

Health Informatics

Series Editors: Kathryn J. Hannah · Marion J. Ball

Alfred Winter · Reinhold Haux
Elske Ammenwerth · Birgit Brigl
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Health Information Systems

Architectures and Strategies

2nd Edition

 Springer

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With a Foreword by Reed M. Gardner

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Dedicated to Prof. Dr. Claus O. Köhler (1935-2008)

“Any technology sets a relationship between human beings and their environment, both physical and human. No technology can be seen as merely instrumental. This is especially relevant when dealing with large automatic information systems, developed to contribute to the management and integration of large organizations, such as hospitals.”

Jean-Marie Fessler and Francois Grémy (first recipient of the IMIA Award of Excellence). Ethical Problems with Health Information Systems. *Methods of Information in Medicine* 2001; 40: 359-61.

“1.1 Why Do We Need Biomedical and Health Informatics [BMHI] Education?

Despite the documented benefits, there are still barriers to HIT [health information technology] in clinical settings, including a mismatch of return on investment between those who pay and those who benefit, challenges to ameliorate workflow in clinical settings, lack of standards and interoperability, and concerns about privacy and confidentiality

Another barrier, lesser studied and quantified but increasingly recognized, is the lack of characterization of the workforce and its training needed to most effectively implement HIT systems ... This has led to calls for BMHI to become a professional discipline ... and for it to acquire the attributes of a profession, such as a well-defined set of competencies ...

...

Table 2: Recommended ... learning outcomes in terms of levels of knowledge and skills for professionals in healthcare ...

...

1.6 Characteristics, functionalities and examples of information systems in healthcare ...

1.7 Architectures of information systems in healthcare ...

1.8 Management of information systems in healthcare ...

...”

Recommendations of the International Medical Informatics Association (IMIA) on Education in Biomedical and Health Informatics - 1st Revision. *Methods of Information in Medicine* 2010; 49: 105-120.

Foreword from the 1st Edition in 2004

Healthcare management is a complex and ever-changing task. As medical knowledge increases, as clinical management strategies or administrative management strategies change, and as patients move from one city to another or from one country to another, the challenges of managing healthcare have changed and will continue to change. Central to all of these changes is a need to store and process administrative and clinical records for the patient. For the reasons listed above, computerization of record systems in hospitals and clinics has been and continues to be a slow and complex process. Developing a strategy to provide the best healthcare service at the lowest possible cost is a common goal of almost every healthcare system in the world. Care given in the hospital is typically the most advanced, the most complex, and the most expensive. As a consequence, understanding and managing healthcare in hospitals is crucial to every healthcare delivery system. This book provides a wonderful overview for students and medical informatics professionals. It also provides the background that every medical informatics specialist needs to understand and manage the complexities of hospital information systems.

This book deals primarily with the underlying administrative systems that are in place in hospitals throughout the world. These systems are fundamental to the development and implementation of the even more challenging systems that acquire, process, and manage the patient's clinical information. Hospital information systems provide a major part of the information needed by those paying for healthcare, be they hospital administrators, health insurance companies, public health authorities, or local or national political leaders. As a consequence an important and complex set of strategies has been implemented to document medical problems and procedures that hospitals are dealing with. Problems are usually coded with International Classification of Diseases (ICD-9 or ICD-10) coding systems while medical procedures are designated using Current Procedural Terminology (CPT) codes. Typically, these codes are used to generate bills to an insurance company or governmental unit. As a consequence, these data must be generated, transmitted, and processed accurately and promptly. Computer technology enhances the ability of hospital clinical and administrative staff to provide these data.

Because of the complexities and changing needs of medical information, the field of medical informatics is in need of a growing number of professionals who understand how to use computers and are familiar with the administrative requirements of the healthcare field and clinical medicine. Having a person who has knowledge in all of these fields is unusual. However, I am convinced that the rate at which medicine is able to better use computer technology is limited by the lack of a sufficient number of well-trained professionals who have an understanding of all of these fields. As a consequence, I congratulate each of you who is studying hospital information systems and encourage you to take what you will learn from this book and move the field forward.

After you have an understanding of what is presented in this text, I encourage you to take on the challenge of clinical informatics. Study and learn how computers can be used to advantage by those providing clinical care – physicians, nurses, pharmacists, therapists, and other caregivers. In the future we must all work toward developing computer and communications systems that will enhance the acquisition of clinical data so that the data can be used to provide better patient care and more efficient and better administrative documentation.

Enjoy this book. Its clearly written materials and exercises should give every reader a challenge and opportunity to learn. I found Appendix A, the thesaurus, a treasure of important information. The thesaurus will be very handy for everyone for years to come. I congratulate the authors for their knowledge, skillfulness, and dedication in writing and publishing this book.

Salt Lake City, Utah, USA

Reed Gardner

Series Preface

This series is directed to healthcare professionals leading the transformation of healthcare by using information and knowledge. For over 20 years, Health Informatics has offered a broad range of titles: some address specific professions such as nursing, medicine, and health administration; others cover special areas of practice such as trauma and radiology; still other books in the series focus on interdisciplinary issues, such as the computer-based patient record, electronic health records, and networked healthcare systems. Editors and authors, eminent experts in their fields, offer their accounts of innovations in health informatics. Increasingly, these accounts go beyond hardware and software to address the role of information in influencing the transformation of healthcare delivery systems around the world. The series also increasingly focuses on the users of the information and systems: the organizational, behavioral, and societal changes that accompany the diffusion of information technology in health services environments.

Developments in healthcare delivery are constant; in recent years, bioinformatics has emerged as a new field in health informatics to support emerging and ongoing developments in molecular biology. At the same time, further evolution of the field of health informatics is reflected in the introduction of concepts at the macro or health systems delivery level with major national initiatives related to electronic health records (EHR), data standards, and public health informatics.

These changes will continue to shape health services in the twenty-first century. By making full and creative use of the technology to tame data and to transform information, Health Informatics will foster the development and use of new knowledge in healthcare.

*Kathryn J. Hannah
Marion J. Ball*

Preface for the 2nd Edition

In 2004, the textbook “Strategic Information Management in Hospitals – An Introduction to Hospital Information Systems” appeared in this Health Informatics Series of Springer. The book was received well and belongs – according to the publishing house – to the top selling books of this series.

Five years after its appearance, both Springer and we as authors felt the need to prepare a 2nd edition. In this 2nd edition we wanted to consider the progress in our field and also the lessons learned from our students, when using the book in our lectures, e.g. in the international “Frank van Swieten Lectures on Strategic Information Management in Hospitals” (International Journal of Medical Informatics 2004; 73, 97-100 and 807-15). Also, due to the changed perception of information systems in healthcare, which are no longer limited to single institutions like hospitals, but can embrace several healthcare institutions within healthcare networks, this revision has become necessary.

With this book on “Health Information Systems – Architectures and Strategies” we have prepared a substantially revised and elaborated 2nd edition.

What are the major differences from the 1st edition, which appeared in 2004? We shifted the focus from hospital information systems and their strategic management to strategic information management of health information systems. However, information systems in hospitals still play a major role in the book. All contents have been carefully updated. The book has been restructured in order to improve the use as a textbook for lectures on health information systems.

In addition to the four authors of the 1st edition, two new authors (N.H., F.J.) have also contributed to this edition. For the 2nd edition we also invited an international board of experts – CIOs and researchers in the field of health information systems – to give us their advice and comments, including examples and use cases.

All authors have been either directly or indirectly influenced by the visionary views on health information systems of Claus O. Köhler. Dr. Köhler was Professor of Medical Informatics at the German Cancer Research Center in Heidelberg, Germany, and long-term faculty member at the Heidelberg/Heilbronn Medical Informatics Program. His book on the 'integrated hospital information system', which appeared in Germany in 1973, significantly influenced the development of health information systems at least in Germany. Claus passed away in 2008. We want to dedicate this book to him.

Alfred Winter
Reinhold Haux
Elske Ammenwerth
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Acknowledgements for the 2nd Edition

Also for this 2nd edition we want to express our cordial thanks to all colleagues, contributing to this book, in particular to Bakheet Aldosari, Carl Dujat, Christopher Duwenkamp, Marco Eichelberg, Gert Funkat, Mowafa Househ, Alexander Hörbst, Florian Immenroth, Hagen Kosock, Michael Marschollek, Bassima Saddik, Paul Schmücker, Claudia Siemers-Marschollek, and Thomas Wendt.

We are grateful to the members of the book's International Advisory Board – leading CIOs and researchers in the field of health information systems – for spending their time in commenting on this book and giving us significant advice. It is our hope that we could well include these comments.

The members of the book's International Advisory Board are Dominik Aronsky (Nashville, USA), Willem Jan ter Burg (Amsterdam, The Netherlands), Young Moon Chae (Seoul, Korea), Andrew Grant (Sherbrooke, Canada), Rada Hussein (Cairo, Egypt), Georg Lechleitner (Innsbruck, Austria), Christoph U. Lehmann (Baltimore, USA), Dirk May (Hannover, Germany), Fernán González Bernaldo de Quirós (Buenos Aires, Argentina), Christoph Seidel (Braunschweig, Germany), Amnon Shabo (Haifa, Israel), Jan Erik Slot (Amsterdam, The Netherlands), Katsuhiko Takabayashi (Chiba, Japan), and Majid Al Tuwaijri (Riyadh, Saudi Arabia).

Again, our students helped us a lot by evaluating our lectures and by providing us with many constructive ideas and helpful comments. In addition, we thank Ulrike Weber who designed a lot of the figures in this book.

Acknowledgements for the 1st Edition

We would like to express our thanks to all of our colleagues who contributed to this book, especially Reed Gardner, who commented on it and wrote the Foreword. Thanks also to many other people who helped to produce this book, especially Frieda Kaiser and Gudrun Hübner-Bloder.

We would also like to thank the following colleagues for helping to obtain figures and screen shots: Marc Batschkus, Thomas Bürkle, Andrew Grant, Torsten Happek, Marianne Kandert, Thomas Kauer, Georg Lechleitner, Otwin Linderkamp, André Michel, Gerhard Mönnich, Oliver Reinhard, Christof Seggewies, Pierre Tetrault, Raimund Vogl, and Immanuel Wilhelmy. In particular, we are grateful to Ursula and Markus Beutelspacher for allowing us to take a picture of their Heidelberg quintuplets for the cover (quintuplet picture by Bernd Krug).

Not least, we want to thank our students, who kept asking critical questions and drew our attention to incomplete and indistinct arguments.

Annotation to the Figures

All persons shown in the photos have given their permission. With the exception of the Heidelberg quintuplets, no real patients are shown. The patients in the figures are mostly the authors, their families, or medical informatics VIPs. We have partly used screen shots from commercial software products in this book. This use cannot be regarded as a recommendation for those products. We only want to illustrate typical functionality and typical user interfaces of software products that support specific hospital functions. Therefore, we did not mention the product names.