Abstract
We present in this paper the extraction of relational patterns on a hospital discharge database to monitor for quality of care. We delineate the requirements set for the extraction of meaningful medical practices from the data and describe how relational patterns address these requirements. Patterns representing practices regarding hospitalization instances are comprehensive and easy to interpret -- making them useful for quality management decision making. We demonstrate how relational patterns can be applied to identify poor practices embedded in hospitalization processes and trigger subsequent inquiries.

1. Introduction and Motivation
Healthcare organizations such as hospitals, clinics and other care providers maintain large repositories of data regarding their patients as well as internal operations. Data pertaining to patients typically contain demographic information, medical histories, and diagnosis and treatment records. Patterns embedded in this extensive clinical and administrative information may allow researchers to highlight vaguely understood practices in the organization. Such patterns may lead to valuable insights about the quality of medical care and provide useful input into decision making processes. In this study, we employed a new pattern extraction approach on the database of a large general hospital in Israel. Our goal was to reveal practices within the hospital to be monitored for quality of care. Currently, quality control administrators can submit queries to the database and receive reports describing a specified subset of patients. Such reports typically list instances satisfying a set of specifications, or summarize over qualified attributes (i.e., costs, or length of stay). However, none of the current reporting capabilities provide much-needed insight into the entire hospitalization process. Moreover, administrators cannot find new patterns without specifying them in advance, and so unknown or unexpected patterns are unlikely to be discovered.

The database we used contains information on the entire hospitalization process, including patient's length of stay, cost incurred, status upon discharge, and demographic information, as well as descriptions of the transitions a patient went through, such as departments in which he or she stayed, diagnoses determined at each phase and procedures performed. We recognized that an approach to capture patterns in processes or practices would be most informative if it were to incorporate the complete hospitalization process and allow any type of relationship between the various characteristics and phases to be captured. In this context, it is also important that patterns representing practices reflect any arbitrary relationship amongst various characteristics of a scenario. For example, it is important to identify whether patients who stayed more than 15 days in the cardiology ward and passed away are men or women, of what age, whether they had also stayed in other departments, and what procedures and diagnoses were performed there. Since we look at a hospitalization process as a whole, it is essential that all relevant characteristics constituting an integral part of that process can be automatically captured in the patterns we extract.

Like many other organizations, the hospital maintains a relational database, where data are stored in interrelated tables. An interesting observation is that the organization of tables and the relationships between them capture some basic knowledge about the domain. For instance, one hospitalization summary record can relate to many records in the Department table where