Telehealth Systems: As They Should Be

Their Role in Our Lives and Welfare

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Abstract: - We discuss some fundamental concept of telehealth with relating welfare systems based on the Internet facility from the standpoints of their beneficiaries and social infrastructure. Our approach is here by our own work more than 30 years which was introduced in the newspaper "Science News Japan, Tokyo" with some examples. As there remains however still important things in this area, we further discuss according to the reference of subjective needs of individual beneficiaries in our aged society. Thus, the support rather than the surveillance of beneficiaries is first discussed with expenses of curbed and equipment simplified in ordinary telehealth cases. Secondly, community-wide medicare offering security is talked about utilizing timely offered technologies. Emphasis is however placed on Face-to-Face communication and on easy handling by beneficiaries, providing as examples such opportunities of enjoying games for the disadvantaged and for dementia patients. Then, the same technological concept based on broadband are discussed to make it enable to have teleconferences, teleeducation for rural depopulated region. The proposal is thereby made in order to appeal to smaller information gaps and to keep sufficient capacity communication in telehealth-society.

Key-Words: Telehealth, Medicare, Nursing, Welfare, Wellbeing, Ageing society, Internet, Telecommunication

1 Introduction

Longer life spans and declining birth-rates have transformed Japan into an ageing society, with a ratio of the elderly to total population reaching 14% in 1994. As may be well-known, the pace of this change has since been accelerating. An inevitable result is the aged society, in which interpersonal relationships have lost structural and economic equilibrium balances in a lurching anxiety-filled society. We find such typical phenomena as the elderly taking care of the elderly, a declining labor population and falling worker morale [4,8-10].

Comprehensive policies are being urgently needed in order to correct such severe imbalances. Any efforts to forge such policies requires for not to regard the present Japan negatively as lacking in vitality and promise. Instead, we should view the nation positively, while listing problems and speaking out, proposing and carrying out countermeasure.

Needless to say, history proves that concepts peculiar to an era, overemphasis of some features in a social system, and trends in any given times have generated a sizable minority of people in weak positions. However, our argument here centers on the aged society that has been realized in Japan because of the unprecedented speed in human history with which lifespan extension and low birth-rates have occurred. Such a society should be dealt with quite differently from past ones. One can see fundamental differences in social backgrounds as between the present and the past. Therefore, our argument needs, from time to time, to take into account historical changes up to today in demographic segmentation, popular consciousness and levels of science and technology. These are found in a symbiotic society containing mutual relationships and joint activities among the same generation or between different generations.

However, to our regret, no one in academia or elsewhere has so far come up with clear answers to questions about how a society should be. Thus we are coming in the dark in an attempt to build up a "culture", in the broad sense of the word, while considering new human relationships in a different kind of society.

This paper will touch on welfare themes, based on basic research and development efforts, and on the multiple practical applications meeting requests from various people in which the author and his colleagues have been engaged. That is, we will describe how our thoughts on welfare by the Internet could contribute in the process of development of engineering measures and their real-life applications. We also discuss the importance of what we call "simple and common technology", and its further development and results of concrete applications, together with the proposed path through which we can contribute to solving welfare issues in an aged society. The proposing welfare path through telehealth including various medical and nursing care based on the telecommunication facility is paved including some problems regarding government policy and technical systems management that we have encountered*[1].

2 Telecommunication's Role in Human Lives and Welfare Based on the Demand of Necessity of Beneficiaries

*Support Rather than Surveillance,
with Expenses Curbed and Equipment Simplified*

Medical care, clinical nursing and nursing-care and the like which are provided based on telecommunications circuits are collectively called remote medicine and welfare, or telehealth for short. What would the term "remote medical care" –the oldest category– remind you of? Your response may be one of the following three: a patient's diagnosis provided by a distantly located expert, using information and telecommunications technology (ICT) – much touted by the mass media; efforts for more accurate diagnosis based on

discussion and data exchange between two or more experts rather than a single person; and obtaining guides to expert knowledge or facilities. All these approaches have been realized as a natural outcome of rapid ICT's progress and are delightful things made possible in today's Internet society.

However, none of the three responses does not exactly suits the feelings of welfare beneficiaries. The reason is that using such methods patients and other beneficiaries do not show their faces. Their actual expressions remain unseen. This is because experts concerned have not sufficiently considered what circumstances require medicare and welfare, including the time and the place.

Anyone could realize this point by imagining a situation in which you are alone in a life-or-death emergency. If someone were with you, he/she would contact a medical institution to arrange for your immediate treatment. If it were not an emergency case, you would have time to choose a medical institution with adequate facilities. In a plain emergency you naturally want to call a doctor right away so that you can obtain top priority treatment. This may look like a patent's selfish demand. However, in my view, this is the starting point not only of medical care but of all welfare, as I shall explain. This is what the public expects of medical specialists engaged in publicly-offered medical care.

So I would like to highlight the major points which is titled by "telehealth systems: as they should be" as the following:

Our ageing society is faced with the task of offering long-term medical care based on provision of trained personnel, including clinical nurses and nursing-care staff. This is where ICT can come in, promising support in a wide sense based on finely-tuned services [10].

To date, various systems have been installed and commercialized, including image transmission by TV-camera, the spotting of anomalies using information on such activities as the opening and closing of doors into rooms and houses, and emergency alert systems based on transmission gadgets built into pendants. All these strategies represent efforts to meet the needs of many people, as the systems have been developed to simply find and report patients' anomalies, depending on the needs.

However, these methods "measure" individuals' movements, although they are not tantamount to only surveillance of patients. Moreover, medicare experts often tell about keeping communications

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*[1] Based on the special Articles of Newspaper. "Science News Japan", 2008 by H. Wakamatsu [10,12].

with patients through teleconferences to check their conditions.

Nevertheless, on due thought, one realizes that from the standpoint of medics had better be "absent" when patients are enjoying their daily lives and/or are healthy. It follows that the helping hand had best show only when a need arises, while usually being unseen, so that patients will be unaware of the support. For patients, having others watching them constantly is unpleasant, as it means that every one of their actions is being watched.

In a life-threatening emergency when urgent help is needed, you want something done immediately. Naturally, it's helpful if a system exists for paramedics to reach you in a flash thanks to network functions with emergency options. This in itself is fine. Still, what about just regular positive support methods intended to ease patients' pains and anxieties? Although not every aspect of welfare calls for such arrangements, we have to consider what situations truly warrant invasion of privacy. Thus, it is necessary to have a support system that can balance guarding privacy with positive intervention.

We have been developing, for more than 30 years, medical-care systems that are suitable in emergency cases and for steady provision of clinical nursing and nursing-care services, while protecting privacy. Systems need to be built up from the standpoint of the patients, and the doctors and nurses.

To do so, while keeping in mind what patients request, we have to grasp where to post our limited number of staff; what area is to be covered by a welfare program; and what economic foundations are available. It's vital to know what infrastructure is available; and what are the working conditions of medicare staff people, especially in remote country areas and little islands. What we need are fast and large-capacity telecom networks and remote-control measuring devices.

Fortunately, Japanese technology is up to provide such systems. Improvements are going on across the nation all the time. Still, we must keep in mind that the systems we have contain pitfalls. Not all the intended beneficiaries can be helped. Some corners of Japan are hard to reach. And after all mental and physical deterioration is inevitable in everyone.

There are mountains of problems in daily lives, in health management and in coping with emergency cases. Among these problems is the nursing of patients whose recovery is difficult. Some physical, psychological and economic burdens can be reduced by use of electronic devices.

Furthermore, various systems can be built up, based on existing technologies, to better people's lives and let them participate in society by outsourcing work, offering support for the weak, including the mentally and physically challenged. We need to better the lives of the aged, children, families and nursing-care staff. We need to see communications between different generations.

There are always cost problems. Still, we have witnessed nursing support systems serving as the factors to upgrade institutions and homes. Given this situation and the improvement of telecoms, we have come up with comprehensive solutions, using existing ICT and the Flash Media Servers (FMS). Such devices operate on the same principles whether the beneficiaries are the healthy or intellectually and physically challenged or those in need of emergency care.

In our work, we have upgraded telehealth systems into region-wide support system that guarantees protection and peace of mind to the weak and the poor, while reducing the pressure on nursing-care personnel.

In sum, what we offer by way of reducing economic burdens and simplifying the use of electronic equipment basically matches the needs of those who seek help [7].

3 Medicare Welfare Suitable to Nation with Longeval People

Community-wide Medicare, offering Security and Utilizing timely technologies

Given the longevity of its people, Japan is experiencing rising concerns over health management not only at the national government level but also in provinces and among individuals.

All of us want to realize a society in which the elderly and the sick alike can have peace of mind [7-10]. That is, our citizens increasingly expect support in a wide range of aspects covering their daily lives and medicare, as offered in the various forms of public health, nursing care and clinical nursing, rehabilitation and first aid.

Linked to this trend are the positive adoptions of various new technologies. A major reason for this is that both human and economic resources are limited, thus there are rising expectations that telecom and control technologies should play a larger and more aggressive role in medicare.
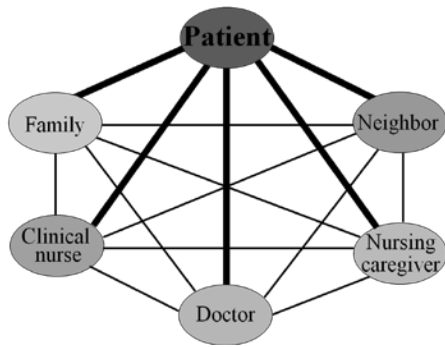
Fig.1 Wellbeing relationship in a community[1-3].

We require a system that allows a family member to work and to be away from the home and to be outside for a while without worries about nursing his/her invalid relative, offering assistance to offset declining physical strength and intellectual capacity.

Thereby we need to make arrangements using current technologies that improve individuals' daily lives and health, to help promote close relations with neighbors, and to offer better chances of working at home.

This way, new technologies can contribute to physical and mental health of beneficiaries, and foster a sense of fulfillment and a keeping of their identity. Realization of such aims can mean a step forward toward creating a true welfare society. This requires researchers to work out and confirm the effectiveness of comprehensive technology systems, offering assistance in daily lives and medicare, as well as a broad range of tasks and proposals that have so far been presented.
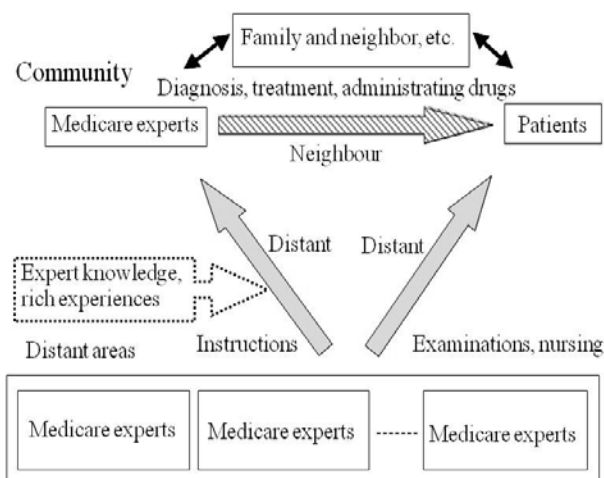

Fig.2   Role of medicare personnel for patients [4,7-10].

As Figs. 1 and 2 are shown, given the needs arising in connection with the medical personnel's role in a community's welfare relationships, the applications of information and communications technology (ICT) should be directed towards self-management of daily lives, rehabilitation, and nursing support.

Together with my colleagues I often visited special nursing homes for handicapped elderly people in 1986. At the time we learned that what worried nurses and managers most was that some of the aged residents went out of doors and wandered into dangerous places, without the knowledge of the home's nursing personnel [1].

Accordingly we began a project to develop a protective system capable watching over the patients and any sudden departures, which provided the first chances of dealing with the elderly – our first welfare-related project.

In a society where people live for so long, I proposed that we conferred recognitions on the people who have become senile.

Let our researchers find ways to help the elderly and infirm live happily with pride and composure. We face a historically unprecedented task — letting the aged and the younger generations live together afresh. We all wish to improve existing ways of life and/or develop new ways contribute to the natural mixing of the generations at home and facilities, by whatever means.

Thought we have is to bring the generations together by offering them recreation, without big pre-guideline, in an informal way. Play based on computers can offer free-form environments, which bring families and friends together, without big facilities or teams of helpers [10-15].

We forged game content and design using computers in such a way to allow the aged, adults and children to naturally join in—and to leave freely. This brought people together in a natural way at the home and outside.

Separately, when the Internet came to be used by the public, we carried out a project for a first-aid system, based on the Integrated Services Digital Network (ISDN), which was to be further used by the people living alone and/or aboard on a vehicle. [3,10].

Regrettably, we found that legal regulations made it impossible to put this system into practical use. However, let me describe our initiative because it has important points.

The system was intended to provide a person being alone who suffers an emergency with feelings of personal security as if he/she were actually being assisted by doctors. The patient helps himself/ herself by directly obtaining doctor's instructions.

Specifically, a mini-computer gets started up when it detects a change in internal atmospheric pressures in a mask worn by a patient. This way, a patient can be enabled to inhale a vaporized standard drug or drugs so that physical pains can be alleviated even if temporarily.

The mask, designed to be adhesive, will stick to the patient's face even if he/she becomes unconscious. Many patients' chronic diseases are known so that necessary drugs can be kept in readiness by the system, following doctors' prescriptions. Simultaneously, the mini-computer automatically transmits signals, with a voice alarm notifying a doctor of an event so that a distant anthroposophy (Ocular inspection) can follow [3,10].

Moreover, remote measuring technology can be utilized to check a patient's breathing, cardiac signals, and body temperature, thereby to check the functioning of the heart and the lungs. This procedure can be followed by the selection of drug or drugs, and by adjusting the flow of air and oxygen to be inhaled.

The system includes additional features such as allowing for requests by a clinical nurse and/or nursing caregiver on the ground to arrange for a wheel-chair, or for requests from a patient in an isolated environment from a doctor's advice on such as an airliner and a ship.

Or our system can be just the key device to be used alone – minus the communications functions – for the treatment of an asthma attack.

The important point is to realize a community-wide medicare system which provides a sense of security – even though it may not be totally sufficient. The arrangement takes into account fully patients' wishes for help and for survival.

To meet a patient's needs, in case a doctor of first choice is unavailable, a second one can be designated who can provide at least standard advice.

We are currently trying to develop a similar system with a built-in mini-transmitter for use at home or in a vehicle.

Since information networks have spread so much among the public and virtually eliminated distance in many areas, we have also attempted to come up with a "home production system." That is intended not only to provide emergency support but also to help a bed-ridden patient to work at home to increase his/her participation in society [3]. In addition to these systems, we have proposed development of systems specifically intended to help patients suffering from diabetes – said to be a national disease – to manage their daily lives, and to help nurses and rehabilitation experts [7,10].

We have together with our colleagues had various opportunities of explaining the basic technologies to continually support today's publicly-offered medicare and of discussing future prospects of related technologies [10,11].

Our current projects also include a comprehensive distant-nursing system that can help nursing education, too. We wish that various applied systems of engineering technologies shall lead to a new branch of industry and help people in their daily lives. Based on such an achievement, we anticipate that communal medicare systems, linked with a support by the government and by local administrations, shall be gradually created.

4 Same Operational Principle Leading to Inexpensive and Simple Methods

Emphasis on Face-to-Face Communication and Easy Handling by Patients

The concept of telehealth dates back about 40 years and this led to attempts at practical development starting in the 1980s. However, most of the initial systems were for consultations and TV conferences between medical experts using transferred images. Few arrangements were intended to directly involve patients. It was in such a situation that the author's laboratory launched in 1986 a development project for a system to prevent elderly patients suffering from dementia from wandering outside [1,10,15].

At the time, the Internet was not being widely used, thus we were obliged to build de facto usable networks based on telecom circuits for the automatic collection and management of information on patients.

In parallel to this planning, we developed a virtual-reality-based game of a simple nature as a support system to activate mental and physical functions. This system does not require the users to prepare anything, making it possible literally for

anyone to start it at once, thus is offering a natural kind of training and rehabilitation – an asset contributing to a better medicare environment [2].

By the 1990s, when ordinary citizens came to have access to the Internet, researchers came to consider systems that deal directly with patients and others in need of daily care.

The Internet can be applied in a manner as explained hereby.

There are systems for community management of aged people's health, relying on CATV or common carriers such as Nippon Telegraph and Telephone (NTT). A patient's blood pressure, body temperature and weight are measured while electrocardiograms are taken, all at his/her home. These data, together with a doctor's record based on talks with the patient, are relayed to a medical institution. There, a doctor studies the data before sending back his/her comments, recommending an examination of the patient in situ, if necessary [10].

In another sort of system, food or drinks are photographed and the images are transmitted so that an analyst working somewhere else can check and make a relay of contents. In this case, expert advice can be obtained as for diet control, to which many people are finding importance [13-15].

However, simultaneous utilization of various systems requires coping with different operational environments and with different usages, with the result that there are serious barriers. Easy-to-use systems that run on the same principles are desirable for the general public in order to take the advantage of these network devices. What's more, not all they have sufficiently taken into account the importance of person-to-person communication [16-19].

In developing distant medicare systems at our laboratory, we have tried to incorporate comprehensive viewpoints, to put an emphasis on
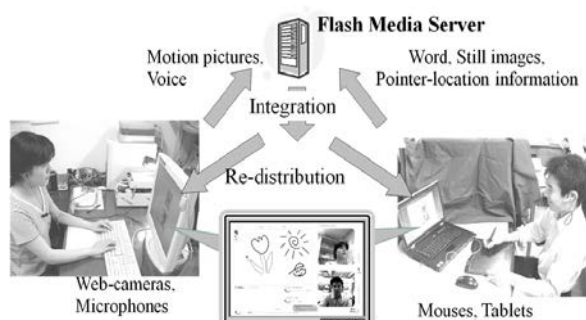
person-to-person talks and to use the same concepts and principles as illustrated by Fig.3. This is a system behind the BPSE method developed at Tokyo Medical and Dental University, which assumes further improvement of broadband networks and does not require installation of a special software program [15-18].

In our BPSE system, integrated voice, images and other data are distributed by using Flash Media Servers (FMS). Accordingly, as Fig.3 shows, once a user prepares basic communications functions and supporting hardware, he/she is guaranteed person-to-person communication at a distance, just by designating a server's URL [10,11]. For convenience, we choose to connect telecom circuits to two physically separated groups of servers, in which software systems with different functions are placed. This arrangement is designed to realize load sharing for the servers and bandwidths, whose advantages include stabilizing the whole system and easy identification of obstacles in case of problems.

Such a system places most of the economic and physical burdens on the service provider, which involves no special procedural and other burdens on the beneficiaries, thus increasing the chances of adequate utilization. This obvious advantage – no need of prior knowledge or experience for the user –confirms what the author with his colleagues have long maintained.

This system served as the basic structure, or the launch pad, for the most fundamental and important video-teleconference system that of course enables distant person-to-person communication. A simple operation can carry out such works as presentation by all the users of still images, slides and motion pictures, not to mention voice.

Another feature is simple procedures for changing the screen layouts as well as the number of communication participants. For example, as shown in Fig.4, the number of users can be raised to three

Fig.3   Basic video-teleconference system for various purposes using Flash Media Server.
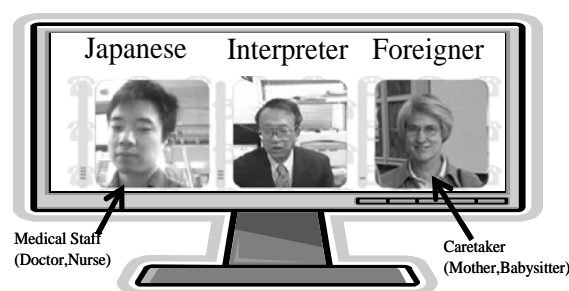

Fig.4   Long-distance medicare system for the foreigner who cannot talk in Japanese.

so that an interpreter can be recruited from a distant place to join in the dialogue between a Japanese doctor and a foreigner.

Our next development project, based on this system, featured additional functions necessary in mentoring and consultations for clinical and other sorts of nursing, and in welfare and rehabilitation programs for both the aged and the handicapped.

The system enables the sick, including bed-ridden patients, to work at home ("the distant production system") and it was realized as part of this comprehensive program. To be sure, this system can help communities of all kinds but it proves its usefulness – and truly shines – especially in depopulated regions, such as in the mountains and on little islands out at sea. Such places are known for shortage of welfare services, as there are so few qualified persons.

In sum, we have made efforts to build comprehensive systems that are useful in a broad range of publicly-offered medicare applications. The kinds of systems we have developed can be applied to many areas – a topic I will cover later on.

5 Some Examples of Games and Rehabilitation Programs

Providing Opportunities of Enjoying Games for the Disadvantaged and Dementia Patients

Now let me describe our research team's essential systems, which operate all on the same principles and concepts.

Our first examples are games on offer via networks to the aged and disadvantaged people located in distant places. Secondly, let us touch on an experimental distant guidance as used to train rehabilitation staff on little islands and in remote corners of Japan [2,3,10,11].

The first example in Fig.5 is a simple game that involves beckoning to a baby. A player reacts to a series of changing images. No prior training is needed because the player's actions are caught on a web-camera and projected on to a corner of a screen, making it possible to watch oneself. As the action evolves, so do the baby's moves – or a different object in a different game. During this time an execution file is offered by a web-server in the network.

Fig.5 Playing game on the screen using a web-camera under the Internet..

What the player has to do to run the file is merely select a menu item. In this example, just one player is involved, but several people in different distant places can simultaneously enjoy the same game together thanks to integrated communications based on Flash Media Servers (FMS). Arrangements such as adjusting the camera's position and angle, using a larger screen and upgrading sound and voice quality can result in games that require moving the whole body with a stronger sense of presence or allowing the participation of more than two persons.

Figure 6 shows a bed-ridden patient enjoying a game with the player and an object presented on a screen which is attached to the ceiling. A game can be replaced by communications with the outside world.

These games can help augment opportunities for game-playing or communication for people who are largely deprived of such options for one reason or another. Accordingly, they can offer a more attractive living environment even to people whose living space is limited.

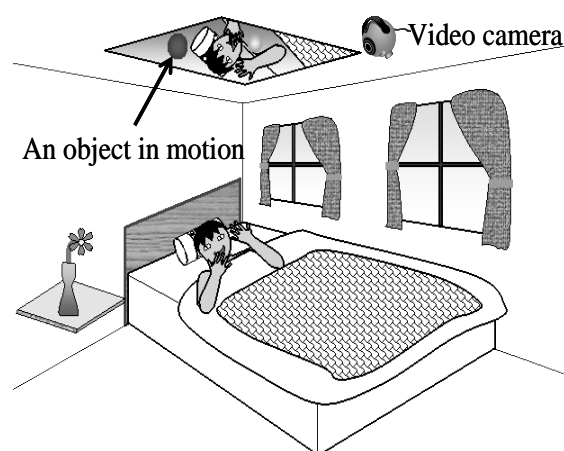External stimulation — reactions to a patient's

Fig.6 A Game system for the bed-ridden to enjoy.

Fig.7 A patient (right image) receives rehabilitation with assistance of a family member according to an expert's instruction from a remote location (left image).

actions, images, and sound and voice — can be expected to have beneficial psychological and physiological effects. For example, experts have observed that aged dementia patients tend to decrease their sudden abnormal behavior while being engaged in a game or after playing.

Figure 7 shows how a distant rehabilitation system works, offering guaranteed person-to-person communication. That is to say, an instructor located in a distant place confirms how a patient undergoing a program is doing from dialogue and by video, while issuing appropriate instructions conveyed by gestures, if necessary. A third person – a professional nurse at an institution or a family member – may assist the patient as needed.

This system, however, cannot relay directly such data as the tension in the patient's muscles and the sense of touch. Still, rehabilitation to a certain degree is possible, given communication through an assistant and visual confirmation of the patient's movements and postures.

Thus, guidance for rehabilitation is available in remote corners of this country which lack experts. Chances for rehabilitation increase because the patient and the expert alike can save time and expenses.

Regarding this point, a physical therapist in Okinawa prefecture, who often visits little islands, has testified, confirming the system's usefulness.

However, operating systems like this one throughout a region require not only favorable economic systems but also cooperation with local administrators.

Now, let me indicate to you how doctors and nurses regard these systems by quoting what they say.

First, here is a comment by a doctor who is taking care of her mother at home on Sado Island.

"My mother suffered a subarachnoid hemorrhage three years ago, which resulted in aphasia and paralysis of the right half of the body. In Sado treatment in the acute phase and rehabilitation are impossible, making it necessary for her to visit Niigata nearby the island. Now these diseases are chronic, and she is being treated at home.

Here on the island I found this situation: because of the increase in the aged population, including the elderly living alone, and because of revisions of the medical fee structure, there are medicare personnel shortages and cost issues emerged. As a result, visits by rehabilitation specialists to private homes are not available even in areas where it is difficult to send a patient to a hospital.

As for the islanders' present sentiment, many feel that a family should take care of an ill member and that it is shameful to leave care to non-family members or to a professional service. This partly keeps special services from spreading. A lot of effort is needed to help a patient use a toilet or take a bath. A family member trying to take entire care of another cannot have time for himself/herself, and fatigue sets in and simply keeps accumulating. With a serious patient in the house, the family members are constantly under strain having little time for relaxation."

This doctor told us that she is interested in our systems as a care-giver and as a doctor.

Meanwhile, a Tokyo-based nurse who is studying at graduate school and her colleagues let us know their opinions, after actually using our game system, as follows:

"We knew about the amusement system for the mentally and physically disadvantage and for the aged dementia patients, from the Internet. But the system was a surprise from the nursing standpoint. I found it strange – and interesting – to feel as if I was playing in a different world that the screen presents. This can give the elderly various sorts of stimulation.

We can say that this approach can be effectively used in a rehabilitation program, while we actually often heard aged people saying that they enjoyed playing and talking in a group.

Since this amusement system can be enjoyed collectively we had the impression that a whole group of people can receive wellness through conversations and other exchanges. We also were interested in distant medicare systems, which we think can back up medical care and daily lives in tiny island communities."

We have repeatedly heard remarks like these [2.10].

6   How Users See Possible Multilateral Applications

Broadband Enables Teleconferences, Distant Education for Rural Regions

Our systems, as before mentioned, all run on the same principles. This helps to keep cost under control. System researchers like us have much to say about such systems' social usefulness and medicare economics.   But, first, we should see what the users say, and based on their views and our past typical achievement, we should take a view of the future.   Expected effects are manifold not only for our reviewed systems plus their possible applications and their combinations with others but also for other arrangements that have yet to be fully demonstrated and proved.

As matters stand now, both patients in general or beneficiaries and medicare personnel at work feel that the infrastructure is insufficient in places.   It is impossible to get enough telecommunication facilities to meet demand.   With matters as they are in telecoms environments, we cannot make accurate and objective evaluations of systems in use. Only if the telecom environment is improved, with wider use of broadband, can we make objective appraisals of the increasing use of medicare systems.

As a matter of fact, in the information and communications sector, once a technology is established, it can spread in a relatively short period of time. As we gradually extend and improve our systems while making use of ongoing evaluations, we can expect to realize significant progress.

Here let me present four examples of the evolution of our laboratory's telecom-aided lecture system, originally aimed at providing general medicare education, by taking advantage of improvements in the telecom environment [5,6,11].

The first example is a real-time multi-campus program for educating graduate students, who earned credits. This event involved Tokyo Medical and Dental University (TMDU), Okinawa Prefectural College of Nursing (OPCN) and Meio University also in Okinawa prefecture as well an obstetrician and gynecologist at his home on Miyako Island in Okinawa. As Fig.8 shows, the collaborative work was relayed live on large screen

Fig.8   Long-distance multi-site lectures connecting Naha, Nago, Miyako Island and Tokyo.

set up in classrooms [5,10,11]. It involves seminars held by OPCN as part of its graduate-school program for working students living outside of Okinawa. The college scored a good result by offering guidance for writing academic papers, and in other ways.

Secondly, the Japan Society of Rural and Remote Area Nursing held a symposium to discuss public health and nursing at Meio University in Nago City which is located on an island in Okinawa. As indicated in Fig.9, not all the participants were physically present on the Nago Meio campus.

Those from TMDU and OPCN were far away and appeared on large split-screens, while others represented Meio University, the University of Tokyo, Jichi Medical School and Siebold University of Nagasaki were actually at the meeting place.
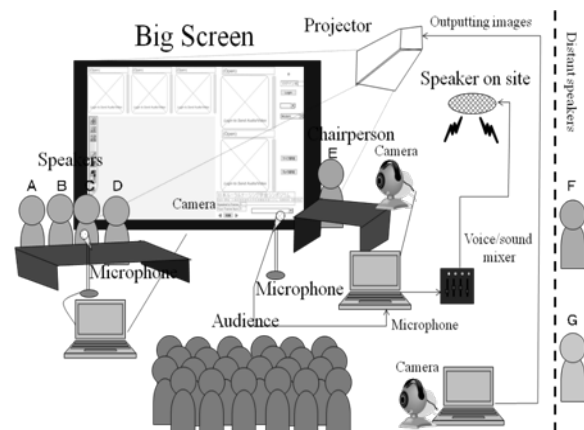

Fig.9   Long-distance symposium held by the Japan Society of Rural & Remote Area Nursing.

In addition, TMDU and Meio University have teamed up with a hospital, owned and managed by a local doctors' group, and other parties to carry out regular study sessions to probe into long-range support systems.

Regarding evaluations as I stated earlier, the introduction of long-range systems has changed the way lecturers and students communicate, as in guidance for writing papers by graduate students.

That is to say, in parts of Japan, which have the benefit of broadband, our new systems, like our video-teleconference, have helped to overcome time and space constraints. They have resulted in increased opportunities and options for person-to-person communication [5,6,10].

However, our systems under operation have also enabled us to listen to the pained remarks of nurses who study at graduate school of OPCN on Okinawa Island, while working in nearby little islands. Their cries of dismay indicate the extent of problems existing in regions without adequate telecom facilities.

"We are eager to receive post-graduation education," said one. "So we pay for commuting, lodging and tuition from our monthly pay, which is not necessarily much. A more serious problem is that, when we leave our island to attend lectures, the community has no specialists left, say, nurses and professional care-givers, who can handle emergency cases. To address this problem, long distance lecture systems would help, but actually the network is insufficient, blocking our path to education.

To address the islands' general communications problem, the authorities propose a satellite-based information highway that will raise telecom capacity to the level enjoyed on the main islands. But the new highway is likely to end at the local administrative outposts. Even so, we regard it as most important that enough telecom capacity be guaranteed."

Meanwhile, a graduate student who lives in an urban area and is little exposed to those problems, mentions of another bunch of issues.

"In light of the trend towards moving in-patients to residences, people at all levels and specialties in the medical profession have to collaborate with each other to accomplish this transition. Though time considerations and distance make cooperation difficult in some cases, the problems can be attacked by using this distant medicare system. Since the system includes necessary communications back-up,

I felt that it can be truly useful on the spot in the light of ongoing globalization.

For instance, oftentimes, there are cases where foreign mothers who don't speak much Japanese visit health centers for regular checkups of their babies and infants. If their children suddenly get sick, they need help for sure, but the Japanese language may become a barrier to communication. Such a situation can be addressed by having a third person act as an interpreter in a way given previously by Fig.4, even if he/she is in a far-off spot.

The video-teleconference medicare system looks very useful given that three parties or more can join in it. From my experience with the system, I recognize that there is a close connection between publicly-offered medicare and information and communications technology and that today's calls for cooperation between various academic and practical fields."

That was really a passionate message for us.

7 Telecom Environment and Medicare in Depopulated Regions

Appeals to Close Information Gaps and Insufficient Capacity Promptly

As to regional disparities we see a contrast between depopulated mostly rural areas and big cities. Discussion on information gaps is taken up according to the illustration by Fig.10.

The public thinks of depopulated areas such as inland communities and little islands as areas marked by lack of lively crowds – there being little or no access to public transport. When a community's productivity falls, depopulation follows and so does ageing – a vicious circle. Given this situation, medicare enterprises cannot make two ends meet, which in turn makes it difficult to improve facilities and to expand the workforce [12].

Since the need for medicare services keeps rising every year, optimal postings of personnel alone cannot fully address current problems. It should be noted here that aircraft – notably helicopters – are needed to carry patients away from little islands, but the cost is too high to utilize them widely.

Meanwhile, recent press reports indicate that medicare in big cities is hindered by traffic congestion and by deficient arrangements in

hospitals when it comes to accepting emergency patients and others. Major cities have the same kind of problems as little islands, especially in the matter of patients' access to medical centers.

Given such a broad situation, our emergency needs are to secure patients' blood circulation and respiration. For example, there are many newly installed automated external defibrillators (AED) in place today. They are not part of any long-distance medicare system. They are posted independently of large systems in a variety of medical and other public facilities.

I recall that at our laboratory we eventually expanded our efforts to cover various long-range systems, initially centered on assistance in emergency. At the outset, we aimed to apply high technology in an attempt to help improve regional medicare operations in Japan.

Medical welfare is offered not only to emergency patients but also to chronic sufferers and to those who need assistance in their daily lives. While being engaged in systems research we became convinced that depopulated regions badly need long-distance medicare systems. For this reason, our group chose Okinawa as a model region for our research, while wishing that our systems will be used beyond the islands of Japan—in such maritime states as the Philippines and Indonesia.

The scheme works as an on-the-web multi-functional dialogue system in which multiple individuals related to various concerning experts as given by Fig.11. It represents various kinds of participation in the comprehensive welfare for requiring life states in various stages. The beneficiaries are timely provided with various systems such as entertainment, assisting & rehabilitation, common experience programs as sharing of space and/or time for people living in
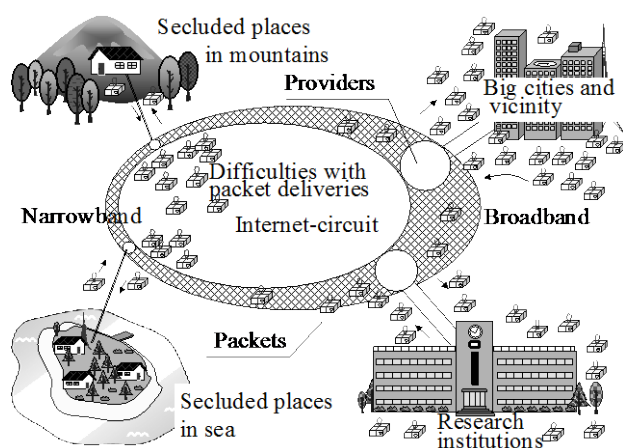

Fig.10   Telecom capacity with information gaps
between big cities & Regions

remote spots. As various parts of wellbeing are illustrated overlapping in space, as participated by various kinds of welfare including medical and nursing staff as given by the second column corresponding to the help of daily activities for the beneficiaries. For these systems to be fully utilized, the telecom and information environment has to be adequate. In order for us to realize user-friendly systems, various sorts of data—written texts, voice, still photographs, motion pictures, and medical, personal test data—need to be exchanged smoothly and in several directions, anywhere and anytime.

For such ubiquitous communication we need adequate-capacity broadband networks. But there are still places where the necessary networks are unavailable, thereby delaying wide-spread use of long-distance medicare services [12,15-20].

Let me here briefly describe the developing history of telecom environment in Japan, using government data.

Japan entered the broadband era in earnest in 2000 when the IT Strategy Headquarters was established. The next year it was renamed "e-Japan Strategy." This strategy has been carried over to the present-day "u-Japan," with the name indicating realization of ubiquitous networks.

Furthermore, the new policy dubbed "next-generation broadband strategy 2010" has two declared goals. First, it aims to eliminate "zero broadband areas," secondly; the plan is to rise to more than 90% the number of households equipped with a super-fast broadband network. It was made by "focusing on regions with unfavorable conditions and with poor investment prospects."

As for the actual spread of broadband in Japan, 95.8% of all homes had access to it as of December 2007, compared with 85.3% for super-fast broadband. But there are regional gaps. The figure exceeded 99% in Tokyo, Kanagawa, Osaka, Mie and Toyama Prefectures, while the number was below 90% in another rest prefecture. Super-fast broadband was in use in more than 99% of all households in Tokyo, Kanagawa and Osaka, while the figure was below 60% in some of the above mentioned prefectures.

The prefectures with low percentage points are known for the depopulation of little islands and mountain communities. The Ministry of Internal Affairs and Communications has been trying since 2006 to find ways to promote broadband in local areas suffering from lack of facilities.

Status	Person in charge		Place	Method	Daily life
Healthy	Family	Care Manager	Home	Tele-Health	Benefit by Remote System
Help, Assist & Care	Home Helper			Tele-Assistance Tele-Nursing	Work, Chores & Shopping for Daily Necessities Playing
Nursing Care Medical Care	Care Worker		Facilities Ambu-lance	Tele-Medicine	Rehabilitation Share of Living Space & Time
Emergency	Emergency Medical Technician				Need in Rescue
Hospitalization	Doctor Nurse		Hospital	Medicine	Possible Cooperation

Fig.11   Comprehensive wellbeing sages related to various concerning experts.
Our trials since 1986 supporting wellbeing for various sate of life [15-20].

In addition, fixed wireless access (FWA) was regarded as a leading method that would benefit remote corners in Japan because of its low cost. To confirm FWA's technical feasibility, a government agency has much developed what it called Wideband Internet Working Engineering Test and Demonstration Satellite (WINDS). A world record speed for satellite data transmission was achieved. Then, an organization called Broadband Internet Service via Satellite (BBISS) plans has been put in orbit commercial satellites. Among local governments, Okinawa prefecture has been doing its work for little islands to take advantage of the above enterprise.

Despite these efforts, there still have remained village communities that are left out. They include Ogasawara, Tokyo; Toshima, Kagoshima Pref.; and Minami- and Kita-Daito, Higashi, Ogimi and Kunigami, all of Okinawa prefecture.

Let me here introduce what a nurse has to say about telecoms.

She grew up in Tokyo and now works in Minami-Daito Island while being enrolled at Okinawa Prefectural College of Nursing as a graduate student. She used her days off to attend lectures, while utilizing long-distance education systems for additional lectures and to obtain guidance on writing papers.

"Here on this island, we don't have the kind of broadband environment that is common elsewhere.

We have telephone circuits, and we receive TV broadcasts by commercial channels as well as Nippon Hoso Kyokai (NHK, the Japan Broadcasting Corp.) reports. The entire communications of the villagers depend on satellite-based systems. This means there are limits to available capacity that the whole village can use for purposes other than for the phone and to receive broadcasts.

When one uses a long-distance lecture system in this situation, one has to get used to frequent delayed responses and sound gaps. E-mails sometimes move slowly! Large files such as those containing medical data simply do not reach me sometimes. There is no system available other than the current low-capacity telephone circuit even for my listening in our long-distance lectures that include images, audio and chat time.

Still, we have great expectations for long-range education as a means of getting post-graduate training and widening a nurse's scope of ability on a little island. We would like the authorities to improve the telecom infrastructure for those many little islands that for still live with information gaps, having no alternative. Incidentally, when an emergency case arises, just when a nurse is attending lectures on the main island of Okinawa, a video teleconference system can be used effectively, because it enables consultations to take place between two or more medical specialists. Opening a way to the video approach is vital."

Such a remark makes us painfully aware that prompt improvements in the telecom environment are needed so that broadband in future reaches every nook and cranny of Japan.

8 Conclusions:

In this study, present author emphasized expected feature of wellbeing system not from the provider but from the recipient side. It is quite natural that the new technology should possess two features in our life: incorporating scientific and other achievements that fit the present social structure; while seeking after a culture that is helpful in forming a new kind of human relationship based on own tradition.

Now, we harbor an ardent wish —revealing one of the aspects of this engineer — that future trial-and-error efforts and new knowledge will help to increase the opportunities of "weak" people in joining in social activities and solidarity, which will help to result in a more lovable society where people can feel warmth towards each other [20].

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