

# Chapter 48

## Mental Health Clinical Decision Support Exploiting Big Data

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### ABSTRACT

*The complexity of clinical decision-making is immensely increasing with the advent of big data with a clinical relevance. Clinical decision systems represent useful e-health tools applicable to various tasks within the clinical decision-making process. This chapter is devoted to basic principles of clinical decision support systems and their benefits for healthcare and patient safety. Big data is crucial input for clinical decision support systems and is helpful in the task to find the diagnosis, prognosis, and therapy. Statistical challenges of analyzing big data in psychiatry are overviewed, with a particular interest for psychiatry. Various barriers preventing telemedicine tools from expanding to the field of mental health are discussed. The development of decision support systems is claimed here to play a key role in the development of information-based medicine, particularly in psychiatry. Information technology will be ultimately able to combine various information sources including big data to present and enforce a holistic information-based approach to psychiatric care.*

### INTRODUCTION

The objective of this chapter is to discuss clinical decision support systems, their benefits, the importance of big data for clinical decision making, and their analysis within clinical decision support. Particular attention is paid here to psychiatry, namely to its specific features preventing telemedicine tools to become more widely spread or to specifics of statistical analysis of psychiatric data.

First, general principles of decision support systems together with their potential and limitations will be described. Recommendations for the design, implementation and validation stages are given, stressing that clinical decision support systems may bring new unexpected sources of errors which must be anticipated. While modern technology undergoing a dynamic progress allows a more effective diagnosis and therapy, the increase in effectiveness does not necessarily imply higher safety of patients and thus the criteria of effectiveness and safety must be considered jointly.

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The interest in clinical decision support for the particular field of psychiatry penetrates throughout this chapter. While decision support systems are generally acknowledged to have potential for increasing the quality of healthcare, they have not apparently penetrated to a routine usage in psychiatry yet. Therefore, distinctive challenges for the development of telemental healthcare tools are discussed based on literature research on recent references. Decision support systems contribute to the shift of clinical practice to the ideals described as information-based medicine, which will include the analysis of big data as its integral part. Within psychiatry, there will be a need to overcome specific and rather serious barriers before the mental healthcare can reach the ideals of the information-based psychiatry.

## **CLINICAL DECISION SUPPORT SYSTEMS WITHIN CURRENT HEALTHCARE**

Medical decision making can be described as a process of selecting an activity or series of activities among several alternatives integrating uncertainty as one of its intrinsic aspects with an influence on healthcare (Zvárová & Zvára, 2011). The physician solves the medical decision-making task based on knowledge and data connected to the cognition and determination of diagnosis, therapy and prognosis (Berner, 2016). Decision support systems can be described as very complex systems with a potential to compare different possibilities in terms of their risk. Thus, they represent potentially very useful and powerful e-health tools for the clinical decision-making process, capable to solve a variety of tasks, to analyze different information components, to extract information of different types, and deduce conclusions from them. While the first systems based only on expert knowledge were not sufficiently successful, improved performance has been obtained with systems learning the knowledge from clinically relevant data.

Up to now, clinical decision support systems have established their place as inherent part of e-health with an indisputable ability to improve clinical decision making and with a facility to contribute to a further transformation of clinical medicine (Hanson & Levin, 2013; Lech et al., 2014). There are specialized decision support systems focused on finding the diagnosis within individual clinical fields or prescription of medicaments. However, the search for the appropriate therapy is more complex and depends on many factors and only a few decision support systems aiming at therapy have been sufficiently evaluated up to now. There has been even less attention paid to decision support systems for prognosis, while there are still obstacles to apply decision support systems in healthcare routinely, although everyday healthcare would greatly benefit from reliable interdisciplinary and multidisciplinary systems.

## **DEVELOPING CLINICAL DECISION SUPPORT SYSTEMS**

Designing and implementing a decision support system is a very complex and demanding process. The usage of decision support systems is strongly dependent on factors of legal, social, technical, economical and ethical environment. If the systems should offer a truly unobtrusive and easy-to-use interface, they must meet the needs of the particular healthcare providers and therefore their introduction requires changing organizational and workflow issues of hospitals as well as their healthcare specialists. Also, it is important to realize that adopting a foreign decision support system typically requires translating the system to the local language together with accommodating all details to the local environment.

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