Chapter 8
Data Warehouse Facilitating Evidence-Based Medicine

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ABSTRACT

In the past, much effort of healthcare decision support systems were focused on the data acquisition and storage, in order to allow the use of this data at some later point in time. Medical data was used in static manner, for analytical purposes, in order to verify the undertaken decisions. Due to the immense volumes of medical data, the architecture of the future healthcare decision support systems focus more on interoperability than on integration. With the raising need for the creation of unified knowledge base, the federated approach to distributed data warehouses (DWH) is getting increasing attention. The exploitation of evidence-based guidelines becomes a priority concern, as the awareness of the importance of knowledge management rises. Consequently, interoperability between medical information systems is becoming a necessity in modern health care. Under strong security measures, health care organizations are striking to unite and share their (partly very high sensitive) data assets in order to achieve a wider knowledge base and to provide a matured decision support service for the decision makers. Ontological integration of the very complex and heterogeneous medical data structures is a challenging task. The authors’ objective is to point out the advantages of the deployment of a federated data warehouse approach for the integration of the wide range of different medical data sources and for distribution of evidence-based clinical knowledge, to support clinical decision makers, primarily clinicians at the point of care.

DOI: 10.4018/978-1-60566-748-5.ch008
INTRODUCTION

Since it is a challenge task for clinicians to gather all necessary knowledge about given diseases, the practice of evidence-based medicine would not be imaginable without IT support. With rapid changes taking place in the field of healthcare, decision support systems play an increasingly important role. Healthcare institutions are deploying DWH applications as decision-support tools for strategic decision-making.

The combination of data warehousing technology and evidence-based medicine opens an innovative application field of information technology in healthcare industry. Medical institutions, as well as health insurance companies, are primarily interested in increasing the patient healing rate and reducing treatment costs. In the long term, the application of DWH in the area of evidence-based medicine could prove economical by avoiding the duplication of examinations, saving time through automation of routine tasks, and simplifying the accounting and administrative procedures.

Caused by the growing and aging population, chronic illnesses are going to become the major concern of the healthcare industry. Diseases of elderly people, like Diabetes, Alzheimer’s disease, cardiac insufficiency, and sight loss (macular degeneration) will cause more treatment effort and therapy costs than the treatment of most difficult illnesses (cancer and heart attack) generate nowadays. Since these diseases can be treated more efficiently and more cost-effectively when detected in the early stages, the mission of modern medicine is to become able to recognize the patterns of disease formation and development. Evidence-based medicine deals with the analyses of the existing medical records, clinical studies etc., and searches for the recurring samples of disease symptoms. Data warehousing and data mining techniques play a crucial role in acquisition and gathering of existing medical experience from diverse data sources and in statistical analysis of that data. The extracted experience values and formulated knowledge (evidence-based guidelines) are used for more efficient prediction, discovery, and treatment of diseases.

In this chapter, we present some application fields which are relevant to the clinical knowledge management, especially:

- Developing new knowledge – the data warehouse-supported creation of evidence-based guidelines and clinical pathways
- Knowledge sharing – the data warehouse as an easy to use platform for knowledge dissemination among healthcare decision makers.

The rest of this chapter is organized as follows. In the next section we introduce Evidence-based Medicine and its use in clinical decision support system, followed by a guideline of deploying an evidence-base data warehouse. The process of controlling clinical treatment pathways with data warehouses incorporating EBM will be introduced afterward. Then we review the healthcare standard for message exchanges. After that, we discuss the semantic integration in federated Data Warehouse Model. Finally, we introduce a running example using Federated DWH supporting clinicians at the Point of Care and point out some future work.

EVIDENCE-BASED MEDICINE

Testing the outcome of medical interventions has been performed for hundreds of years. During last century, this effort started to impact all fields of welfare and healthcare. One of the founders of evidence-based practice was professor Archie Cochrane, a Scottish epidemiologist, whose engagement in this field resulted in an increased acceptance of the concepts behind evidence-based medicine. He was the first one to point out and promote the vital importance of use of medical evidence resp. randomized controlled trials for