Development of an Input System with Access to Medical Record Data and a Database Tailored for Clinical Study

In 1995, Osaka University Hospital, teaming up with NEC, launched a research and development project to work on an electronic medical record system. In 2000, they released "MegaOak-NEMR," the first electronic medical record system. Development continues on an ongoing basis. The introduction of electronic medical record system is making good progress from clinics to large-scale hospitals, but if wider application is to be achieved, it is necessary to develop a method of alleviating the burden of inputting as well as a medical record data utilizing system. We asked Associate Professor Yasushi Matsumura of Osaka University Graduate School of Medicine, Department of Medical Informatics, who engages in electronic medical record system development focusing on secondary utilization of crinical information, about the dynamic template, an electronic medical record inputting tool, and the mechanism for accumulated data utilization.

Client Profile

Name: Osaka University Hospital
Number of beds: 1,076 beds
Address: 2-15, Yamada-oka, Suita-city, Osaka, Japan
URL: http://www.hosp.med.osaka-u.ac.jp

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Inputting Detailed Medical Findings Using a Hierarchically Layered Template

Associate Professor Yasushi Matsumura of Osaka University Graduate School of Medicine, Department of Medical Informatics is engaged in the development of an electronic medical record system with emphasis on a structured data inputting method and a data warehouse (DWH)-based electronic medical record system.

"It is taken for granted that an electronic medical record offers various functions such as information sharing and service efficiency enhancement. It has been our belief that it is important to be able to utilize the data accumulated in electronic medical records. To make that possible, we have been engaged in the development of a retrieval-and-analysis-enabling input method and a mechanism for the utilization of such data."

One of the challenges in inputting data to electronic medical records concerns the handling of medical findings written by doctors.

"The description of patients' symptoms, physical findings, and so forth contains a large amount of complex and detailed information. One idea would be to input data in free text with a word processor and submit the data for natural language analysis, but it would take time and labor. So what was needed was a tool for collecting data in structured form with a minimum burden on inputting."

The inputting method jointly developed by Associate Professor Matsumura and NEC was based on the use of a "dynamic template" (DT).

"With the template system under which one inputs items selected from among pre-registered ones, it is possible to register structured data, but with the regular template it is not

possible to handle the complex contents of medical findings. So we made it possible to handle complex statements by equipping the basic element with a hierarchical structure. Taking the ease-of-inputting factor into consideration, we designed the operation such that a click on an item in the hierarchy section would trigger appearing subordinate layer. The result would be stored as hierarchically structured XML data into the database. Since the development work was started in 1995, we may be allowed to claim that, in conceptual terms, we preempted XML."

The data input via DT goes through natural language conversion, and sentences reading as naturally as if they had been input by a word processor will come out on the display.

The template form may be convenient for input purposes, but is unsuitable for reference purposes. The method of recording in computer-processable form and performing processing in such a way that the display comes out naturally readable for the human user leads the world in the area of standardization of structured medical documentation.

DT: Already in Use at 60 Hospitals as an Inputting Tool for MegaOak, Electronic Medical Record Systems

DT, which can be mounted as an inputting tool on NEC's electronic medical record system, is being used at more than 60 hospitals today.

"It is used in a wide variety of ways: for inputting medical findings pertaining to diagnoses into electronic medical records, compiling examination reports incorporating complex contents such as cardiac ultrasound reports, endoscopic reports and more, compiling discharge summaries, keeping nursing care records, and for other purposes. Above all, it is gratifying to see DT embraced by its users as convenient and easy to use. Once data is input through DT, ways are developed for utilizing the data."

Templates used at one hospital for electronic medical record purposes number anywhere between 600 and 1,000. Associate Professor Matsumura has launched a university-based venture specializing in template contents. Thus far, it has produced approximately 8,000 such templates.

"DT is a type of program, so we must prepare template items and sets of options to go with each as well as a master for natural language conversion. The end user can set up his or her own master, but the hospital as a whole will eventually require a great quantity of templates, making it impracticable for a hospital to undertake such a task on its own. That is where we come in with our contents service. One of our up-and-coming challenges, then, will be to organically systematize the templates we have been creating by assigning meaning/concept codes to the items and values in them."

Supporting Clinical Research with XML Data Mining

Work followed to develop DWH, which is a mechanism for secondary utilization of clinical data, registered through DT, for clinical study.

"With the use of DT, it has now become possible to input analyzable data, but the data, such as it is, isn't suitable for analysis or lookup. An electronic medical record exhibits an excellent performance in the display of crinical information when looked up with patient identity as the key, but its database is not structured to be looked up for a given item across patient records. So we made just such a lookup possible by converting the data into analyzable data by using DWH. We constructed the DWH as a 'simple-structured database' in which the tree structure of XML data, in all its parts down to the 'leaves' of its deeper hierarchical layers, would be factorized item (value) by item (value). If data utilization is in connection with research, for example, a database can be built by re-extracting required items from the DWH, case by case and project by project. In this way, input template is separated from database for analysis, so it makes possible to freely create fresh templates and add new items, allowing flexible measures to be taken such as subsequently adding items need for which may have newly cropped up."

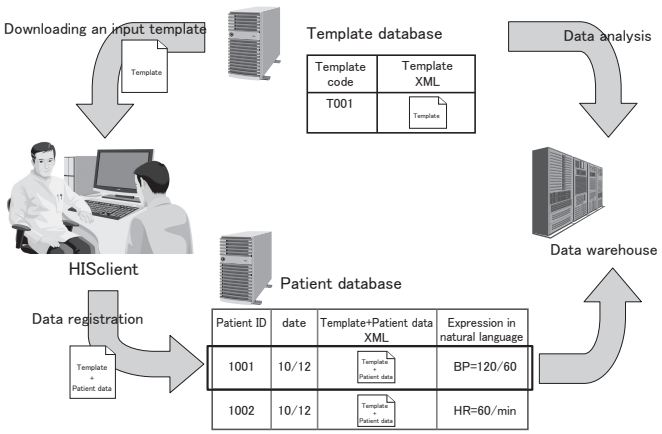

Fig. Image of an electronic medical record system that makes data utilization possible.

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As for databases extracted for clinical study, the mechanism of their extraction from DWH (MegaOakDWH) and the retrieval mechanism for such databases are to be addressed en bloc as a function of DWH (MegaOakDWH) (see **Fig.**).

"Clinical study serves the purpose of verifying hypotheses posited on the basis of day-to-day diagnostic activity and is essential to the development of the medical science. But because of the enormity of the clinical information to be processed, a heavy investment in time and labor is necessary for its collection and analysis. We may be allowed to say that, thanks to a system having been developed that integrates the whole range of operations from data input and output to retrieval, the electronic medical record now offers itself as a basic tool that is sure to contribute to further advance in medical practice and clinical study."

FOCUS POINT

Developing a Dynamic Input Template and a Mechanism for Automatic Retrieval of Pertinent Data

(1) Dynamic Template

We have developed an inputting tool equipped with the ability to have hierarchically structured dynamic template input medical records which would conventionally have been input in free text and record them as XML data and furthermore output them after converting them back to natural-language sentences. This tool is in common use on site at clinical locations. Here we have successfully made it possible to have medical records as structured data.

(2) Data Analysis Mechanism

All XML data registered with a template is first stored to a simple-structured database in which one value is recorded as one record. A database file is set up in which a necessary data item is selected individually for each clinical research project, and each case is stored as one record, and a mechanism is in place for automatically extracting and storing data from a simple-structured database file.

For inquiries, please contact:

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