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No.112



From the Editor

Ever since the bubble burst, there have been no full-dress signs of economic recovery, tending Japan's economy to worsen still more from the middle of 1997. Business failures in finance and securities have continued to occur, and the unemployment rate and depression-type bankruptcies have increased. In other words, Japan is now under the pressure in dealing with a long-term economical depression, industrial cavitation that accompanies overseas transfers of production sites, decreasing international competitiveness while globalization progresses, and various societal problems.

Amid such a situation, there is a rapid spread of growth in every area of the information technology and the open network, represented by the internet, from industries down to the society and individual lives. Because of the possibility to realize electronic commerce (EC), the digitization of economic activities from development and manufacture down to administration and control, EC is being

promoted in many countries, and is being worked on aggressively in Japan as well, with public and private sectors together. Therefore, the major advanced countries in the world, including Japan, are apt to experience a paradigm shift toward a digital economic society, along with the rapid growth of digital information technology.

In May 1997, the Ministry of International Trade and Industry announced the "Action Plan for Economic Structure Reform". It discusses how Japan's economy should be within the world's economy of rapidly advancing globalization, and especially states that the key to dealing properly with the issues of industrial cavitation and employment, and securing good employment opportunities, is to create new industries, including the enhancement of existing industries. For this reason, it is said that various policies must be promoted intensively, organically, and as soon as possible in 15 areas expected for future growth, under close linkage of the govern-

ment offices concerned. And the first industrial areas expected for growth are in the areas concerned with medical care and welfare.

In this context, an increase is expected in diverse medical care needs to correspond to elderly persons, along with the rapidly increasing elderly population. In other words, a growth is expected in advanced medical equipment industries, such as telemedicine services for treatment and diagnosis at home, and the development of medical equipments that would not task the patient's body during diagnosis. In addition, an even higher level of specialization and efficiency would be demanded from the hospital's medical treatment function itself, and thus progress is expected in outsourcing common tasks, and in businesses that execute hospital services, such as clinical inspections and provision of hospital meals, in place of the hospital. Based on these circumstances, 18 items are specified as action plans for promoting informatization in medical care and welfare, and the major items are shown below.

* Building an information network

based on municipal health centers

* Promoting telemedicine experimentation to persons recuperating at home

* Promoting the construction of a receipt computer processing system

* Examining a health insurance card system for insured persons

* Establishing ultra-high-precision image transmission technologies, image processing technologies, and verification technologies to support the realization of telemedicine and so on

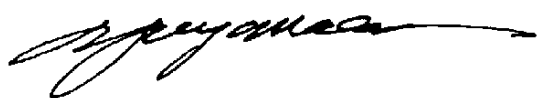
* Research and development of communication system technologies for the acting and support of functions for elderly and disabled persons

* Promoting technological examinations for a satellite communication system to connect hospitals with emergency vehicles and so on

However, in order to realize a widespread regional medical information network and the computerization of various medical information, we must first deal with a mountain of issues, such as the protection of privacy, security, deregulation, and promotion of standardization.

In this edition, I have mainly put to-

gether articles on Japan's health care and informatization. The Medical Information System Development Center has given me overall cooperation in putting these articles together, and I would like to express my gratitude here. I hope readers find this JIQ useful.

A handwritten signature in black ink, appearing to read 'Yuji Yamadori', with a long horizontal flourish extending to the right.

Yuji Yamadori
Director
Research & International Affairs

I. Japan's Health and Medical System

KIMIYA KATO

Director

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THE MEDICAL INFORMATION SYSTEM DEVELOPMENT CENTER

Summary of Japan's Medical Insurance Policy and System

1. The Surrounding Environment of Health and Medical Care

(1) A society of decreasing child-births and an increasing elderly population

The decrease in the death rate due to the progress in medical technology and the decrease in childbirths are causing the structure of our country's population to change drastically. The total population of Japan is 130 million, but roughly 15% of it is occupied by elderly persons 65 years and older, and the future trend is toward an even bigger increase.

The decrease in childbirths is also on the rise, with the total birth rate at 1.42. Furthermore, our country's average life expectancy is presently at the world's top level.

(2) Changes in the illness structure
Infectious diseases, with tuberculosis as the former main cause of death, are decreasing, and chronic illnesses caused by daily habits of life, such as virulent new organisms, cerebrovascular diseases and cardiac diseases, are on the increase. Presently, preventive measures for these diseases are being actively advanced in adult health measures and elderly health measures, mentioned in a later section.

(3) Sophistication and diversification of the people's needs

Health and medical services are becoming more sophisticated and diversified to respond to the needs of people, together with the rising concern toward good health. Conventional group-centered services would have to be changed toward providing services to meet individuals.

(4) National medical care expenses

National medical care expenses nowadays are moving toward a remarkable increase of approximately one trillion yen yearly due to the growing population of elderly persons, changes in the structure of illnesses, and advanced medical technologies, and amounted to approximately 27.2 trillion yen (expectation) in 1995. Because of the increase in medical care expenses, the medical insurance economy is worsening, and finding measures against it is the big issue now. The changes in the national medical care expenses is shown in Figure 1.

2. Description of Medical Facilities and Medical Workers

Japan's medical care facilities are greatly divided into hospitals, general medical clinics, and dental clinics. These medical care facilities are at the top level in the world as of quantity, due to previous aggressive preparations. However, they are concentrated in urban areas, and thus there is a maldistribution of areas.

Among the medical workers, doctors already exceed the administrative

goal of 150 (per 100,000 persons). However, there are still not enough public health nurses for the annually increasing regional health and sanitation activities, such as mother and child health measures, adult health measures, and elderly health measures.

The annual changes in the number of medical care facilities and hospital sickbeds, and the number of medical workers are shown on Tables 1 and 2.

3. Description of the Health and Sanitation Administration

The health and sanitation administration for national health is mainly divided into the following three areas.

- ① Regional health (for residents of a region)
- ② School health (for school students)
- ③ Occupational health (for company workers)

As for the policy on regional health, a consistent system is established of the country (Ministry of Health and Welfare), prefectures (Health Administration Department Bureau), health centers, and municipalities (Health

Administration Section).

Among these, the health centers (approximately 700 facilities) play an extremely vital role as the central organization of public health activities, such as illness prevention, health promotion, environmental health, in the life and health of regional residents.

On the other hand, school health and occupational health will not be mentioned here since they are within the jurisdiction of the Ministry of Education, Science, and Culture and the Ministry of Labor, respectively. Here, we will mention on mother and child health, adult health, and elderly health from the regional health measures.

(1) Mother and child health measures

Japan's mother and child health measures are based on the consistent system of before marriage, pregnancy, delivery period, new-born infant period, and infant period, and systematization is attempted for providing the most suitable service (health guidance, health checkups, medical care, etc.) for each period.

As a special characteristic of Japan, a woman who is pregnant must report it

to her city, town, or village, and a maternity record book is given in return. This report helps the administration grasp the number of pregnancies, and is a vital starting point for enforcing consistent mother and child health measures from a woman's period of pregnancy to the infant period.

The maternity record book is a health record in regard to pregnancy, childbirth, and child care, as well as an item that provides administrative information, health, and child care information concerning the mother and child's health.

As a result, our mother and child health level is top class in the world.

(2) Adult and elderly health measures

Cancer, cerebrovascular accident, heart disease, and diabetes all originate from life habits and aging, so countermeasures against them are an extremely vital issue in the elderly society.

For this reason, Japan enforces various types of health medical care services, starting with health checkups, based on the "Geriatric Health Law", with the purposes of illness prevention, early detection, and early

treatment.

These services are given to regional residents 40 and over, and the city, town, or village is obliged to be the main service provider.

Services are mentioned below.

- ① Provision of health record books
- ② Health education
- ③ Health consultations
- ④ Health examinations
 - Basic health
 - Stomach cancer
 - Uterine cancer
 - Lung cancer
 - Breast cancer
 - Large intestine cancer
 - Comprehensive health
 - Remedy and guidance of life habits
- ⑤ Functional training
- ⑥ Visiting guidance

4. Medical Care Supply System (Medical Care Plan)

Japan's medical care level is highly ranked worldwide. However, the environment surrounding medical care is also changing drastically, such as in the arrival of an elderly society, changes in the structure of illnesses, and progress in medical technology. From now on, a system would be

required to provide efficient and high-quality medical care services to deal with these changes.

Because of this need, the "Medical Law" made it obligatory for the prefectures to plan a "Medical Care Plan" and to reexamine the plan every five years. In order to promote the preparation of a systematic regional medical care supply system to deal with the nation's diversified and sophisticated demands on medical care, the medical care plan aims at the efficient use of medical resources and ensurance of mutual interaction of functions between medical facilities.

The contents of the medical care plan are comprised of required and optional items. The required items are used in setting up the medical areas as a unit for preparing the medical care provision system, and in determining the number of sickbeds to be equipped in each medical area. The optional items are the items shown in (2) below.

(1) Required items

① Setup of medical areas

Secondary and tertiary medical areas must be established.

The tertiary medical areas are the areas in which hospital sickbeds

are prepared for the provision of special medical care, e.g., one that requires advanced technology, and as a principle, they are granted to prefectural regions.

The secondary medical areas are the areas of general medical care, excluding special medical care, where a system must be secured for providing medical care mainly for hospitalization, and are generally granted to regions of everyday life. Presently, secondary medical areas are instituted in 348 areas.

② Instituting the necessary number of sickbeds

The required number of common sickbeds is determined for each secondary medical area. The required number of sickbeds for patients with a mental disorder or with tuberculosis is determined with the prefecture as the region.

(2) Optional items

- ① Items concerning the preparation goals with consideration to hospital functions
- ② Items concerning the security of medical care and emergency medical care in remote areas
- ③ Items concerning the mutual in-

teraction of the functions of hospitals, medical care clinics, and pharmacies

- ④ Items concerning the security of medical workers, such as doctors and nurses

5. Description of the Medical Insurance System

Japan has an all-citizen insurance system, and thus all Japanese citizens have some kind of medical insurance. Medical insurance is divided into employment insurance, national health insurance, and elderly medical care from the "Elderly Health Law" which is shared contribution from the two mentioned before. Employment insurance is the health insurance, mariner's insurance, and benefit society, which covers company workers as the insured. National health insurance is centered on the national health insurance of city, town, or village, with the common regional residents as the insured. Elderly medical care only applies to persons 70 and above that have employment insurance and national health insurance, and persons from 65 to 70 who are acknowledged with a handicap.

The types and applicable persons of

medical insurance are shown on Table 3.

6. Mechanism of Insurance

Health Examinations

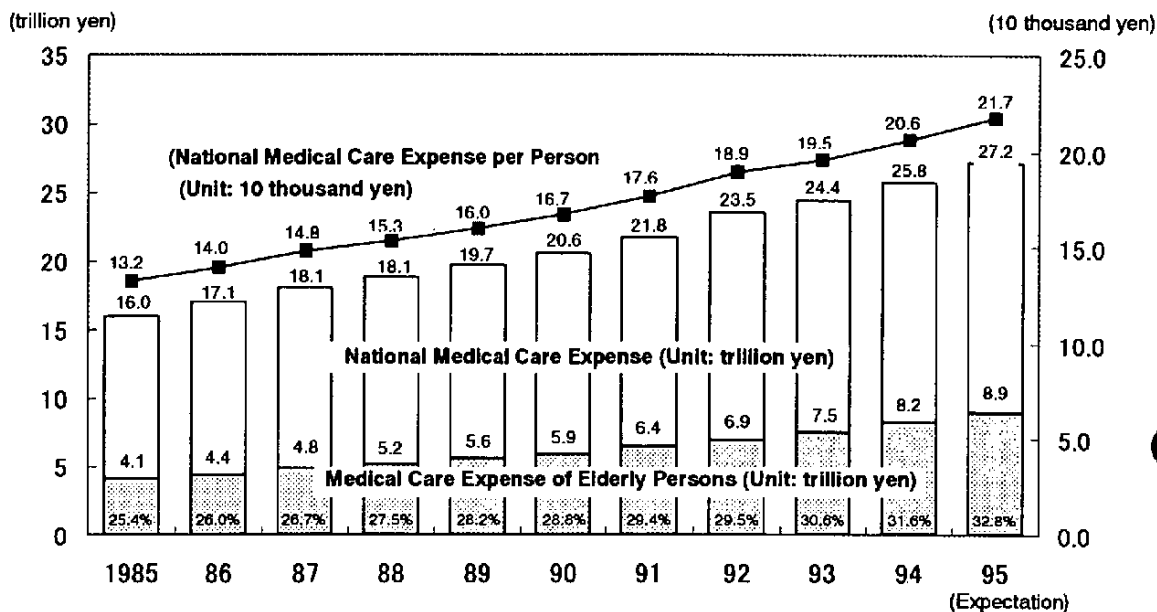
In Japan, the patients are free to choose the medical care organization for receiving medical service. The expense on medical service is paid out of the patient's medical insurance to the medical care organization by passing through an examination payment organization (an organization that examines the bill from a medical care organization for its validity and then makes payment). The expense is determined by the medical fee system as the official rate, according to the description of the provided medical service. The mechanism of the insurance health examination is shown in Figure 2.

7. Nursing Care Insurance System

From now on, the elderly population will increase more than ever, and a big national cause of worry is arising

from the issue of nursing elderly persons in their remaining years. A societal problem is also arising from the extremely heavy burden that a family must shoulder economically and physically to care for the elderly. The nursing care insurance system was founded to support nursing care of elderly persons at the societal level from the year 2000. The nursing care insurance system provides adequate service to persons who need it, using the insurance premium for the payment of that expense.

The enforcement of nursing care service, collection of insurance premium, and payment of expenses in regard to the nursing care insurance system are done mainly by the city, town, or village. The insured must be persons 40 and above.



Data: Ministry of Health and Welfare

Figure 1 Changes in the National Medical Care Expenses

Table 1 Changes in the Number of Medical Care Facilities and Sickbeds

	No. of Facilities						No. of Sickbeds	
	Hospitals		General Medical Clinics		Dental Clinics		Hospitals	General Medical Clinics
	Actual No.	Rate (per 100,000 persons)	Actual No.	Rate (per 100,000 persons)	Actual No.	Rate (per 100,000 persons)	Rate (per 100,000 persons)	Rate (per 100,000 persons)
1955	5,119	5.7	51,349	57.5	24,773	27.7	574.3	127.6
1960	6,094	6.5	59,008	63.2	27,020	28.9	735.1	176.8
1965	7,047	7.2	54,524	65.7	28,502	27.1	889.0	207.6
1970	7,974	7.7	68,997	55.5	29,911	28.8	1,024.4	240.7
1975	8,294	7.4	73,110	65.3	32,565	29.1	1,039.9	235.9
1980	9,055	7.7	77,611	66.3	38,834	33.2	1,127.1	245.9
1985	9,608	7.9	78,927	65.2	45,540	37.6	1,235.5	234.2
1990	10,096	8.2	80,852	65.4	52,216	42.2	1,356.5	220.4
1994	9,731	7.8	85,588	58.5	57,213	45.8	1,341.3	209.8
1995	9,606	7.7	97,069	69.3	58,407	46.5	1,329.9	206.5

Note: As of October 1 for 1985, 1990, 1994, and 1995. As of the year end for other years.

Data: Ministry of Health and Welfare "Medical Care Facilities Survey"

Table 2 No. of Medical Care Workers

		Actual No.	Rate (per 100,000 persons)
1996	Doctor *	230,519	184.4
	Dentist *	81,055	64.8
	Pharmacist *	176,871	141.5
	Public Health Nurse	31,581	25.1
	Midwife	23,615	18.8
	Nurse, Practical Nurse	928,896	738.0
	Dental Hygienist	56,466	44.9
	Dental Technician	36,652	29.1
	Masseur/Masseuse	98,070	77.9
	Acupuncturist, Causterist	137,445	109.2
	Judo Epithesis Doctor	28,244	22.4
	Physical Therapist (PT)**	12,312	9.8
	Occupational Therapist (OT)**	5,181	4.1

Note 1) Male nurses are included in the number.
 2) Male nurses are included in the number.
 3) *: This is the number reported in the end of 1994.
 4) **: This is the number reported from hospitals and general health clinics as of October 1995.
 Data: Ministry of Health and Welfare

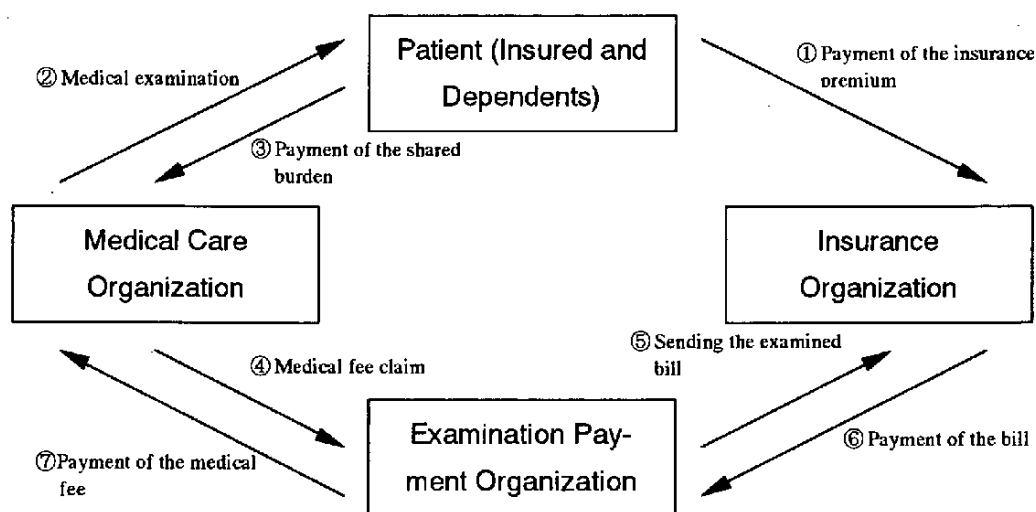


Figure 2 Mechanism of Insurance Health Examinations

Table 3 Description of the Medical Insurance System

System			Applicable Persons	Insurer	No. of Policy-holders
Employment Insurance	Health Insurance	Government	Workers of smaller enterprises	Country	37,660,000
		Association	Workers of large enterprises	Health insurance association 1.817	32,550,000
		7 of Article 69 Insured	Persons of daily employment	Country	100,000
	Mariner's Insurance		Mariners	Country	350,000
	Benefit Society		Government employees Local employees Private teaching staff	27 associations 54 associations 1 association	11,800,000
National Health Insurance			Farmers Self-employed persons	3,252 municipalities	37,970,000 cities, towns, and villages 4,560,000 in national health insurance associations
				166 national health insurance associations	
	Medical Care System of the Retired		Retired persons with employment insurance	3,252 municipalities	3,350,000 with employment insurance
Elderly Health			Note: Persons 70 and over who have employment insurance and national health insurance, and persons 65 to 70 who have a handicap	[Main body of enforcement] City, town, and village heads	7,800,000 with national health insurance

II. Development and Present State of the Medical Information System

1. The Present Situation of Japan's Health and Medical Care

Card System

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Introduction

With the approach of a low childbirth and increased elderly population society, the environment surrounding our country's health and medical care is changing drastically. The provision of health and medical services is reaching a turning point along with the nation's rising concern toward good health and the diversification of needs.

On the other hand, there is remarkable progress of the information-oriented society, and the use of information communication technology is greatly anticipated for the efficient provision of health and medical servi-

ces and the attempt for qualitative improvements. Various health and medical information systems are already being used in medical care organizations and regions, and we can say that information orientation in the health and medical care areas is the current tendency.

In recent years, with the autonomies as the nucleus, a health and medical card system (called card system hereon), card-type media as IC cards, is being introduced for the health management of residents. Our foundation has also been working on the research and development of the card system since 1987, as a commission business of the Ministry of

Health and Welfare.

Here, based on these accomplishments, we will introduce the present and future trend of our country's card system.

1-1. What is the "Health and Medical Care Card System"?

The medical information of an individual at a medical care organization and the information of the health examination results at an autonomy cannot be called an interactive and effective health record of the individual, from the fact that the information is kept and managed separately. The card system has the characteristic of enabling a gathering of all health records of an individual into one card for the individual to carry. Its purpose is in the continuous management of one's health record by having the individual submit the card during medical examination at a medical organization or during health consultation and guidance at a health center. The following points indicate the expected results.

(1) Increased health awareness of

regional residents

Since individuals keep and manage the information concerning their health, their awareness toward health will rise. An increase in the rate of having health examinations can also be anticipated.

(2) A feeling of security toward health

By carrying the card, residents will feel the security of knowing that their doctor understands their health information at all times.

(3) Increased trust and relationship between the doctor and patient

From the time series display and graphs of test and health examination results, and also from the historical reference of dosage, it would be easier for the doctor to explain the content of medical care to the patient. And it would also help the patient better understand the explanation of the medical content.

(4) Application of test results and prevention of overlapping dosages and medicine that must not be taken together

More appropriate and efficient

medical practice can be anticipated with the interactive reference to the test results and dosage details from other medical care organizations.

(5) Stronger medical care organization linkage

By having medical care organizations share their patients' information, an even stronger medical care organization linkage can be expected.

1-2. Introduction of the Health and Medical Care Card System

The autonomies presently using the card system are shown on Table 1. There are different bodies involved in the card system; the country participates in some, and autonomies work independently in others. Table 1 shows the autonomies that are chief providers of this system.

(1) Model work of the Ministry of Health and Welfare

From 1987 to 1989, our foundation, as a commission business of the Ministry of Health and Welfare, has worked on the method of stor-

ing health and medical information on IC cards, and the research and development of processing and using the recorded information, using Goshiki, Hyogo-prefecture as the field experimentation site. And based on the results, a measure for spreading and establishing the card system in the national level was sought from 1991 to 1993 as a societal system, using Himeji, Hyogo-prefecture as the field experimentation site. The experimentation has already been finished, but it is still being continued in some towns and cities as an independent work, and is making sure and steady progress.

Based on the results of the two field experiments, the Ministry of Health and Welfare indicated the "Health and Medical Care Card System Guidelines" to prefectures, as mentioned in a later section.

(2) Model market of the Ministry of Home Affairs

The Ministry of Home Affairs has unfolded a "Regional Card System" business from 1991 with the purpose of effectively providing administrative service to regional residents, such as the issuance of

various certificates, as certificates of residence, and the use of various public facilities, as libraries. 17 organizations are presently designated as fields for this business.

- Primary designated organizations (1991)
Yonezawa, Yamagata; Kitaibaraki, Ibaraki; Hiyoshi, Kyoto; Okayama, Okayama; Nariwa Okayama
- Secondary designated organizations (1992)
Chino, Nagano; Hamasaka, Hyogo; Kagawa, Kagawa; Saijo, Ehime; Isahaya Nagasaki
- Tertiary designated organizations (1993)
Iwamizawa, Hokkaido; Tateyama, Toyama; Izumo, Shimane; Toyoda, Shizuoka; Yonago, Tottori; Ohseto, Nagasaki; Yamaga, Kumamoto

These designated organizations are in pursuit of building a standard model system that can be used at all national autonomies, and excluding the organizations that are still in the development process, operation has already being started. The Ministry of Home Affairs has gathered the results up now, and announced the standard

system that can also be used at other autonomies. It is also taken up as an essential measure in the health management of regional residents.

(3) Model work of the Social Insurance Agency

The Social Insurance Agency held the experimentation of using IC cards for health insurance policies from 1995 to 1998, using Yatsushiro, Kumamoto as the field experimentation site. The cards are issued to the insured and to each dependent, having the function as an insurance policy, as well as the ability for recording health diagnosis information. The number of issued cards amount to approximately 80,000, and is of the largest scale in our country. Recently, according to Japan's "Activity Plan for the Reform and Creation of the Economic Structure (cabinet council decided on May 16, 1997)", it was decided to "start the adjustment of parties concerned in 1997 for using cards for health insurance policies, and hold the necessary examinations." In this way, Japan has decided to introduce and examine this system aggressively, as a country as well.

(4) Work Other than that of the Country

Other than the work in which the country is involved, some are executed as an autonomy's independent work, some are executed independently by medical care organizations, some are executed with the region as the object under the cooperation of regional medical society and private enterprises, and some are executed by private enterprises for the health management of their employees.

1-4. Health and Medical Care Card System Guidelines

The card system is a brand new type of health and medical information system, requiring the residents to keep and manage their own health record, and there are unique matters that require attention for its efficient and smooth introduction and implementation. Based on the field experimentation results held in Goshiki and Himeji, in which our foundation was entrusted by the Ministry of Health and Welfare, the basic conditions for autonomies to introduce the

card system were indicated to all prefectures in July 1994 as the "Health and Medical Care Card System Guidelines".

In addition, our foundation has gathered matters of caution on the guidelines, from concrete explanations and introduction to implementation, in the "Health and Medical Care Card System Introduction Manual".

The guidelines give the following points as the basic conditions for safe, effective, and smooth implementation of the card system.

(1) Thorough provision of knowledge to residents, such as the purposes of the card system

Make sure health and medical care organizations, such as local autonomies and regional medical societies, enforce public relations by running articles on public relations magazines and publicizing the card system at health examinations, so the residents thoroughly understand the purposes and usage of the card system, and the facilities permitting its use. In addition, make sure the window for inquiries from residents is defined.

(2) Cooperation and participation of

health and medical care of parties concerned

Reliable information input and output are essential for better use of health and medical care information with the card system, and health and medical care organizations must be in agreement to co-operate.

(3) Establishment of measures for ensuring security

Measures must be established for ensuring security, as establishing rules on the protection of privacy and the public announcement of information. Privacy protection is especially an essential function for the health and medical care information system that relies not only on computer technology, but also on the appropriate handling by all parties participating in the card system, such as the residents and health and medical care parties concerned, and the most effective measure must be taken to match the region's situation.

(4) Security of information compatibility

In view of the wide migration of residents, it is essential for the accumulated information in the card

system to be usable even in a region that is not the region of issuance, and a measure must be taken for securing information compatibility so information can be used widely.

(5) Measures toward the enrichment of health and medical care services

Measures must be enforced toward the enrichment of health and medical care services, such as active regional health activities done by health and medical care parties concerned and linkage of functions between health and medical care facilities.

Further, it is desirable to have an interaction between the existent health and medical care information system and the card system, such as creating a database on the health examination results and basic information (name, address, etc.) of the residents.

1-5. Present Situation of Health and Medical Care Card System Standardization

Presently, most of the cards of the card system introduced by an autonomy are unusable in the administrative area of that autonomy. Along with the widening of the residents' area of daily life, it is highly demanded for future card systems to be usable in a wide area, exceeding the administrative area of the autonomy, as also indicated in the guidelines. In other words, there is a great need for the security of compatibility (standardization).

In regard to the card systems which already use IC cards, standard base technology to secure compatibility is being developed as follows.

(1) CAM (Contents Access Manager) software

In the present card systems introduced by the autonomies, the autonomy itself determines whether to record data in which area of the card memory (memory allocation), and builds the system. And compatibility cannot be secured because the allocation differs for each autonomy.

CAM software was developed by the New Media Development Association Foundation as a means for solving this problem techno-

logically, and it is used for reading and writing card data without the need to be conscious of memory allocation. With CAM, a "tag number" is granted to each data item to be recorded on the card, such as the name and address, and the data is read and written by designating the tag number. The tag numbers correspond to each data item with a 1:1 ratio, and CAM handles the tag number and data item as a pair (Figure 1). This is presently adopted in the "Regional Card System" of the Ministry of Home Affairs, a system in Takigawa, Hokkaido.

(2) Standard items and tag numbers

Compatibility can be attained technologically by incorporating CAM, but the data items and corresponding tag numbers must have a unified common expressional format.

Our foundation has established the standard data items commonly used in the health and medical care welfare field, and added tag numbers to them in the "Health and Medical Care Card System Standardization Manual". Table 2 shows an example of the standard items and tag numbers.

(3) Access rights

As indicated in the guidelines, the protection of privacy in the card system is vital, and thus the operation cards (IC cards) are issued according to the work type (doctor, nurse, etc.) that uses the information. The operation cards have a set range (access rights) for reading and writing information on the card, depending on the work type, to limit access to information.

Our foundation has gathered together a form of standard access rights, according to the work type, in the "Health and Medical Care Card System Standardization Manual". Table 3 shows an example of access rights.

1-6. Future Trends of the Health and Medical Care Card System

This section, closely correlated to the conventional card system, puts in order the trends that are thought to cause a great influence.

(1) Using cards in place of health insurance policies

As mentioned before, Japan's "Activity Plan for the Reform and Creation of the Economic Structure (cabinet council decided on May 16, 1997)" decided to "start the adjustment of parties concerned in 1997 for using cards for health insurance policies, and hold the necessary examinations."

In the conventional card system, the cards were issued only to the applicants, but the health insurance IC cards would be issued to each citizen, as a rule. However, legal arrangements and systematic arrangements are still necessary for enforcement, so a sufficient examination period would be necessary for materialization.

(2) Electronic chart developmental work

Our foundation has been working on the research and development of electronic charts from 1995 as commission work of the Ministry of Health and Welfare. This is an attempt for an even greater promotion of information orientation in the health and medical care field, by developing a system to record the information of medical examinations electronically, which would

be the starting point and origin of health and medical care information. The electronic charts would be at the center core of all health and medical care information systems, and the card system would be a part of the surrounding systems.

The time taken to input information into the card system is said to be the cause that is hindering progress. According to the flow of information, the electronic charts are the starting point, and by realizing a mechanism to connect with this system, it would make possible the efficient input of information. We think the future spread of electronic charts would help prepare the base for popularizing the card system.

(3) Access key to the network

The 21st century is said to be the network era, and medical care organizations are expected to be interactively connected by networks. Plans for the card system are being considered not only for recording a lot of health and medical care information, as has been done up to now, but recording only the locations of storage, and acquiring detailed information through the network by accessing the location of

storage as needed.

(4) The plan for creating a basic resident register network system

For the improvement of resident services and efficiency in administrative work, the Ministry of Home Affairs is considering making a basic resident register network system, so certificates of residency could be issued at any city, town, or village in Japan. Here, it is also considered for the city, town, or village to issue basic resident register cards (IC cards) with common specifications nationwide to applicants for identifying the applicant in network access.

The empty area of card memory could be used for special city, town, or village uses, and its application in the health and medical welfare field is also anticipated.

(5) Security of international and reciprocal operability of the G7-Health Care Data Card

In Brussels, Belgium in February 1995, the seven-nation information communication Cabinet meeting was held, and the enforcement of an international joint project was agreed on 11 themes in regard to

the arrangement and application of a worldwide information communication base. Theme 8 was taken up as the worldwide health and medical care application, and is called "Global Health Care Application". In addition, theme 8 consists of nine sub-projects, and sub-project 6 is aimed at the international harmonization of data cards in the health and medical care field. Examinations are being held for sub-project 6 for solutions to the technical issues in realizing card compability and reciprocal use between G7 participating countries, and verification experimentation is also under project. Our foundation is also cooperating actively on sub-project 6.

be vital to thoroughly examine these tendencies before introducing the card system.

In Conclusion

The environment surrounding the card system, such as health insurance cards, electronic chart development, and access keys to the network, is changing rapidly. And together with this change, it is only natural to expect the conventional card system, used mainly for health history records, to change as well, in its use and how it should be. From here on, it will

Table 1 List of Card Systems Adopted in the Health and Medical Care Fields

[Medical Information System Development Center Research of March 1998]

[* : Planned No. for Distribution]

Administering Subject, Local Autonomy

Administering Region	Starting Date of Operation	Purpose	Card Type	Card Name	Subject for Card Distribution	No. of Cards Distributed
Takigawa, Hokkaido	February 1996	To use the medical examination and health promotion data for health management.	IC card	Genki Card	Citizens	* 6,000
Yonezawa, Yamagata	September 1994	A model region for the "Regional Card System" (Ministry of Home Affairs, designated in 1991)	IC card	Genki Card	Subjects applicable to a four month health examination after September 1, 1994 Elementary to junior high school students	* 10,000
Kitaibaraki, Ibaraki	October 1994	A model region for the "Regional Card System" (Ministry of Home Affairs, designated in 1991)	IC card	Fureai Card Sukoyaka Card	65 and over 0 to 3	* 6,500
Mitaka, Tokyo	July 1992	To make use of individual basic information, home care information (ADL information), and information of medical examination by interview in the health management of home medical treatment patients.	IC card	Mitaka Comprehensive Citizen Card	Patients 65 and over receiving home medical treatment	* 1,500
Isehara, Kanagawa	February 1992	To use basic information, emergency information, health check-up information, welfare service records, and health guidance records for health management and welfare promotion of the citizens.	Optical card	Sukoyaka Card	Elderly persons In the future, all citizens	21
Hakushu, Kitakoma, Yamanashi	July 1988	To use the medical examination data of the Health Law for the Aged for health management of the citizens.	Optical card	Life Passport	Subjects applicable to the Health Law for the Aged	3,500
Tanbayama, Kitatsuru, Yamanashi	April 1992	To use the medical examination data of the Health Law for the Aged for health management.	Optical card	Health Information Optical Card	Subjects applicable to the Health Law for the Aged	2,500
Toyoda, Shizuoka	April 1996	A model region for the "Regional Card System" (Ministry of Home Affairs, designated in 1994)	IC card	Toyoda-cho Card Toyoda-cho Card	0 to 15 65 and over	1,000
Tateyama, Nakanii-kawa, Toyama	July 1996	A model region for the "Regional Card System" (Ministry of Home Affairs, designated in 1993)	IC card	Otassha Card Jr. Card Nikochan Card	60 and over Elementary to junior high school students Babies and infants	* 8,000

Administering Region	Starting Date of Operation	Purpose	Card Type	Card Name	Subject for Card Distribution	No. of Cards Distributed
Hiyoshi, Funai, Kyoto	October 1994	A model region for the "Regional Card System" (Ministry of Home Affairs, designated in 1991)	IC card	Hiyoshi Fureai Card Hiyoshi Sukoyaka Card	65 and over Subjects applicable to a three month health examination	* 5,000
Wazuka, Sohraku Kyoto	August 1990	To use the medical examination data in health management.	Optical card	Wazuka Health Management IC Card	Subjects applicable to the Health Law for the Aged	1,800
Goshiki, Tsuna, Hyogo	March 1989	For medical care organizations to mutually browse the medical care data and medical examination data, and use them in practice. (Ministry of Health and Welfare, 1987 to 1989) Also, to use the health card for welfare services. Issuance of the "Sukoyaka Card" in May 1992 for managing the medical care and health checkup information of new-born infants to adults.	IC card	Health Card	30 and over	6,300
				Sukoyaka Card	Babies and infants from 0 to 8	700
Kakogawa Arca, Hyogo (Kakogawa, Inami, Harima)	April 1991	Mainly for diabetic patients, to make use of the individual's basic information and health examination record information in life guidance. Also, to make use of a new-born infant's individual basic information, development history information, and delivery information in future health examinations.	IC card	Kinocard	Patients with a chronic illness, sick babies and infants	8,000
Himeji, Hyogo	December 1992	Experimentation site for the "New Health and Medical Care Card System" (Ministry of Health and Welfare, 1991 to 1993) Experimentation site for the realization of mutual use, by integrating health, medical care, and welfare information. (Hyogo, 1993)	IC card	Iki-iki Card	60 and over Elderly persons 65 and over who are receiving home welfare services	10,000
Hamasaka, Mikata, Hyogo	December 1995	A model region for the "Regional Card System" (Ministry of Home Affairs, designated in 1992)	IC card	Anshin Card	60 and over	1,700
Okayama, Okayama	October 1994	A model region for the "Regional Card System" (Ministry of Home Affairs, designated in 1991)	IC card	Okayama Fureai Card	65 and over	* 40,000
Nariwa Kawakami, Okayama	October 1994	A model region for the "Regional Card System" (Ministry of Home Affairs, designated in 1991)	IC card	Nariwa Sukoyaka Card	65 and over	* 5,000
Higashi Hiroshima, Hiroshima	December 1993	To make use of it in health and welfare services, as a regional care support information system.	IC card	Higashi Hiroshima-shi Fureai Welfare Card	Elderly persons 60 and over who need help	3,000

Administering Region	Starting Date of Operation	Purpose	Card Type	Card Name	Subject for Card Distribution	No. of Cards Distributed
Izumo, Shimane	April 1991	To use the medical examination data in medical practice, administrative window service (issuance of the certificate of residency and seal registration certificate) Issuance of the "Children's Card" from December 1993. A model region for the "Regional Card System" (Ministry of Home Affairs, designated in 1993)	IC card	Izumo-shi Welfare Card Izumo-shi Children's Card	70 and over	6,000
					15 and under	16,000
Kagawa, Kagawa, Kagawa	October 1995	A model region for the "Regional Card System" (Ministry of Home Affairs, designated in 1992)	IC card	Iki-iki Card Genki Card	65 and over Adults 40 and over who are having a medical examination Infants	* 5,000
Saijo, Ehime	December 1995	A model region for the "Regional Card System" (Ministry of Home Affairs, designated in 1992)	IC card	Saijo-shi Iki-iki Card Saijo-shi Genki Card	65 and over Infants	* 9,500
Isahaya, Nagasaki	November 1997	A model region for the "Regional Card System" (Ministry of Home Affairs, designated in 1992)	IC card	Isahaya Citizen's Card	Pregnant women, babies and infants 70 and over 65 and over (with a disability handbook)	
Saiki, Oita	April 1992	To use the medical examination data in medical practice, administrative window service (issuance of certificates of residency and seal registration certificates)	IC card	Saiki Citizen's Card	Citizens 20 and over Persons needing help	22,000
Yufuin, Oita, Oita	April 1994	To use the card for welfare consultation support and case management support	IC card	Yufuin Iki-iki Card	65 and over	1,000
Kunitomi, Miyazaki	February 1997	Support of welfare service provision Linked with the health and medical care welfare card that is enforced at the National Labor Cooperative and Miyazaki medical societies	IC card	Cosmos Card	65 and over (receiving home welfare services)	340
Yatsushiro, Kumamoto	April 1995	Test introduction of the medical insurance card to take place of the "Health Insurance Certificate of the Insured". (Social Insurance Agency)	IC card	Medical Insurance Card	The insured and dependents of Government insurance and national health insurance	78,000

Figure 1 Format of Data Items

Tag No.	Length	Value
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Table 2 Example of Terms and Codes in the Standardization Manual

Class Code	03	Health Information Field (Adult and Elderly Health)
Sub-class Code	Tag	Standard Item (Term)
06		Inspection information (Basic health examination)
	10	Examination date
	11	Medical care organization
	12	Medical care organization code
	13	Examination No.
	14	Examination type
	15	Height
	16	Weight
	17	Standard weight
	18	Rate of obesity
	19	Percentage of body fat
	1A	Thickness of subcutaneous fat
	1B	Thickness of subcutaneous fat (upper arm)
	1C	Thickness of subcutaneous fat (back)
	1D	Vision
	1E	Vision (naked · right)
	1F	Vision (naked · left)
	20	Vision (corrected · right)
	21	Vision (corrected · left)
	22	Hearing
	23	Hearing (1000Hz · right)
	24	Hearing (1000Hz · left)
	25	Hearing (4000Hz · right)
	26	Hearing (4000Hz · left)
	27	Body temperature
	28	Blood pressure
	29	Max. blood pressure
	2A	Min. blood pressure
	2B	Pulse rate
	2C	Proteinuria
	2D	Urinoglucose
	2E	Urinoglucose (on an empty stomach)
	2F	Urinoglucose (after one hour)
	30	Urinoglucose (after two hours)

Table 3 Example of Access Rights of the Card System

Operator's Work Type Class Sub-class	Card Issuer	Administrative Work					Emergency		Health and Medical Care Work										
		Resident Information Supervision Post	Health Information Supervision Post	Welfare Information Supervision Post	National Health Insurance Information Supervision Post	Pension Information Supervision Post	Paramedic	Emergency Staff	Doctor	Dentist	Pharmacist	Public Health Nurse, Midwife	Nurse, Practical Nurse	PT, OT	Dental Hygienist	Medical Radiation Engineer	Clinical Inspection Engineer	Nutritionist	Clerical Worker
01 Individual's Basic Information Field																			
01 Individual's Basic Information	○	○	○	○	○	○	△	△	△	△	△	△	△	△	△	△	△	△	△
02 Administrative Window Information	○	○	○	○	○	○	×	×	△	△	△	△	△	△	△	△	△	△	△
03 Health Insurance Information	○	○	○	○	○	○	×	×	○	○	△	△	△	△	△	△	△	△	△
04 Public Expense Burden Information	○	○	○	○	○	○	×	×	○	○	△	△	△	△	△	△	△	△	△
05 Pension Information	○	○	○	○	○	○	×	×	△	△	△	△	△	△	△	△	△	△	△
06 Handicapped Person's Handbook Information	○	○	○	○	○	○	×	×	△	△	△	△	△	△	△	△	△	△	△
02 Emergency Information Field																			
01 Emergency Information (Indispensable Medical Care Information)	○	×	×	×	×	×	△	△	○	○	△	△	△	△	△	△	△	△	×

Operator's Work Type Class Sub-class	Welfare Work				Sch ool	La- bor
	Social Welfare Worker	Care Worker	Clerical Worker	Field Worker (Without Qualifications)	Nursing Faculty	Health Administrator
01 Individual's Basic Information Field						
01 Individual's Basic Information	△	△	△	△	△	△
02 Administrative Window Information	△	×	△	×	×	△
03 Health Insurance Information	△	×	○	×	△	△
04 Public Expense Burden Information	△	×	○	×	△	△
05 Pension Information	△	×	△	×	×	△
06 Handicapped Person's Handbook Information	△	×	○	×	△	△
02 Emergency Information Field						
01 Emergency Information (Indispensable Medical Care Information)	△	△	×	△	△	△

Note: The codes on the table carry the following meaning.

- { ○: Reading and writing is enabled
 { △: Reading is enabled
 { ×: Reading and writing is disabled

2. R & D and Verification Experimentation of the Integrated System

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2-1. The Need for Development

Acute infectious diseases are decreasing due to improvement in the nation's sanitary level, while chronic illnesses, such as geriatric diseases, are inclined toward an increase. To deal with this, long-term, comprehensive data and case files are demanded as effective data in medical practice.

Moreover, the Ministry of Health and Welfare gave notice of "Technical Criteria on the Storage of Medical Image Information onto Electronic Media" in March 1994, permitting the electronic storage of medical image information.

This means that the original copies of medical images used in medical practice could be stored on an electronic medium, such as an magneto-optical disk, instead of the conventional X-ray films.

There is also an attempt to make use of card media, such as IC cards that are input with health and medical

information for each individual to keep and manage, in medical practice at medical care organizations and in health consultations and guidance at health centers.

In addition, along with the popularization of networks, represented by the internet, patient information and medical images are being transmitted and linked by telecommunications, for the realization of telemedicine.

The electronic application of medical information by the use of such information technology plays a great part in improving the quality of medical care with the effective use of information in future medical care, the efficient and rational response to increasing needs, and linking medical care organizations in an area.

Furthermore, if related organizations of health and medical care are linked, and facilities and households are connected through networks in the future, the demand would rise for environmental preparations for the accurate

and safe availability of information.

However, each set of information on the magneto-optical disk, IC card, and in communication is presently dealt with as an individual system, and is not being used effectively.

Therefore, it is necessary to develop the base technology of Integrated System, so the information centered on medical images stored on the magneto-optical disk, the letter information on the IC card, and the letter and image information sent by telecommunications could be integrated, and such information could be used effectively, based on the security of using operation cards to discriminate medical workers.

2-2. Development Objectives

There are various types of medical information, such as images, sounds, letters, and numbers, that must be input and stored according to the data size and format of use.

For example, a large capacity magneto-optical disk is appropriate for medical image, such as an X-ray film, with the data size of 8MB per sheet. Letter and number data, such as the individual's basic information, as the patient's name and birthdate, allergy

information, record of examinations held at other medical organizations, disposed records, and health checkup data are small in capacity, and thus could be stored on an IC card to be carried and managed by the individual. The information in inside-hospital information systems and general medical information and medicinal information could be obtained by accessing a database through the use of telecommunications. The need for using telecommunications is also increasing in data exchange among medical care organizations. Since individual data is regarded as vital medical information, security must be ensured to protect the individual's privacy and prevent alteration.

Especially in the medical organization's use of the network through telecommunications, it is a precondition to use public lines, bringing up the issue of security during the transmission of individual information.

An agreement is needed for data exchange, for the safe and sure data exchange between different systems and facilities.

As a means to realize this kind of system, the use of IC cards, stored with key information that requires

security, such as the operation card (an IC card containing information for discriminating whether one is a medical worker) indicated in Figure 1, is extremely useful in improving the security of a system.

From this context, it is demanded for the provision of a base for constructing Integrated System, comprised of the magneto-optical disk system, IC card system, and telecommunications system, for the safe and accurate use of an individual's health data, medical examination data, and medical information from an online system.

The following advantages are expected from Integrated System.

- (1) The operator could obtain necessary information without having to worry about the medium.
- (2) Space is saved and operability is increased by integrating the system.
- (3) Information could be shared between different medical information systems.
- (4) Security could be ensured against illegal accesses that are made during the exchange of information through telecommunications.
- (5) System development could be done in a short period of time at a low cost by using middleware.

The base technologies of the FM (File Manager, Medical Information System Development Center) for the magneto-optical disk system, and the CAM (Contents Access Manager, New Media Development Committee) for the IC card system, have been developed already, and many systems are showing good performance results. On the other hand, base technology for the security of a communication system is still undeveloped.

Therefore, in this development, it was decided for the base technology of security communications to be developed in main, with FM and CAM also worked on as verification experimentation systems.

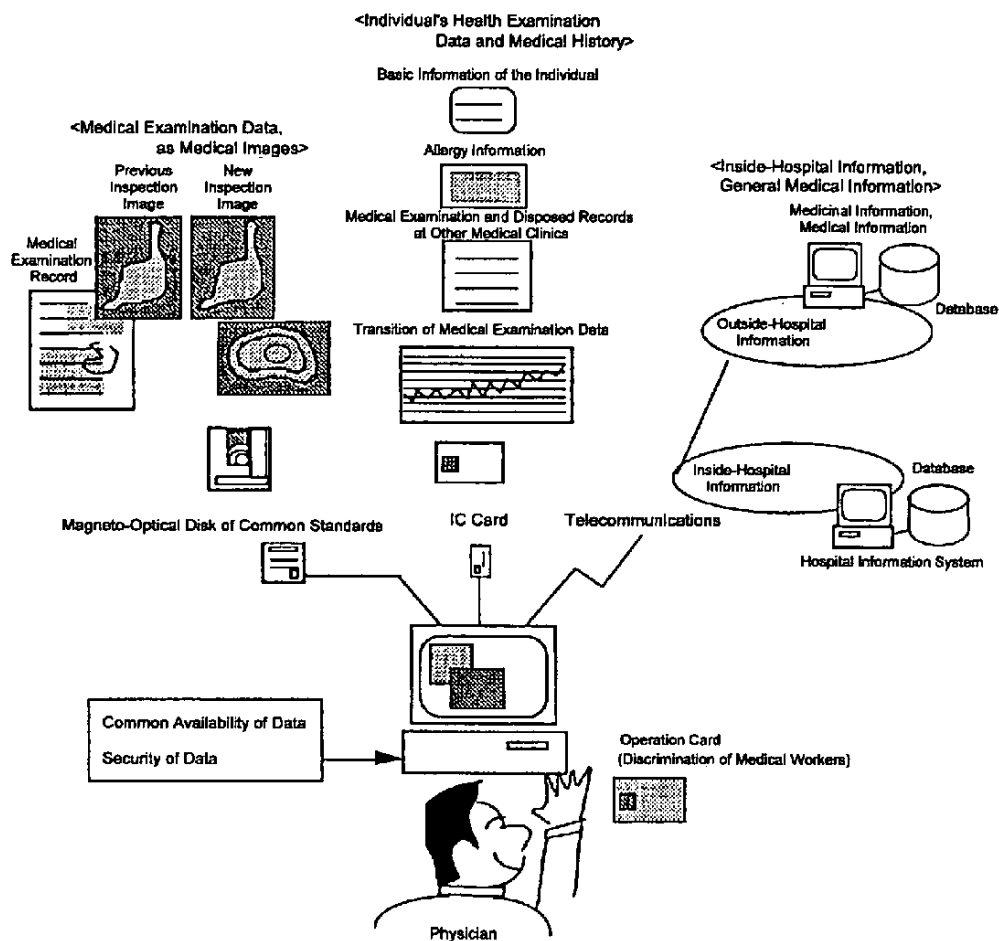


Figure 1 Concept of the Integrated System

2-3. Concept of the Integrated System

(1) Figure 2 shows Integrated System in layers. At the very bottom, as the physical layer, are the recording media and drives, and then the layers advance higher into the interface, Integrated Software, and application layers, in this order.

Each medium connects with Integrated Software at the FM, CAM, and CM (Communication Manager) areas. The CM area is used in accessing telecommunication networks. With these layers, application development and system construction are enabled without having to be conscious of the lower levels.

(2) Figure 3 shows the structural concept of Integrated Software.

Each medium would pass through Integrated Software to connect to the application. Here, we will explain the constituting factors of Integrated Software as control unit and the modules of the OCM (Operation Card Manager), FM, CM, and SM (Security Manager).

The OCM controls the operation cards as the CAM host, and the SM

ciphers, composes, and detects manipulation. The control unit controls the startup of each manager as required.

The connection between the integration software and application is unified as API (Application Programming Interface).

This means the application developer could develop each application without having to consider the details of Integrated Software specifications.

The main items for examination of Integrated Software are shown below.

- 1) Ensuring security between managers (OCM, FM, CM)
- 2) Ensuring security during the use of telecommunications by the establishment of a reliable means for authorization with the IC card
- 3) Improving the security level and ensuring the common availability of the entire system using the two items above.

2-4. On Verification Experimentation

Verification experiments on the development of an individual health and medical information Integrated Software have been executed from 1995 as a three-year-project; basic design and detail design of the experimental system in 1995, making of the experimental system in 1996, and evaluation and modification of the experimental system in 1997.

The field for verification experimentation was based at the endoscope units in the National Cancer Center Central Hospital and the National Cancer Center Hospital East. The two hospitals were connected with ISDN (INS64) public lines, and a system was constructed for data transmission and cooperative image diagnosis of mainly endoscopic images.

The verification experiments were held by assuming cases in which it was necessary for the staff of both hospitals to exchange opinions and

discuss the case, such as when a patient goes to both hospitals for inspections.

The entire structure of the verification experimentation system is shown in Figure 4.

2-5. Summary

In order to integrate the magneto-optical disk, IC card, and telecommunications for use, we developed Integrated Software for the base of security communication, together with the use of existent FM and CAM, and held verification experiments. As a result, we were able to ensure full security from Integrated Software, realizing the reliable authorization of communicating persons, protection of privacy with ciphering, and detection of alteration.

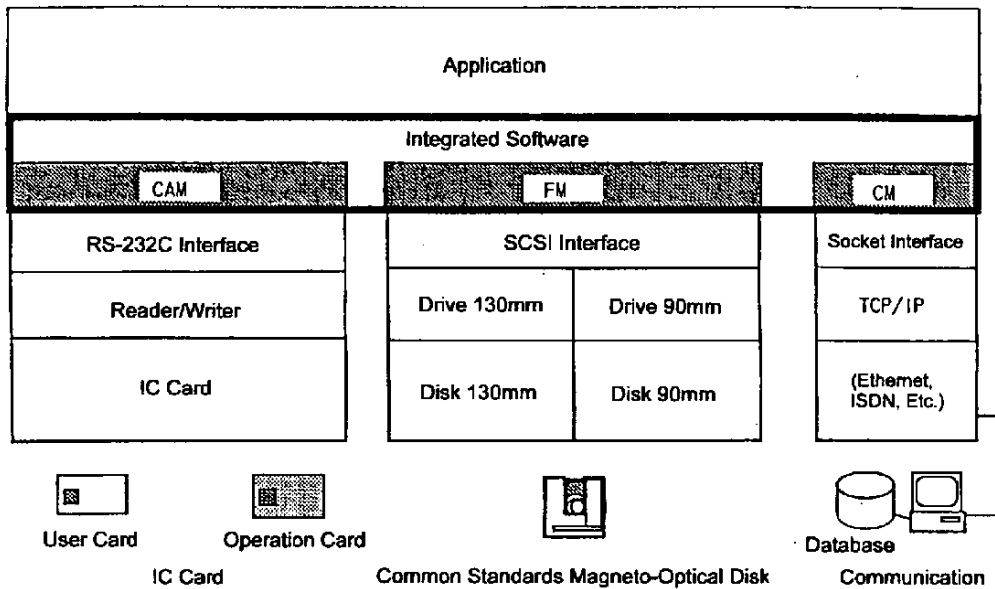


Figure 2 Layer Structure of the Integrated System

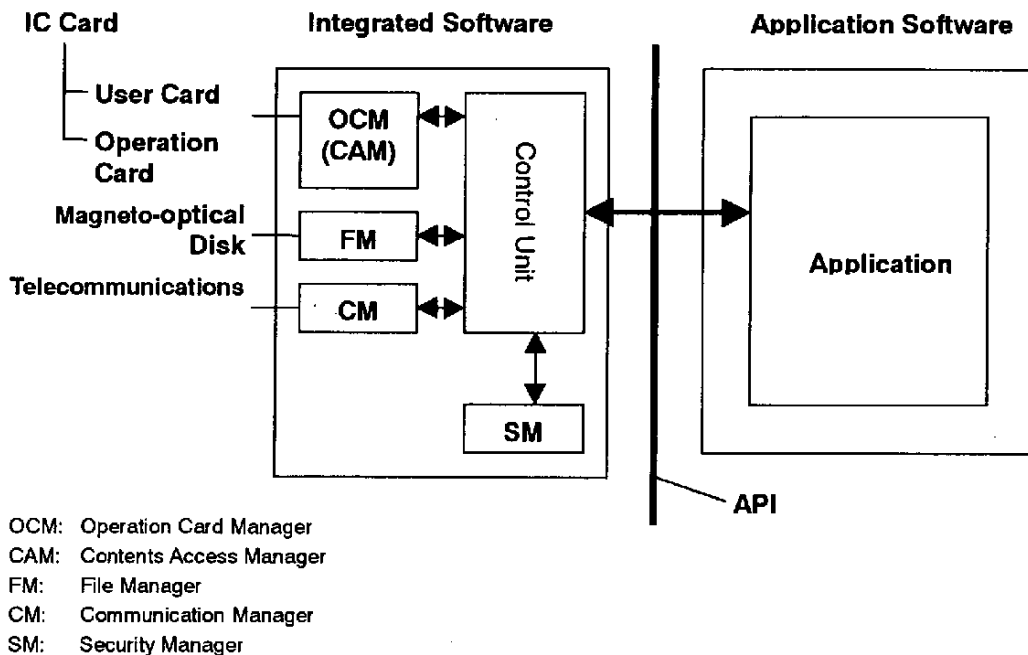


Figure 3 Structural Concept of the Integrated Software

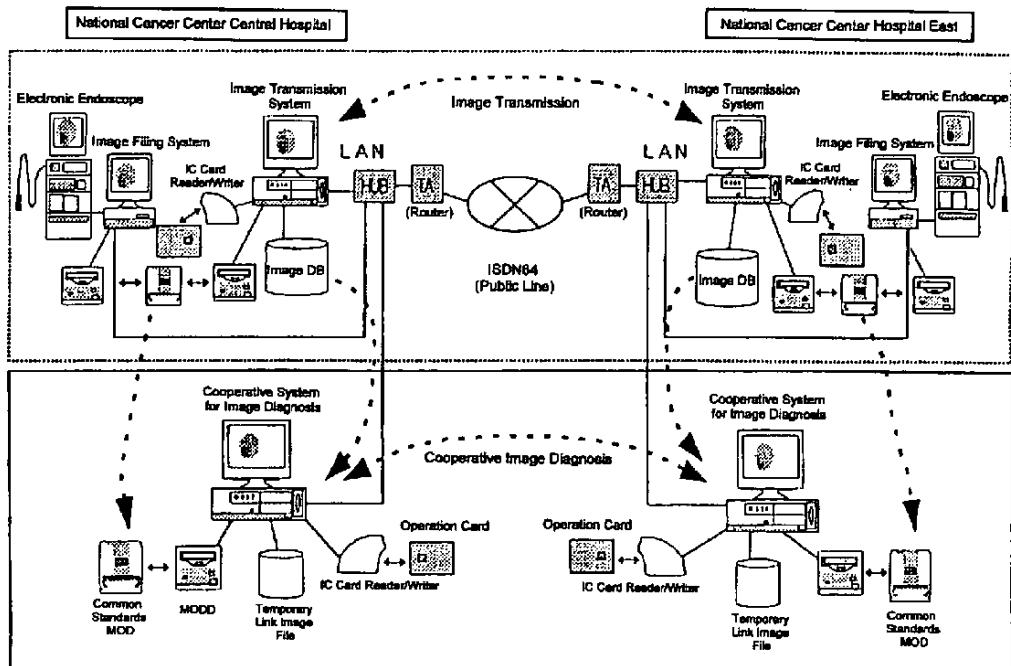


Figure 4 Structure of the Verification Experimentation System

3. R & D and Verification Experimentation on the Image Linkage System

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3-1. Aim of Development

To connect communication lines (ISDN lines) between key hospitals in the city, and between key hospitals and medical clinics to check the effectiveness of the medical image linkage system in hospital-hospital links and hospital-clinic links, such as in online case conferences and support of remote readings of X-rays, along with the development of necessary base technology and field verification experiments from the viewpoints of security, reproducibility, and common availability in order to build a medical image linkage system that will prove useful in the promotion of medical care organization linkage.

3-2. Description of the Image Linkage System

In the image linkage system, personal computers and work stations that are able to display the patients' medical care information (especially image data of X-ray pictures, X-ray CTs, and MRIs) are connected by ISDN lines for doctors in remote areas to treat or examine a case while looking at the same image.

In Figure 1, the same image is displayed on the image linkage systems of Clinic A and Hospital B, and a common pointer is also displayed on both image linkage systems to move in synchronicity, with such functions as free handwriting.

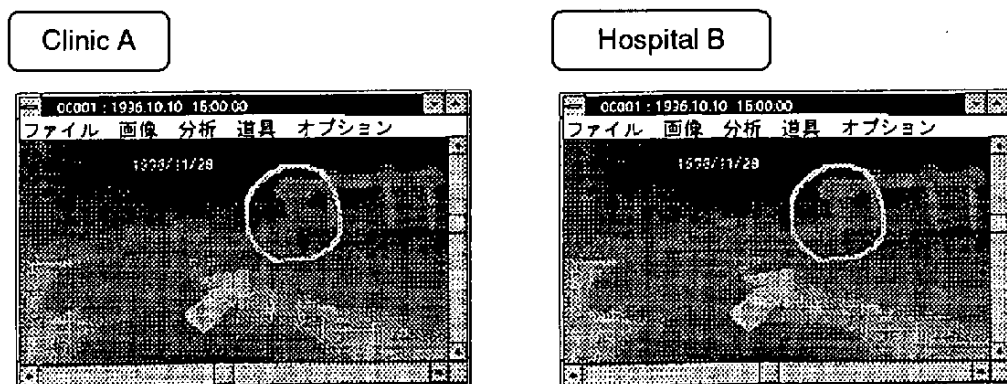


Figure 1 Example of Image Display on the Image Linkage System

3-2-1 System Configuration

The basic system configuration of the image linkage system is shown in Figure 2.

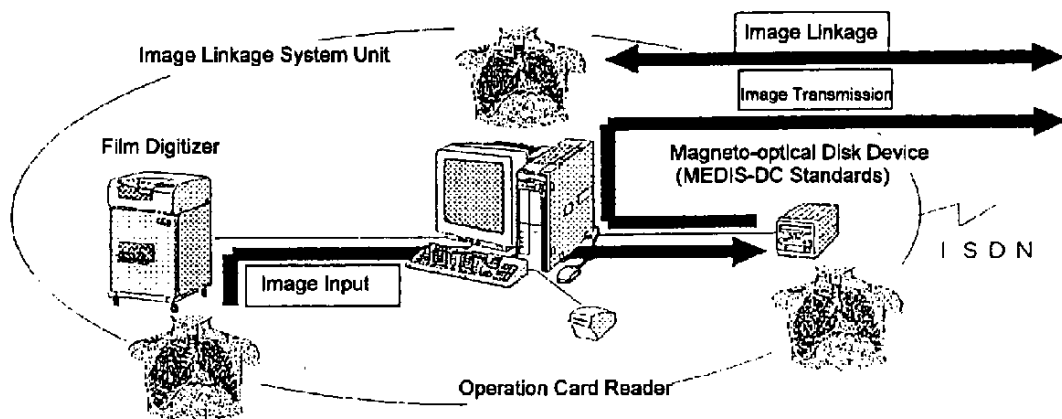


Figure 2 Basic System Configuration

(1) Hardware configuration

The basic hardware configuration of the image linkage system is shown on Table 1.

Table 1 Basic Hardware Configuration

Item No.	Hardware	Description
1	Image Linkage System Unit (Personal Computer or Work Station)	Controls the entire system.
2	Display Monitor	Displays the image.
3	Film Digitizer	Used to input and digitize the image information from the X-ray film.
4	Operation Card Reader	Used to input the IC card (JIS) for network security.
5	Magneto-optical Disk Device (Common Standards)	Stores the digitized image information and document information onto the magneto-optical disk.
6	Terminal Adapter or Router	Used to connect with the ISDN lines.
7	ISDN	Used to transmit the digitized imaged information and document information.

(2) Software configuration

The basic software configuration of the image linkage system is shown on Table 2.

Table 2 Basic Software Configuration

Item No.	Software	Description
1	Windows 95/Windows NT/UNIX	Operating system
2	Integration Software	Uses an IC card in the communication requiring information security.
3	Common Standards File Manager	Used to input from a magneto-optical disk of common standards
4	Image Linkage Software	Used to manage the messages in the image linkage system.
5	Image Processing Application	Image linkage system application used in displaying the image, enlarging and minimizing the image, etc.

3-2-2 Functions of the Image

Linkage System

The functions of the image linkage system are shown on Table 3. The functions on the table indicated with a “○” mark for the linkage function are the functions that work in synchronicity with the image linkage system, and in order to realize this, we are attempting the standardization of messages sent and received between the image linkage systems. The image linkage system security function is realized by use of the “integration software”, developed in the “Individual Health and Medical Care Information Integrated System Development” project.

Table 3 Functions of the Image Linkage System

Item No.	Class	Function	Description	Link abe
1	Input/Output	Input film	Used to take in the film designated by the digitizer	—
		Input media	Used to read the image data from the magneto-optical disk (common standards)	—
		Output media	Used to write the image data onto the magneto-optical disk (common standards)	—
2	File	Initialize media	Used to initialize the magneto-optical disk (common standards)	—
		Delete file	Used to delete a file in the magneto-optical disk (common standards)	—
		Copy file	Used to copy a file in the magneto-optical disk (common standards)	—
3	Transmission	Transfer image	Used to transmit the image to the designated party	—
		Reverse compression	Reverse compression of 2 to 16-bit JPEG (monochrome)	—
		Normal compression	Normal compression of 8 and 12-bit JPEG (monochrome)	—
4	Browse	Set browsing conditions	Used to browse the image in the magneto-optical disk under the designated conditions	○
5	Image Display	Scroll	Image scroll	○
		Image size	Window size of image display	○
6	Image Operation	Convert gradations	Used to convert and display the gradation	○
		Enlarge/Minimize	Used to enlarge and minimize the image	○
		Rotate	Used to rotate the image 90. to the left and right or 180.	○
		Invert	Used to invert the image up and down or left and right	○
7	Image Analysis	Display pixels	Used to display the pixels at a set position on the image	○
		Display distance	Used to display the distance between two designated points	○
8	Conference Tool	Shared pointer	Used to display the pointer at a set position	○
		Free script	Used to show the line segment	○
		Show lines	Used to display letter information, such as comments	○
		Alter lines	Used to alter the word line	○
		Move	Used to move selected free script	○
		Clear	Used to clear selected free script	○
		Clear all	Used to clear all free script	○
		Select	Used to select free script	—

3-3. Research and Development

The required element technology for the image linkage system, system concept design, and basic design of the image linkage system were executed using the image linkage WG.

In addition, seven development manufacturers attempted in the standardization of messages to represent the linkage functions, and each of them developed image linkage software and image processing application to work on the selected hardware.

3-4. Verification Experimentation

As shown in the figure below, 10 verification experimentation systems developed by the seven manufacturers were constructed in the seven medical care organizations in Nishiharima region health and medical care area, which are the fields for verification experimentation.

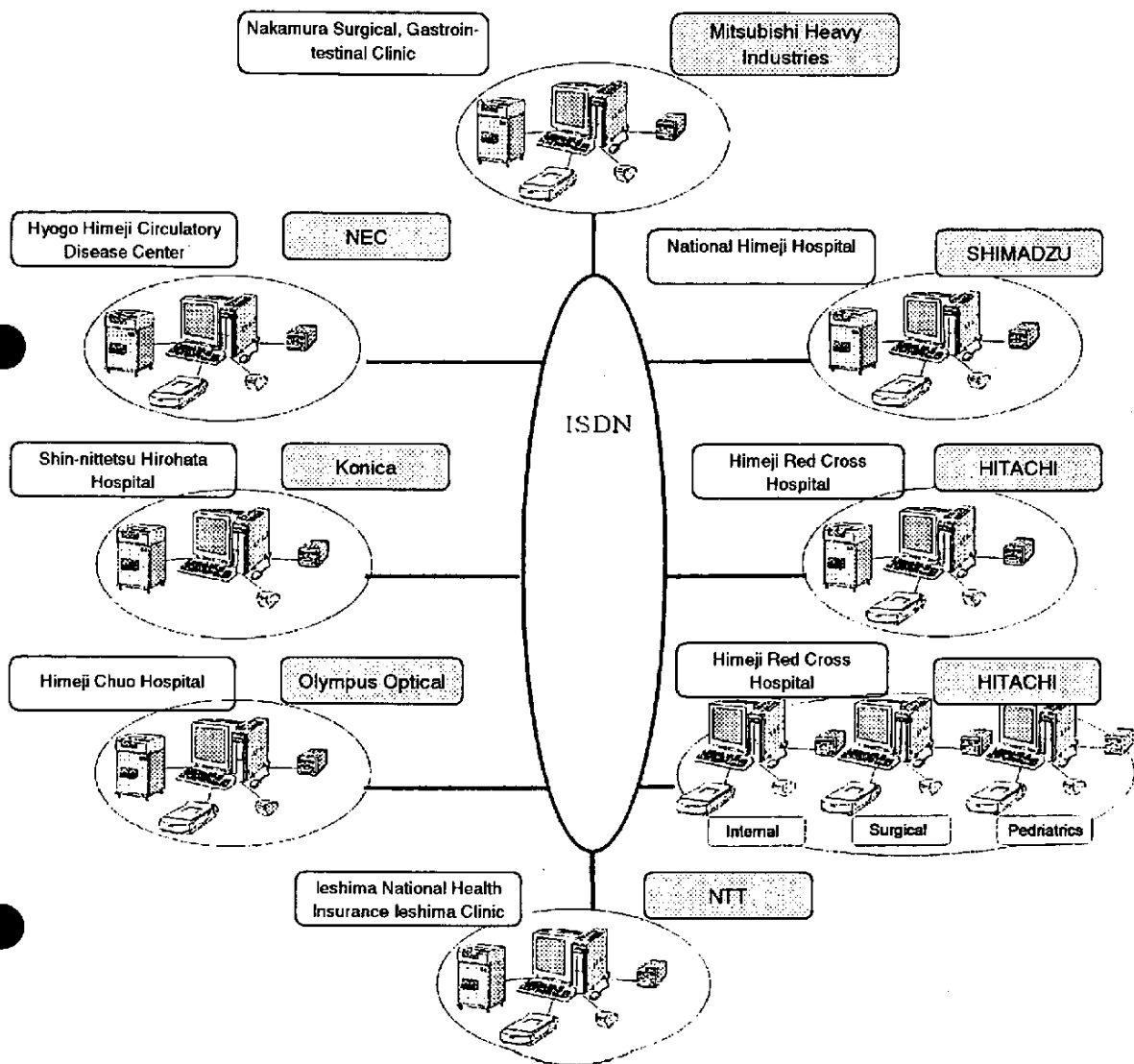


Figure 3 Overall Configuration of the Verification Experimentation System

4. The Present Situation and Standards of the Electronic Storage of Medical Images

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Introduction

There is an obligation by law to store the original copies of medical records, such as medical images, represented by clinical charts and X-ray pictures (Article 24 of the Medical Act and Article 20 of the Medical Law Execution Regulation). Its purpose is to provide the effective use of medical information, and to prepare for future expected problems, such as malpractice, by having the information used in medical examination and treatment stored.

The medium for storing the clinical records was limited to paper for clinical charts, and film for medical images. However, paper and film were bulky, requiring a large storage space, and it was also difficult to pick out necessary information immediately.

In order to cover such weak points, it was natural that demands be made to store information on electronic media instead of paper and film for mini-

mized space and easy retrieval of necessary information. However, storage on electronic media had the following problems.

- 1) It is easy to make copies and changes, and no marks would be left behind.
- 2) Storage onto general magnetic media for comparatively long periods of time is difficult due to degradation.
- 3) There is a limit on reference, due to differences in the manufacturer and model of the display.

In regard to these problems, electronic media were not equipped with the functions as a medium for recording original copies, and therefore did not take the place of paper and film for a long time.

To improve this situation, the Ministry of Health and Welfare gave notice on March 29, 1994 on the "Technical criteria of storing medical images with legal storage obligations onto electronic media (called "technical

criteria" hereon)".

This article, based on the technical criteria, mentions on the "MEDIS-DC Standards for electronic filing of medical images" (called "MEDIS-DC standards" hereon), enacted by the Medical Information System Development Center (called "MEDIS-DC" hereon). Presently, the MEDIS-DC standards are the only standards on the electronic storage of medical images.

4-1. Electronic Storage of Medical Images

In 1989, research was promoted in several research projects by the Ministry of Health and Welfare and the Ministry of International Trade and Industry to solve the problems in storing original copies of medical images onto electronic media. Based on the results, the Ministry of Health and Welfare announced the "technical criteria", mentioned before. And MEDIS-DC announced the "MEDIS-DC standards" on December 8, 1995 as a set of standards to fulfill the technical criteria.

With standards like the MEDIS-DC standards that satisfy the technical

criteria, medical images stored on electronic media is legally authorized as the original copies. The system of electronically storing medical images with storage obligations to satisfy the technical criteria is called "electronic storage of medical images".

4-2. Technical Criteria

In the technical criteria, the three functions of "security", "reproducibility", and "common availability" (called "three principles" hereon) are indicated as necessary functions for the electronic storage of medical images.

1. Security

The medical images with storage obligations must be stored safely so it is not erased, overwritten, or used and referred to by unauthorized persons on purpose or by accident.

2. Reproducibility

The medical images used in practice must be stored for long periods of time, without degradation or changes in quantity or quality. Furthermore, it must be possible to accurately reproduce as required the images that has been stored for a long time as the identical image used in medical prac-

tice.

3. Common availability

The images stored on the electronic medium must be commonly available, not only on the device that it is stored on, but also on other image equipments.

There is a great significance in the three principles of electronic storage, and by satisfying these principles, many features of electronic storage that film media does not possess will be displayed, rolling in a big wave to the efficiency and advancement of future medical practice.

For example, it would be possible to construct a high-level medical practice support system, since various types of medical examination information, such as letters and numeric data, waveform data, image data, and more, could be stored on one large capacity electronic medium, such as a magnetic disk. In addition, concerning the effective use of the division of functions and medical care resources, there is a demand for the linkage of medical care organizations, but by following the three principles, it would be easy to reproduce and provide records of medical practice that guarantee the same contents as the original copies, enabling the con-

struction of a medical care organization linkage system, and thus it is anticipated that the three principles become the basic principles for the practical application of information in medical care.

4-3. MEDIS-DC standards

The MEDIS-DC standards consist of technical specs that satisfy the technical criteria. Manufacturers that produce electronic storage equipments of medical images develop their product based on these specs, receive an inspection of whether it conforms to the MEDIS-DC standards (MEDIS-DC standards conformity inspection), and after it passes the inspection, provides the equipment (model) to the user, along with an inspection stamp (Figure 1). The MEDIS-DC standards conformity inspection is executed by MEDIS-DC, based on the cooperation of educators and specialists.

4-4. Background of the Establishment of the MEDIS-DC standards

In 1989, the Japan PACS research group and MEDIS-DC, with assis-

tance from the Ministry of International Trade and Industry and the Ministry of Health and Welfare, started on the study and research of a medical image filing system using magneto-optical disks. This study and research group organized the IS&C (Image Save and Carry) committee as a joint industry-university project, and after two years of field work at universities and medical organizations, gathered the data into the IS&C standards. The data format of the IS&C standards are based on the MIPS (Medical Imaging Processing System) standards, in which the Japan Radiation Equipment Industrial Company translated Version 2.0 of the ACR/NEMA (American College of Radiology/National Electrical Manufacturers Association) standards into Japanese.

From 1991 to 1992, the Disk Format Standards (December 1991), Data Format Standards (February 1992), Host Interface Specifications (July 1992), Magneto-optical Disk Cartridge Specifications (English, July 1992), and Magneto-optical Disk Device Specifications (July 1992) were published as IS&C standards. In the IS&C standards, data compati-

bility and security systems were examined at first, and devices equipped with a security system were specially called medical information IS&C. Some images IS&Cs that had a security system were supplied from a portion of the manufacturers for study and research, but manufacture was stopped with the establishment of the MEDIS-DC standards.

With receipt of notice from the Ministry of Health and Welfare on the "Storage of X-ray Pictures onto Magneto-optical Disks" in March 1994, MEDIS-DC announced "MEDIS-DC standards 1 on the Electronic Storage of Medical Images" in November 1994. This was based on the IS&C standards that were already being used in the filing of medical images, with the necessary additions, deletions, and modifications made after reexamining it against the informed technical criteria.

After that, with the request from America, Japan and America agreed on creating MEDIS-DC standards that used the data format of DICOM standards (Digital Imaging and Communications in Medicine) which were developed from ACR/NEMA, Version 2.0. In February 1995, the U.S. DICOM committee and the Ja-

pan Specialists committee (composed of the Japan Radiation Equipment Industrial Company, Japan Health and Medical Care Information System Industry, IS&C committee, and MEDIS-DC) held joint examinations, and created the original plan "MEDIS-DC standards 2 on the Electronic Storage of Medical Images" in May 1995. Since both MEDIS-DC standards 1 and MEDIS-DC standards 2 had many common areas, and from the addition of the image reverse compression specifications and 90mm 230MB magneto-optical disk and device specifications that were under examination, the "MEDIS-DC standards for electronic filing of medical images" were revised as the present constitution of standards. The MEDIS-DC standards are divided into Type 1 (based on medical care information IS&C) and Type 2 (based on DICOM media standards) according to the data format. Figure 2 shows the succession and flow of medical image data standards.

4-5. Realizing the Three Principles

The three principles in the MEDIS-DC standards, established by the Ministry of Health and Welfare, are realized in the methods shown below.

1. Security

Medical images is classified into the following four ranks, to prevent deletions or alterations on the images to be electronically stored (Figure 3).

- 1) Original: The image output from an image diagnosis device for medical practice before diagnosis
- 2) Authorized: Image used in diagnosis, having storage obligations
- 3) Authorized Copy: An accurate copy of the authorized image, used in medical practice, to be used for examinations in other rooms and for hospital examination linkage
- 4) Not Specified: An ordinary image without storage obligations, used for research purposes

2. Reproducibility

The guaranteed life of the magneto-optical disk cartridges used in the MEDIS-DC standards is 30 years, having a much longer period of reproducibility than ordinary magnetic media. And because a unique medium-inherent discrimination number including the month of manufacture is put on each cartridge in the manufacturing process, it is easy to find the

date of manufacture, as well as specify the electronically-stored medium.

3. Common Availability

The disk format and data format are made common for recording the medical images onto the magneto-optical disk, and as a principle, the medical images stored on the cartridge or equipment with the MEDIS-DC standards inspection stamp could be used regardless of different hospitals or machines.

4-6. The Framework for Ensuring Security

Generally, IDs and passwords are managed on application software as preventive measures of unauthorized access into the information system. However, this is not enough for ensuring the security of medical images, requiring a stronger protection system. Furthermore, security and common availability, demanded in the technical criteria, are in a relationship of antinomy, and both issues must be solved simultaneously. One measure for simultaneous solution is to unify the design specifications of the security system to satisfy security in the technical criteria.

Integrated specifications for ensuring security are comprised of the "Security Function Specifications", which provides matters on security, and the "Security Design Specifications", which is the security system that satisfies such matters. Among the two, the "Security Function Specifications" is released to the public, but the "Security Design Specifications" is disclosed only to image equipment manufacturers, for they are only needed at product development and for reasons of security.

With these two security specifications, the MEDIS-DC standards grant the following security functions to the magneto-optical disk, magneto-optical disk device, host interface, and file manager.

1) Magneto-optical disk

Discrimination information, indicating it is a medium that conforms to the MEDIS-DC standards, is granted during physical format (at manufacturer's factory shipment).

2) Magneto-optical disk device

Possesses discrimination information, indicating to the host computer it is a device that conforms to the MEDIS-DC standards, and a function to judge whether the inserted magneto-optical disk is a re-

cording medium that conforms to the MEDIS-DC standards.

3) Host interface

The host computer and magneto-optical disk device transmit to each other, and start activity after confirming that both equipments conform to the MEDIS-DC standards. An ANSI SCSI interface is the basic specification.

4) File manager

The program used to file the particular disk format (logical format) onto the magneto-optical disk is the file manager. The file manager manages four ranks (Original, Authorized, Authorized Copy, Not Specified).

4-7. Products in Conformity with the MEDIS-DC standards

The products in conformity with the MEDIS-DC standards as of September 1997 are shown on Table 1. These products are classified into the three groups of magneto-optical disk, magneto-optical disk drive, and the electronic storage system of the first two combined. There is a total of 14 companies and 41 products that con-

form to the MEDIS-DC standards; five companies and eight products of magneto-optical disks, four companies and seven products of magneto-optical disk drives, and seven companies and 26 products of electronic storage systems.

In Conclusion

MEDIS-DC, with the cooperation from others in the industry, intends to proceed with the preparation of the MEDIS-DC standards for the popularization of electronic storage of medical images. In regard to the matter at hand, examinations are being held on the addition of new recording media, and LAN standards inside the hospital (enabling the use of PACS).

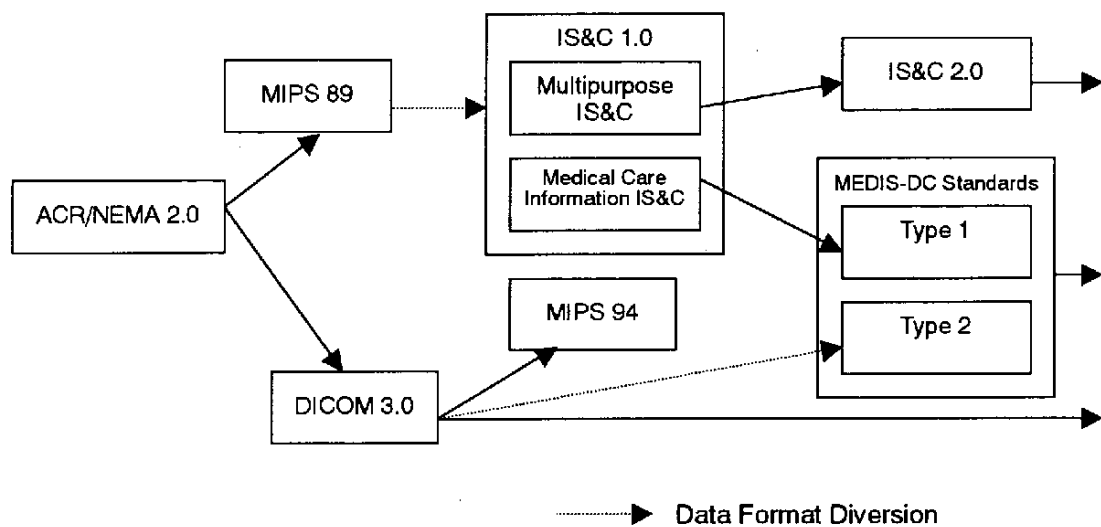


Figure 2 Succession and Flow of Medical Image Data Standards

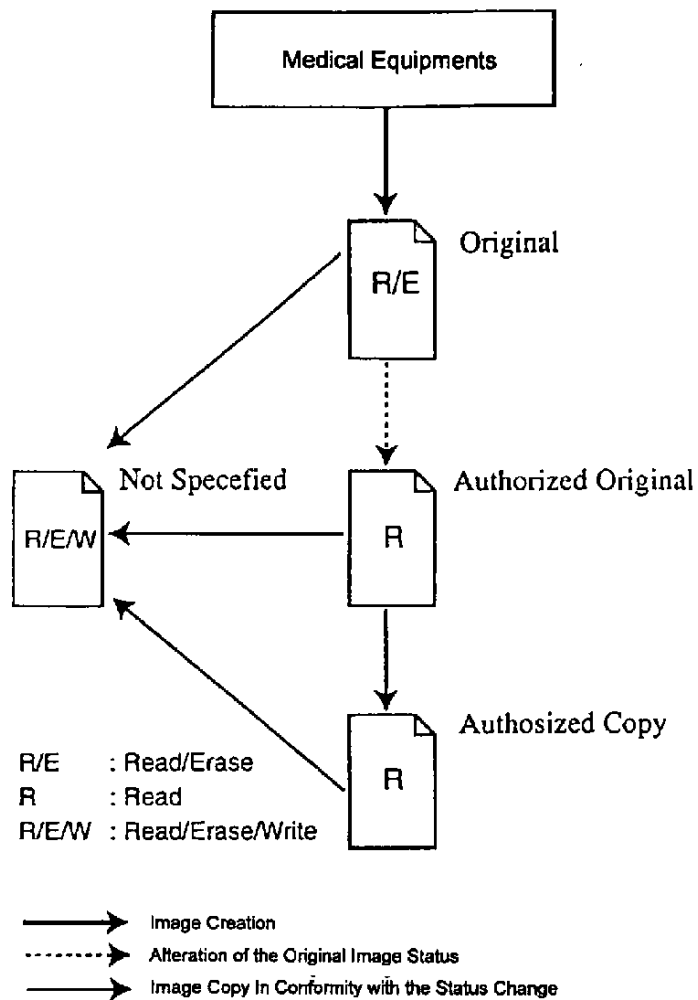


Figure 3 File Status Change in the MEDIS-DC Standards

Electronic Storage System

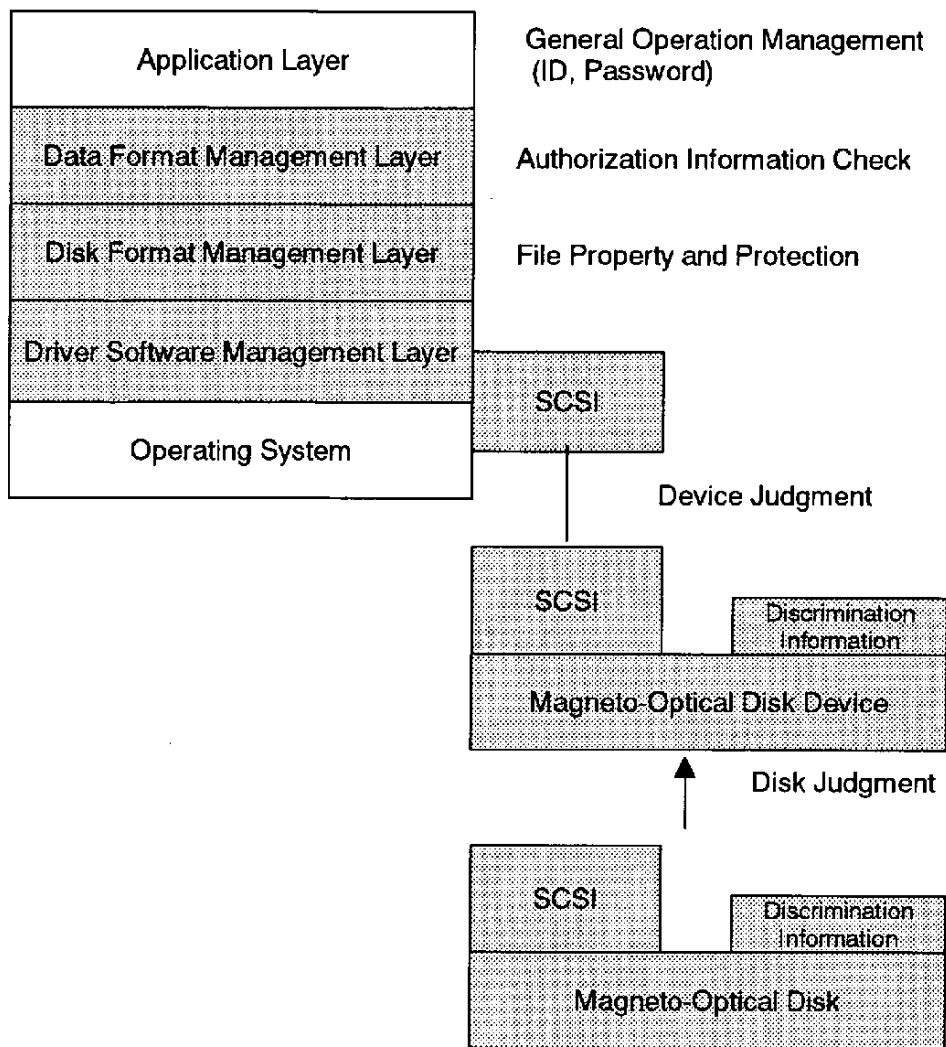


Figure 4 Functional Layers and the Security System

Table 1.1 MEDIS-DC standards Conformity Products List
(Magneto-optical Disk)

Conformity Proof No.	Product Name	Model	Applicant
C-0001	Mitsubishi 650MB MO	MH650MED	Mitsubishi Chemicals (Corp.)
C-0002	TOSOH MO	TODC-5A101	Tosoh (Corp.)
C-0003	KYOKKO 650MB MO	KX501	Kasei Optonix (Corp.)
C-0004	Medical Information MO Disk	MA-113.MED	Hitachi Maxell (Corp.)
C-0005	MO Disk Cartridge	MO-652Dr	Teijin (Corp.)
C-0006	Mitsubishi 1.3GB MO	MH1G3 MED	Mitsubishi Chemicals (Corp.)
C-0007	TOSOH MO	TODC-5D101	Tosoh (Corp.)
C-0008	KYOKKO 1.3GB MO	KX5027	Kasei Optonics (Corp.)

Table 1.2 MEDIS-DC standards Conformity Products List
(Magneto-optical Disk Drive)

Conformity Proof No.	Product Name	Model	Applicant
D-0001	MO Disk Drive	RO-5031Ei	(Corp.) Ricoh
D-0002	MO Disk Device Subsystem	RS-9200Exi	(Corp.) Ricoh
D-0003	MEDIS-DC standards Conformity 5.25-inch MO Disk Device	TAHITI-3C	(Corp.) Kubota
D-0004	MEDIS-DC standards Conformity 5.25-inch MO Disk Drive Device	TAHITI-3000C	(Corp.) Kubota
D-0005	MO Disk Device	A-6968-MU2	Hitachi Computer Equipments (Corp.)
D-0006	MO Disk Device	A-6968-MB2	Hitachi Computer Equipments (Corp.)
D-0007	130mm 1.3GB MO Disk Device	ODM1301-156	NEC (Corp.)

Table 1.3 MEDIS-DC standards Conformity Products List
(Electronic Storage System)

Conformity Proof No.	Product Name	Model	Applicant	Type
S-0001	Digital Radiography Device	IDR-1000IDR-1000	(Corp.) Shimazu Factory	1
S-0002	Hitachi Realtime Digital Radiography	DR-1000	(Corp.) Hitachi Medical	1
S-0003	Hitachi Realtime Digital Radiography	DR-2000	(Corp.) Hitachi Medical	1
S-0004	HITLOOKS	P-SYMI-002	Hitachi Computer Electronics (Corp.)	1
S-0005	VISICUL MODEL 200D	VISICUL MODEL 200D	Konica (Corp.)	1
S-0007	X-Ray CT Device SCT-7000T	SCT-7000TX	(Corp.) Shimazu Factory	2
S-0009	X-Ray CT Device SCT-7000T	SCT-7000TH	(Corp.) Shimazu Factory	2
S-0010	X-Ray CT Device SCT-7000T	SCT-7000TC	(Corp.) Shimazu Factory	2
S-0011	Image Filing System for Electronic Storage	TEFS-400A	(Corp.) Toshiba	1
S-0012	Toshiba Medical Image Observation Device	TWS-400A	(Corp.) Toshiba	1
S-0013	CBF Image Processing System	AZ-7000Wd	Anzai Medical (Corp.)	1, 2
S-0015	Brain Labo V2.0	Brain Labo V2.0	(Corp.) Ricoh	1
S-0023	Konica Direct Digitizer	DD-141DD-141	Konica (Corp.)	1
S-0024	Image Filing System for Electronic Storage	TEFS-400B	(Corp.) Toshiba	1
S-0026	X-Ray CT Device	SCT6800SCT-6800TH	(Corp.) Shimazu Factory	2
S-0027	X-Ray CT Device	SCT6800SCT-6800TX	(Corp.) Shimazu Factory	2
S-0028	SimRAD	SimRAD	(Corp.) Shimazu Factory	1, 2
S-0029	CC·DR System	DDX-1000A/D1	(Corp.) Toshiba	2
S-0030	CC·DR System	DDX-1000A/D2	(Corp.) Toshiba	2
S-0031	CC·DR System	DDX-1000A/D3	(Corp.) Toshiba	2
S-0032	CC·DR System	DDX-1000A/M1	(Corp.) Toshiba	2
S-0033	Brain Labo V2.5	Brain Labo V2.5	(Corp.) Ricoh	1, 2
S-0034	Toshiba Medical Image Observation Device	TWS-400A	(Corp.) Toshiba	1, 2
S-0035	Toshiba Medical Image Observation Device	TWS-460A	(Corp.) Toshiba	1, 2
S-0036	Toshiba Digital Radiography Device	ADR-100A/R1	(Corp.) Toshiba	2
S-0036	Toshiba Digital Radiography Device	ADR-100A/R2	(Corp.) Toshiba	2

III. Other Medical Information Systems

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1. The Present Situation of the Hospital Information System

In Japan, since the 1970s, the medical matters accounting system was started in the hospital management field, and the automatic electrocardiogram analysis system was started in the medical treatment support field. The systems used general-purpose computers in those days, but now, work stations and personal computers are being increasingly used.

Regarding the present hospital information system, the order entry system, also called the ordering system, is increasingly being used to realize the input of information sources, and it is becoming the mainstream to build overall hospital informa-

tion systems in which sections could share information by connecting individual systems through networks. At first, the order entry system was only introduced to large-scale hospitals, such as university hospitals, but recent years show a trend toward an aggressive introduction of this system to smaller hospitals as well.

In addition, there is an increasing number of medical care organizations adopting the electronic storage of medical images and transmission inside the hospital, but the burden of cost is still great. However, it is expected in the future for the electronic storage of medical images and transmission within the hospital to increase because the "MEDIS-DC standards for the electronic storage of medical images" have been announced al-

ready, and online security standards are also being examined as an addition.

Furthermore, pilot studies on a receipt (medical treatment payment bill) computer processing system have been started for medical care organizations to submit receipts to the audit payment treasury, not using paper media, but using floppy disks and magnetic tapes.

At the beginning of the 21st century, it is expected for the electronic storage of electronic medical charts and medical images and the submittance of receipts using magnetic media to begin a wide spread.

In addition, there are new attempts being made, especially in large hospitals, for connections between the hospital information system and the internet, a general hospital information system based on UNIX, and a full-scale adoption of GUI in the hospital information system.

1-1. Popularization of the Ordering System in Japan

1) Introduction

The ordering system, also known as the order entry system, uses a direct terminal inside the hospital where information is supplied in order to input data. Compared to the medical matters accounting system that was the core of the hospital's office work section, the ordering system has the feature that allows direct input of data and receipt of information through a terminal, even in sections directly involved with medical examination, such as the doctor's office and nurse station.

The pillars of the rapidly growing ordering system comprise source data input in every section of the hospital, speedy transmission of data to necessary sections, and the ability to efficiently use the data that is entered into computers in various sections.

In 1996, the Medical Technology Information Promotion Office of the General Affairs Section, Health Policy Bureau, The Ministry of Health and Welfare held

a survey on the actual situation of information orientation in medical care organizations. We will describe the part of the survey on the ordering system. The survey was intended for hospitals having at least 300 sickbeds, and the survey period was from October to November 1996. Replies were received on the questionnaire survey from 248 hospital facilities that had 300 sickbeds or more.

2) Adoption State of the Ordering System

The adoption state of the ordering system is shown in Figure 1. Adding the 29.3% in operation and 8.8% in development indicates that the ordering system will be adopted in nearly 40% of the hospitals. Also, the total of the percentages in operation, in development, in planning, and in examination exceeds 70%, and thus we could anticipate popularization of the ordering system in a great number of hospitals during this century.

Seen from the scale of sickbeds,

approximately 20% of the hospitals with 300 to 500 sickbeds, more than 40% of the hospitals with 501 to 1,000 sickbeds, and more than 50% of the hospitals with 1,001 or more sickbeds have already adopted the ordering system, and at present, the greater the scale of sickbeds, the higher the rate of adopting the ordering system.

The top five problems in adopting the ordering system are; "Too expensive" at 29.7%, "Inable to gain a consensus within the hospital" at 15.5%, "Immature hardware and software" at 13.8%, "Environmental problems, such as buildings and personnel" at 9.2%, and "No promoters in the hospital" at 6.3%. Since 1995, the Ministry of Health and Welfare has been promoting the research and development of electronic charts, and realization of these electronic charts should clear many of the problems mentioned above.

Among the hospitals presently using the ordering system, the form for using the medical matters accounting system previous to adopting the ordering system

was as follows: Most adopted the system on their own at 63.2%, but some hospitals adopted the ordering system from a computer center commission system (8.8%) or joint use system (4.6%), and some even adopted the ordering system without previous adoption of the medical matters accounting system (2.1%).

3) Adoption Purposes

The purposes for adopting the ordering system are mainly in the "Improvement in patient services" (45.2%), followed by "Reduction in office work" (15.1%), "Provision of medical examination support and nursing support information" (14.6%), and "Improved administration and acquisition of administrative support information" (7.5%).

Ramifications of improved patient services indicate the "Minimization of patient waiting hours" at an outstanding 48.1%. We could clearly understand how urgent the matter is to the hospi-

tals to reduce patient waiting hours, and how great the expectations are on the information system. The improvement in patient services is continued to be ramified as follows: "Improved accuracy in medical examination (provision of medical examination support information, various checks, etc.)" (21.8%), "Improved services to patients (hospital admittance guidance, reservation, medical examination order display, etc.)" (4.2%), and "Reduction in slips to be carried by the patient" (4.2%).

By ramifying the reduction in office work, which is second highest, the order indicated is "Cuts in overlapping tasks (connections between sections, etc.)" (18.8%), "Reduction in slip creation tasks" (18.4%), "Reduction in various posting tasks" (14.6%), and "Decrease in posting errors and mis-postings" (13.8%).

Detailed items within the provision of medical examination support and nursing support information are in the order of "Speed and accuracy in various result inquiries" (21.8%), "Provision of various types of informa-

tion (patient attribute, nursing, assistance, medical record, medicinal record, DI)" (20.5%), Clinical use of order data (DO, order history in one's own section and in other sections" (12.6%), "Various checks (contraindication, overlapped use, allergies, quantity, period)" (10.9%).

Details within the improvement in administration and acquisition of administrative support information are in the order of "Prevention of leaks in the bill" at 29.3%, the most demanded, followed by "Provision of administrative diagnosis information" (11.3%), "Reduction in personnel and labor" (7.5%), "Reduction in slips and printed books and slips" (7.5%), and "Intensified linkage between sections and education of employees" (7.5%).

4) Period Until Adoption

The period taken from planning to adoption was highest at "Six months to a year" at 22.2%, continued by "A year and a half to two years" at 13.0%, "A year to a year and a half" at 11.7%, and

"Two to three years" at 9.6%. The period from adoption to operation was highest at "Six months to a year" at 20.9%, continued by "A year to a year and a half" at 13.4%, "A year and a half to two years" at 12.6%, and "Two to three years" at 8.8%.

The periods from planning to adoption of the ordering system, and from adoption to operation, varied according to the hospital, and this seemed to be influenced by various factors, such as whether it was newly-developed software or package software, how much experience was present in introducing computers, and whether there was a strong promoter.

5) Developing Software of the Ordering System

Development Methods

In most cases, software of the ordering system is developed based on package software, with a partial addition or modification of functions. In some other cases, it is developed based on package software, with a drastic addition or modification of

functions. For now, most package software are not used in their original state. There are many cases in which hospitals already using the ordering system develop their own software anew, but hospitals that are presently in the development or planning process indicate a trend for a reduced rate of new software development, compared against hospitals already using the ordering system. This is seemed to be caused by the announcement of a yet better ordering system package software which utilizes the experiences of hospitals that initially adopted the ordering system.

When the number of hospitals already using the ordering system and the number of hospitals developing or planning on the ordering system are combined, the results indicate that the method used mostly for developing the ordering system is "Based on package software, with a partial addition or modification of functions" at 44.4%, followed by "Based on package software, with a drastic addition or modification of functions" at 19.2%, "New development of software" at 6.7%, and "Using package software

in its original state" at 1.3%.

Within only the hospitals that are already using the ordering system, new development of ordering system software is high among the total number of hospitals, at 18.6%. In the number of hospitals that are in software development, new software development is decreasing considerably, at 4.8%.

The method "Based on package software, with a partial addition or modification of functions" is on the increase in hospitals that are in software development, at 66.7%, and it is advisable for hospitals that are going to be adopting the ordering system to adopt the ordering system of partially-modified package software.

6) Work Division Between Hospitals and Vendors

The division of labor among hospitals, manufacturers and vendors, and consultants in the development and adoption of the ordering system was classified into "Analysis and Requirements", "Basic Design", "Adoption", "Education", "Master Preparations", "Implementation",

and "System Evaluation". The surveyed results are shown below. The overall results indicate that hospitals were in charge of the major three tasks, "Analysis and Requirements", "Master Preparations", and "System Evaluation".

When the number of hospitals already using the ordering system and the number of hospitals developing or planning the ordering system are combined, the results indicate that "Analysis and Requirements" was mostly done at hospitals, at 44.8%, followed by manufacturers and vendors at 15.1%, and consultants at 3.8%. In "Basic Design", manufacturers and vendors led at 41.4%, followed by hospitals at 18.0%, and consultants at 2.5%. In "Detailed Design", there was a further percentage increase in manufacturers and vendors to 51.9%, and the percentage decreased in hospitals to 9.6%. In "Programming", more manufacturers and vendors took charge at 62.8%, and the cases in hospitals totaled 2.9%.

In "Overall Testing" and "Adoption", many hospitals took charge again, and manufacturers and vendors decreased instead. In "Overall

Testing", manufacturers and vendors indicated a percentage of 38.5%, compared to the hospitals at 22.2%. Even in "Adoption", manufacturers and vendors had a percentage of 38.9%, while hospitals were at 21.8%. In "Overall Testing" and "Adoption", both reached the same ratio.

In "Education", manufacturers and vendors had almost the same ratio as hospitals, at 30.5% for manufacturers and vendors and 28.9% for hospitals.

Compared to the hospitals mostly in charge of "Master Preparations" at 43.9%, manufacturers and vendors decreased to 17.6%.

Many manufacturers and vendors were involved in "Implementation", at 43.9%, and hospitals were only in charge of 18.0%.

"System Evaluation" was mostly done at hospitals at 55.2%, indicating only 6.3% for manufacturers and vendors. Consultants also showed a low number of cases, at 0.8%.

Tasks performed by consultants showed 3.8% for "Analysis and Requirements" and 2.5% for "Basic Design", and all other tasks were at 2% or less.

Now, the statistics taken only at hospitals that are using the ordering system showed a drastic reduction in "Indefinite" and "Other", and the percentages make it clear on which tasks are done more by hospitals and which ones are done more by manufacturers and vendors. The top three hospital tasks, "Analysis and Requirements", "Master Preparations", and "System Evaluation", are the same as seen in the overall statistics.

The following shows only the data of hospitals using the ordering system. Hospitals were mostly in charge of "Analysis and Requirements" at 61.4%, while manufacturers and vendors were at 30.0%. When it came to "Design" and "Program-

ming", there was a sudden increase of manufacturers and vendors taking charge in the hospitals, showing high percentages of 64.3% in "Basic Design", 75.7% in "Detailed Design", and 90.0% in "Programming".

Compared with "Design" and "Programming", the number of hospitals increased when it came to "Overall Testing" and "Adoption", reaching 35.7% in both.

Figure 3 is a bar graph indicating whether the hospitals or the manufacturers and vendors were in charge of developing and adopting the ordering system in hospitals already using the ordering system.

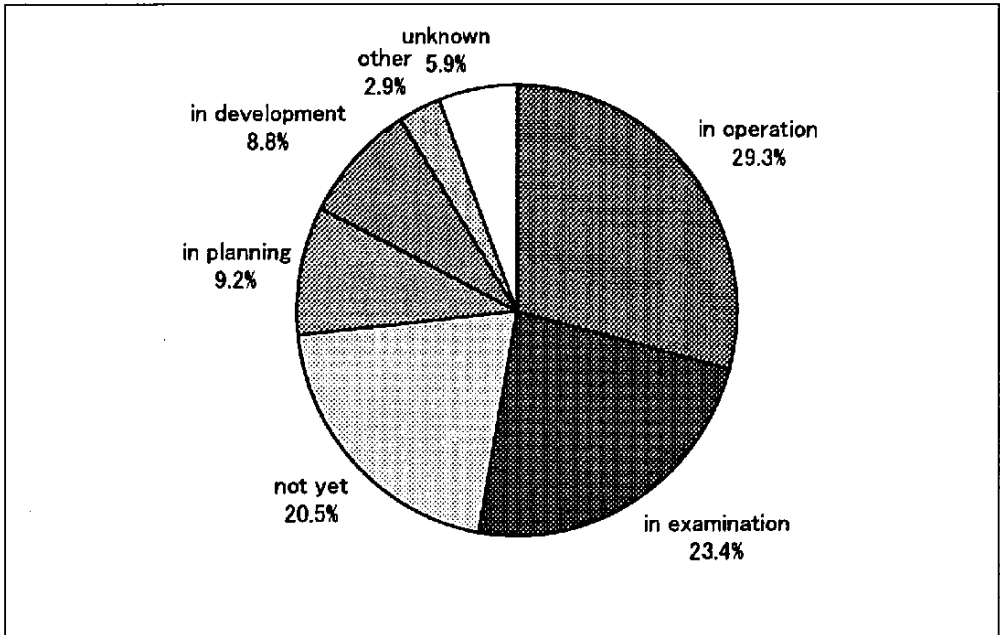


Figure 1 Adoption of the Ordering System

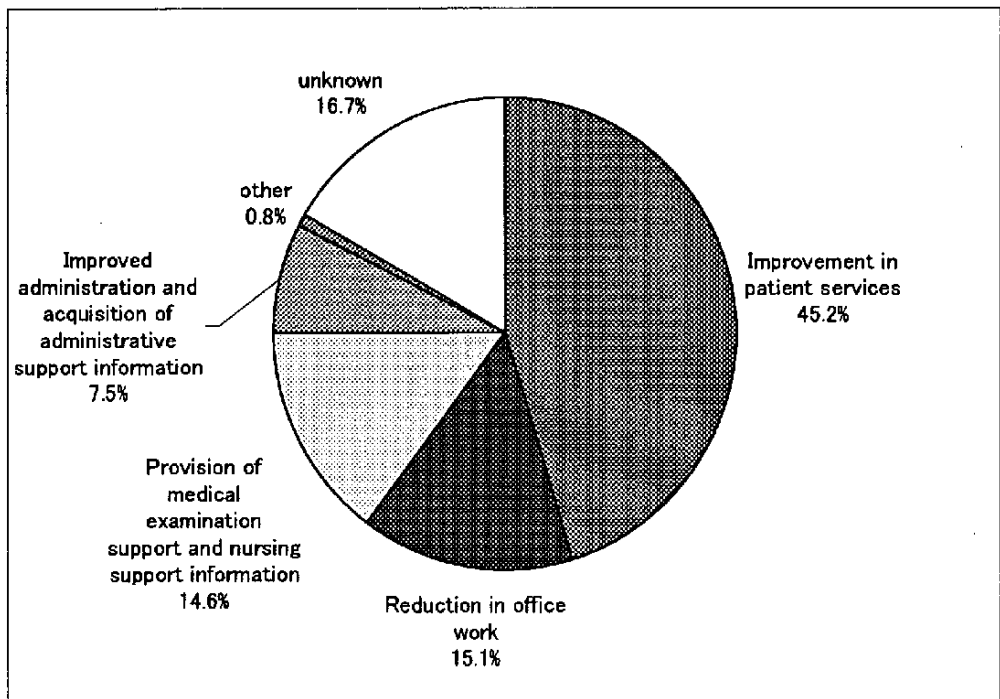


Figure 2 Purposes of Adopting the Ordering System

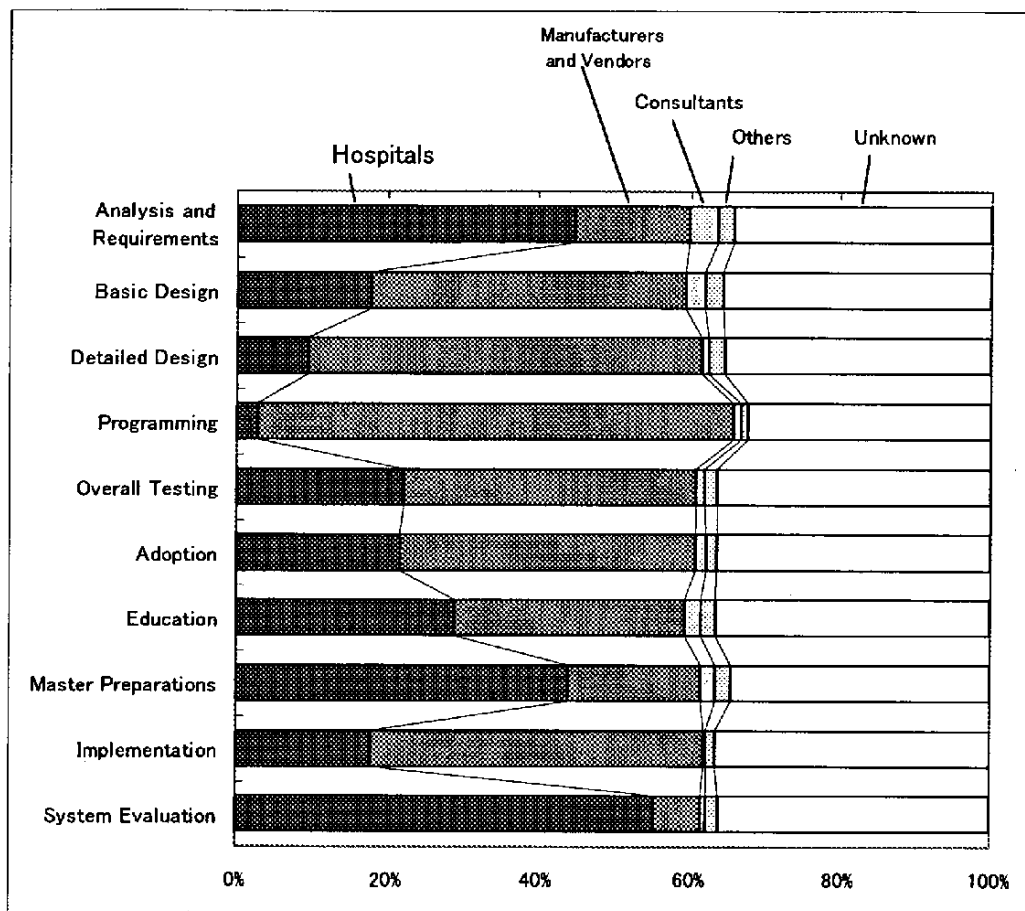


Figure 3 Ratio Assigned to Development of the Ordering System, Etc.

2. The Present Situation of the Regional Medical Information System

The regional medical information system is centered on regional medical care, such as the isolated district medical care information system, emergency medical care information system, medical care organization linkage system, remote area treatment support system, and home medical care support system.

At first, electrocardiograms were transmitted by using telephones, and patient information was transmitted by using facsimile machines. After that, with the progress in information technology, there was a new attempt to transmit not only letter information, but medical images, such as CTs (Computed Tomography), between medical care organizations. Today, satellite communication is used to send medical images to hospitals from marine vessels, and high-resolution

transfer of medical images is done with high vision.

Roughly 30 autonomies have already begun introducing health and medical care cards in which citizens carry their own IC card or optical card, recorded with their medical history and past test results, to present to their doctor when having a medical examination at their medical care organization, also making it possible for other medical care organizations to refer to the patient's medical history and see the results of checkups that are held at other autonomies. Many autonomies issue health and medical care cards especially to the elderly and newborns.

Electronic networks using the internet and personal computer communications are being constructed at district medical societies and district pharmaceutical societies, heading online information transmission and information exchange to realization.

It is expected for regional medical information systems,

starting with regional hospital-clinic links and hospital-hospital links, to spread even more in the future with the use of the information system.

3. Other Medical Information Systems

• Electronic Charts and Systems

The public budget indicates that research and development of electronic charts were first held with the Ministry of Health and Welfare's supplementary budget in 1995. This, 1) promoted the orientation of medical information through the development of a system to electronically record and collect medical care information, which would be the starting point of medical information, 2) contributed to quality improvement and efficiency of medical care through the analysis of diagnosis and treatment processes and transplantation to the electronic charts, and 3) with the integration of electronic charts and other information systems, has the development goal of efficient medical resource use and hospital administration streamlining. The research and development of electronic

charts is being continued from 1995 to today.

To be concrete, the development of man-machine interfaces, and research and development in system design and security technology are being executed as the development of a medical examination model, along with the development of templates per region, research and development in medical examination process models per region, and systematization of terms and expressions.

For the development of templates per region, templates assembled with the medical examination mode (guidelines, etc.) are developed for each region, together with the structuralization of a medical examination record input method for each region. In addition, a standard descriptive mode and expression tools are researched and developed to enable compatibility of medical examination record information and sharing between medical care practitio-

ners.

For the research and development in the medical examination process models per region, medical examination processes (includes the judgment and testing processes) are analyzed for each region and then a model is developed. The models are presented in a manner where the medical examination process and judgment criteria could be visually seen, and by following them, the medical care practitioner's judgment is supported, and policies, such as treatment plans, could be decided on.

For the systematization of terms and expressions, the medical terms and expressions used in the medical examination records are examined for standardization, and then they are systematized to be used in this project.

For the development of man-machine interfaces, an electronic chart Viewer (portion that could be visually seen) is developed with the goals of improving input operability

and a menu constitution and menu development that reflects the desires of the medical examination practitioner.

For the research and development in system design and security technology, research and development is held in system design and security technology of the hospital information system, centered on electronic charts, and a standard system is presented. The medical care organizations are classified according to their scale and functions and other conditions. Then the arrangements necessary for preventing hazards from occurring due to the introduction of the information system to medical care organizations, and the decisions on management and operation are made and presented, with consideration to the trade-off against cost.

The 17th Medical Informatics Union Meeting held in November 1997 was comprised of the symposiums, "How Electronic Charts Were Formed, and How to Realize Them" (5

issues presented) and "The Medical System in the Electronic Chart Era - How the medical system should change according to the changes in the medical care environment - " (5 issues presented), the general lectures, "Electronic Charts - Medical Examination Account" (7 issues), "Automatic Creation of Electronic Chart Summaries" (2 issues), and "Electronic Chart and Database Browsing Support" (4 issues), and the demonstration session (3 issues).

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