Health Informatics

Eta S. Berner *Editor*

Informatics Education in Healthcare

Lessons Learned

Springer

Health Informatics

Eta S. Berner
Editor

Informatics Education in Healthcare

Lessons Learned

Springer

Editor
Eta S. Berner, EdD, FACMI, FHIMSS
Department of Health Services Administration
School of Health Professions
University of Alabama at Birmingham
Birmingham
AL
USA

Department of Medical Education
School of Medicine
University of Alabama at Birmingham
Birmingham
AL
USA

ISBN 978-1-4471-4077-1 ISBN 978-1-4471-4078-8 (eBook)
DOI 10.1007/978-1-4471-4078-8
Springer London Heidelberg New York Dordrecht

Library of Congress Control Number: 2013948756

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

To our students, from whom we have learned much.

Preface

Twenty years ago almost the only individuals involved in healthcare who had even heard the term "informatics" were those who identified themselves as medical or nursing informaticians. Today, we have a variety of subfields of informatics including not just medical and nursing informatics, but informatics applied to other health professions (such as dental or pharmacy informatics), as well as health informatics, biomedical informatics, bioinformatics and public health informatics among others.

This book addresses the broad range of informatics education programs available today. My own background in health professions education over 40 years ago at the beginning of my career and in online informatics education in my work today has provided me with a tacit understanding of the breadth of content, pedagogical techniques, strategies and approaches to informatics education in a wide variety of areas. As a leader of UAB's Center for Health Informatics for Patient Quality and Safety and the UAB Curriculum Development Center that was part of ONC's health IT workforce development program, I have seen the rapidly growing interest in the development of new informatics education programs.

The aim of this book is to make the tacit knowledge explicit and to share some of the lessons learned by a group of very experienced informatics educators. The contributors to this volume are internationally recognized informatics educators and this short preface cannot do justice to their expertise. However, to give the reader a snapshot of their knowledge and experience, the following is a description of the contributors' expertise as related to the particular chapters that they wrote.

Dr. Jacqueline Moss, who co-authored the overview chapter with me, is an experienced nursing informatics educator, who has been integrally involved in informatics education at the national level and throughout her institution in other areas in addition to nursing informatics. The authors of Chap. 2 have taken the insights gained by years of experience in online education and articulated them in a series of strategies that will be useful for others, especially those who have struggled with the issues that are raised. In addition to my own expertise in online informatics education, the other authors bring additional expertise and experience. *Ms. Lorrinda Khan* has years of online learning experience, both as an instructor and as an

instructional design expert. *Dr. Michael Dieter* is currently program director for the online masters of health informatics program at the University of Illinois at Chicago (UIC), where *Dr. Annette Valenta* had also served as program director. In addition, Dr. Valenta is the developer of the AMIA 10×10 program at UIC.

The authors of the chapters describing different training programs in the US have direct experience with the programs they describe. *Dr. Valerie Florance* is Associate Director of Extramural Programs at the National Library of Medicine (NLM) and has been responsible for oversight of the many NLM-funded informatics training programs. *Drs. Reed Gardner* and *Charles Safran* were leaders of the task forces that led to the approval of the clinical informatics subspecialty. They also both are members of the certification examination test committee. In addition to Dr. Moss, *Dr. Beth Elias* is co-author of the chapter on nursing informatics. Dr. Elias teaches in a variety of nursing informatics areas, including nationally funded nursing education projects. *Amanda Dorsey* and *Meg Bruck* bring the perspective of both health informatics students and instructors to their chapter. They were both students in the University of Alabama at Birmingham (UAB) MSHI program and have gone on to become broad-based informatics educators. Ms. Dorsey led the transition of the MSHI program to an online format and Ms. Bruck also teaches a variety of courses in health informatics as part of the ONC workforce development program. Both Ms. Dorsey and Ms. Bruck also participated in the ONC Curriculum Development Centers program. The final two chapters in this section are written by *Dr. William Hersh*. Dr. Hersh is internationally recognized as an informatics educator. He is the leader of OHSU's informatics education activities which include not only the NLM-funded informatics training program, but also the University-based training program funded by ONC as part of the ONC workforce development program. He has been a leader in other ONC-funded workforce programs including the Curriculum Development Centers program and the National Training and Dissemination Center. In addition to his work with the ONC workforce programs, Dr. Hersh was the impetus behind the AMIA 10×10 program and was director of the first 10×10 program.

The contributors of the chapters on informatics education programs for other health professionals bring a similar breadth of experience as those for the dedicated informatics programs. *Dominic Covvey* is internationally recognized for leading the development of competency descriptions for multiple roles including informatics researchers, applied informaticians, and clinician users of informatics applications. *Margaret Schulte* was the leader of the HIMSTA project described in Chap. 10 and also has years of experience as both a leader of HIMSS' education activities and in her work with the Commission on Accreditation of Health Management Education (CAHME). *Dr. Chiquito Crasto* has expertise in bioinformatics and has been working for several years developing the innovative bioinformatics education program he describes in Chap. 11. *Drs. Peter Embi and Philip Payne* are widely recognized as the major leaders in the US in the area of clinical research informatics (CRI). Dr. Embi led the first AMIA CRI conference and also developed the AMIA 10×10 course in this area. Both authors have published seminal articles in this domain.

All of the chapter authors on worldwide informatics education are experienced educators within their own country and around the world. *Dr. John Holmes* and *Jeffrey Williamson* were instrumental in working with AMIA's Global Health Informatics Partnership which was involved with disseminating informatics educational materials to countries around the world. The authors of Chap. 14, *Drs. Paula Otero* (Latin America), *Antoine Geissbuhler and Caroline Perrin* (Sub-Saharan Africa), and *Ngai-Tseung Cheung*, *Nawanan Theera-Ampornpunt*, *and Kwok Chan Lun* (Asia Pacific) have developed highly regarded informatics education programs in the respective regions that they discuss.

In addition to the outstanding contributions of the chapter authors, and the support of Grant Weston and the Springer editorial team, I would like to thank Ms. Joy Ptacek whose assistance with this book and with all of our informatics educational activities, has provided the support that was essential in bringing this book to fruition. I think I speak for many of the contributors to this volume in also expressing our appreciation to the US Office of the National Coordinator for Health Information Technology (ONC), and to Charles Friedman, Ph.D., in particular, whose vision in developing and funding the ONC health IT workforce development program has provided the stimulus for the enhancement of informatics education programs around the world.

AL, USA Eta S. Berner, EdD, FACMI, FHIMSS

Contents

Contributors

Eta S. Berner, EdD, FACMI, FHIMSS Department of Health Services Administration, School of Health Professions, University of Alabama at Birmingham, Birmingham, AL, USA

Department of Medical Education, School of Medicine, University of Alabama at Birmingham, Birmingham, AL, USA

Meg N. Bruck, MSHI Department of Health Services Administration, University of Alabama at Birmingham, Birmingham, AL, USA

Ngai-Tseung Cheung, MBBS, BSc (Med), MSc (Comp Sci), DIC Department of Health Informatics, Hong Kong Hospital Authority, Kowloon, Hong Kong

H. Dominic J. Covvey, BA, MSc Faculty of Science, University of Waterloo, Waterloo, ON, Canada

Chiquito J. Crasto, PhD Division of Research, Department of Genetics, University of Alabama at Birmingham, Birmingham, AL, USA

Michael G. Dieter, PhD, MLIS, MBA Department of Biomedical and Health Information Sciences, University of Illinois at Chicago, Chicago, IL, USA

Amanda D. Dorsey, MSHI Department of Health Services Administration, University of Alabama at Birmingham, Birmingham, AL, USA

Beth L. Elias, PhD Department of Community Health, Outcomes and Systems, School of Nursing, University of Alabama at Birmingham, Birmingham, AL, USA

Peter J. Embi, MD, MS Department of Biomedical Informatics, The Ohio State University, Columbus, OH, USA

Valerie Florance, PhD National Library of Medicine, NIH, DHHS, Bethesda, MD, USA

Reed M. Gardner, PhD Department of Biomedical Informatics, University of Utah, Salt Lake City, UT, USA

Antoine Geissbuhler, MD, FACMI Department of Radiology and Medical Informatics, Geneva University School of Medicine, Geneva, Switzerland

William R. Hersh, MD, FACMI, FACP Department of Medical Informatics and Clinical Epidemiology, Oregon Health and Science University, Portland, OR, USA

John H. Holmes, PhD, FACE, FACMI Department of Biostatistics and Epidemiology, University of Pennsylvania Perelman School of Medicine, Philadelphia, PA, USA

Lorrinda Khan, MFA Department of Health Services Administration, School of Health Professions, University of Alabama at Birmingham, Birmingham, AL, USA

Kwok Chan Lun, PhD Department of Information Systems, School of Computing, National University of Singapore, Singapore, Singapore

Jacqueline A. Moss, PhD, RN, FAAN Department of Adult Health, School of Nursing, University of Alabama at Birmingham, Birmingham, AL, USA

Paula D. Otero, MD Department of Health Informatics, Hospital Italiano de Buenos Aires, Buenos Aires, Argentina

Philip R.O. Payne, PhD Department of Biomedical Informatics, The Ohio State University, Columbus, OH, USA

Caroline Perrin, MSc Department of Radiology and Medical Informatics, Geneva University School of Medicine, Geneva, Switzerland

Charles Safran, MD, MS Division of Clinical Informatics, Department of Medicine, Beth Israel Deaconess Medical Center and Harvard Medical School, Boston, MA, USA

Margaret F. Schulte, DBA, FACHE, CPHIMS Department of Graduate Programs, Northwestern University, Chicago, IL, USA

Masters in Medical Informatics, School of Continuing Studies, Northwestern University, Ottawa, OH, USA

Nawanan Theera-Ampornpunt, MD, PhD Informatics Division, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Nakhon Pathom, Bangkok, Thailand

Annette L. Valenta, DrPH Department of Biomedical and Health Information Sciences, University of Illinois at Chicago, Chicago, IL, USA

Jeffrey J. Williamson, MEd Department of Education, AMIA, Bethesda, MD, USA

Acronyms and Abbreviations

AACN	American Association of Colleges of Nursing
AAMSI	American Association for Medical Systems and Informatics
ABMS	American Board of Medical Specialties
ABP	American Board of Pathology
ABPM	American Board of Preventive Medicine
ACGME	Accreditation Council for Graduate Medical Education
ACMI	American College of Medical Informatics
AHI	Applied Health Informatics
AHIMA	American Health Information Management Association
AMIA	American Medical Informatics Association
ANA	American Nurses Association
ANCC	American Nurses Credentialing Center
APAMI	Asia Pacific Association for Medical Informatics
ARRA	American Recovery and Reinvestment Act
ASL	Asynchronous Learning
AUPHA	Association of University Programs in Health Administration
BIOTEC	National Center for Genetic Engineering & Biotechnology [Thailand]
BISTI	Biomedical Information Science and Technology Initiative
BSN	Bachelor of Science in Nursing
CAHIIM	Commission on Accreditation for Health Informatics and Information Management
CAHIMS	Certified Associate in Health Information & Management Systems
CAHME	Commission on Accreditation of Healthcare Management Education
CBMI	Regenstrief Institute Center for Biomedical Informatics
CCNE	Commission on Collegiate Nursing Education
CDC	Curriculum Development Center
CE	Continuing Education
CEO	Chief Executive Officer

CERTES	Center for Research Expertise in Telemedicine and eHealth [Centre d'Expertise et de Recherche en Télémédecine et E-santé]
CHCF	California Healthcare Foundation
CHI	Center for Health Informatics [Singapore]
CHIRAD	Centre for Health Informatics Research and Development [South Africa]
CIN	Computers, Informatics, Nursing [Journal]
CIO	Chief Information Officer
CMIO	Chief Medical Information Officer
CMS	Centers for Medicare and Medicaid Services
CMS	Clinical Management System [Hong Kong]
COSTAR	Computer Stored Ambulatory Record
CPHIMS	Certified Professional In Health Information & Management Systems
CPOE	Computerized Physician (or Provider) Order Entry
CRI	Clinical Research Informatics
CTRI	Clinical and Translational Research Informatics
CTSA	Clinical and Translational Science Awards
DHHS	Department of Health and Human Services [US]
DNP	Doctor of Nursing Practice
EBM	Evidence-based Medicine
EBP	Evidence-based Practice
EDUCTRA	Education and Training in Health Informatics
EFMI	European Federation for Medical Informatics
EHR	Electronic Health Record
EMR	Electronic Medical Record
EMRAM	Electronic Medical Record Adoption Model (HIMSS)
ENRICH	Enhancing Research & Informatics Capacity for Health Information in Colombia
EU	European Union
EXPASY	Expert Protein Analysis System
FEMI	Federación Médica del Interior [Uruguay]
FOA	Funding Opportunity Announcement
G2HI	Gateway to Health Informatics [Singapore]
GBS	Graduate Biomedical Sciences
GHIP	Global Health Informatics Partnership
GMDS	German Medical Informatics Association
GNU	Refers to a free software license
GPRS	General Packet Radio Service
GWAS	Genome-wide Association Studies
HELINA	Health Informatics in Africa
HELP	Health Evaluation Through Logical Processing
HIBA	Hospital Italiano of Buenos Aires
HIBBS	Health Informatics Building Blocks
HIM	Health Information Management

HIMSS	Healthcare Information & Management Systems Society
HIMSTA	Health Information Management Systems Technology and Analysis
HIPAA	Health Insurance Portability & Accountability Act
HIT	Health Information Technology
HITECH	Health Information Technology for Economic & Clinical Health
HITPRO™	Health Information Technology Competency Exams
HSP	Hybrid Skills Development Program [Singapore]
ICT	Information and Communication Technologies
IDA	Infocommunications Development Authority [Singapore]
IMIA	International Medical Informatics Association
INFOMED	Telematic Network for Health [Cuba]
INS	Informatics Nursing Specialist
IOM	Institute of Medicine
IR	Information Retrieval
IS	Information Systems
ISD	Information Services Department
ISfTeH	International Society for Telemedicine and e-Health
IT	Information Technology
ITU	International Telecommunications Union
JAMA	Journal of the American Medical Association
JAMIA	Journal of the American Medical Informatics Association
KHI	Kigali Health Institute
LDS	Latter Day Saints
LMS	Learning Management System
MIT	Massachusetts Institute of Technology
MLAA	Medical Library Assistance Act
MOC	Maintenance of Certification
MOOC	Massive Open Online Course
MRI	Magnetic Resonance Imaging
MRS	Medical Record System [OpenMRS]
MSHIM	Master of Science in Health Information Management
MSN	Master of Science in Nursing
MU	Meaningful Use
MUMPS	Massachusetts General Hospital Utility Multi-Programming System
NCBI	National Center for Biotechnology Information
NCHS	National Center for Health Statistics
NCSBN	National Council for State Boards of Nursing
NEHR	National Electronic Health Record [Singapore]
NHIP	National Healthcare Information Project [Taiwan]
NIH	National Institutes of Health
NIHI	National Institutes of Health Informatics (Canada)
NLM	National Library of Medicine
NRSA	National Research Service Award
NTDC	National Training and Dissemination Center
NUR	National University of Rwanda

NUS	National University of Singapore
OER	Open Education Resources [OER Africa]
OHSU	Oregon Health & Science University
ONC	Office of the National Coordinator [for Health Information Technology]
PAHO	Pan American Health Organization
PDB	Protein Data Bank
PHR	Personal Health Record
proTICS	Professionalization Program in Information Technology & Communication in Health
PURE-HIT	Professional University Resources and Education for Health Information Technology
QUIPU	Andean Global Health Informatics Research & Training Center
RAFT	Reseau en Afrique Francophone pour la Télémédecine [Research in Africa for Telemedicine]
RCR	Responsible Conduct of Research
RDHI	Research and Development Health Informatics
REACH-Informatics	Regional East African Center for Health Informatics
REC	Regional Extension Center
REHCE	Regional e-Health Center of Excellence [Kigali]
REIMICOM	Malian Medical Information and Communication Network
RHIT	Registered Health Information Technician
RN-BC	Registered Nurse – Board Certified
SCAMC	Symposium on Computer Applications in Medical Care
SWOT	Strengths Weaknesses Opportunities Threats [Analysis]
TBI	Translational Bioinformatics
TIGER	Technology Informatics Guiding Education Reform
TMI	Thai Medical Informatics Association
TMT	Taiwan Electronic Medical Record Template
UAB	University of Alabama at Birmingham
UBT	University-based Training
UCSF	University of California-San Francisco
UIC	University of Illinois at Chicago
UP-HI	University Partnership for Health Informatics [University of Minnesota]
VistA	Veterans Health Information Systems and Technology Architecture
WEB	Workshop on Education in Bioinformatics
WHO	World Health Organization

Part I
Introduction to Lessons Learned

Chapter 1
Introduction and Overview

Eta S. Berner and Jacqueline A. Moss

Abstract With the increase in the use of health information technology in clinical and research settings there has been an increasing interest in the development of health and biomedical informatics education programs. This chapter describes the content of the book and the themes contained within it. In addition to the introductory and concluding sections, the book is divided into three sections: (1) Training Informatics Specialists in the U.S.; (2) Informatics Education for Other Health Professionals; and (3) Informatics Education Worldwide. Common themes across chapters include the multidisciplinary basis of informatics education, the identification of informatics competencies and criteria for certification of individuals and program accreditation, and the need to adapt to current and future healthcare delivery and informatics needs. In addition, strategies for online informatics education are discussed in many chapters. The book concludes with a synthesis of lessons learned.

In the last 20 years, there has been a proliferation in the number and types of informatics education programs. The interest in health and biomedical informatics education has increased dramatically in response to the increase in use of healthcare information technology (HIT) in both clinical and research settings. Accompanying the growth in these programs is the concurrent interest in the development

E.S. Berner, EdD, FACMI, FHIMSS (✉)
Department of Health Services Administration, School of Health Professions, University of Alabama at Birmingham, 1705 University Boulevard, Birmingham, AL 35294-1212, USA

Department of Medical Education, School of Medicine, University of Alabama at Birmingham, 1705 University Boulevard, Birmingham, AL 35294-1212, USA
e-mail: eberner@uab.edu

J.A. Moss, PhD, RN, FAAN
Department of Adult Health, School of Nursing, University of Alabama at Birmingham, NB 506, 1720 2nd Ave. South, Birmingham 35294-1212, AL, USA
e-mail: mossja@uab.edus

E.S. Berner (ed.), *Informatics Education in Healthcare*, Health Informatics,
DOI 10.1007/978-1-4471-4078-8_1,

of informatics certification processes and program accreditation standards. Some of the impetus for informatics education in the U.S. comes from the growing use of HIT in clinical settings as a result of the HITECH Act [1], a part of the American Recovery and Reinvestment Act, which tied adoption of Health IT to incentives from the Centers for Medicare and Medicaid Services (CMS). In research settings, drivers for the increased use of health IT include the growing interest in personalized medicine, the growth of the bioinformatics field, and the emphasis on biomedical informatics to support research as a part of the Clinical and Translational Science Awards (CTSA). In other countries, as in the U.S., as the technological infrastructure has grown there is also increasing use of HIT and the concomitant need for education not only for informatics professionals, but for the clinicians and others who will use the systems.

While there have been many definitions of informatics in the literature over the years [2–6], as well as in this book, it is more productive to examine the scope of the field, rather than a specific definition, when we talk about education in informatics in healthcare. The following description of the scope of the field was developed by the first author (ESB), with some recent adaptation, 15 years ago as a result of conversations with her students, each of whom thought the educational program they were entering was covering a different aspect of the field.

> Informatics involves developing and utilizing a broad range of **information technology** to facilitate the collection, management, exchange, analysis, use (and re-use) and storage of **patient** (**including clinical and genomic**), **fiscal**, **and administrative information** to support and improve (1) the **quality** of patient care and health outcomes, (2) **secure access** to information, (3) professional and organizational **efficiency**, and (4) the **decision making** capabilities of health professionals, administrators and others within the healthcare organization.

The highlighted areas above indicate that information technology supports the field, but the focus of informatics is on the **information**, rather than the technology per se. This book describes the major initiatives in informatics education, not only in the U.S., but worldwide. It includes education to produce informatics researchers, applied informatics practitioners, and informatics education programs for other healthcare practitioners as well. The focus is on the lessons learned from the variety of health and biomedical informatics programs, some of which are fairly young, while others have been established for decades. Although we will describe a variety of types of programs for different audiences, some common themes run through them.

Interdisciplinary Basis

The practice of informatics and therefore the education necessary for this practice draws on knowledge from a wide variety of disciplines. Informatics practice, and the research of phenomena central to this practice, involves knowledge that informs the optimal design of information systems for the optimization of data collection, delivery, and analysis, as well as usefulness and usability for end-users. All of the

relevant knowledge and skills related to aspects of organizational science, information science, human factors, computer science, and cognitive science must also be nested within the associated healthcare context. This context may be primarily driven by who will be the end users, such as in consumer informatics, nursing informatics or pharmacy informatics, or it may be driven by the setting, such as in public health informatics.

All informatics education programs, regardless of their healthcare focus, include content from these other related disciplines and apply this content to either the design of research for the generation of knowledge in informatics or the application of this knowledge to the practice environment. Each group applies this interdisciplinary content in relation to their healthcare focus, however all informatics specialties are based on the same or very similar theoretical underpinnings. Several of the chapters in this book explicitly describe curricular content in some detail and the interdisciplinary nature of the content is obvious.

Informatics Competencies

Another consistent theme echoed by multiple contributors to this edition, is the assertion that all healthcare professionals require basic competencies in the use of information technology to work in today's technology rich environment. A competency is 'an expected level of performance that integrates knowledge, skills, abilities, and judgment' [7] (page 12). First, all healthcare professionals need to acquire basic computer competencies to be able to interact, not only with electronic medical records, but also with a variety of patient and information and communication technologies that are increasingly a part of every aspect of healthcare. Second, every healthcare professional needs to be information literate. Finding, evaluating, and synthesizing the best evidence helps ensure that patients receive the highest level of care available from their providers. Those managing the organization and delivery of this care require current and accurate information on how to effectively and efficiently manage care access and organizational resources. Finally, all healthcare professionals require basic competencies related to the management and analysis of data. Development of data management competencies enables individuals and organizations to understand the need for ensuring the privacy and confidentiality of data, standardized data collection, and patient and organizational outcomes analysis. Chapters 4, 9, and 10 in particular list competencies that reflect these emphases and provide references that include the recommended competencies in more detail.

Standards for Certification and Accreditation

As the field of informatics education has matured there has been an increasing interest in certification of individuals' competencies and accreditation of informatics education and training programs that produced these individuals. Different

organizations are often involved in certification of individuals than are involved in the accreditation of the programs preparing these students. The International Medical Informatics Association has focused on informatics education program accreditation on a worldwide basis [8]. In this book we include other examples of accreditation efforts. For instance, as described in Chap. 10, the Commission on Accreditation of Healthcare Management Education (CAHME) is responsible for accrediting programs in healthcare management. Within their accreditation guidelines are the information management competencies that are expected to be taught. None of these accreditation programs oversees a certification program for individuals. On the other hand, there are certification programs for individuals that are not specifically tied to program accreditation. The HITPRO examination that was initially designed for students graduating from the ONC-funded workforce program (see Chap. 7) does not require specific educational preparation for the credential. The CPHIMS credential, administered by the Health Information and Management Systems Society (HIMSS), that is designed to certify healthcare IT managers like those described in Chap. 6, also does not prescribe specific educational preparation. The American Nurses Credentialing Center (ANCC) in association with the American Nurses Association offers a credential for nurse informatics specialists (Chap. 5), but a different organization, the American Association of Colleges of Nursing (AACN), is involved in accrediting nursing education programs. Graduating from an accredited program is not required for eligibility for the certification examination. On the other hand, the new clinical informatics subspecialty examination for physicians described in Chap. 4 is closely tied to preparation in an accredited training program, especially after the first five years of the examination. Although the program accreditation will be done by the Accreditation Council for Graduate Medical Education (ACGME), there is close collaboration in this case between the organizations that certify individuals and accredit programs.

Currently, very few of the informatics training programs that are described in this book have undergone formal accreditation, although the Commission on Accreditation for Health Informatics and Information Management Education (CAHIIM) [9], which began as a Health Information Management (HIM) accrediting body, has now added health informatics to its name and some informatics programs are starting to seek accreditation from them. As informatics education programs proliferate and more individuals are trained, we can expect to see that both individual certification and informatics education accreditation will become more important.

Adaptation to Current and Future Needs

One of the challenges of developing informatics education programs in today's world is that the world keeps changing and the change is in the direction of requiring more and varied informatics competencies, even if one is not an "informatician" and especially if one is. 'Big data' and 'data science' have become buzzwords [10], but being able to use the data that, with the help of electronic health records we are

now able to collect, will require some traditional and some new informatics competencies. Similarly, the focus on Meaningful Use in the U.S. [11] is leading to more interest in informatics-trained professionals (see Chaps. 4 and 7). New developments in genomic research have spurred the development of programs in bioinformatics education (Chap. 11), as well as programs for translational scientists [12] that integrate both clinical and bioinformatics (Chap. 12). Existing programs for health professionals have also seen the need to incorporate informatics into the basic educational preparation of clinicians (Chaps. 5 and 9) and other health professionals (Chap. 10). Chapter 6 focuses directly on the need to adapt curricula to a changing external environment, but virtually all of the chapters recognize that informatics competencies will change and evolve as the environment in which they apply changes.

Online Education

One of the major changes that has been occurring in education generally, and informatics is no exception, is a trend toward more and more education being delivered online via distance learning technology. Several programs described in this book are either primarily or entirely delivered online (see Chaps. 5, 6, 7, 8, 11, 12, 13, and 14). Examples of online curriculum content, strategies for creating online content, and feasible methods of content delivery are included in these chapters. Chapter 2 is focused exclusively on online education, specifically on the different assumptions and expectations of students and teachers in online education as compared to face-to-face programs. While the focus of this book is on informatics education, and not distance learning per se, there is a great deal of information for those who want to start a distance-accessible informatics education program.

Arrangement and Focus of Book

This book is arranged in three major sections with an introductory and concluding section. This overview and the chapter on online education (Chap. 2) form the introductory section. The three major sections include chapters on:

1. Training Informatics Specialists in the U.S.
2. Informatics Education for Other Health Professionals
3. Informatics Education Worldwide

The section on training informatics specialists in the U.S. includes chapters on the National Library of Medicine (NLM) training programs (Chap. 3), the curricula and certification procedures for the clinical informatics medical subspecialty (Chap. 4), programs to train IT managers and other IT and informatics workforce professionals (Chaps. 6 and 7), and continuing education in informatics, specifically