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## Research and Education

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# *Introduction to the Department of Medical Information Science of Osaka University Hospital*

### **Introduction**

The department of Medical Information Science at Osaka University Hospital was established in 1986 and takes a double responsibility: research in medical informatics, and implementation, operation and maintenance of information systems in the hospital. The double function is a common characteristic in the Japanese department of medical informatics in national university hospitals.

The first professor (1986- 1997) and director was Michitoshi Inoue who is now the director of the Osaka National Hospital and the president of the Japanese Association of Medical Informatics. The second professor of the department is Hiroshi Takeda who has been the associate professor since 1986.

Research is conducted in both basic and applied medical informatics areas, ranging from the electronic patient record system, hospital information system, PACS system, clinical data warehouse, regional networks, tele-medicine and remote consultation. Other topics include decision-support systems and check systems are also of concern. In 2000, the department also belonged to the Osaka University Graduate School of Medicine. In 2001,

Professor Hiroshi Takeda was appointed director of the department of Clinical Quality Management which is the first department for patient safety and clinical quality improvement in the Japanese national university hospitals.

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### **Research Activities**

#### **1. The Hospital Information System (HIS)**

An integrated hospital information system called "HUMANE" (human oriented universal medical assessment system under network environment) was developed in 1993. There are two groups of application programs inside HUMANE: one is an interdepartmental or common application program including patient registration, an accounting and billing system, an order entry system (prescriptions, laboratory testing, radiological examinations, admission, operation, and meal service), disease name registration, a reporting system (laboratory test and radiological examination), reservation (re-visit, special examination), admission management, and a nursing care system; while the other is a department-specific application program including the pharmacy department, laboratory department,

radiological examination department, operational department and meal service department. The system architecture of the first generation was main-medium-micro frame link and featured a quick response time and a good man-machine interface by using GUI (Graphical User Interface). The hardware configuration was totally changed into a client-server system in 2000. The system has been developed with the Nippon Electric Company (NEC) since 1986. From the beginning, the physicians' direct order entry has been established in "HUMANE" and the database provides the basis for clinical data management in conjunction with the paper-based medical record that is totally integrated into one-patient-one-file in the central storage.

#### **2. PACS system**

In our hospital, image data of almost all modalities including CR, CT, MR, ultra-sound and RI are in PACS (Picture Archiving and Communication System). The Image data is sent through a Multi-image Terminal to a Multimedia Server with a jukebox type MO disk. A client PC can request the patient information as the reporting system of radiological examination by means of HIS-RIS (Radiological Information System)-PACS coupling.

Although there are some arguments against its costs, it does assist decision making of referring doctors in very short turn-around time.

### 3. The Electronic Patient Record (EPR) System

Due to the successful operation of the ordering and reporting system, an electronic patient record system of the Osaka University Hospital (EPROU) was deployed in January 2001. The system is also developed jointly with NEC. The EPROU features 1) physicians' direct structured data entry, 2) multi-modal output of registered clinical data and 3) dynamic problem oriented system.

Next, we are planning to transfer this structured data into a data warehouse and link it with speech recognition input with which may achieve other functional goals of an EPR, i.e. clinical decision support, access to knowledge resources, and improvement in the overall process of recording and retrieving clinical data.

### 4. Clinical Data Warehouse (CDW)

The nature of CDW as a source for analysis and rapid retrieval of data is tailor-made for EPR and provides a mechanism used to identify individuals at risk for target diseases and to identify costs and revenue opportunities. Thus, many hospitals are developing their data warehouses. We have finished implementing our data warehouse and installing "Business Objects" for data analysis this year and are now conducting the following research:

- Methodology of deducing the regional morbidity from CDW;
- Investigation and analysis of the occurrence frequency of drug side-effects;
- Method of selecting specific data for diagnosis;
- Predicting the prognosis of diabetes;
- Evaluation of the effectiveness of risk reduction initiatives

- Analysis of the costs affected by prescribing different types of hypotensors.

### 5. Regional health care networks

For the sake of providing more efficient and effective health care to the patients and sharing the patients' information with other institutions, we have made our hospital system tightly connect in the regional health care institution networks. Last year, we contracted with the Ministry of Economics and Trade Industry in developing an introductory networked EPR system, which has been put in practice and is currently being evaluated. Further, with the progress of standardizations in medical informatics and the improved security environments, we are engaging to develop a digital radiological imaging and electronic prescription system among regional health care networks.

### 6. Telemedicine and remote consultation

Telemedicine is a cost-effective form of medical practice for rural area patients and a quick and easy method for primary care clinicians to get expert consultations via electronic access. We have successfully developed a high quality oriented teleconference system and remote Open MRI operation system with the function of sharing DICOM and 3-D images and the navigation of a remote operating process.

### 7. Decision-support and check system

The more developed the HIS decision-support function is, the more benefits can be seen by health care providers and patients. Currently when we conduct ordering, we can do some checking as well. For instance, we can check the overdoses, the repetitions, the contraindications, the drug-drug inter-effects, etc. In order to enforce this checking system, the well-estab-

lished knowledge base is inevitable.

Based on this incentive, we are also conducting research on selecting similar cases from CDW by using data mining technology.

### 8. Clinical quality management

In conjunction with the department of clinical quality management, the on-line incident report system has been developed and operated for two years by using the intranet of the HIS. The accumulated reports have been analyzed to prevent medical errors in the hospital. In order to respond to the implementation of the first Japanese DRG (diagnosis related group)/PPS (prospective payment system), which will be scheduled to start next April, the data gathering concerning clinical process, major diagnoses, major care procedures and their costs has started and is being entered into a database. Several studies will be conducted to measure the quantitative quality of health care in the very near future.

### 9. Health care standardization

As Prof. Takeda is a project leader of the work item: framework of emergency data sets in the working group 1 of ISO/TC215 (medical informatics), existing emergency data sets are collected world-wide and analyzed to make a framework that will position and map those data sets. Other standardization projects have been involved in this department to facilitate networked EPR systems in Japan.

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## Staffs and students

For conducting studies and research, both the department of medical information science and clinical quality management have worked together. The greater department consists of three faculties (Prof. Hiroshi Takeda, Associate Prof. Yasushi Matsumura, and Assistant Prof. Kazue Nakajima) and three full-time staff (one registered



risk manager nurse, one registered health information administrator and one secretary). There are currently one post-doctoral fellow, two research fellows and seven graduate students. The maintenance of HIS is mainly provided by ten members in the administration office of the Osaka University Hospital.

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