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Current Clinical Status of Telehealth in Korea: Categories, Scientific Basis, and Obstacles

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Objectives: Through telehealth, medical services have expanded beyond spatial boundaries and are now available in living spaces outside of hospitals. It can also contribute to patient medical knowledge improvement because patients can access their hospital records and data from home. However, concepts of telehealth are rather vague in Korea. **Methods:** We refer to several clinical reports to determine the current clinical status of and obstacles to telehealth in Korea. **Results:** Patients' health conditions are now reported regularly to doctors remotely, and patients can receive varied assistance. Self-improvement based on minute details that are beyond medical staff's reach is another possible benefit that may be realized with the help of a variety of medical equipment (sensors). The feasibility, clinical effect, and cost-benefit of telehealth have been verified by scientific evidence. **Conclusions:** Patients will be able to improve their treatment adherence by receiving help from various professionals, such as doctors, nurses, nutritionists, and sports therapists. This means that the actual treatment time per patient will increase as well. Ultimately, this will increase the quality of patients' self-administration of care to impede disease progression and prevent complications.

Keywords: Telemedicine, Telecommunications, Remote Consultation

I. Introduction

South Korea recently carried out a national telehealth demonstration project [1,2]. Telehealth is a broad term defined as the provision of medical knowledge or medical technology to remote users through information technology (IT) [3]. There are various categories of telehealth: telemedicine, telemonitoring (home telehealth or telecare), telecounseling, teleconsultation, teleassistance, etc. However, distinctions among these categories are rather vague in Korea. The term *ubiquitous healthcare* (u-healthcare) is used more widely than telehealth. It is a combination of two words: *ubiquitous* meaning 'anytime and anywhere' and *healthcare*. It refers to healthcare or medical services that are provided regardless of time and place. In other countries, other terms, such as mobile health (m-health), electronic health (e-health), and

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smart-health (s-health), are in use as well.

The reason telehealth or u-healthcare is a concerning subject in many countries is that the demand for medical services has expanded due to the aging of populations and increases in the prevalence of chronic diseases. Korea is a country with a strong IT base, which could be employed to achieve rapid growth in the telehealth field. However, there have been conflicts of opinion regarding telehealth in Korea [4,5]. There are many issues to be resolved before it can be successfully applied in the healthcare field. In this paper, we will review and elucidate the basic concepts of telehealth (or u-healthcare), examine issues to be resolved for successful application in Korea, and review research on telehealth use in hospitals as evidence.

II. Categories in Telehealth Systems

1. Telemedicine

Telemedicine assists doctors in learning about patients' signs and symptoms through IT so that they can provide patients with diagnosis or treatment (Figure 1). The concept of telemedicine is reflected well in 'live video (telehealth video)'. It is exactly like regular consultation except that the place of communication between the doctor and patient is not in a hospital. Medical staff and patients can see each other and communicate through live video or telephone in real time. Medical staff and patients in distant places are able to communicate. Audio and video equipment are essential to enabling communication. Most states in the United States have Medicaid program policies to compensate for the medical costs of live video [6].

In Korea, video telemedicine services have been provided on a trial basis to patients living on islands and in remote rural areas and prisons [1,7]. However, there are many issues to be resolved, including the fact that video is inadequate to replace inspection, palpation, percussion, and auscultation. System resolution, communication server failure, and ambiguity of responsibilities are also concerns.

2. Telemonitoring/Telecoaching (Remote Patient Monitoring)

Most of the rapidly increasing chronic illnesses [8] can only be managed effectively with regular hospital visits and home self-administration. IT advances have enabled systems to assist patients in constant and rigorous self-administration. Among many types of telehealth, telemonitoring is the best known. Telemonitoring regularly transmits biometric data (blood sugar, blood pressure, etc.) of remote patients to medical staff, who can observe and consult patients based on the transmitted data (Figure 2). Ultimately, it enables medical staff to care for patients at all times regardless of time and place. Telemonitoring assists self-administration within living environments outside of hospitals for patients who are already being treated at hospitals. It can be applied to patients with chronic illnesses, but not to patients with acute illnesses or emergency patients.

Recently, telemonitoring has been introduced for diabetic patients in Korea [9-11] and abroad [12,13]. Its clinical effects have been consistently reported by university hospitals [9,14,15]. Moreover, various anthropometric sensors and linked solutions are being actively developed with much interest due to the popularization of smartphones. Their short-term [14] and long-term [15] effects are already proven. Such monitoring programs are reported to be satisfactory to

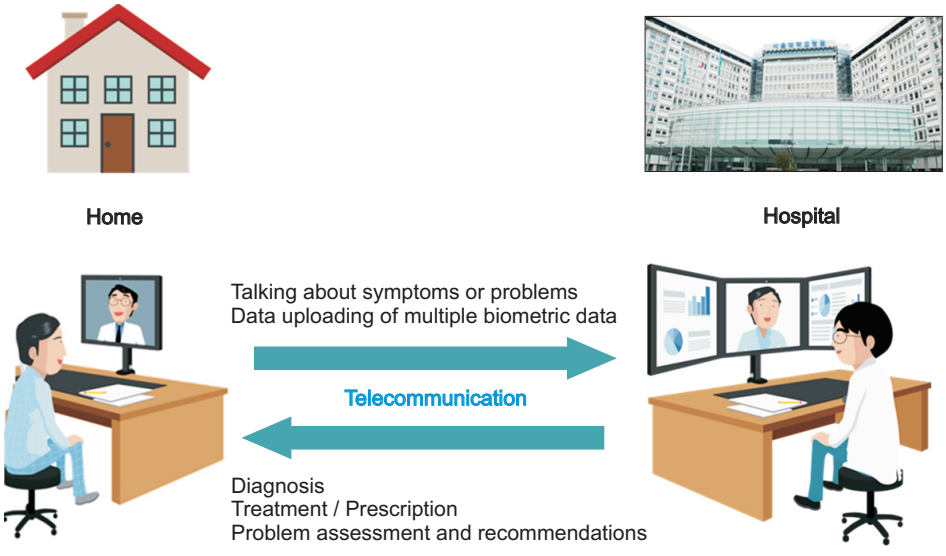

Figure 1. A telemedicine scheme. Medical staff diagnose, prescribe, assess problems, and recommend treatments to their patients based on data from a long distance.

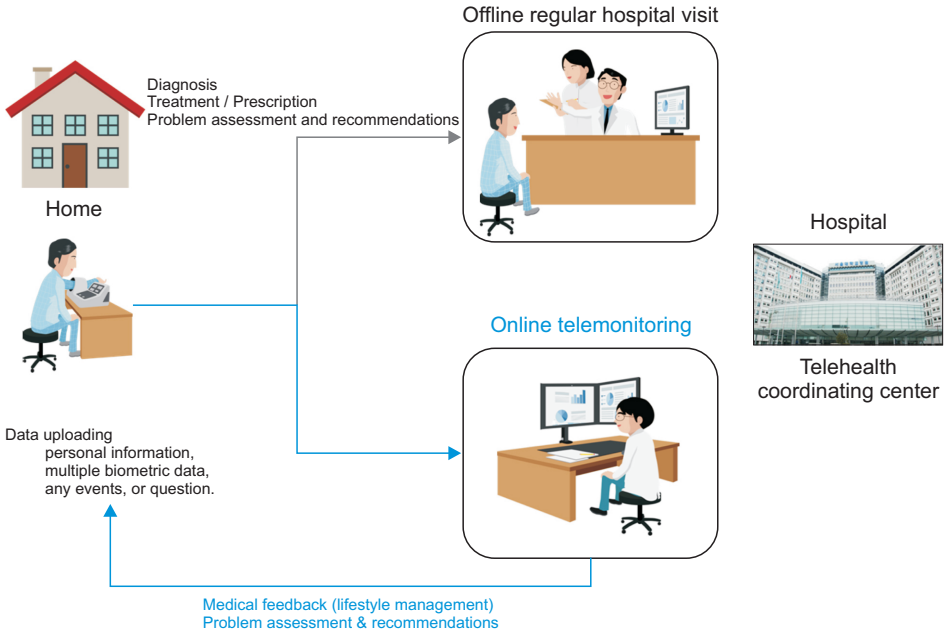

Figure 2. A telemonitoring scheme. Medical team uses the data measured by individuals to provide medical services for their patients.

their users and effective in chronic disease treatment [16,17].

III. Scientific Basis of Telehealth Systems

There are three steps to apply telehealth to the actual clinical healthcare field. First, the system has to be feasible. It depends on clinical use as well as the satisfaction of medical staff and patients after the system is constructed. Second, the telehealth system should be clinically effective when actually applied to patients. This is the most important part because medical treatment must be the main agent. Finally, telehealth has to operate efficiently and economically when applied to actual health care. These three steps should be verified by scientific evidence.

1. Evidence-Based Feasibility of Clinical Applications

Many telehealth-related domestic and foreign articles show high patient satisfaction regarding telehealth [18-22]. In Korea, most chronic patients are willing to participate in chronic disease care services [14,15,17]. Various services have been constructed for many diseases overseas, and they have become commercialized applications for actual healthcare.

2. Evidence-Based Clinical Effect

The clinical effects of telehealth in various fields, including diabetes mellitus, acquired immunodeficiency syndrome (AIDS) [23-25], asthma [26,27], cardiac disease [28-31], and cancer [32,33], have been shown through studies using various methods [34]. Positive reports from its users can also be found in many papers. However, some researchers have suggested that there are negative effects of telehealth due to its application through inadequate systems [9,35,36]. It is necessary for medical professionals and IT developers to cooperate closely from the beginning of a telehealth application to consider target illnesses and patients [37-40].

Other than clinical research data, empirical data from telehealth services conducted in actual hospital surroundings have shown good results as well. Colorado (USA) has at-home telemedicine programs; "Centura Health at Home" is one of the best known [41]. It is a remote patient monitoring program conducted with 200 patients. It has reduced the number of 30-day rehospitalizations of patients with congestive heart failure, chronic obstructive pulmonary failure, and diabetes mellitus by 62%. The patient rehospitalization rate is also significantly lower at 6.3% compared to 18% for traditional home care patients. The frequency of nurse visits has also decreased from 2–3 per week over 60 days to approximately 3 visits over the entire 60-day period. Kansas (USA) also has a telemedicine system. With this system, patient hospital days were reduced from 6 to 3 days. Emergency department (ED) visits were also reduced from 23 to 15 visits [42]. The total cost, which included ED and hospital cost, was also reduced. Thus, hospital days, ED visits, total costs, and hospital costs were significantly reduced during the home telehealth intervention period.

3. Evidence-Based Cost Analysis

Telehealth's cost-benefits and cost-effectiveness should be considered after its clinical effects. Medical-social cost sav-

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ing effects should also be investigated. Telemedicine services are being provided to patients with congestive heart failure, chronic obstructive lung disease, asthma, and diabetes in Colorado. This at-home remote telemedicine program has achieved cost savings of US $1,000–$1,500 per patient [41]. In Kansas, hospitals and emergency health facilities have achieved cost savings of US $1,350,332 through an at-home remote telemedicine service to monitor a patient's heart rate, blood pressure, mean arterial pressure, body weight, oxygen saturation, and body temperature [43]. According to the Home Care Association of New York State [44], telehealth has reduced readmissions by 4%–26% and saved more than a million dollars annually.

Thus, telehealth's economic aspects should be considered in its commercialization. Particularly in Korea, medical insurance fees for telehealth have not been established. Telehealth commercialization and industrialization cannot be achieved without considering the labor costs of medical professionals, system maintenance costs, and server maintenance costs. Thus, it is absolutely necessary to develop a system in which the time and labor costs of medical professionals are minimized [45] while user satisfaction is increased. Programs to reduce medical professionals' labor have been developed and clinically adapted. Such attempts are ultimately to improve cost affordability and convenient accessibility of medical services through telemedicine. We can expect improvements in people's health and macroeconomic effects to reduce national healthcare costs.

IV. Obstacles to Telehealth in Korea [46]

The role of Korean policymakers is crucial for successful telehealth application because there are no obvious points to attract medical staff's active participation now. The most urgent issue in successful telehealth application in Korea is health insurance coverage. Telehealth services have not been covered by health insurance, an aggravating burden on consumers and medical professionals that prevents active telehealth utilization. Thus, telehealth should be covered by health insurance and health insurance fees for telehealth to be established. Another urgent issue is the reorganization of medical law related to telehealth. Internet privacy is quite vulnerable in Korea. It is difficult for patients to trust telehealth services while responsibilities remain ambiguous in cases of personal information leaks or medical malpractice. Moreover, responsibility for accidents during telemedicine service (equipment or communication failure) has not been settled. Such matters should be clarified by law to encourage the active participation of medical professionals. In addition, low healthcare incentives and environment changes to improve confidence between medical staff and patients should be resolved. For this, rich experiences should be developed by constant promotion and demonstration. Moreover, there should be additional clinical evidence. At the same time, cost analysis of actual healthcare should be completed.

Low physician compliance in medical facilities is also an important issue. Medical professionals must accumulate telehealth experience and knowledge, and system experts should assist them. For this purpose, a health coordinating center is an essential means to provide medical professionals with training. It needs to be organized by professional expert groups and be able to support medical staff in various ways. Introduction of telehealth licensing should also be considered.

Finally, it is necessary to use IT for telehealth, so the verification of IT-related factors is required. Medical sensors and devices for biomedical measurement should be accurate and trustworthy. In addition, stable network servers should be provided. It has to be easy for elderly patients who are unfamiliar with using electronic devices. Most users are chronic patients and their mean age is relatively high. More studies on user-friendly systems, such as simple interfaces, need to be conducted.

V. Conclusions

The United States is one of the countries with advanced telehealth systems. Both commercialization and institutional telehealth frameworks are being actively developed in private and public sectors. In the United States, telemonitoring has been evolving in all 50 states to fit each state's circumstances. Telemonitoring in the United States is concentrated in the residential environments of patients who are being treated at home. Most of these patients are treated through telemonitoring linked with home healthcare services, and the government supports their telemonitoring costs. Positive outcomes of telemonitoring programs have consistently been reported. Such outcomes include 1) increased number of patients registered for the service, 2) decreased patient hospital visits, 3) decreased re-hospitalization, and 4) reduced yearly costs of rehospitalization as the major performance indicators.

We will also attempt to improve Korea's medical system. Telehealth is a new model in illness administration and a field in which we can achieve great advances. Moreover, telehealth advances can also promote development in medical equipment, wireless communication networks, data processing, software, and other industries. Korea is one of the most advanced countries in the fields of IT and medicine, and it

has optimal conditions to advance telehealth (especially telemonitoring) significantly. We expect that advances in medical services, equipment, sensors, and communications will ultimately lead to significant industrial benefits. Together with the popularization of smartphones, we can promote social awareness of telemedicine to accelerate the development of the telemonitoring industry.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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