Model-based Healthcare Decision Support System

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Abstract - The growing use of Information and Communications Technology (ICT) in the healthcare industry has opened a new avenue for translating voluminous healthcare data into usable information. Current decision support capabilities of On-line Analytical Processing (OLAP) have demonstrated its ability for efficiently processing large amounts of data and providing multidimensional views of data to facilitate analysis. Although OLAP provides the decision maker with an efficient means of analyzing data, it does not learn from the data or create new knowledge. An effective decision support system should combine the knowledge of the problem domain and the means to analyze relevant data to provide superior decision-making. This research has developed a prototype model-based healthcare decision support system using OLAP with data mining. Its strength lies in the combination of the analytical capabilities of OLAP with the knowledge gained from data mining to provide information that is not likely to be discovered using OLAP or data mining alone.

Keywords: Decision Support Systems (DSS), Healthcare Decision Support Systems, On-Line Analytical Processing (OLAP), Data Mining.

1 Introduction

The healthcare industry today is under increasing pressure to lower cost and increase the quality of service that requires efficient decision making. As the production of information costs money, the healthcare industry must strive for greater operational efficiency [2]. To improve the quality of service, it must adopt innovative approaches that will help generate relevant and timely information. Information technology should enable healthcare professionals to filter and analyze data in a variety of ways so that the decisions they make are good for the patients [1].

One of the critical problems facing the healthcare professionals today is the lack of availability of relevant and timely information [11]. The information generated is either too much, incomplete, inaccurate, in the wrong place, or difficult to make sense [11]. The information is often so disjointed that it cannot be used for effective decision making.

To alleviate some of these limitations, various Decision Support Systems (DSS) have been developed. Although they do assist in the decision making process, they are nevertheless not very effective [2, 12]. For example, these systems do not allow examination of more alternatives or the evaluation of complex relationships among them, or predict expected outcomes. This research proposes a more powerful DSS that overcomes some of these limitations.

2 Current Approach And Limitations

2.1 On-Line Transaction Processing

On-Line Transaction Processing (OLTP), typically based on relational databases, is suitable for recording business transactions (Figure 1) [5]. It provides information in two dimensions and automates repetitive tasks (e.g., order entry) [3, 13]. Structure Query Language (SQL) is typically used to access the information contained in these databases and the results usually take the form of reports. Healthcare professionals use these reports to make their clinical decisions.

![Figure 1. An Entity-Relationship Diagram (ER-D) of relational database model](image)

However, OLTP has a major drawback. The huge amount of data in normalized form require a large number of joins to satisfy even moderately complex queries [1, 13]. A simple query to analyze relationships between say, hospital and patients, would require massive table scan and multi-way table joins which