Advanced Total Healthcare Solutions of Hitachi Group Corporations

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OVERVIEW: Because the average life expectancy in Japan is increasing while the birthrate is declining, persons 65 years of age and older are rapidly coming to account for a larger percentage of the Japanese population. In average age, in fact, Japan's population is fast becoming the oldest in the world. Demands are being made, meanwhile, to hold down the expanding costs of medical treatment, a factor contributing to substantial changes occurring in the environment surrounding the medical field. Hitachi Group is tackling advanced healthcare from the prevention stage to diagnosis and therapy, aiming to realize tailor-made medicine most fitting for the physical condition of each patient and minimum invasive surgery for less trauma to patients when surgery is required. It is also strengthening its approach to providing total medical solutions for medical institutions and in the area of regenerative medicine, aiming to support higher quality and more effective medical treatment than has been available up to now.

INTRODUCTION

OVER the past 20 years or so, Japan has boasted of the world's highest average life expectancy for both males and females. Together with that trend, the average age of the Japanese population has increased at a rapid pace not seen elsewhere in the world as the

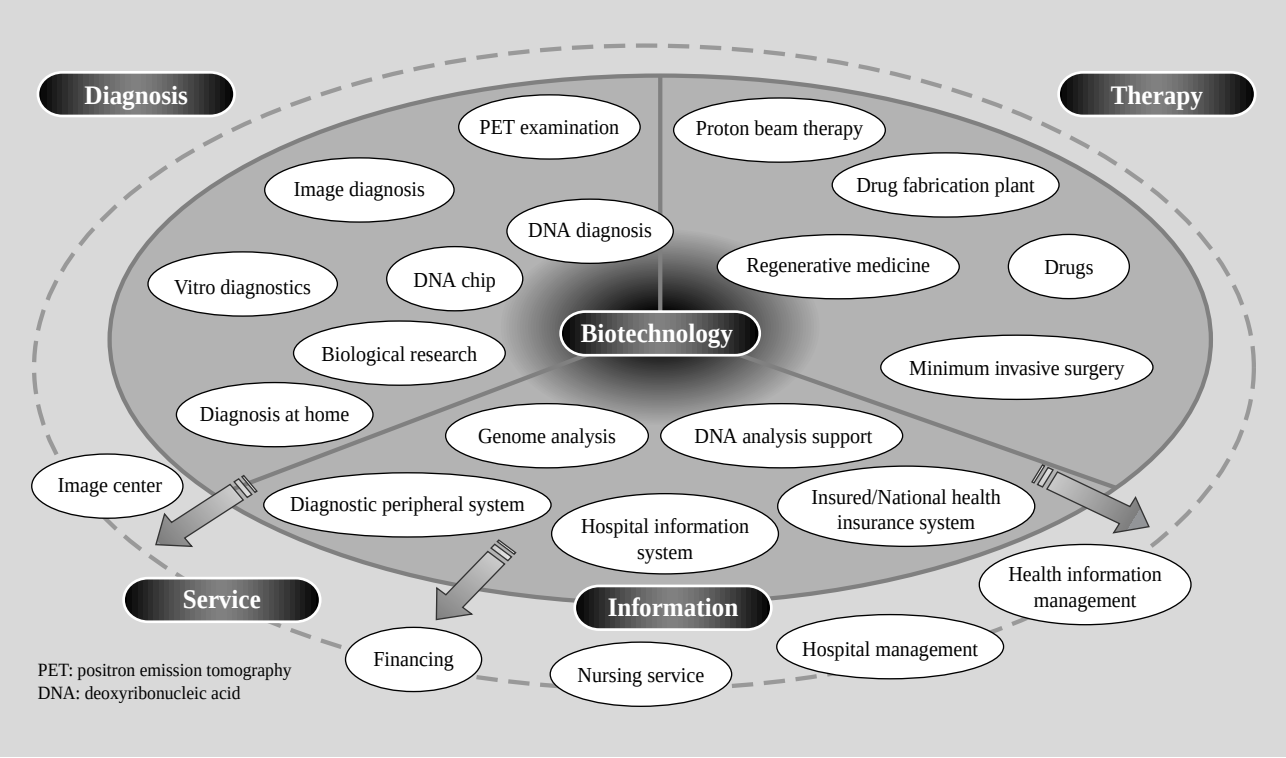

Fig. 1—Outline of Advanced Total Healthcare Solutions of Hitachi Group.
Hitachi Group has strengthened its approach to conducting business in the healthcare field as a new field. Although its interests are centered on diagnosis, it also emphasizes therapy, information, and biotechnology research. In the future, it will also promote activities in the service field, thus providing total solutions from the customer's viewpoint.

percentage of the population accounted for by persons 65 years old or older has risen. In FY (fiscal year) 2002, the percentage of persons 65 years old or older reached 18.5 percent of the total population, ranking Japan with Italy as the two oldest populations in the world. The 2003 edition of the Japanese government's "Annual Report on the Ageing Society" predicts that in 2015 that percentage will increase to 26 percent and in 2050 it will increase to 35.7 percent. In 2050, therefore, over one-third of the Japanese population will be 65 years old or older. Together with changes in the age structure of Japanese society and in the daily life environment, the nature of sicknesses in Japan is expected to change substantially. Infectious diseases like tuberculosis will decrease, and illnesses closely related to lifestyles and living habits, like cancer, high blood pressure, cerebrovascular disease, and diabetes, will steadily increase.

This article discusses the thinking concerning the kinds of healthcare that will be needed to meet the expected social changes in Japan, and the business approach of Hitachi Group (see Fig. 1).

HEALTHCARE FOR FUTURE

Government Action

Medical expenditures (about 30 trillion yen) as a percentage of national income have remained steady at around 8 percent. Because of the rapidly declining birthrate and the ageing population, however, they are expected to increase to 81 trillion yen in 2025, about 12 percent of the national income, roughly the current level in the United States. At present, all shared health insurance systems, including the government-managed health insurance system, cooperative health insurance systems, and the national health insurance system, are operating under substantial deficits, caused by increases in medical care payments for the aged and decreases in revenues due to the ongoing business recession.

In that backdrop, the Ministry of Health, Labour and Welfare in FY2002 proposed reforms in the medical care system. Now being promoted, the reforms emphasize the maintenance of good health and the prevention of sickness. Reform of the medical treatment fee system includes the reform of the medical care system, reductions in the medical treatment fee, and a switch from piecework payment to a system of flat payments. The premium rates for medical care for the elderly are also now being reviewed.

IT (information technology), meanwhile, is being introduced in order to streamline the operation of hospitals. At the end of 2001, the Ministry of Health, Labour and Welfare formulated a grand design for computerization of the medical care field. Targets included in the grand design include the spread of electronic medical record filing systems to at least 60 percent of all hospitals with 400 beds or more, and the spread of computerized medical treatment statements to 70 percent or more of all hospitals in Japan. The utilization of IT in the medical field was a specific example listed in the IT basic strategy "e-JapanⅡ" approved by the IT Strategic Headquarters in the Prime Minister's Cabinet. According to that strategy, by 2005 the authentication infrastructure will be put into order, including approval for storing electronic medical records outside medical institutions. Another target, to be achieved by 2010, is to switch to an online system of electronic medical statements for all medical institutions that apply for the change.

The most basic and effective way of suppressing medical care expenses is to maintain good health continuously from a young age, in other words, through primary stage sickness prevention and the promotion of good health. The Ministry of Health, Labour and Welfare was central in promoting passage of the Health Promotion Law in July 2002. The law, which went into effect in May 2003, is the basic legal foundation supporting the government's aggressive support during the period 2000 to 2010 of the targets in the "People's Health Promotion Campaign for the 21st Century" ("Healthy Japan 21").

Ideal Direction for Future Medical Care

As mentioned, in order for a society with an aging population to maintain its vitality it is necessary to extend as much as possible the period of good health of its citizens. The key to extending the period of good health is prevention. Also of importance is the cycle of diagnosing disease as early as possible, treating it appropriately, and recovering quickly to allow an early return to society (see Fig. 2). To make this cycle of extending the active period of life a reality, it is important to move away from the medical care of the past based on standardized values and to consider finely meshed medical care "tailored" to each person's physical constitution. Another important point during medical treatment is to lighten the burden on the patient's body as much as possible in order to ensure high QoL (quality of life) after leaving the hospital. This is accomplished by using minimum invasive surgery. Since tailored medical care and minimum invasive surgery are both advanced approaches to

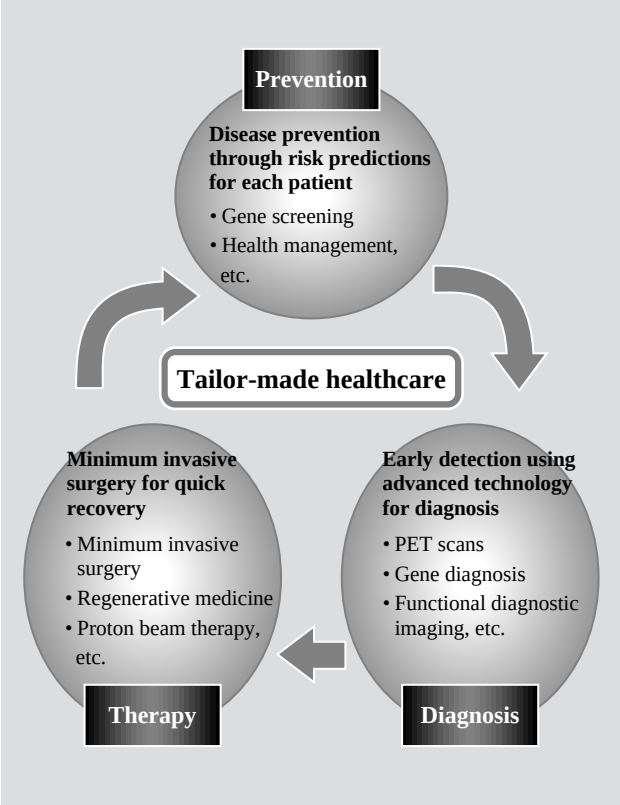

Fig. 2—Health Life Cycle Based on Tailor-made Healthcare. Disease prevention based on disease risk projections, early detection of disease based on advanced healthcare technology, and quick recovery through tailored medical treatment all contribute to maximizing the active period of a person's life.

healthcare, some quarters are concerned about a possible increase in medical costs. Actually, however, such advanced approaches to healthcare can be expected to contribute toward suppressing the social costs of medical treatment. Earlier diagnosis and treatment will become possible, and minimum invasive surgery will allow patients to recover more quickly, thus reducing the overall social costs.

HEALTHCARE APPROACH OF HITACHI GROUP

As shown in Fig. 1, Hitachi Group is approaching the healthcare field in five categories: diagnosis, therapy, information, biotechnology, and service. Besides the diagnostic field, in other words, that includes devices such as image diagnosis equipment and clinical auto analyzers, it has also entered the therapeutic, information, and biotechnology fields, and has pooled its overall resources to conduct business in the service field, thus aiming to provide total healthcare solutions from the viewpoint of the customer.

Diagnostic Field

In addition to high-speed 3D imaging using image diagnosis equipment such as multi-slice imaging arranged in parallel with a detector for X-ray CT (computed tomography) and cone-beam CT utilizing a flat panel detector, other diagnostic equipment that captures functional changes before pattern changes occur is becoming more important in the medical field. PET scans use low-dose radioactive sugar in producing images of body locations where metabolism is especially active. Such scans are especially effective in detecting cancer in its earliest stages. Fully digitalized ultrasound scanners, meanwhile, provide high-quality images and also make functional diagnostics possible, such as images of tissue elasticity. Other functional diagnostic equipment currently being commercialized includes optical topography that utilizes optics to produce images of brain activity and a magnetocardiograph using a superconducting magnetic sensor.

Another major trend is diagnostic equipment combined with therapy. Typical equipment includes open-type MRI (magnetic resonance imaging) equipment. Since it is open, patients do not feel like they are suffocating. The equipment can also be used to take images during surgery, thus providing guidance to doctors. Ultrasound scanners are also being developed that combine diagnosis with therapy.

Concerning automatic analyzing equipment in the biotechnology field, integrated automatic analysis equipment is currently being developed that conducts immunology analysis and ties it to networks. Two other products scheduled for commercialization are a total support system for clinical laboratories to link service centers and reagent manufacturers via networks in order to perform high-quality tests, and a clinical laboratory system that conforms to the rules for clinical information exchange while providing a high level of adaptability to network environments.

Therapeutic Field

For several important reasons, expectations are high for growth in the area of minimum invasive surgery. Therapy can be safely undertaken, for example, while placing as light a burden as possible on the patient's body. Also, the post-surgery recovery time is relatively short, allowing patients to leave the hospital fairly quickly after surgery. Minimum invasive surgery is thus gentle on patients and reduces hospital costs.

Other areas Hitachi Group is tackling include making it possible to perform operations that could not be performed easily before, designing next-generation operating rooms with open-type MRI equipment appropriate for performing more accurate, safer surgery, and supporting the development of surgical assistance robots. Based on accelerator technology developed over many years, meanwhile, favorable clinical tests have been conducted with a device for proton beam therapy that focuses on attacking cancer tissue with minimum damage to healthy tissue.

Information Field

The role of medical information systems is becoming more and more important for supporting the increasingly advanced diagnostic and therapeutic fields. Calls are becoming stronger, for example, for providing medical care based on scientific evidence derived from analyzing accumulated diagnostic and therapeutic data. In order to improve the quality of diagnoses and therapy and reform the management of hospitals by streamlining their medical-related administrative tasks, it is essential to develop functions that support those activities. Hitachi Group is moving to realize such support functions by making strenuous efforts to develop medical information systems, centered on electronic medical record systems, and next-generation electronic medical records with reinforced management support functions. With an eye toward the future, Hitachi Group is aiming to build an information infrastructure that will provide integrated solutions to regional medical institutions connected via networks.

Biotechnology Field

A capillary array DNA sequencer Hitachi Group developed contributed significantly to the decoding of the human genome. Genetic diagnosis is also important for realizing tailor-made medicine. By finding and investigating the individual differences between genes, various types of new action will become possible at the preventive, diagnostic, and therapeutic levels. At the preventive level, disease prevention and health maintenance become possible based on attack risk; at the diagnostic level, medical check-ups and simple confirmation will improve the accuracy of diagnoses; and at the therapeutic level, it will become possible to diagnose the efficacy and side effects of drugs and a patient's radiation susceptibility. Also, through the application of regenerative medicine technology that allows the replacement of tissue and entire organs, it will become possible to conduct therapy that was previously extremely difficult, thus enabling patients to recover and eventually lead healthy lives. For many years Hitachi Group has conducted R&D into biological measuring and analyzing technology and related devices, such as sequencers and bio-informatics, and is strengthening its approach in the biotechnology field through the use of the human resources and know-how it has accumulated.

Service Field

Hitachi Group is also expanding its efforts in the service field. Besides business centered on financing, such as the leasing of equipment to medical institutions, its approach includes management support services related to hospital operation and advanced diagnosis support systems utilizing networks. Another new business in the service field is support services for clinical PET, in the context of PET clinical equipment becoming quite expensive when it includes accelerators and chemical black boxes.

Hitachi Group is already providing support services to hospitals that include financing and engineering. It will strengthen its presence in that field in the future by providing a wider variety of healthcare services, such as individual heath maintenance.

OTHER AREAS

This article thus far has introduced typical examples of diagnostic and therapeutic devices, systems, and services that Hitachi Group is providing or will provide in the medical and healthcare fields to create new medical services with added value. This last section outlines examples of new healthcare approaches such as total solutions for medical institutions and regenerative medicine.

Regenerative Medicine

Regenerative medicine refers to the definitive therapeutic method where sick tissue or organs are completely replaced. Donors are not required using this therapy, ensuring its wide acceptance in Japan and giving it the potential to spread rapidly. Overseas, the replacement of skin and cartilage is already a thriving business, and the replacement of bones, corneas, blood vessels, and nerves will also soon become a reality. Research also continues on problems related to replacing the liver, heart, pancreas, hair, and teeth. A main feature of this field is that almost all the technology derives from university research labs. Hitachi Group is currently promoting joint research

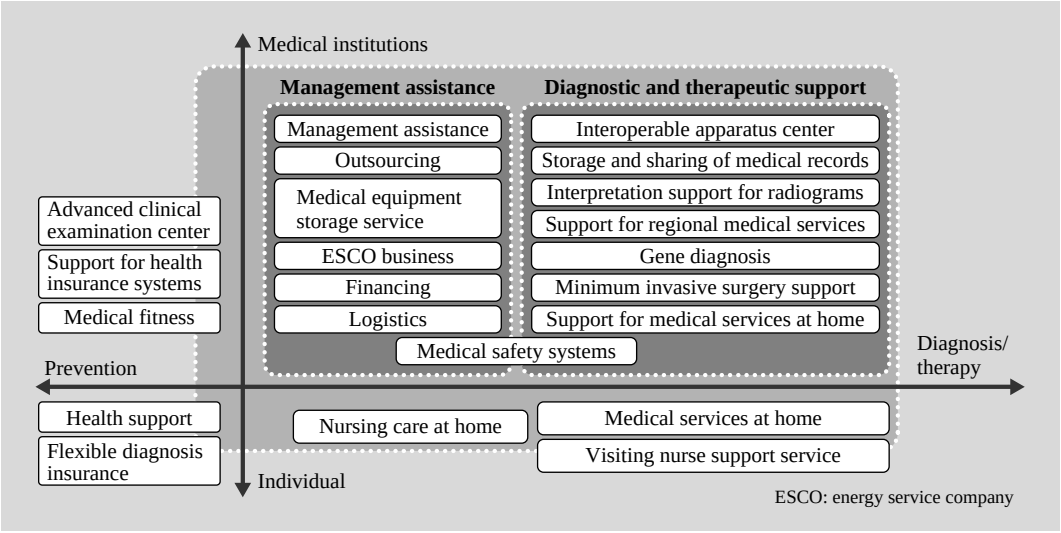

Fig. 3—Types of Medical Service. Medical institutions and individuals are requesting a wide variety of services.

with Nagoya University concerning the regeneration of tooth germs and with Tokyo Women's Medical University, CellSeed Inc., and Osaka University concerning the regeneration of corneas.

The market for regenerative medicine in Japan is forecast to expand to between 200 and 400 billion yen in 2010. In order to participate in and benefit from that market it is first necessary for Hitachi Group to establish safe cultivation technology and then expand it to include the technology needed for mass volume cultivation. Cultivation from a patient's body cells (auto-cultivation) faces fewer problems than cultivation from the body cells of other persons (allo-cultivation). The latter requires the development of technology for overcoming immunoreactions to the transplant of foreign tissue.

In the future, regenerative medicine is expected to move in the direction of cultivation through differentiation control that uses genes from cells prior to differentiation. For that purpose, new technology is essential that integrates IT, genome, and cellular engineering. Based on an R&D network that spreads horizontally across the companies in the Hitachi Group, research will be promoted in the cultivation equipment business and the service business, including cultivation, storage, and transport.

Total Solutions for Medical Institutions

The Ministry of Health, Labour and Welfare's review of the system of compensation for diagnostic and therapeutic services in the national health insurance system resulted in a major negative impact on the management of medical institutions. Medical institutions in Japan currently face two principal tasks: one is the upgrading of service to patients, and the other is risk management to prevent medical incidents. Lined up with those two tasks is a third one: the improvement of business management for earnings stability. By utilizing various services, it is possible to improve the quality of healthcare at medical institutions and to raise the efficiency of management through superior cost control (see Fig. 3). Hitachi Group will gradually introduce these services through solutions based mainly on advanced healthcare and IT, thus responding to the increasingly diversified needs of the marketplace.

The formulation of proposals for improving medical management requires the tackling of a wide range of tasks. It starts with analyses of the basic management situation and the demographics of the area within visiting distance of a hospital, and moves on to capital procurement, plans for plant and equipment renewal, plans for the control and operation of information and equipment, and plans for outsourcing. The regional functions and role of a medical institution must also be clarified, and the results reflected in those plans. The companies in the Hitachi Group liaise closely with each other not only to provide particular types of equipment and services but also to provide integrated solutions that respond in finely meshed detail to the needs of patients and medical institutions (see Fig. 4).

CONCLUSIONS

This paper has introduced the approach of Hitachi Group for providing total solutions for regenerative medicine and medical institutions in order to respond to healthcare needs in Japan and overseas.

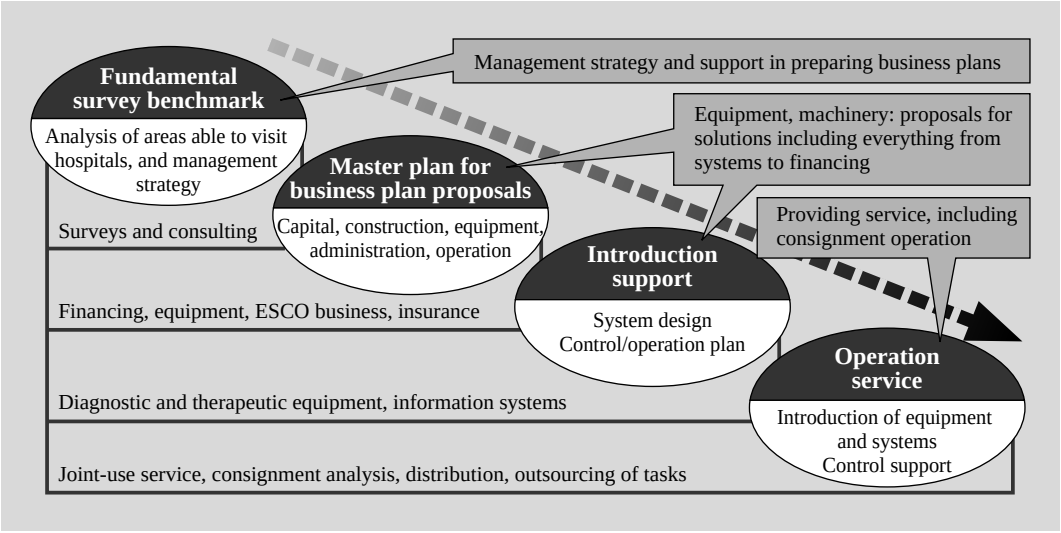

Fig. 4—Solutions for Medical Institutions. One-stop total solutions, from upstream to downstream.

In particular, the declining birthrate and the aging of the Japanese population are proceeding at faster rates than expected. In the context of those changes, the healthcare business is presenting itself as one of very few growth areas in the Japanese economy. Hitachi Group is already performing much healthcare-related R&D and have high expectations for developing new businesses in the healthcare field. One of its missions is to contribute toward building a solid social infrastructure. By putting to use the technology it has cultivated up to now and by conducting new R&D, Hitachi Group will develop and provide systems and services to serve a social role in the healthcare field as well.

The New Energy and Industrial Technology Development Organization (NEDO) has commissioned Hitachi Group to conduct some of the research related to surgical support systems, genetic diagnosis, and regenerative medicine. Grants-in-aid for the creation of innovations through business-academic-public sector cooperation from the Ministry of Education, Culture, Sports, Science and Technology are also supporting some of that research.

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