Understanding Health Information Systems

FOR THE HEALTH PROFESSIONS

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Dedication

This book is dedicated to the patients whose health and comfort is our priority, and for whom we strive as health professionals.

This book is also dedicated to my parents, Steven A. Balgrosky and Evelyn Margaret Cook Balgrosky, whom I love and miss every day.

Jean Balgrosky

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Preface

To improve the state of health care in this country, we must have better experienced, and more powerful and effective health information systems (HIS). To have better HIS, we must invest in the educations of future leaders, providers, and innovators in the field of health care. *Understanding Health Information Systems for the Health Professions* is meant to further those goals.

As a chief information officer (CIO), educator, and bootstrap entrepreneur doing and managing information systems and technology in health care for my entire career, sharing what I have learned over the years has always been a goal of mine. Currently, this goal feels particularly urgent, given recent massive investments in information technology in health care, the unmet promise of those efforts and investments, the need to adapt the U.S. health system from fee-for-service to value-based care, and the ineffective status of health care in the U.S., which spends about twice as much of its GDP on health care than other countries and results in worse outcomes in almost every category.[1] Additionally, serious issues exist in the user interface and user experience in use of EHR systems by physicians and other clinicians, to the point that many are considering leaving their practices.[2]

These problems are not for the faint of heart, nor are they superficial, but with the right preparation and approach, they are solvable. HIS touches every one of these issues and holds a key to engaging patients and helping providers deliver more effective care. A core part of the solution to these problems is education about a systemic, deep-rooted problem: only the IT staff, vendors, and consultants know what goes on in the "black box" of IT and HIS, keeping all other parties at a distance, many of whom are the "beneficiaries" of and participants in these efforts. With a wide range of results, these contributors are often left with little feeling of true involvement other than following instructions and procedures. Successful HIS adoption involves *all* disciplines touched by an implementation in meaningful ways, as well as those responsible for managing core functions of the organization, for everything is affected by a major implementation; the ripples are felt from corner to corner of the organization.

In my experience as a CIO, the greatest challenge has been doing this work in organizations full of intelligent, hard-working, committed, compassionate, highly trained healthcare professionals, from clinicians, to the board of trustees, to registration personnel, when precious few of them have had access to any training or education in HIS or IT at all. The motivation for this book is to provide accessible, comprehensive understanding of HIS to those preparing for a health profession such as medicine, nursing, management, and public health, in addition to those working in IT, law, computer science, or other disciplines applied to health care. A lack of this HIS training and education makes the hard work of HIS

1 https://www.oecd.org/unitedstates/Health-at-a-Glance-2017-Key-Findings-UNITED-STATES.pdf.
2 http://med.stanford.edu/content/dam/sm/ehr/documents/SM-EHR-White-Papers_v12.pdf.

implementation and adoption even harder. And certainly, this overhead of frustration and unhappiness contributes to current problems in quality and the high cost of health care in the U.S. These results could be so much better and must improve for the health and well-being of our society. While better training is helpful, the answer to these user experience problems is embedded deep within the design of these systems and must be ferreted out. The answer is not to bring in more consultants or provide scribes to follow around physicians to do data entry work. No. The answer is to break out of this trap *through education*. Providing a comprehensive, foundational HIS education to *all* health professionals is where we break the back of this monster of a dilemma, and fight our way back to solutions that help, protect, delight, and heal. It is all possible.

This book is my humble contribution to that cause, and I hope every student of medicine, nursing, health law, software engineering, management, public health, and analytics has access to some class based on this type of book if not this one, and enters their career armed with confidence in HIS information, skills, and perspective so that they may be active participants in the planning, design, implementation, enhancement and use of HIS, rather than passive recipients of whatever IT and the vendors deliver.

Understanding Health Information Systems for the Health Professions is a broad, introductory book that covers the totality of modern HIS: systems and management, data and analytics; people and processes; and global health, research, and policy. It provides in-depth coverage of the principles and techniques of HIS planning and management to help organizations achieve cost-effective and quality health care, while emphasizing population health management, innovation, patient engagement, and prevention. Written to the audience of graduate and upper-level undergrad students taking classes such as Health Information Systems, Health Informatics, or Health Information Technology, it is written to those studying to be health managers and administrators, physicians, nurses, other clinicians, engineers, attorneys, analysts, researchers, and policymakers—and all those learning to be responsible in some way for planning, implementing, and managing systems in healthcare settings. The contents are organized into five sections.

I. HIS Basics: Definitions, Contexts, and Scope
II. HIS Strategy, Planning, and Governance
III. HIS Systems and Their Management
IV. Harvesting the Fruits of Your Labors
V. A Changing HIS World

Let me outline the chapters of the book in each section.

Section 1: HIS Basics: Definition, Contexts, and Scope

Chapter 1: HIS Fundamentals

This chapter introduces the basics of HIS, including HIS fundamentals and key concepts; provides the HIS Model, a graphic that helps students conceptualize the total scope of HIS, which is then described step-by-step in the text. Basic HIS terminology and definitions are presented to give students a solid grasp of common terminology used when speaking the language of HIS. This chapter provides descriptions of key concepts in the working relationship between vendors and providers and gives a brief history of HIS, so students can be aware of deep-rooted issues and lessons learned.

Chapter 2: The Scope, Definition, and Conceptual Model of HIS

In this chapter, the student learns about systems and their management in the context of the HIS Model, providing a comprehensive understanding of all layers of the totality of HIS. This model provides the student with a conceptual framework for learning key elements of HIS as an organizing construct for the subsequent chapters of the textbook. In addition to describing the total view of HIS, this chapter describes varieties of uses of HIS in organizational and community settings.

Chapter 3: Aligning HIS in the Dynamic Healthcare Environment

In Chapter 3, the student learns about alignment between HIS and the dynamics and challenges of health care today. Understanding how this relates to the types of core systems needed strategically, current types of HIS initiatives, as well the relationship between HIS and population health management gives perspective to uses of HIS and challenges of health professionals in their use in the dynamic healthcare environment.

Section II: HIS Strategy, Planning, and Governance

Chapter 4: HIS Strategic Planning

This chapter provides the student with an understandable approach to HIS strategic planning, taking the mystery out of which types of systems belong in a healthcare organization HIS portfolio. This is done through the application of a straightforward HIS Planning Framework that can be used to define essentials systems for any type of healthcare organization.

Chapter 5: HIS Planning Tactics

In this chapter, the student learns HIS planning tools and techniques for carrying out HIS planning activities, such as how to construct an HIS business plan including the use of a five-year cost estimate spreadsheet, as well as other planning techniques, readily applicable to hands-on HIS planning work. Lessons learned also prepare the student to be an active and confident participant in these important activities.

Section III: HIS Systems and Their Management

Chapter 6: Application Systems and Technology

Chapter 6 describes the wide variety of HIS software systems and familiarizes the student with applications and uses of each of these types of software. The basics of technologies and networks used to support and enable the software systems are also covered in this chapter.

Chapter 7: HIS Management and Technology Services

Chapter 7 describes the methods, roles, and processes used to manage and deliver HIS technology services in organizations. Students will understand the foundation of a well-run IT department from the materials in this chapter.

Chapter 8: HIS Implementation and Managing Change

Chapter 8 provides students with knowledge and perspective of the all-important implementation of HIS and managing change associated with those projects. This chapter also covers project management including techniques to be applied in managing change and the role of a project manager. Also presented are insights into EHR system implementations, along with lessons learned to inform students of reasons for successes and failures in implementations.

Section IV: Harvesting the Fruits of Your Labors

Chapter 9: Adopting New Technologies

This chapter presents the theory of diffusion of innovation in adopting new technologies as well as real life lessons of implementations, history of HIS innovation, unintended consequences of HIS uses, effects of new technologies on existing HIS, and the importance of including new technologies in the training and education of healthcare providers.

Chapter 10: Data

Chapter 10 introduces the student to the world of data, including the current status of the data explosion in our modern world, the discipline of managing data, concepts and principles of data ownership, stewardship, security, requirements for data for regulations such as MACRA, and data challenges and best practices. To understand HIS, one must understand data.

Chapter 11: Analytics, Business Intelligence and Clinical Intelligence

Chapter 11 presents the exciting topic of analytics and BI/CI, including the history of BI/CI, data and architectural models, challenges, artificial intelligence (AI), and the future these capabilities.

Section V: A Changing HIS World

Chapter 12: HIS and Digital Health

Chapter 12 discusses evolving digital health technologies, capabilities, and uses. The importance of informatics in digital health is emphasized along with human-centered design, and techniques for involving insights and expertise of subject matter experts, in this case, health professionals, in the determination of ways to use new technologies in digital health.

Chapter 13: HIS Around the Globe

This chapter shifts gears, immersing the student in insights about what can be learned from HIS uses in countries around the globe, comparing HIS adoption according to different countries' health system structures, policies, expenditures, and health outcomes. Each country faces its own challenges, with themes and trends providing perspective to HIS initiatives everywhere. Observations provide insights into U.S. as well as global HIS challenges, giving students food for thought into how some of those problems might be solved.

Chapter 14: Key Issues in HIS and Future HIS

This chapter describes key topics that speak to future HIS such as the development of digital health capabilities and their role in the changing healthcare landscape. Issues in HIS adoption include disparities in access to these technologies, unintended consequences such as physician dissatisfaction with EHR user interface and user experience, and widespread dependency on scribes due to poor EHR design.

Additional topics describe future HIS directions and possibilities for students of the health professions, who must each understand HIS and apply their subject knowledge to forward progress in health care, with the help of HIS.

I hope that students of the health professions and their instructors find this text a useful resource for learning about HIS in ways that can be applied in real practice, to help them have satisfying, productive careers, to improve their patients' and their own experiences and health, and by extension, our health overall.

Jean A. Balgrosky, PhD, MPH, RHIA

Prologue

"I am "excited about this book! The topics are very appropriate for what the industry expects to see from graduates."

"I believe students will be glad to see where IT is going in their industry"

"Includes topic across the spectrum, from health information technology to health informatics"

These are the types of comments that reviewers have provided for *Understanding Health Information Systems for the Health Professions*. They didn't just happen; they reflect the extensive Health IT experience, the diverse teaching experience, and the successful textbook experience that Dr. Jean Balgrosky brings to her newest Jones and Bartlett Learning textbook.

Dr. Balgrosky brings to health information systems (HIS) her extensive experience implementing HIS at Scripps Health and Holy Cross Health System (now Trinity Health) and her ongoing experience supporting digital health start-up companies as founder of Bootstrap Incubation and as CIO of MD Revolution, as well as studying and teaching HIS 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 HIS.

Understanding Health Information Systems for the Health Professions is designed for a broad range of health professions from advanced undergraduate and graduate students to health managers, administrators, clinicians, and policymakers. It is structured as a textbook with learning objectives, case examples, numerous graphics, and a range of ancillary materials to help instructors engage students in the excitement of HIS.

The textbook takes a broad introductory approach that covers the totality of modern HIS. It covers the principles of HIS planning and management to help organizations achieve cost-effectiveness, quality improvement, efficiency, population health management, innovation, patient engagement, and prevention. Students will discover how these goals are enabled by technology, data, and analytics. These skills are increasingly needed for institutional survival in a continuously changing healthcare landscape.

The world of HIS is an exciting one which holds the promise for making health care safer, more accessible, more effective, and more efficient. New systems do not happen by magic or by pressing a button. They require the skills of a wide range of professionals who understand both the art and the science of HIS. As Dr. Balgrosky writes "A well-architected and orchestrated HIS system is a thing of beauty…"

The future of HIS is unfolding, limited only by our imaginations. *Understanding Health Information Systems for the Health Professions* will guide your way into this emerging world and help you cope and contribute.

Richard Riegelman, MD, MPH, PhD
Professor and Founding Dean, Milken Institute School of Public Health, The George Washington University

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Acknowledgments

I have had the privilege and pleasure of teaching this subject for the past 10 years to the outstanding graduate and extension students at the University of California Los Angeles Fielding School of Public Health. These excellent students have provided valuable feedback and input regarding ways to introduce key HIS concepts and subject matter. My colleagues through the years, including those at Scripps Health, Holy Cross Health System (Trinity Health), Peat Marwick, MDRevolution, and UCLA, have been instrumental in shaping the approach I have taken in my work as a CIO and thus explaining the essential elements of this complicated topic, any one of which could be a book in itself. These professionals include physicians, nurses, and other clinicians, information technology specialists, attorneys specializing in software law, fellow CIOs, healthcare business people, and many more. I am grateful for these many experiences and interactions, just as I am for the encouraging words from my students, colleagues, and mentors who recognize the need for a comprehensive textbook on this topic.

I owe my passion for connecting the worlds of health care, public health, and information technology to my education and training at UCLA's Fielding School of Public Health, where I earned my bachelor of science degree in Health Services with a specialization in Medical Records Science, Masters of Public Health in Health Services with a concentration in Health Information Systems, and PhD in Health Services with a cognate in Health Information Systems and Technology. I must thank several people along that journey in particular. In my early days as an undergraduate, Ms. Olive Johnson, RHIA, and Dr. Ray Goodman guided my academic path in meaningful ways. Ms. Johnson was a woman ahead of her time, teaching not only the science of managing medical records for clinical, legal, and business purposes, but how to harvest data from the treasure trove of these records for research, analytics, and quality applications. I would also like to thank Dr. Jonathan Fielding, my long-time mentor, who has been an advocate for my academics and work in public health and HIS, and pursuit of my career as CIO, entrepreneur, and innovator. Also since my undergraduate days, Dr. Paul Torrens has provided me with enthusiastic support in my studies and work in health information systems and technology, including serving on my PhD dissertation committee. Dr. Jack Needleman has served as my PhD advisor and chairperson of my PhD committee, providing guidance through the dissertation research process. Dr. Diana Hilberman has been a mentor in teaching and provided important opportunities for me to integrate the discipline of health information systems and technology into graduate programs in health policy and management at UCLA. Much of the success of my early career is owed to a lucky break from Sister Geraldine M. Hoyler, C.S.C., who hired me into my first CIO role at Holy Cross Health System where I served for over 11 years. Jay McCutcheon and Bart Neuman, early leaders in the HIS field and inventors of the HIS planning model that I use to this day, provided me mentorship and early guidance as a consultant.

I'd like to thank my Bootstrap Incubation and Venture Partner as well as MD Revolution

colleagues who have picked up the slack and patiently waited as I went through the spurts and marathon of writing and revising. Thank you for helping me stay current and involved in new directions in health care, as every day we strive to create innovations enabled by health information technology. I am ever so grateful for a team inspired in the pursuit of digital health, population health management, care management, empowered patients, and better experiences for providers.

I owe special thanks to my author comrades and contributors, Jim Brady (Chapters 6 and 7) and Ric Speaker (Chapters 10 and 11). 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. I am lucky and so grateful to have loyal friends and brilliant collaborators such as you.

Dr. Richard Riegelman, editor of the *Essentials of Public Health* series and champion and advocate of *Understanding Health Information Systems for the Health Professions*, has provided me with the extraordinary combination of opportunity, guidance, constructive feedback, support, and enthusiasm for this volume. He has contributed so much to the advancement of health care and public health, and we all are beneficiaries of his understanding of the relevance of health information systems to that quest.

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Last and most importantly, to my family—nothing in life is possible without you. To my dear husband Parker, thank you for your support and encouragement and for understanding how cathartic it has been for me to do this textbook, a way to distill 30 years of CIO'ing out of my brain and onto the pages of this book. To my children, Jessica, Wyatt, CJ, Steven, Melissa, Seth, and Sarah, thank you for being you and for being our children and giving us grandchildren—you and your families are my inspiration for all things. 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; thank you for your love, encouragement, and motivation to strive to do something good with my life. And to my sister Wendy, brother Steve, and niece Robyn, thank you for your constant love and support, which has always provided such great comfort and joy. To each and every member of my family—I cannot imagine my life without you and every day, I am profoundly grateful we have each other.

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About the Author

Jean Balgrosky, PhD, MPH, RHIA, teaches Health Information Systems and Technology at UCLA Fielding School of Public Health, where she also received her PhD in Health Services with a cognate in health information systems and technology, her MPH in Health Services, majoring in health information systems management, and BS in health services with a specialization in medical record science. In 2015, she published her first textbook, *Essentials of Health Information Systems and Technology*. 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 30 years, consulting and teaching this topic at the graduate level. More recently, she has become an entrepreneur, mentor, and board member for start-up companies in life sciences, digital health, software-as-a-service, and healthcare analytics arenas. She is currently also CIO of a digital health company.

Understanding Health Information Systems for Health Professionals is Balgrosky's second book, for which she draws largely from her long career as a CIO, consultant, and entrepreneur. She has authored numerous papers and articles, 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 in small versus large practices.

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.

Dr. Balgrosky lives in Del Mar, California, with her husband of 34 years, Parker. They have seven children and, at current count, nine grandchildren. Their family brings them the greatest joy and meaning every single day.

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Chapters 6 and 7

Dr. Brady is the recipient of the Becker's Hospital Review 2018 and 2017 List of Hospital and Health System CIOs to Know, the Los Angeles Business Journal 2015 CIO of the Year Award, the HIMSS 2015 Distinguished Fellows Service Award, and the HIMSS SoCal 2015 Chapter of Year and President Level Advocacy Awards. He has three decades of experience leading technology and security initiatives in complex academic medical center and multihospital healthcare settings. His expertise in ITIL standards for IT service management and delivery, and ISO/IEC 27001 for information security compliance bring unique insight into Chapters 6 and 7. Brady is CIO for Los Angeles Department of Health Services, Past President of HIMSS, and adjunct faculty at National University. He most recently served as Area CIO for Kaiser Permanente Orange County 2013–2018. During his PhD studies, Dr. Brady wrote his dissertation on information technology security in health care.

Ric Speaker

Chapters 10 and 11

Mr. Speaker has 40 years of executive business experience, consulting, and lecturing in the field of healthcare technology. As a successful serial entrepreneur and expert in health BI/CI, Speaker guides his clients—largely healthcare providers, services, and technology companies—to harvest meaningful, actionable information from HIS; govern data; and enact effective security protocols. His expertise makes Chapters 10 and 11 excellent resources for readers. He is a Managing Partner of Commonwealth Health Advisors, Board Member and Charter Member of the Healthcare Summit at Jackson Hole, Chairman of the Board at the Sursumcorda Resource Group, Industry Advisor at LRVHealth Venture Capital, and Chief Visionary Officer at Bear Creek Works.