

Chapter 10

Business Intelligence and Nosocomial Infection Decision Making

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ABSTRACT

The implementation of Business Intelligence tools in healthcare organizations helps the managers and the healthcare professionals in their decision making process through data manipulation and data analysis. The main goal of this chapter is to evaluate the applicability of the Business Intelligence tools and concepts to healthcare and their performance as a Clinical Decision Support System, analyzing the evolution of nosocomial infection in the Centro Hospitalar do Porto, by defining a set of indicators that can help the nosocomial infection management and inducing Data Mining models to predict the occurrence of nosocomial infections (sensitivity of 91%). The knowledge obtained with the analysis of the indicators and the knowledge obtained with the nosocomial infection prediction can be applied by healthcare professionals in their decision making. Through the analysis of the data collected, Business Intelligence tools help overcome the problems associated with the complexity, heterogeneity, and distributiveness present in the healthcare environment.

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INTRODUCTION

With technological advancement, health organizations have been increasingly adopting information systems. The Health Information Systems (HIS) handle data processing, information and knowledge in healthcare environments (Winter, Haux, Ammenwerth, Brigl, Hellrung, & Jahn, 2011). The Electronic Health Record (EHR) is a HIS which covers the various services and units of a healthcare organization. It consists in a set of standardized documents, compiled by health professionals, for the registration of the medical procedures provided to a particular patient. The EHR main goal is to improve the provision of healthcare to patients, which is the task of all of those who work in hospitals. The EHR brings the new information technologies in all its aspects, aiming to eliminate paper and consequently, to expedite and to improve the healthcare delivery to the patients (Duarte, Portela, Abelha, Machado, & Santos, 2011; Hasman, 1998; Salazar, Duarte, Pereira, Portela, Santos, Abelha, & Machado, 2013).

Besides registration, consultation and research of all clinical information, resulting from the provision of healthcare to a particular patient, the EHR also allows the prescription of medicines and complementary means of diagnosis such as exams, called electronic medical prescription (Simões, Gomes, & Paiva, 2009).

The electronic medical prescription is a procedure performed through the use of information and communication technologies, in this case applications certified by the regulatory organization of healthcare services in Portugal, called *Serviços Partilhados do Ministério da Saúde* (SPMS) (Ministério da Saúde, 2014).

The healthcare environment is characterized by a highly distributed and heterogeneous computational environment, where different systems and people need to be in contact and to communicate, exchanging data and knowledge that are indispensable for decision making (Cardoso,

Marins, Portela, Santos, Abelha, & Machado, 2014; Machado, Alves, Abelha, & Neves, 2007). In addition, the healthcare environment and its processes are extremely dynamic, complex and multidisciplinary (Rebuge & Ferreira, 2012).

However, more and more healthcare organizations act constantly under financial pressure, forcing them to improve the efficiency of their activities and processes and applying their resources as efficiently as possible in order to improve the quality of services (Foshay & Kuziemy, 2014; Rebuge & Ferreira, 2012).

In the healthcare sector it is very important to make fast and quality decisions because the decisions are frequently related to the human well-being. Furthermore, the healthcare decision making is always a very complex process and to be correct, it requires high quality information (Foshay & Kuziemy, 2014; Lenz & Reichert, 2007).

Nowadays, with the implementation of Information Technologies (IT) in the healthcare organizations, the amounts of data collected have exponentially increased (Spruit, Vroon, & Batenburg, 2014). In the healthcare environment, decision support is mostly related to knowledge that can be extracted from the collected data, which makes the information management essential for these organizations (Lenz & Reichert, 2007). Thus, the extraction, analysis and presentation of the information in an useful and timely manner can reduce costs and improve the quality, safety and efficiency of healthcare delivery, once they allow a more rational decision. In consequence, the implementation of knowledge extraction techniques became a fundamental operation to support healthcare organizations, because they support the extraction of rich and quality information that can be applied in decision making. These decisions can be related to clinical and/or administrative issues (Mettler & Vimarlund, 2009; Spruit et al., 2014).

Thus, the decision process and the Clinical Decision Support Systems (CDSS) are fundamental for the actual healthcare organizations. The

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