*, begins with the *Alignment: Health Information Systems and Technology and Current Challenges in Health Care* chapter, which explains why HIS and technology matter so much in health care and public health today. Topics include HIS's relationship to primary issues in health care today, health care cost and quality, motivations for today's emphasis on HIS, the role of the U.S. government in HIS in health care and public health today, changing consumer expectations, uses in other countries, opportunities for research and policy making, and relevance to the public's health. The *HIS Scope, Definition, and Conceptual Model* chapter presents the HIS model and lays out the types of settings in which HIS and technology are used.

The second section, *Systems and Management* (the first sphere of the HIS model), addresses planning, managing, and implementing HIS and technology. It begins with the *Health Information System Strategic Planning* chapter, which presents a conceptual HIS planning framework. I had the good fortune to be introduced to this planning tool early in my career, thanks to the transformative work of Jay McCutcheon and Bart Neuman, pioneers in HIS planning and strategy. I have used this HIS planning framework during my entire career, including now as I teach what I have learned over the years. It seldom fails to make the proverbial light bulb come on for my students, as I explain it and their eyes brighten and they smile, which tells me they now grasp a clarifying construct for understanding how all these different types of systems and technologies fit together, just as I did when I learned this timeless concept early in my career.

The *HIS Application Systems and Technology* chapter walks you through the basics of software systems and technology. It was written by the skillful hand of James Brady, a stellar expert in the technology and security of HIS. This chapter covering the basics of technology may seem a bit daunting but take a deep breath and jump in—you will gain so much by doing so.

The *Managing HIS and Technology Services: Delivering the Goods* chapter teaches you about managing people, projects, and processes of HIS and technology. The *Implementation* chapter introduces you to the exciting and challenging world of selecting and implementing systems—a topic essential to anyone who actually wants to put these new systems to work in an operational environment. Implementation is exciting work, but definitely not for the faint of heart; it is rewarding because you will use everything you have ever learned every single day of an implementation project.

The last chapter in this section is *Leadership and Adoption of HIS and Technology*, in which you are introduced to HIS leadership methods and roles, and the interesting tale of adoption of new technologies in health care and generally in organizations of any type.

The third section, *Understanding Health Informatics*, begins with the *Health Informatics* chapter. This chapter familiarizes you with various types of health informatics and roles for informaticists, such as in medicine and nursing; relates HIS and

technology to Donabedian's health care quality framework including structure, process, and outcomes; and delves into the unsettling but important topic of unintended consequences of implementing HIS in healthcare organizations.

Penned by the pragmatic and knowledgeable Ric Speaker, the *Data* chapter explores the vital world of data, and discusses sources and characteristics of data, "Big Data," data stewardship and management, data challenges, and data security and protection. The importance of understanding and appreciating the essential topic of data when learning about HIS and technology cannot be overemphasized—at the end of the day, it is always about the data.

The *Business and Clinical Intelligence* chapter covers an area of enormous interest—the use of systems and their data for secondary uses that give us insight into the details and evidence regarding what we do clinically and in the business of health care. This exciting world of analytics—retrospective, real time, and predictive—creates new knowledge for the purpose of improving health outcomes.

The next section, *Research, Policy, and Public Health,* contains the *HIS and Research, Policy, and Public Health* chapter. It discusses uses of HIS for research, including roles of universities, government, private foundations, and reporting organizations in that worthy cause. The relationships of HIS and technology to policy and public health are examined as well.

The final section, *New Directions for HIS and Technology*, includes the *What Lies Beyond the Current State of HIS and Technology?* chapter, which explores the trajectory and potential future paths of emerging technologies and their application and use in health care and public health. eHealth, mHealth, uses of social media, personalized health care and medicine, and telemedicine are discussed, followed by an introduction to some of the issues and ethical dilemmas associated with ubiquitous use and access to data for purposes of health care and public health, including the dynamic tension between security and privacy of information versus access.

I have put my heart and soul into *Essentials of Health Information Systems and Technology*, just as I always have into the work experiences, mistakes, and lessons learned that are contained within this text. I hope you like it; but more importantly, I hope you find it useful and can apply what you learn here as you pursue the path in health care that ignites your passions. As I tell my students in the classroom, I share the mistakes I have made and the lessons learned from those experiences, so you can go into your careers equipped with that knowledge—and make new mistakes and learn a fresh set of lessons on your own!

Jean Balgrosky

Prologue

Essentials of Health Information Systems and Technology is intended as a basic but thorough introduction to a complex and intimidating topic. It is intended to take the mystery out of a subject that some people find exciting but others feel they cannot master because it is too highly technical.

Jean Balgrosky brings to health information systems (HIS) and technology her extensive experience implementing health information systems at Scripps Health and Holy Cross Health System (now Trinity Health) and her ongoing experience studying and teaching about health information systems at the University of California, Los Angeles. Her experience places her in a unique position to understand and teach both the theory and the practice of health information systems and technology. As she writes in the Preface: "A good deal of my career has been spent explaining health information systems and technology…". This will be obvious as you read the book.

Essentials of Health Information Systems and Technology is an important addition to our *Essential Public Health* series. This text emphasizes key concepts as well as many specifics about health information systems and technology. Once these concepts are understood, such as the need to match the structure of the HIS to the structure of the organization, the architecture of the HIS system becomes much easier to understand. It is then far easier to "get it" in terms of the types of technology that are a "fit" for various organizational or information scenarios.

This text provides substantial information about and clear explanations of the key technologies used to create systems and networks for healthcare and public health purposes. The concepts are presented without assuming extensive background, using an easily accessible approach. The text is ideal for use in introductory courses without prerequisites. Understanding the concepts is key because the applications are sure to change—and change rapidly—in the coming years. If you understand the essential components of technology such as hardware, software, networks, and mobile devices, you do not need to be a technical expert. You can focus on the basics, and then learn the technology specifics necessary for each project.

Therefore, the key principles are the focus of this text, which highlights HIS and technology planning and strategy, architectures, implementations, and uses, with accessible explanations and examples. Successful systems implementations are the result of cooperation and collaboration between the many different types of expertise found in any health enterprise. This is true whether one is selecting and implementing a new electronic health record system for a community clinic or a complex multihospital system, or designing and implementing new early-warning surveillance capabilities for public health agencies around the country, or using social media and smart phones to reach out with important health-related information to difficult-to-access rural areas.

The world of HIS and technology is an exciting, interesting, sometimes frustrating, and hopefully rewarding arena of possibilities and promise for making health care and public health safer, more accessible, and more effective. But it is not without its risks and unintended consequences. The proper attention is needed to determine the appropriate

amount of change introduced at once. In addition, a balance must be struck between offering access to information and protecting the privacy and security of sensitive information on individuals. This text addresses these more caution-laden concepts so as to develop a realistic perspective of what it takes to implement systems and technology successfully.

New systems are not magic, and the benefits we hope to achieve from their use do not happen just by pushing a button. These systems and the data they produce must be carefully stewarded to ensure positive results and the avoidance of new problems that can result from improperly implemented or managed systems. The future of HIS and technology is unfolding, limited only by our imaginations and our will to adapt our systems and work methods carefully, creatively, and productively. *Essentials of Health Information Systems and Technology* will guide your way into this emerging world and help you cope and contribute.

Richard Riegelman MD, MPH, PhD
Series Editor

Acknowledgments

Essentials of Health Information Systems and Technology is a labor of love stemming from the challenging, exciting, complex area in which I have spent my career. As a chief information officer (CIO), educator, and bootstrap entrepreneur doing and managing information systems and technology in health care, sharing what I have learned over the years has always been a goal of mine. I have had the privilege and pleasure of teaching this subject for the past 6 years to the outstanding graduate and extension students at University of California, Los Angeles's Fielding School of Public Health, who have provided valuable feedback and input regarding ways to introduce key HIS concepts and subject matter. These students and colleagues, along with the many people with whom I had the privilege of working throughout my career at Scripps Health, Holy Cross Health System, Peat Marwick, and UCLA, have been instrumental in shaping the approach I have taken in explaining the essential elements of this complicated topic, any one of which could be a book in itself. I am grateful for these many experiences and interactions, just as I am for the encouraging words from my students, colleagues, and mentors.

I have attempted to weave connections between all types of health information, whether initially produced in a healthcare organization, for public health purposes, or by an individual. Previously separate areas of our health world are converging as we embrace use of mobile technologies, the Internet, and e-commerce in healthcare and information technology innovation. This brings hospitals, physician offices, and other healthcare delivery settings in touch with public health needs, prevention, and population health management, reflecting the true focus of our greatest needs in health care today: improving quality and health status, becoming more cost-effective, and preventing and reversing troubling trends of increasing epidemics of illness associated with behaviors, the environment, and daily lifestyle habits.

I owe my passion for connecting these two worlds to my education and training at UCLA's Fielding School of Public Health, and to several people in particular. In my early days as an undergraduate, Miss Olive Johnson, a health information leader with a vision that was well before her time, provided me with mentorship and foundational education in medical record science as an undergraduate, then welcomed me back as a graduate student during a challenging time in my life to get my master's degree in health information systems management. She gave me an opportunity that forever favorably altered my life. Dr. Ray Goodman awarded me a scholarship that sustained me and my daughter through my days as a graduate student and single parent. He had the foresight to anticipate the emerging importance of health information systems and the need to prepare qualified graduates in this area. I would also like to thank Dr. Jonathan Fielding, who sponsored me in my Masters internship into the PhD program and who has been an advocate for my studies and work ever since. Since my undergraduate days, Dr. Paul Torrens has provided me with enthusiastic encouragement in my studies and work in health information systems and technology as well. To this day, Drs. Fielding and Torrens are my mentors, colleagues, and friends. Dr. Jack Needleman has served as the chairperson of my

PhD committee and provided the guidance I have needed through the dissertation research process. Dr. Diana Hilberman has been my mentor in teaching and provided important opportunities for me to integrate the discipline of health information systems and technology into the graduate programs in health policy and management at UCLA. All these people have made huge differences in my life, education, and career, and I am eternally grateful to them. I would also like to thank Drs. Leah Vriesman, Fred Zimmerman, Robert Kaplan, Tom Rice, Paul Fu, Doug Bell, and the members of the Fielding School of Public Health's Department of Health Policy and Management faculty for their support of and interest in my PhD studies and teaching. I am grateful for their enthusiastic support of developing an HIS curriculum for the department and the opportunity to develop and teach classes on this topic, which has provided me with the testing ground for much of this text's content.

Another early lucky break in my career trajectory is owed to Sister Geraldine M. Hoyler, C.S.C. She plucked me out of a crowd of more typical candidates at the time and gave me my first job as a CIO at the age of 32. My work in those days was fueled by insights and innovations of Jay McCutcheon and Bart Neuman, inventors of the HIS planning model that I use to this day, and which provides a key framework for the concepts presented in this text. My friends and colleagues Dr. Neetu Chawla and Jessie Chatigny have provided valuable advice and encouragement, acting as expert sounding boards as I waded through the challenges of structuring and writing chapters. I'd like to thank my Bootstrap Incubation colleagues Kyle, Brandy, Sonya, Wyatt, Courtney, Melanie, Seth, CJ, Chris, Mannix, Brian, Kevin, and Bryce, who have picked up the slack and patiently waited as I went through spurts of writing and revising. Thank you for keeping my knowledge current as every day we strive to create innovations in health information technology together. I am ever so grateful for my new friends and colleagues—in particular, Dr. Samir Damani and his team, who inspire me and many others in the pursuit of digital health, population health management, and personalized medicine.

I owe special thanks to my author comrades and contributors, Jim Brady and Ric Speaker. They threw their hats willingly into the ring to help get this text written, tackling incredibly vital and challenging chapters. Bravo to their contributions and commitment to the text, among all their other responsibilities. We all have agreed: It was the hardest thing we have ever done! Jim and Ric, this text would not be here without you. I am lucky to have loyal friends and brilliant colleagues such as you. I also owe a debt of gratitude to Danny Boye Meyers, genius at the Apple Store genius bar in La Jolla, California, who rescued my raw, original Chapter 8 from the jaws of the asterisks bug in a split second, nimbly outsmarting my laptop, making it think it had crashed before it dissolved the chapter before our very eyes, ultimately and amazingly recovering the chapter at a critical time in the schedule to compose this manuscript. I am humbled by his adept brilliance. Further, I want to acknowledge all the hard-working information technology professionals I have been privileged to call my colleagues throughout my career. You have taught me everything about HIS and service to the mission of health care.

Through the several years-long process from conceptualizing through writing and revising this text, Dr. Dick Riegelman, editor of the *Essentials of Public Health* series, has provided me with the extraordinary combination of opportunity, guidance, constructive feedback, support, and enthusiasm for this volume. I hope *Essentials of Health Information Systems and Technology* matches his hopes and expectations for a topic so relevant to a complete education in public health and health management. I appreciate his vision and believe students will benefit greatly as a result.

I would like to thank Mike Brown of Jones & Bartlett Learning for his vision and excitement about adding this title to the series, and Chloe Falivene for her organized, professional, and energetic approach to getting this text from outline to manuscript to published product. Sarah Bayle has provided stalwart and focused editing leadership, along with copyeditor Jill Hobbs and permissions expert Ashley Dos Santos, whose discipline ensures a properly referenced and cited book. I always felt as if my hard work was very important to each of them and, along with Dr. Riegelman, they provided me with a fantastic, professional support team.

Last and most importantly, to my family—nothing in my life is possible without you. I am eternally grateful to you for your love and patience while I spent weeks at a time holed up writing. To my dear husband Parker, thank you for your support and encouragement to write this text, and for understanding how important it was to me to do this. (And thank you for handling family responsibilities during those days on end I was writing.) To my children Melissa, Jessica, Seth, Sarah, Wyatt, CJ, and Steven, thank you for being here—you and your families are my inspiration for everything I do. I also want to express my love and gratitude to my parents, who, although no longer with us, instilled in me the value of education and the importance of books, and provided me with unending motivation to strive to do something good with my life. This text is for you. And to my sister Wendy and brother Steve, thank you for your constant love and support, which has always provided such great comfort to me.

About the Author

Jean Balgrosky, MPH, RHIA, teaches Health Information Systems and Technology at UCLA Fielding School of Public Health, where she also received her MPH in health information management and BS in health services with a specialization in medical record science. She is currently a PhD candidate in health policy and management and is completing her dissertation, *Adoption of Health Information Technology by Physicians for Use in Their Practices*. Ms. Balgrosky's career in health information systems and technology has included the role of chief information officer (CIO) in large, complex healthcare organizations for more than 20 years, consulting, and teaching at the graduate level. More recently, she has become an entrepreneur, mentor, and board member for start-up companies in the life sciences, digital health, software-as-a-service, and healthcare analytics arenas. She is also CIO of a digital health company.

Essentials of Health Information Systems and Technology is Ms. Balgrosky's first book, for which she draws largely from her 30-year career in health information systems and technology as well as from teaching graduate courses at UCLA the past 5 years. She has authored numerous papers and articles over the course of her career, is a frequent speaker, moderator, and panelist at health information technology conferences, and plans to publish the results of her dissertation research regarding physician adoption of electronic health records.

Ms. Balgrosky has provided leadership throughout her career to the evolving health information systems and technology industry, maintaining her accreditation as a Registered Health Information Administrator as the foundation of her knowledge of medical record management and electronic health records. Her goal in writing this and subsequent books is to develop courses and resource materials for health information systems curricula, as well as to infuse necessary information technology topics into other courses taught in schools of public health and health management. Examples of courses that now require information technology components include financial and human resources management, quality, organizational behavior, strategic planning, marketing, and medical and nursing educational programs.

Ms. Balgrosky lives in Del Mar, California, with her husband Parker. They have seven children and, at current count, nine grandchildren.

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