CLINICAL INFORMATICS

Andre Kushniruk
School of Health Information Science, University of Victoria, Victoria, British Columbia, Canada

Joseph Kannry
Mt. Sinai Medical Center, New York, New York, U.S.A.

Keywords: clinical informatics, electronic health records, electronic medical records, clinical decision support systems, clinical information systems

Contents

Summary

Clinical informatics involves the design and deployment of health information systems to support clinical activities and facilitate healthcare. As such, developments in clinical informatics have spanned the past several decades and have been developed in response to the limitations of traditional paper-based approaches to documenting, supporting and structuring healthcare. Clinical informatics has its origin in the 1960's and 1970's with the concept of "medical information systems" which has encompassed electronic storage and access of patient data and began to be integrated and extended to storage and retrieval of digital and multimedia images and data. Currently the electronic health record (EHR) is the central application in clinical informatics around which considerable effort and expense is being paid. The EHR is conceived as being an electronic repository for a range of data (including clinical data) collected about individuals, with the electronic medical record (EMR), the electronic patient record (EPR) and the personal health record being related types of systems that are encompassed by the EHR. Other clinical information systems

include clinical decision support systems (CDSSs) which are designed to aid and facilitate clinical decision making, and a range of supporting systems including imaging systems, monitoring systems and clinical departmental systems. Despite the promise of many of these information systems and their associated technological advances, widespread implementation of clinical information systems has proven more difficult than expected. This chapter also discusses a number of the issues that have been encountered in implementing clinical information systems.

1. Introduction

Over the past several decades a wide variety of information technologies have been deployed within an ever increasing variety of clinical and healthcare settings in an effort to streamline and modernize healthcare delivery. Much of this effort has been in response to the limitations of ways that healthcare information has traditionally been collected, retrieved and communicated. For example, the limitations of handwritten paper-based medical records, which have been the predominant form of recording patient and medical information for over a century, have been well documented (Shortliffe & Cimino, 2006). This includes difficulty in obtaining information stored in paper-based records, illegibility of handwritten notes and lack of ability to connect information in the paper-based record with other relevant data being stored in growing clinical, hospital, regional and national health databases and repositories. Conventional approaches to managing healthcare information that met the needs of healthcare professionals and organizations in past decades have not scaled well to the current information needs of modern healthcare (Shortliffe & Cimino, 2006).

In response to this need, a wide range of computer-based information technologies have been designed and deployed, ranging from systems designed to support retrieval of basic patient data to physician order entry systems designed to support ordering of medications by healthcare workers in clinical settings (Borycki & Kushniruk, 2005). However, despite the promise of information technology for improving healthcare, much of the current healthcare system worldwide continues to be based on outmoded traditional models for information management and exchange. Furthermore, studies examining the potential benefits of the introduction of healthcare technology are mixed and some studies have indicated that information technology that is not designed or deployed properly may lead to little or no benefit (Chaudhry, Wang, Wu, Maglione, Mojica, Roth, et al., 2006). This is a consequence of a range of difficulties encountered in attempting to modernize healthcare using information technology, both technical and non-technical. In this chapter we will discuss the evolution of information systems designed predominantly for clinical use, the types of clinical information systems being developed and some of the current and future issues in developing such systems. The focus on this chapter will be on clinical informatics, which focuses on the design, development and deployment of information technology to support clinical activities.

2. Background: The Origins of Clinical Informatics

Since the introduction of computers in health care settings in the 1950's, they have continued to evolve considerably. Early systems were limited in scope and were often designed to deal with specific healthcare applications, such as systems for housing

information about laboratory results, obtaining ECG results, library retrieval systems and niche research applications. These applications were task oriented in that they focused on a specific information service or function (and typically functioned in isolation). According to Ledley and Lusted an information service consists of the following: a system for organizing and documenting information in a file, a method for locating this information and a method for keeping the information up to date (Collen, 1995). The concept of the "medical information system" soon emerged as a formal arrangement by which facts about a patient were stored, organized and retrieved. Throughout the 1960's medical information systems evolved and were spurred by advances in computer science, including solid-state integrated circuits, advances in database technologies. During the 1970's database technology had evolved considerably and spurred further developments of information systems in healthcare along with a trend towards integration of systems. Clinical information systems began to be integrated into a complex mesh of multiple subsystems embedded throughout organizations such as hospitals and clinics. Clinical information systems (CISs) refer to those systems which are related to the direct care of patients and form the focus of this chapter.

-
-
-

TO ACCESS ALL THE **10 PAGES** OF THIS CHAPTER,
Visit: http://www.eolss.net/Eolss-sampleAllChapter.aspx

Bibliography

Borycki, E., and Kushniruk, A.W. (2005). Identifying and preventing technology-induced error using simulations: Application of usability engineering techniques. *Healthcare Quarterly*, 8, 99-105. [This article details an approach to the study of clinical information systems that can detect and prevent technology-induced errors before releasing systems in real clinical settings]

Collen, M.,F. (1995). A history of medical informatics in the United States. Indianapolis: American Medical Informatics Association. [This book provides a comprehensive overview of the history of medical information systems in the United States and provides excellent context for considering the evolution of the full range of clinical information systems]

Chaudhry, B.,Wang, J.,Wu, S., Maglione, M., Mojica, W., Roth, E. et al. (2006). Systematic review: Impact of health information technology on quality, efficiency, and costs of medical care. Annals of Internal Medicine, 144:E-12-E-22. [This article provides an up-to-date systematic review of evidence about the impact of healthcare technology on quality, efficiency and costs of clinical care]

Gardner, R.M., & Shabot, M.M. (2006). Patient-monitoring systems. In Shortliffe, E. H., and Cimino, J. J. (Eds.). Biomedical informatics : computer applications in health care and biomedicine (3rd ed.). New York, NY: Springer.[This chapter provides an excellent discussion of advances in patient-monitoring and the evolution of monitoring systems in clinical informatics]

Grant, A., Kushniruk, A., Villeneuve, A., Bolduc, N, & Moshyk, A. (2004). An informatics perspective on decision support and the process of decision-making in health care. In L. Lemieux-Charles & F. Champaigne (Eds.) Using Knowledge and Evidence in Health Care: Multidisciplinary Perspectives, Toronto: University of Toronto Press. [This chapter provides an overview of clinical decision support systems, including their history, evolution and current issues]

Kannry, J. (in press). Operationalizing the science: Integrating clinical informatics into the daily operations of the medical center. In A.W. Kushniruk & E. Borycki (Eds.) Human, Social and Organizational Aspects of Health Information Systems, Hershey, Pennsylvania: IGI Press. [This articles argues for the need for the integration of clinical informatics into the daily operations of medical centers and the need to bring research finding from health informatics into practice]

Miller, R.A., & Masarie, F.E. (1989). The demise of the 'Greek Oracle' model for medical diagnostic systems. Methods of Information in Medicine, 29, 1-2. [This landmark paper argues for the application of decision support in clinical settings that truly supports human clinical practice rather than attempting to replace it]

Protti, D. (in press). A comparison of how Canada, England and Denmark are managing their electronic health record journeys. In A.W. Kushniruk & E. Borycki (Eds.) Human, Social and Organizational Aspects of Health Information Systems, Hershey, Penn.: IGI Press. [This book chapter describes the journeys taken by three different countries in attempting to integrate electronic health records into routine healthcare practice]

Shortliffe, E. H., and Cimino, J. J. (2006). *Biomedical informatics : computer applications in health care and biomedicine* (3rd ed.). New York, NY: Springer. [This is a comprehensive textbook on biomedical informatics with chapters written by leading experts in each subfield of biomedical informatics]

Van Ginneken, A.M., van Bemmel, J.H., Moorman, P.W. (1997). Clinical departmental systems. In van Bemmel, J.H., Musen, M.A. (Eds). Handbook of Medical Informatics. Springer: Heidelberg, Germany [This book chapter provides excellent background on a range of clinical departmental systems]

van Bemmel, J.H., Musen, M.A. (1997). Handbook of Medical Informatics. Springer: Heidelberg, Germany. [This book provides an excellent overview of the field of medical informatics, with numerous chapters dealing with clinical informatics and related information technologies]

Biographical Sketches

Dr. Andre Kushniruk is an Associate Professor and Director of the School of Health Information Science at the University of Victoria. Dr. Kushniruk conducts research in a number of areas including evaluation of the effects of technology, human-computer interaction in health care and other domains as well as cognitive science. His work is known internationally and he has published widely in the area of health informatics. He holds undergraduate degrees in Psychology and Biology, as well as a M.Sc. in Computer Science and a Ph.D. in Cognitive Psychology. He focuses on developing new methods for the evaluation of information technology and studying human-computer interaction in health care and he has been a key researcher on a number of national and international collaborative projects.

Joseph Kannry, MD, has dual appointments in IT and Medicine at Mount Sinai Medical Center in New York. He is chief, Division of Clinical Informatics, Mount Sinai Center and director of the Center for Medical informatics and Director of IT for the Department of Medicine. Dr. Kannry is an Assistant Professor in Medicine and a practicing board certified Internist. In 2004 Dr. Kannry successfully led the Ambulatory EMR Selection process for Mount Sinai Medical Center and in 2005 was the Informaticist in charge of EMR implementation.