

# Medical Information DWH System “MegaOakDWH”

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## Abstract

This paper describes the MegaOakDWH system which is under development and construction at NEC. It goes on to explain how the system can serve medical diagnoses, clinical study and management improvement by using: the requested information generated inside a hospital, execution (achievement) information, basic treatment payment information and medical accounting statistics information as well as medical care reports, summaries and nursing information.

## Keywords

DWH (Data Warehouse), electronic medical record, medical care support, clinical study, management support

## 1. Introduction

In July 2007, the Strategic Headquarters for the Promotion of an Advanced Information and Telecommunications Network Society (IT Strategic Headquarters of the Japanese Prime Minister’s Cabinet Office) published “Priority Policy Program 2007.” This publication proposed that in order to contribute effectively to the prevention of diseases and to improvements in the quality and efficiency of medical care the IT-based medical structural reform needs a “mechanism for the nationwide collection and analysis of health information.” Such a mechanism should also include diagnosis information, health checkup results and health insurance claim form data. It also proposed that there should be due consideration to the protection of personal information, such as by anonymity. Aiming at a secondary use of such collected and analyzed medical information, NEC is developing and constructing the MegaOakDWH system. In the following, this paper describes the clinical study and management improvements made possible by using MegaOakDWH.

## 2. Outline of MegaOakDWH

MegaOakDWH is a system for storing, searching and utilizing a variety of information that is typically generated in a hospital. Fig. 1 shows the concept of this system.

### (1) Information Storage Function

Document information including: medical care reports and summaries, nursing, ordering, medical statistics and logistics information are collected from the backbone job system via a standard interface, the collected job data is

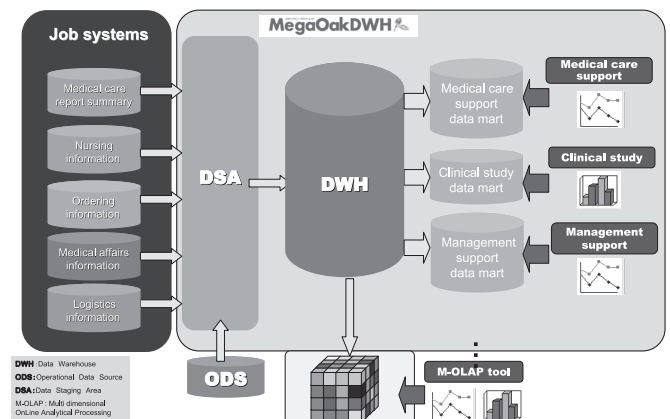


Fig. 1 System concept of MegaOakDWH.

converted into analysis data in the DSA (Data Storage Area) and then stored in the database of the DWH server. In addition, the data sources that are necessary for information collection/analysis of the DWH system but do not exist in the job system (Operational Data Sources) can be imported from a separate interface.

### (2) Search & Extraction Function

The information stored in the DWH system can be searched and extracted for utilization in medical care support, clinical study and management support using various search tools. Search and extraction efficiency may be improved at the same time by compiling data marts, which collect only the data required for each purpose, such as medical care support, clinical study and management support from the information stored in the DWH system.

### (3) Security Function

The search function of the system is capable of authentication at login but can also attribute authority for using the

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search function to each occupation type or each user. It also features an access log function for use in checking who performed what kind of search of the DWH-stored information and at which time.

### (4) Atypical Searches & Multidimensional Analysis

In order to enable atypical searches and multidimensional analyses of stored information, the system provides template samples for the OLAP (Online Analytical Processing) tool.

## 3. Example of Applications for Clinical Studies

As an example of utilization of in-hospital data for clinical studies, this section introduces the Departmental Clinical Study Database System.

### 3.1 System Outline

The Departmental Clinical Study Database System makes it possible to store and extract reports and documents containing information required for a secondary use of medical care information by each hospital department. These are processed into and from the medical care report information and document information stored in the DWH system. Fig. 2 illustrates the concept of the Departmental Clinical Study Database System.

#### (1) Import Condition Setting Function

The system assists compilation of departmental clinical databases by providing a function for setting the data import conditions according to each clinical study subject or to the clinical department. For example: the import status of documents such as leaving hospital summaries and medical care reports, information on dynamic template items, storage

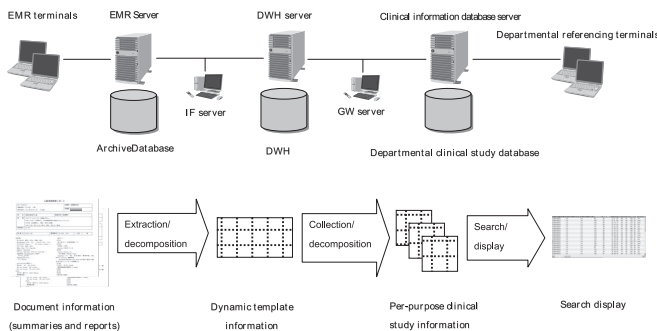


Fig. 2 Concept of departmental clinical study database system.

target conditions (terms, patients, etc.) and the authority for utilization.

#### (2) Gateway Function

The gateway of the system has the function of extracting information from the DWH according to the set import condition and for storing the decomposed dynamic template information into the database set according to the items with specific conditions in a one-record-per-case format.

#### (3) Information Inquiry Function

A tool for referencing the information in the departmental clinical study databases stored per clinical study subject is also provided. This function enables inquiry of target information by selecting the database item and specifying the search conditions for use in the inquiry. The accessed information can be output to an external file.

### 3.2 Operation Examples

This system makes it possible to effectively utilize the medical care information generated in hospitals for clinical studies. It allows extraction of specific information from the information described in documents created by various departments such as summaries and reports. This includes: “information on stage classification and tissue type in cancer cases,” “information on side effects (nausea, hair loss, skin alteration, muscular pain, etc.) of chemical therapies,” “information on joint motion measurement results in orthopedic conditions” and “information on left ventricular end-diastolic diameter and ejection fraction in heart diseases.”

#### (1) Creation of Documents Using the Dynamic Template Tool

When the hospital departments compile summaries and reports using the dynamic template tool provided by the document creation function of NEC’s MegaOakHR electronic medical record system, each piece of information is created as structured information expressed by the item (ATOM) and content (VALUE) and is stored in the DMH database.

#### (2) Creation of Databases According to Clinical Study Purposes

This system can create per-purpose databases from the document information compiled per department. Using the import condition setting function, it can also collect the document information compiled by multiple departments and store it in a single per-purpose database. For example, even when the formats of the history provide leaving hospital summaries that vary between departments or those of the medical care reports vary between body regions, the

診療科	種別	特定病名	内訳表示	表示条件設定	出力番号	検索	初年度	1月～12月	拡大化				
内科	100010675	LA	LA	108	62	19	9	60	55	44	156	82	poor
内科	100010675	LA	LA	142	68	28	13	77	68	48	173	63	poor
内科	100010675	LA	LA	172	84	70	41	63	38	56	172	80	far
内科	100010675	LA	LA	111	56	30	14	64	54	65	151	40	far
内科	100010675	LA	LA	122	73	72	37	44	28	58	155	57	poor
内科	100010675	LA	LA	124	66	67	41	52	31	36	156	52	far
内科	100010675	LA	LA	110	56	64	34	43	29	45	157	65	poor
内科	100010675	LA	LA	176	46	46	24	69	53	54	172	92	poor
内科	100010675	LA	LA	103	63	71	40	39	23	36	150	37	poor
内科	100010675	LA	LA	116	65	61	32	45	29	30	161	54	far
内科	100010675	LA	LA	161	77	76	44	42	27	36	164	93	poor
内科	100010675	LA	LA	158	76	70	40	40	23	45	150	91	poor
内科	100010675	LA	LA	154	59	58	29	57	41	43	169	56	far
内科	100010675	LA	LA	86	25	79	47	41	22	41	141	43	far
内科	100010675	LA	LA	123	62	75	43	43	27	40	165	48	far
内科	100010675	LA	LA	132	61	66	38	47	29	37	147	63	poor

Fig. 3 Referencing display of departmental clinical study database system.

information can be searched across documents and stored as a single item by using the same dynamic template for each common item.

**(3)Comparative Inquiry of Information**

When the system is used in clinical studies, it is required to find cases containing necessary information and the cases associated with them by repeating several comparisons and analyses under different search conditions. To facilitate the comparisons and analyses, the inquiry function of the system uses a 2-row list display. The first row shows the first search results and the second row shows the results of a search together with the additional conditions of the first row search ( Fig. 3 ).

As described above, while systematized search and extraction of documented medical care information has previously been difficult, the system makes it possible to manage medical care information as structured information by using dynamic templates in the document creation process. It also enables utilization of the medical care information effectively for supporting clinical studies by creating databases according to purpose, clinical department or specific report.

**4. Example of Application in Management Support**

This section discusses the DPCBANK (Diagnosis Procedure Combination Bank) system, which is an application of the in-hospital data of DWH for hospital management improvement.

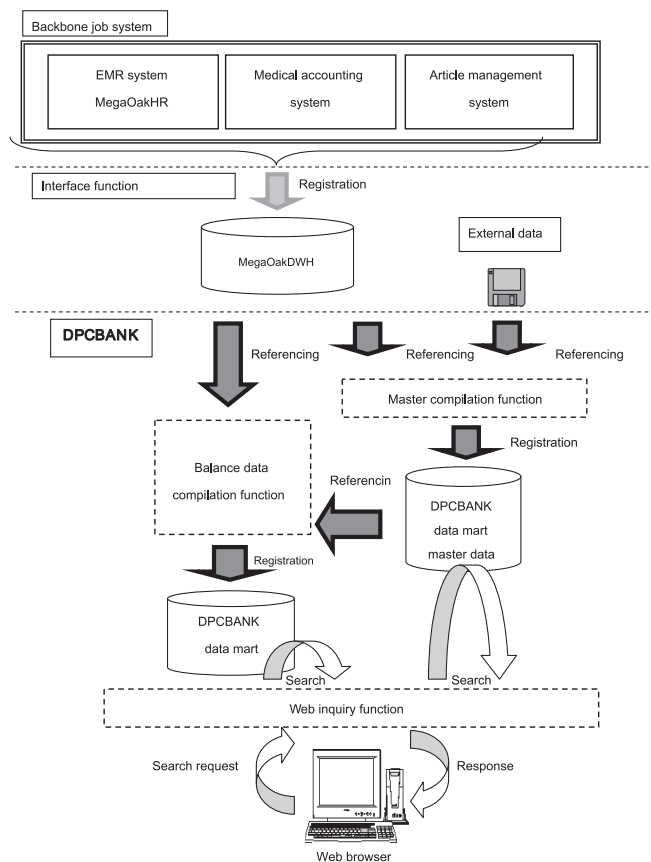


Fig. 4 DPCBANK system concept.

**4.1 System Outline**

The DPCBANK system creates DPCBANK data marts from the medical care information, medical accounting information and article information that is stored in the DWH system. These data marts can be used in comparisons of the treatment fees billed on an inpatient and the actual costs related to the treatment, referencing of DPC determination factor information during calculation of the DPC fee, referencing of the DPC determination factor information from the department to which a patient is transferred. Fig. 4 shows the concept of the DPCBANK system.

**(1)Data Mart Compilation Function**

The data marts of this system can compile the balance information based on the medical care statistics data of the medical accounting system. It can also calculate a sum of the expenses based on the contracted unit prices in the logistics management system by specifying a period or a patient.

## (2) Master Maintenance Function

This function registers and edits the master information on the article masters (medical material master, pharmaceutical master, medical care master, etc.). It also accepts import in the CSV file format.

## (3) Search & Display Function

This function accesses to the data marts information to extracts and displays the DPC information on a patient who has left the hospital, medical care information and balance information according to various conditions including the DPC code, diagnosis group classification code and patient names. It is also capable of exporting the extracted information in the form of CSV files.

## 4.2 Operation Examples

This system has made it possible to investigate the differences in medical care between patients of the same DPC by comparing differences in hospitalization periods, incomes and material expenses. It can thus contribute to improvements in the quality and efficiency of medical care. The system assumes that doctors and nurses in the fields of medical treatment utilize it as a guideline for medical care or for referencing the compilations of treatment protocols and that hospital management utilizes it for eliminating wasteful practices and reducing patients' payments. We will describe an example of the flow of its utilization in the following.

### (1) DPC Trend Display Function

The trend per DPC can be referenced and the comparison with the average data can be displayed by selecting the 2-digit MDC, the 6 digits including the MDC and disease name, or all of the 14 digits. This function enables examination of the DPCs to be analyzed by detecting the cases with high medical materials expense ratios, cases often exceeding the specified hospitalization period (2SD) or cases with variable hospitalization periods.

### (2) DPC Balance List Display Function

This function makes it possible to analyze the existence of patients with large medical materials expense ratios within a specific DPC code by referencing the list of balance information of the DPC code.

### (3) Comparative Patient Data Display Function

This function makes it possible to select the patients with large medical materials expense ratios. It also enables identification of which medical care action (such as prescription) on which day caused the difference in the medical materials expense ratio of each specific patient. This is

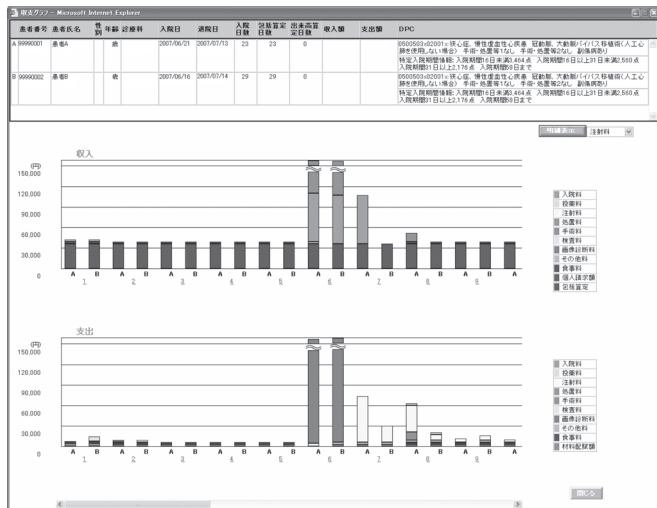


Fig. 5 DPCBANK balance graph display.

achieved by means of comparative referencing of the income and expenses for each day that the patient passed in the hospital ( Fig. 5 ).

### (4) Balance Detail Display Function

This function makes it possible to identify specific differences in the medical material expenses ratio by comparing the details of medical care actions.

In this way, the system is capable of precise referencing of information from per-DPC information to detailed information such as the medical care contents and the pharmaceuticals and other medical materials used in treatments. It is therefore useful in the study of treatment protocol from the viewpoint of medical care as well as for enabling judgments from the viewpoint of management. For example, whether the materials used were wasted or if expensive materials show evidence of effects deserving their costs, etc.

## 5. Conclusion

In the above, we outlined and gave examples of applications of the medical care information DWH system "MegaOakDWH."

In the future, we are planning to extend the system functions to deal with the growing needs of medical care support, clinical study support and management support by more effectively utilizing the available medical information.

In closing, we would like to express our gratitude to those

who assisted us so capably in the development and construction of this system.

#### Reference

- 1) Strategic Headquarters for the Promotion of an Advanced Information and Telecommunications Network Society (IT Strategic Headquarters): "Priority Policy Program 2007," 2007,

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