Chapter 50
SEMantic PATHways:
Modeling, Executing, and Monitoring Intra–Organizational Healthcare Business Processes towards Personalized Treatment

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ABSTRACT

One of the main challenges to be confronted by modern health care, so as to increase treatment quality, is the personalization of treatment. The treatment personalization has to be combined with a decrease in hospitalization costs. It requires continuous reconfiguration and adaptation of the selected treatment schemes since both the "current" circumstances in a health care organization change rapidly, and each patient constitutes a unique case. In this chapter, an innovative software infrastructure is presented, which provides an integrated IT environment concerning the totally dynamic composition of health care business processes (Clinical Pathways) during execution time. The software comprises a health care process execution engine, accompanied by a semantic infrastructure (ontology) for reconfiguring the Clinical Pathways. The SEMPATH (SEMantic PATHways) Ontology comprises three main parts: a) the Clinical Pathway part, b) the Business & Finance part, and c) the Quality Assurance part. During the execution of Clinical Pathways, the system reasons over a set of semantic rules and dynamically selects the next steps of the treatment. A graphical designer interface is implemented for the definition of the rule-set for the Clinical Pathways adaptation in a user-friendly way, alongside with a graphical user interface for the execution of the treatment schemes.

INTRODUCTION

A core research and business challenge regarding the healthcare sector is to achieve at the same time the increment of the treatment quality while reducing the healthcare provision financial and organizational costs. A possible solution to this challenge is the utilization of standardized clinical protocols alongside with their modeling while covering all the possible domains of medical practice. The standardized protocols comprise detailed medical plans that correspond to specific actions for the diagnosis, treatment and follow-ups of the patient. These protocols also encapsulate domain-specific knowledge in order to tackle any exceptional events (adverse events) that might occur during their execution and entail quick response and appropriate modifications to the proposed treatment scheme. Thus, achieving the flexibility and high personalization of the treatment process. A tool that corresponds to abovementioned desired characteristics is the "Clinical Pathway".

As it is mentioned in the literature (Campbell et al., 1998), Clinical Pathways are able to model medical guidelines inside a well-specified healthcare context and decrease undesired variability of medical practice. Clinical Pathways model a timed process of patient-focused care, which specifies key events, clinical examinations and assessments, so as to produce the best prescribed outcomes, within the limits of the available resources, for an appropriate episode of care (Wilson, 1992). The abovementioned process models a-priori the treatment of patients classified within specific case types. This process is not strict, in the sense that the medical practitioner is free to deviate from the proposed pathway and thus permitting clinical freedom. These deviations are called "variances" in the context of Clinical Pathways. The benefits that can be identified include improved patient outcomes (Ogilvie-Harris et al., 1993), increased patient satisfaction for the provided healthcare services (Stead et al., 1995), improved communication between doctors and nurses (Mosher et al., 1992), increased participation of the patient or carer during the patient treatment procedure (Williams et al., 1993). It operational and financial terms the benefits include reduction in the length of stay in hospital, reduction of costs of patient care, and finally reduction in the time health staff spend carrying out paperwork.

An important difference between medical guidelines and Clinical Pathways, is that the later also enclose multidisciplinary valuable resources, e.g. personnel, education level, medical equipment, financial and operational information among others. Medical guidelines require the consensus between medical experts. Clinical Pathways, on the contrary, require a consensus among different and multidisciplinary groups of hospital personnel taking actions during the treatment execution. On a technical level, Clinical Pathways can be perceived as patterns, attempting to increase the healthcare process quality and optimize the utilization of available resources. In this sense, it is possible for a Clinical Pathway to deviate from the appropriate clinical guideline due to administrative or other reasons. A summary of important differences between Clinical Pathways and medical guidelines is presented in Table 1.

In order to support the execution of treatment schemes based on Clinical Pathways and to relieve the medical personnel, a software system is required which would handle the healthcare business processes in an efficient manner (Greiner et al., 2004). A system of this type would be responsible for the observation of the execution and the current status of the applied Clinical Pathways, offer the feature of automatic recognition of exceptional events and provide decision support services in order to handle the exceptions in an efficient and effective way. Moreover, the software system should be capable to dynamically adapt the treatment process, so as to control the appropriate modifications.

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