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Overview of Development and Practical Use of Medical Information Systems in Japan (**)

Dr. Sawasaki explained the philosophical background and practical development process for hospital information systems in Japan very clearly. I will follow his report with one about medical information systems in the general view.

In Japan, a large number of projects are being undertaken to establish such systems. Of course, it would be very difficult to give the details of each project within my limited time, so I would like to report on some of the projects with which I am concerned. (See page 219).

First, I would like to describe the medical system that is the background for development of a medical information system in Japan.

Japan has a population of 120 million inhabitants, which is twice that of Italy, and it has 370 thousand square km of territory, a little wider than that of Italy, but 70% of that area is mountainous, so the real residential area is smaller than that of Italy, I suppose.

As for medical facilities, Japan has 7 thousand general hospitals providing a total of one million beds and 70 thousand in-house medical doctors. In Japan, a hospital is defined by law as having more than 20 beds, more than three in-house doctors, and a moderate medical staff and facilities. There are also about 20 thousand clinics with in-patient facilities of under 19 beds, and 40 thousand clinics without beds for medical consultation of out-patients and consultation by home visit. Available beds for hospitals and clinics total 140 million, including psychiatric beds and facilities for the aged. This provides an average 120 beds and 17 doctors for ten thousand inhabitants in Japan.

The national average stay in hospital beds is 40 days, but in a hospital in the metropolitan area is from 20 to 30 days, and varies according to the type of hospital.

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TAB. 1 - Statistics of Backgrounds of Medical System in Japan in 1985.

Population	120,000,000	(60,000,000 in Italy)
Territory	370,000 Sq. Km.	(301,000 Sq. Km. in Italy)
Hospitals	9,400	General H. 8,200 (1,000,000 beds) Psychiat. H. 1,000 (330,000 beds) (Beds for Infect. Disease 100,000)
Clinics	79,000	With Beds 27,000 (280,000 beds) W/O Bed 52,000
(Dental Clinics 42,000)		Total 1,700,000 Beds
Hospital Beds Occupancy Rate 84.2%		
Average Length of Stay 39.6 Days in General Hospital. (30 - 75 days, differ as Area)		
Number of Patients	Admission to G.H.	20,000/day (1.4% increased/year)
	Out-patients (G.H.)	1,543,000/day (4.6% increased/year)
	Out-patients (P.H.)	28,000/day (5.0% increased/year)
	O.P (Clinics)	4,563,000/day (no remarkable change)
	O-P (Dental Clinics)	1,331,000/day (no remarkable change)
Total National Medical Cost	in 1984: 15,000,000,000,000 yen	
	in 1985: 15,720,000,000,000 yen (suspect) 5.5% Inc/y	
General National Products	in 1985: 365,000,000,000,000 yen (suspect) 6.2% Inc/y	
	(Medical Cost / G.N.P. = 5.23% in 1984)	
Age Group Difference of Medical Cost in 1982: by Ministry of Health and Welfare		
	National Average :	102,000 yen (= 400\$)
	over 70y :	420,600 yen (= 1680\$)
	over 65y :	359,600 yen (= 1440\$)
	45y- 65y :	143,900 yen (= 580\$)
	15y- 45y :	59,400 yen (= 240\$)
	15y :	26,700 yen (= 105\$)
Life Expectancy for New-born in 1984:		
	Male :	74.54 years
	Female :	80.18 years

National medical costs have hovered near 5% of the Gross National Product (GNP), within the past 10 years, but very recently have shown a tendency to increase.

Actual medical cost per person is 140 thousand Yen (US \$600) per year, but the population shift toward aged people will cause an increase in medical costs. Average medical cost for people over 65 years old is 360 thousand Yen (US \$1,540), which is three times the cost for younger ages.

Therefore, the Ministry of Health and Welfare has called for medical cost containment at all medical facilities. At present, 15 trillion yen is the actual cost, which is one-sixth that of US medical cost, and one-third the per-person cost in the US.

Japanese life expectancy is 74 years for males and 78 years for females, which is the longest in the world.

A national medical cost insurance system covers the whole population of Japan, and private medical cost for medical care is minimized. Actual private cost is limited to 50 thousand yen per month per patient, with any higher medical cost covered by health insurance.

Because medical costs are not directly paid by the patient, requirements of the people are to receive high quality medical care within as short a time as possible.

Therefore, from the viewpoint of the patients, the role of the medical information system is not medical cost containment but the increasing of quality of medical and health promotional care. A doctor-less area is defined as a village that cannot access a doctor within a 30-minute walk (2 km). Total inhabitants of such areas are only several percent of the total population of Japan. However, it is considered that medical support for these inhabitants should be achieved by central and regional governments.

Several exceptions are isolated islands and heavy snowfall regions, where accessibility of medical care is well organized. I think, but human wants are unlimited, governments require such support from the medical information systems.

For these reasons, the roles performed by medical information systems are considered to be as follows:

1. Quality assurance of medical and hospital care in all areas.
2. Increasing of accessibility to special medical care resources.
3. Health promotion of individuals.
4. Communication between hospitals and clinics.

Next, I would like to describe the telecommunication network function in Japan. NTT was transferred from the governmental sector to the private sector in April of this year, but public telecommunication lines in Japan are still only supplied by NTT at present. All of Japan was covered by a direct dial-access telephone network in 1983, which was only two years ago. And use of public telephone lines for transmission of information other than voice was allowed only thirteen years ago; but recent improvements in the quality of telecom-

munication lines have been remarkable for analog communication networks, and have reached the highest level in the world, it is said.

However, the quality is still not good enough to transmit bio-physical information directly, because the frequency range of an ordinary telephone line is 300 Hz to 3400 Hz, as you know. Additionally, in telephone transmission of bio-physical signals, circuit noise is very hazardous when defining abnormality in the signals, especially in direct processing of such signals by computer. The human function of noise limiting is excellent, and people find bio-signal abnormalities quite easily, but it is very difficult for a computer.

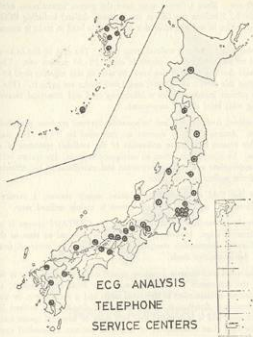
For several years, ISDN (it is called ISN in Japan) has been progressing rapidly in Japan. Digital communication networks are gradually being set up all over Japan, so the situation is changing now. Wide range communication lines with optic fiber cable are now in use. CAPTAIN (Character And Pattern Telephone Access Information Network), a still-pattern communication that is similar to TELETEXT, started practical service in Japan 2 years ago, and the service area has increased gradually.

A VRS (Video Response System) is also being developed for practical use. Government projects for an area-wide communication network are being promoted by the Ministry of Posts and Telecommunications, including TELETOPIA Projects. The item of most interest to the inhabitants of the area is the requirement to support their health care and medical care with this project. Frequent surveys show from 70 to 80% of survey replies contain such requirements.

As a member of the medical side, the problem is how to answer these needs, if it is possible, with telecommunications. Transmission of single-dimensional analog signals of biophysical data is mostly completed by KTH. The developmental interest of many researchers concerned with medical informatics is focused on transmission and processing of miscellaneous medical pictures, including x-ray photographs, computed tomography, digital radiography, digital subtraction, ultrasonic imaging, endoscopic moving pictures and so on. Such picture images have more redundancies and contain a much larger amount of information than other medical information transmitted over digital communications lines. This will be a very important problem for research and development of telecommunications and information processing in the future for engineers and researchers. However, I think, there are other problems to be solved by medical doctors who work in practical fields, before study of such problems.

For instance, how to establish a regional co-work system for doctors in clinics and hospitals, how to increase computer utilization in the medical field so it becomes as common as in other commercial fields, and so on. Of course, these problems should be studied and solved by medical doctors themselves, never depending on other people.

Now, I would like to explain the development and practical use of the medical information system in Japan from the viewpoint of transmission media.



A. *Public telephone line utilization:*

1. There are many applications of narrow-band analog telephone lines. A typical example of bio-physical transmission and processing, which is one such application being used at the practical level, is ECG computer analysis using telecommunications. This analysis service is being carried out mainly in the form of regional medical associations offering this service to their members through their centers. However, there are also some centers that offer this service on a commercial basis. According to the Health Insurance program in Japan, the cost for ECG record analysis is set at 1,500 yen (about 6 dollars), and the diagnosis fee is 380 yen (about one and a half dollars). The ECG computer analysis service using telecommunications offered on a commercial basis costs less

than 1,000 yen. Since a doctor must have the proper transmission equipment, which costs 2-2.5 million yen (about ten thousand dollars) including ECG equipment, at his office in order to offer this service, it is hard to make it commercially practical.

However, this service is utilized quite often. The cost of the ECG analysis equipment to be installed at a center is about 25-50 million yen. Therefore, it can be said that payability is also low. In spite of this negative fact, 33 centers were offering this service as of 1984, and 1,800 clinics are using it. (The service offered at present mainly includes a Minnesota cord and numerical measurement data, along with brief clinical comments).

2. Regional Ambulatory Care Information Systems are now provided in 32 prefectures. Among them, 27 systems are supported by NTT. The main purpose of this system is effective utilization of the available resources of medical institutions. In other words, when an emergency happens, this system will locate the most appropriate and nearest institution and contribute to the effective conveyance of the patient by ambulance.

3. In the field of medical information supply service, a service using MEDLINE medical reference retrieval system is mainly utilized now.

4. Supply of medical information using the CAPTAIN system is now at the experimental stage. However, practical use is expected to start in the near future. General information concerning medicine can be retrieved from this system in the interactive mode.

5. The vocal cord diseases screening system using telephone lines is designed to detect the occurrence of hoarseness caused by vocal cord diseases, such as laryngeal cancer, inflammation of the vocal cords and a vocal polyp, by analyzing the voice frequency distribution. This system has already been utilized in more than 5,000 cases and it is reported that two cases of laryngeal cancer have been detected through close examination of suspected patients by medical specialists.

6. JAPIC (Japan Pharmaceutical Information Center) plans to offer a Drug Information Service. This service will transmit various data concerning available pharmaceutical products. The data are stored on a laser disc and can be retrieved using telephone lines, as necessary, by facsimile. The experiments on this service have been completed and now preparation of data files is under way.

7. A system now under development at KTH but which still requires two or three more years for practical use is "DOCTORS", a medical consultation system. We are now developing this system jointly with many medical specialists in various fields. We are attempting to provide this system with functions of designating the appropriate department by judging symptoms of patients and of giving suitable advice to doctors responsible for such patients, using artificial intelligence. This system will help decrease the burden on doctors who specialize in other fields than the case in question, and will increase the effectiveness of medical services by enabling the detection of diseases in their early stages.



B. Wide-range telecommunication line utilization:

Various medical information systems that use wide-band, high-speed communications lines, including VRS (Video Response Service), are now under development and experiment.

8. Kitasato University Hospital is now using a medical information service through cable television within the hospital. However, this service is offered only one-way. Two-way broadcast is not yet provided.

9. VRS, on which experimentation started by NTT in cooperation with KTH and regional medical associations, will be put to practical use in the near future. This system will enable the retrieval of animated and still images, as well as

voice, in the interactive mode through optical fiber cables connected between regional medical institutions and VRS centers located at telephone offices. This system can also be used among doctors to exchange information about patients, such as when they introduce their patients to other hospitals.

10. Information support systems for hospital clinical practice are being developed by the Medical Information System Development Center (MEDIS-DC) Foundation under co-support of the Ministry of Health and Welfare and the Ministry of International Trade and Industry. The project is divided in three parts:

- 1) Total electronic medical record storage and retrieval system.
- 2) Medical imaging processing system.
- 3) Medical consultation system using artificial intelligence applications.

This project started in 1983 and was expected to be finalized in 1988. However, as a project committee member, I think, in 1988 this project will only reach the experimental stage. It will be after 1988 that practical systems will gradually be developed by many electronics industry companies, including NTT.

C. Information processing and related technologies utilization:

11. The number of hospitals and clinics in Japan that use computers for clerical work has increased since 1975. Recently, due to the decrease in price of mini-computers and supply of standardized processing programs, the number has accelerated rapidly. At the end of 1983, more than 50% of hospitals and more than 10% of clinics had started to use computers. Consequently, the Ministry of Health and Welfare began study of a program to accept insurance bills stored on magnetic tape and floppy disc.

12. The number of hospitals using SHIS reached 70 in 1985. Other hospitals having computers are using packaged programs for 90% of their medical fee calculation.

13. Regional health care is now supported by 80 Automated Multiphasic Health Testing and Service (AMHTS), and Short Stay Human Dock Health Check Systems (SSHDHCS) in 377 of the hospitals in the Japan Hospital Association.

In 1984, 489,053 people were tested using AMHTS and 183,117 were tested using SSHDHCS.

14. A personal health administration system by IC card has just been started in the Tokyo Women's Medical College Hospital.

15. A Personal Health Data Cassette System is being developed as a project under support of the Science and Technology Agency.

D. Future ISDN utilization projects:

16. The Ministry of Posts and Telecommunications started studies on appli-

cation of the communication network to the medical and health care field in 1984, because of promotion of a Teletopia regional plan in Japan.

17. Telecommunication system for the elderly, disabled and handicapped. The system is called the Social Welfare Information Communication System, and has a large number of functions to support such people in society. The study is being conducted by the Ministry of Posts and Telecommunications. These functions include:

- 1) Multi-function cordless telephone;
- 2) Personal computer network;
- 3) Wide-area personal search and call-back system;
- 4) Multi-media information access system;
- 5) Navigation system for blind people.

18. Home Health Care System and devices by telecommunication are being studied by the Ministry of Posts and Telecommunications.

I would like to say in closing that the medical information systems are only established well with co-work of medical doctors, engineers and so many inhabitants who want to use the system. Co-work is the key term of such public use systems.