Appropaches to Implementing Clinical Decision Support in Commercial Hospital Information Systems using JAVA/CORBA/XML

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Introduction. It is widely accepted that computer-based decision support has beneficial impacts in many ways to healthcare providers and patients in order to improve clinical outcomes and cost-effectiveness. Direct integration of knowledge-based functions (KBF) in hospital information systems (HIS) has proven to be more successful than standalone systems.\textsuperscript{1} Thus the aim of this study was to exemplarily embed an existing, proven standalone scoring system for acute abdominal pain into two different commercial hospital information systems in three university hospitals. This decision support has to be platform-independent and easily adaptable to different hospital settings and hospital information systems, using distributed, component-based and scalable information sources.

Methods. After an initial survey among physicians (n=102), which showed that most of them preferred having decision aids available within a hospital information system\textsuperscript{2}, we performed a workflow-based process analysis\textsuperscript{3} of the surgical outpatient ward. Subsequently the software was designed according to the following major cornerstones (see figure 1):

\begin{enumerate}
\item The HIS invokes a knowledge based system manager (KBM) out of the electronic patient record with a HIS-specific invoking mechanism.
\item The KBM retrieves data from the HIS database (HIS DB), using a HIS-specific data access component.
\item According to the clinical situation, the KBM selects a knowledge source out of a distributed "knowledge library".
\item After executing the specific knowledge source the KBM writes the resulting data in the EPR.
\end{enumerate}

Results. The existing scoring module written in C++ was supplemented by a CORBA-Interface, and an exhaustive list of scores related to abdominal pain was added to the scoring database. A Java\textsuperscript{\textregistered}-based KBS manager and HIS specific data access components were built, using XML as syntactical communication standard. Simultaneously in both hospital information systems we defined, according to clinical needs, data entry forms for admission, history and diagnostics representing the electronic patient record. For this purpose the respective HIS data entry module development tools have been applied.

Discussion. The presented concept of distributed component-based knowledge sources grants a maximum of flexibility and scalability and integrates decision support seamlessly into a healthcare environment. Even though we successfully embedded existing external knowledge based functionality into two different hospital information systems, we had major difficulties in getting data out of the electronic patient record, which reflects the closed software architecture and the lack of modern communication standards in current HIS. This is in sharp contrast to the rapid diffusion of most other healthcare technologies and the even more rapid progress in information technology itself. An easier and more flexible, open communications mechanism using modern software standards is highly desirable. Furthermore, many HIS implementations (at least in Germany) still do not cover the breadth of clinical data, which are required for comprehensive decision support.

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References