

Chapter 1

Intelligent Decision Support Systems in Healthcare

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Abstract. This chapter presents an overview of some of the most recent advances in the application of decision support systems in healthcare. A summary of the chapters on clinical decision support systems, rehabilitation decision support systems, and some current factors involving technology acceptance is presented.

1 Introduction

The field of intelligent support systems in healthcare is expanding at a rapid pace. This pace is driven by an information avalanche in health data that is unprecedented. Healthcare is incomprehensively more complex than it was at the beginning of the last century. There is no reason to believe that this complexity and the amount of new information entering the medical field will do anything more than continue to snowball. More players inside and outside of healthcare are involved in every aspect of medical care. Decision supports systems are needed if the healthcare system is successfully to navigate this turbulent environment.

The chapters presented in this volume serve as an excellent introduction to some of the opportunities being offered by the current climate. General purpose data mining techniques are being developed that can handle massive stockpiles of disparate data, and the application of decision support systems is moving into new areas, such as rehabilitation. Each of these is explored in this volume.

The chapters in this book also look hard at some of the problems being faced by the medical field. Of primary importance is the development of innovative intelligent support systems that work well with others and that can handle multiple sources of information. Medical units no longer work in isolation. They must now work together while simultaneously maintaining the autonomy needed to incorporate new

information and the latest technologies. Systems must be developed that can orchestrate the complex work flow. Robust systems that can handle uncertainty also need to be developed.

Finally, the chapters in this book draw attention to the human element. There is the public concern for maintaining privacy while nonetheless providing information to those who need it. Governmental restrictions and policies are constantly balancing the rights and needs of its citizens when it comes to healthcare. This political element must be addressed. Decision support systems must now be flexible enough to handle changes in policy. Clinical decision support systems of the future will need to consider the constraints and uncertain relationship that will exist between technology and the regulations that govern medical data. The chapters also stress that even the best systems can fail if they do not address the needs of the medical practitioners and patients using these systems.

2 Decision Support in Healthcare

The chapters included in this book are divided into the following three parts:

- Part I: Clinical Decision Support Systems
- Part II: Rehabilitation Decision Support Systems
- Part III: Technology Acceptance in Medical Decision Support Systems

The chapters in Part I provide an interesting selection of problems that range from decision support systems that assist health professionals in coordinating procedures across domains to a detailed description of two diagnostic support system approaches: a general-purpose diagnostic decision support system using classifier ensembles and a medical diagnostic support system that combines multiagent system theory, the holonic paradigm, swarm intelligence, and decision theory. We introduce Part I with a chapter that discusses an important desideratum for CDSS, namely, the electronic medical record (EMR). These records are at the heart of many clinical decision support systems and provide an invaluable treasure trove of information that could result in many new advances if properly mined.

In Part II, we focus on new developments in building decision support systems for rehabilitation. The three chapters in this section cover data mining approaches for predicting pregnancy rate successes, gaming for rehabilitation, and intelligent decision-support in virtual reality rehabilitation.

In Part III, we look at often neglected aspects in system design that impact the acceptance and success of decision support systems.

Below we provide a synopsis of each of the ten chapters following this chapter in this book.

Part I: Clinical Decision Support Systems (CDSS)

In chapter 2, *Virtualizing Health Records in the Context of Government Regulations*, Michael Meehan focuses on the constraints that privacy standards, such as HIPAA (Health Insurance Portability and Accountability Act) enacted by the U.S.