Geographical Characteristics of Telemedicine Networks in Korea and Japan

January 2011

Sookyung PARK

Geographical Characteristics of Telemedicine Networks in Korea and Japan

A Dissertation Submitted to

the Graduate School of Life and Environmental Sciences,

the University of Tsukuba

in Partial Fulfillment of the Requirements

for the Degree of Doctor of Philosophy in Science

(Doctoral Program in Geoenvironmental Sciences)

Sookyung PARK

Abstract

The present research employs quantitative and qualitative approaches to scrutinize 1) the geographical characteristics of telemedicine, and particularly of telemedicine networks, in terms of the potential area they can serve at the tertiary care level, and 2) the decision-making characteristics of those telemedicine networks, including major telemedicine users' (doctors' and patients') choices, their decision-making processes, and determinants of choices within the social and medical contexts of the two countries individually.

I selected two areas for the case studies on which this research is based: Choongbook in Korea and Kagawa in Japan. Moreover, two other data sources, online referrals in Korea and K-MIX (Kagawa Medical Internet eXchange) in Japan, were adopted for this research. The former analysis was performed using data on 243 clinical sites using telemedicine in Choongbook and 63 clinical sites using telemedicine in Kagawa. The latter analysis examined decision-making characteristics by interviewing personnel from 4 clinical sites receiving online referrals and the 28 patients referred to them in 2009 in Choongbook, and personnel from 3 clinical sites using telemedicine and the 25 patients referred to them in 2010 in Kagawa. A comparison of the two cases yielded some observations that can be summarized as follows.

Most of the telemedicine networks in Choongbook tend to be centralized in medical institutions providing online referrals in Kyunggi (the central part of Korea), although the secondary diagnosis performed through telemedicine should in principle be carried out within the same diagnostic area. In addition, the selection of Choongnam and Kangwon, two areas bordering Choongbook, instead of Choongbook is frequent, although those areas are not included in the same diagnostic area. Accordingly, the telemedicine networks in Choongbook are characterized by outflows to outlying areas for diagnosis in disregard of the medical laws governing online referrals in Korea. According to the interviews with doctors and patients in Choongbook, the clinical sites in Choongbook may be associated with the external health care sites providing online referrals because patients, as the final decision makers, prefer online referrals for their perceived quality and level of health care services, personal stakes in online referral service sites, acceptability and credibility of good tertiary care centers, and easy access to and use of medical institutions.

Telemedicine networks are decentralized within Kagawa, and it is difficult to find outward-facing telemedicine networks. Also, although telemedicine networks exist within Kagawa, there is no relation between the volume of telemedicine networks and the number of medical institutions participating in these networks. Not only the existing health care system, but also the management of telemedicine itself have been targeted for the regional provision of health care to the residents of Kagawa, and this atmosphere might influence the decentralization of telemedicine networks within a diagnostic area. Moreover, strong personal ties between telemedicine council members and local doctors or between local doctors and patients underlie the telemedicine networks that do not exceed the diagnostic boundary of Kagawa. In addition, telemedicine's technological value, convenience, and original purpose and availability influence the decentralized telemedicine networks in Kagawa.

Given these findings, the results of this study provide empirical evidence that patient decisions that demonstrate a preference for high-quality medical institutions providing online referrals in

outlying diagnostic areas have a decisive effect on the local telemedicine networks in Korea. In Japan, local telemedicine usage is based largely on personal connections or mutual understandings among telemedicine providers and patients. Clinical sites in Korea that receive online referrals of local patients are connected with national-level medical institutions providing online referrals in Kyunggi (centralization). Differently, local clinical sites providing telemedicine in Japan provide services at the regional level (decentralization). Further, the geographical differences between the two telemedicine networks are apparent not only in the telemedicine operations themselves, but also in the existing health care delivery systems.

Keywords: telemedicine; geographical boundaries; online referrals; K-MIX; telemedicine networks; health decision making; Choongbook; Kagawa.

Contents

List of Tables

List of Figures

Chapter 1. Introduction

1. 1 Background and Purpose

In general, telemedicine means the exchange of medical information from one site to another via electronic communications (American Telemedicine Association, 2010; Shannon, 1997; Lucas, 2008; Norris, 2002). Recently, it has been extensively regarded as a new way of delivering existing medicine, extending distance and access through on-line methods for diagnosis, therapy, education, etc. in many quarters (Norris, 2002). In this sense, telemedicine in geography is often mentioned as one of the medical services that can overcome the "tyranny of distance" (Norris, 2002); namely, telemedicine avoids the costs and dangers of transporting patients to external medical institutions (Graham and Marvin, 1996; Mitchell, 1999; Hayashi, 2005). Moreover, it is expected to improve the unequal geographic distribution of health care resources and to ameliorate inadequate access to health care (Shannon, 1997; Warf, 2000). Further, it is also anticipated the development of transferring medical information among regions—and even among nations—without regard to geographical boundaries (Cutchin, 2002).

On the contrary to these expectations, virtual clinical encounters can not be understood in terms of a replication of existing health care services. Because of the dearth of empirical verifications and potential limitations, telemedicine is regarded as an ancillary method of health care delivery in

online in practical terms. Also, many countries stipulate that patients must see medical specialists in person at least once to avoid an incorrect diagnosis via this system (Tanriverdi and Iacono 1999; Oudshoorn, 2009). Resultingly, the accessibility to and utilization of medical institutions is considerable as ever in telemedicine. In this connection, the current researches in geography or related fields have suggested alternative theories within such a context and have been brought to regionalization as one of the practical measures in the existing spatial theories of health care, i.e. how to achieve fruitful health care services in both sides of online, e.g. telemedicine technologies and networks, and offline, e.g. management, regulation, investment, etc. via telemedicine technologies simultaneously within the potential geographic boundary (Cutchin, 2002; Shannon et al., 2002). “Region” is an ambiguous concept, but the definite geographical clue of such a slippery idea is observed in the medical laws and regulations with regard to health care delivery.

In the light of this consideration, telemedicine in Korea and Japan has been also used to disseminate medical information intermittently since the 1980s and its use has steadily increased as ancillary technologies for regional health care under the Korean and Japanese health care system that has been originally conducted on the basis of the tertiary medical care level (Choo, 1999; Japanese Telemedicine Report, 1997; Lee and Kim, 1997; Ministry of Health and Welfare in Korea, 1996; Hasegawa and Murase, 2007; Takahashi, 2001; Yoo, 1997). Telemedicine in Korea has a relatively short history; it has made some important strides. In particular, the online referral system was established to share patients’ medical records on the Web among medical institutions. In Japan, telemedicine is used according to each prefecture’s social and medical circumstances and most of the prefectures use it to support their regional medical system with telemedicine technologies that were developed by each prefecture. Korean telemedicine is structured around private medical institutions. Conversely, Japanese telemedicine is led by the central and local governments and various partners.

When being adopted by many medical institutions at the beginning, the innate respect of both the telemedicine operations were expected that sharing medical records such as checkup results through images, video, audio, and sound files on the Web via each telemedicine system improves

the accessibility to and cost effectiveness of health care. Furthermore, the provision of vital information, alerts, and guidance to doctors and medical specialists through the telemedicine systems could be lead to further improvements in the equity, access, quality, and cost of regional health care in Korea and Japan.

So far, the assessments as to how the geographical characteristics of telemedicine networks are observed in Korea and Japan, in particular, telemedicine networks from local areas, and what decisions and determinants of telemedicine users, whose opinions play a crucial role in telemedicine operations, influence on these geographical characteristics with regard to telemedicine networks are in the embryonic stage in Korea and Japan; moreover, researchers in geography and related fields have not yet noticed and studied these geographical ramifications empirically, despite the significance of the telemedicine systems recently. Giving these reasons, this paper is an attempt to investigate the geographical characteristics of telemedicine, in particular, telemedicine networks in terms of the medical laws and regulations with regard to the potential boundary of the tertiary care level, and the decision-making characteristics toward those telemedicine networks through major telemedicine users (doctors and patients)' choices, their decision-making processes, and determinants in various social and medical contexts. Especially, by detailing telemedicine operations in Choongbook, Korea and Kagawa, Japan as the telemedicine networks of local areas instead of the metropolitan areas, it can contribute to show the question as to how much telemedicine networks exceed the potential boundary at the tertiary care level as the original availability of telemedicine in Korea and Japan more clearly.

1. 2 Research Flow

The research is progressed according to the following flow. The second chapter suggested data and methods, including literature reviews, to help our understanding toward telemedicine and this research comprehensively. It explained definitions and types of telemedicine broadly, literature reviews with regard to regionalization as one of the preferable spatial theories in telemedicine from a geographical perspective; in other words, why regionalization is regarded as an important idea in

telemedicine, brief history on telemedicine in Korea and Japan, and overview of two research areas, Choongbook in Korea and Kagawa in Japan, centering around location, surroundings, and social indexes. Lastly, two major objects, online referrals in Korea and K-MIX in Japan, were introduced minutely in terms of those concepts and mechanisms. Further, it focused on data and methods that embodied geographical characteristics of telemedicine in Korea and Japan and described the detailed processes such as data's contents and characteristics, data's acquisition, analysis methods, questionnaires for the interview, and selection processes of the interviewees, etc.

The third chapter guided us to concrete results on a case study of Choongbook, Korea. Above all, I identified comprehensive telemedicine networks, which are occurred in Choongbook, and those flow; namely, to where telemedicine networks direct, in Choongbook or other diagnostic areas. On the evidence of geographical characteristics of these internal telemedicine networks, I classified them into three types according to the linkage characteristics of telemedicine networks between telemedicine serving sites and those receiving sites with regard to regional characteristics in Choongbook: online referrals from the southern part of Choongbook, online referrals form the eastern part of Choongbook, and online referrals from the central part of Choongbook. The online referral system is to delivery medical information between online referral service sites as high-level medical institutions and clinical sites as a sort of vertical health care delivery in online; accordingly, it is reasonable to say that such a categorization contributed to describe the detailed telemedicine networks in Choongbook. In addition, doctors and patients' decision-making characteristics and determinants were demonstrated according to each regional type respectively.

Likewise, the following part examined comprehensive telemedicine networks of Kagawa, Japan and identified their flow such as in where telemedicine networks occur and in where telemedicine networks flow. In addition, the telemedicine networks in Kagawa were divided into two regional characteristics such as vertical telemedicine networks and telemedicine networks with an offline meeting in Marugame as the mainland, and horizontal telemedicine networks in Shodoshima as an island. The selection of these two areas is based on the practical usage of the telemedicine networks in Kagawa; moreover, they are including the representative utilization types of telemedicine

networks in this research area. Especially, telemedicine networks in Shodoshima as an island show the utilization of telemedicine in an island associated with the original intention of telemedicine operations at the beginning that supported isolated areas in health care. Therefore, this research was progressed on the authority of it. Moreover, I employed detailed descriptions on them through doctors and patients' decision-making characteristics and determinants individually.

The fifth chapter gave the summary of the previous chapters to help our understanding on this research. And the detailed consideration focused on how telemedicine in Korea and Japan has been embraced and developed within the varieties of social and medical circumstances in terms of the existing health care system in Korea and Japan. In addition, this part discussed the results in the light of some questions with regard to regionalization. In other words, I further considered the conclusive proof of the interrelationship between telemedicine networks and regionalization in Korea and Japan; moreover, it suggested the significance of this research considering the futuristic telemedicine networks by examining two complementary cases. Lastly, the sixth part puts in order the results of this research comprehensively.

Chapter 2. Data and Methods

2. 1 Definitions and Types

Generally, telemedicine means the use of information and communication technologies to transfer medical information for the delivery of clinical and educational services and supports referring professional advice to low-level health facilities and sharing the patient's medical records among medical institutions in general (American Telemedicine Association, 2010; Shannon, 1997; Lucas, 2008; Norris, 2002). Within such a context, telemedicine clinical sites (medical institutions receiving telemedicine), intermediated technologies, health care sites providing telemedicine, and other participants such as innovation centers, business sectors, etc. join its management for the most part.

The assessments of telemedicine for its definitions are able to be divided into two directions, geographical approaches and telemedicine technologies. In an initial stage of telemedicine, it was regarded as the innovation for the stable health care system like isolated communities or secluded places, where suffered from the difficulties of health care (Capalbo and Heggem, 1999). With developing infrastructures and related telemedicine technologies, not only medical institutions in urban areas but also rural areas have applied telemedicine to health care for promoting regional health care and its narrow definitions related to geographical approaches have been faded gradually. Accordingly, the contemporary definitions of telemedicine aren't restricted to geographical

classifications and cover geographical meanings broadly.

Table 2-1. Definitions of telemedicine

	References	Definitions
Narrow	Capalbo and Heggem (1999)	Diagnosing remote or scheduled patients through telecommunication methods such as an interactive video
	Bashshur (1997)	Supporting medical information to inequality areas of medical services with solving expenses of health care through innovated technologies
	Reid (1996)	Utilization of advanced communication systems for getting medical information without geographical, time, social and cultural barriers or support of medical information
	Committee on Evaluating Clinical Applications of Telemedicine and Institute of Medicine (1996)	Method of communication technologies and electronic information for diagnosing remote patients
Broad	Norris (2002)	Use of information and communication technologies to transfer medical information for the delivery of clinical and educational services

From the other side, contemporary telemedicine doesn't mean only diagnosis in terms of practical use and teleconsultation such as teleradiology or telepathology for patients in technological terms. Telemedicine has been interlocked for diagnosis, therapy, education, etc. in many quarters. It also includes tele-education between patients and medical specialists or among medical specialists, telemonitoring, telesurgery, etc. comprehensively (Norris, 2002). In this connection, American Telemedicine Association (ATA) defines telemedicine as "telemedicine is the use of medical information exchanged from one site to another via electronic communications to improve patients' health status" (ATA, 2010) and World Health Organization (WHO) suggests the definition of telemedicine as follows; "use of information technology to deliver medical services and information from one location to another (WHO, n.d.)." Likewise, various definitions of telemedicine in Korea and Japan point out across-the-board as same as international ones.

According to the medical law in Korea that was announced in April 2002, telemedicine means the support of medical technologies or information for remote medical specialists using telecommunication such as computer and communication networks. While telemedicine in Japan is defined by "medical care and health supporting practices based on patient information derived from images transmitted from a remote site (Japanese Telemedicine Report, 1997)." Further, other definitions on telemedicine by many scholars can be summarized by the following arrangement (Table 2-1). Overall, although the parameters of telemedicine are various, telemedicine in common is given a definition by 1) the situation that patient stay far from medical specialists without the geographical restrictions such as rural or urban areas, 2) using telecommunication technologies, 3) delivering medical information (medical records of patients) in various quarters.

The scope and categorization of telemedicine practices have changed as the technology has also developed multifariously (Norris, 2002). By and large, the types of telemedicine depend on the technological level, objectives and relational characteristics among objects.

First, telemedicine is identified according to four different types: teleconsultation, tele-education, telemonitoring and telesurgery that cover from low to high-level technologies (Norris, 2002; WHO, 1998). A teleconsultation means the type of telemedicine between two or more carers without patient involvement or between one or more carers and a patient. The most frequent image of a teleconsultation is of a patient and his or her doctor communicating via a videoconferencing link or referring a patient's data to medical specialists through store-and-forward technology such as teleradiology, telepathology and online referrals. And tele-education is the use of telemedical links to deliver educational material and includes clinical education, academic study and public education. Moreover, telemonitoring is the use of a communications link to gather routine or repeated data on a patient's condition. Lastly, telesurgery can be defined by two ways. The first way is the assistance given by specialist to surgeons carrying out a surgical procedure at a remote location. The other way is telepresence surgery, which guides robotic arms to carry out remote surgical procedures. Compared with the other 'tele' applications, telesurgery is in its infancy.

Second, Shannon (2002) suggested the type of telemedicine according objectives (Table 2-2).

Geographically based models are related to the classification in which medical institutions providing telemedicine or those receiving telemedicine are located. And population-based models means the telemedicine service for the insufficiency areas of medical institutions, for example, rural areas, or patients who are suffering from accessibility of and utilization to medical institutions such as prisoners and soldiers. Moreover, specialist or disease-based models depend on the kind of disease and focus on the matter how to support adequate telemedicine technologies according to the kind of disease. Lastly, open or closed systems are the mixtured type of the above.

Table 2-2. Types of telemedicine based on those objectives

Types	Contents
Geographically based models	Among regions (areas), in a country or among some countries
Population-based models	Prisoners, soldiers or residences live in rural areas
Specialist or disease-based models	Diabetics, mental disease's patients or heart disease's patients
Open or closed systems	Mixtured type

Source: Shannon, 2002

Lastly, telemedicine is also typed by the relational characteristic among objects (NTT, 2008). Generally, it is determined by the matter as to how telemedicine objects are connected each other through innovated medical technologies, for example, doctor to doctor (D to D), doctor to other medical staffs (D to N), doctor to patients (Do to P) and other medical staffs to patients (N to P). But owing to its safety that needs more verifications, D to D type is permitted in general in the world, including in Korea and Japan. And telemedicine is stipulated that patients must see medical specialists at least once to avoid an erroneous diagnosis, when they want to use telemedicine in the present. Accordingly, it is general that telemedicine is regarded as an ancillary technology for health care (Reid, 1996).

Giving these contexts, the definition of telemedicine for this discussion refers to 1) the distance situation between clinical sites as medical institutions receiving telemedicine services and health care sites providing telemedicine, 2) using communication technologies, 3) delivering and sharing medical records among medical institutions for diagnosis, therapy, and education. Also, this research from a technological perspective focused on teleconsultation including online referrals in Korea and K-MIX in Japan as major objects for this study. Further, owing to medical laws in Korea and Japan that permit telemedicine among doctors and aim to promote regional health care that is associated with the potential geographical boundary at the tertiary care level inherently, this research dealt with only D to D type (among doctors) in telemedicine and geographically based models. Especially, the medical laws and regulations in Korea and Japan with regard to telemedicine permit the only telemedicine operations among doctors; accordingly, it is reasonable to say that focusing on the telemedicine networks among doctors are considerable for this research in spite of a lot of trials in various fields. Moreover, because of the safety of telemedicine technologies, the medical laws and regulations suggest the direct diagnosis with doctors at least once or the diagnosis via telemedicine with doctors or medical staffs in attendance as an ancillary idea for health care.

2. 2 Literature Reviews

Telemedicine has frequently been noted in geography and related fields but has rarely been studied in depth. This dearth of research on this subject is likely a result of the considerable complexities involved with telemedicine such as considering the relationship of health care to welfare or other public interests, technology, and even economic implications, and the system is continually advancing. Therefore, it is not easy to clearly obtain a geographical consensus with regard to telemedicine (Abou-Shaaba and Naizy, 1991; Reid, 1996; Capalbo and Heggem, 1999; Cutchin, 2002; Glasgow, 2002; Shannon et al., 2002; Mihara, 2004; Gilbert et al., 2008), but a few studies have reported that regionalization is viable and preferable with regard to the spatial organization of telemedicine (Cutchin, 2002; Shannon et al., 2002). Regionalization, with regard to

health care, refers to the purveying of medical services being delegated to a specialized local office and to local organizations within well-defined geographical boundaries in order to increase local input into the health care system (Mills, 1990)[1)]. Within such a context, telemedicine can be attributed to its potential for addressing intransigent problems in health care, including limited accessibility, cost inflation, and uneven quality (Bashshur et al., 2000). Telemedicine for delivering health care in online also comes under those terms. Because telemedicine is associated with cyberspace and place-less-ness (Dyb and Halford, 2009) and is, therefore, not beholden to physical restrictions or geographical considerations, regionalization might seem irrelevant in a discussion about telemedicine. However, the following three reasons show why regionalization is a key geographic factor in telemedicine and health care in general.

First, though a complete shift from offline based on the traditional health care delivery along with patients' travel to online care seems plausible and attractive, telemedicine requires further studies of its related technologies and potential limitations, including language barriers, time limitations, infrastructure-related geographical restrictions and the limited availability of telemedicine from a practical standpoint (Cutchin, 2002; Norris, 2002; Shannon, 1997; Tanriverdi and Iacono, 1999; WHO, n.d.). For example, the present telemedicine mostly coming into wide use allows for medical examinations by interview and is also associated with the dangers of indirect medical interaction such as time difference or language barriers. Moreover, health care itself is strongly associated with face-to-face interaction between medical specialists and their patients rather than interaction with a coded system that is available online (Andrews and Kitchin, 2005). And telemedicine interaction with medical workers in attendance is generally permitted and has led many countries to stipulate that patients must see medical specialists in person at least once to avoid an incorrect diagnosis through this system. Therefore, it is extensively acceptable that telemedicine is regarded as an auxiliary medical innovation instead of a replacement of in-person examinations (Reid, 1996). And it is not free from the accessibility to and the use of medical institutions completely in telemedicine. Accordingly, one of the existing optimal spatial theories in health care delivery (regionalization) has held a considerable place in telemedicine.

Second, with developing its technologies, telemedicine has been connected multifariously to other domains of information sharing in the health care industry, including the control, management, and analysis of medical records for the provision of clinical, administrative, and educational services (Braa and Hedberg, 2002; Grimson, 2001; Mäenpää et al., 2009; Norris, 2002; Lucas, 2008; Solomon, 2007). The collection of medical records via telemedicine is standard on the national and global scale, but information systems are tied up in a complex web of social and technical interactions, according to racial segregation, social strata, or conflict among regions (Braa and Hedberg, 2002). The regional-based telemedicine system, which is regarded as the optimal geographical coverage to control and enhance those systems, has been emphasized within a context whereby the process of related systems is developed from the bottom up movements. In other words, regionalization as an intensive care unit and quality improvements through regional outreach has colligated telemedicine (Nguyen et al., 2010). For example, medical records in the telemedicine system can lend aid in emergency situations because paramedics refer to these records when administering first aid to their patients (Wang et al., 2009). These records can also be used in the analysis of epidemics or chronic diseases in a certain region and can aid in both disease prevention and the provision of better public health care. Moreover, medical records are not only used in medical institutions but also in pharmacies, gyms, schools, companies, and other institutions for improving health care, institutions based in the residents' home area. In practice, although it is difficult to find out the evidence of such a telemedicine usage in Korea, the Japanese telemedicine system has been directed to this aim.

Third, as with general health care, profits derived from telemedicine are not confined to fixed diagnostic areas. Health care, including telemedicine, has two opposing characteristics: effectiveness, which is an economic factor, and equity, a factor that contends with the public interest (Smith, 1977; DeVerteuil, 2000). That said, the most important problem related to health care is how to successfully balance the competing needs for equity and efficiency in delivering health care to the public. Generally, such a question came down to the diagnostic boundary with regard to regionalization that encloses those living within a certain radius of a facility and many

countries have incorporated them into health laws related to the health care delivery system (Milles, 1990). Considering that telemedicine generally appears to center on existing medical institutions instead of new facilities and is conducted under the established health care delivery system, it is necessary to maintain the diagnostic area of each medical institution and to ensure offline delivery of the existing hospitals and clinics, only using online capabilities to extend service to distant areas (Norris, 2002). Confining medical incomes to only one diagnostic area might lead to the broad-scale breakdown of alternative diagnostic areas, which may threaten the balance of effectiveness and equity of health care because profits are directly associated with the offline health care system and telemedical health care is not independent from the offline health care system.

Actually, regionalization is not a new idea in medical geography (Shannon et al, 2002). Regionalization was suggested as the best answer of much vigorous discussion on how to cope with the conflict between equity and efficiency in health care through geographical ideas (Smith, 1977; DeVerteuil, 2000). Many countries have reflected this concept in their health care delivery policies (Mills, 1990). Regionalization as an idea and practice seems to evoke several ideologies. One ideology of regionalization appears to focus on the rationalization of service distributions. This conviction tends to jibe with a welfare-based approach and government objective of service equity across a bounded population. Arguments for regionalization are also used to serve the needs of medical care organization, particularly privately owned ones. This cost-savings ideology is based more directly on the organization's ability to manage a regional system to save expenditures and increase net operating results. A third regionalization ideology appears to be that of local control, where community care offers greater equality of service provision. Rather than the state or medical care organization, grass-roots health care advocates seem to promote this ideology (Cutchin, 2002). Within such contexts, regionalized systems of health care delivery were divided into primary care, secondary care and tertiary care[2)] that are stipulated by the medical laws and related regulations (Virk, 2007).

Such a concept is also applied in telemedicine because telemedicine has been appeared in the existing medical institutions involving in the health are system and is regarded as a new health care

delivery technology among medical institutions in nontraditional ways (Bashshur et al., 2000). More recently, the aforementioned reasons in terms of the limitation of the present telemedicine technologies, futuristic usage and profitability lead regionalization to the graft onto telemedicine. In this sense, it can also find out the clue as to how to concretely define the scale of region as an imaginary and slippery concept according to social and medical circumstances in the diagnostic boundary with regard to health care delivery.

"Region," however, is a flexible idea and changes according to social and medical circumstances. Moreover, regionalization is a slippery concept that varies from writer to writer (Cutchin, 2002). Further, it is not yet feasible to make valid generalizations about the effectiveness of telemedicine, across disparate health services, technological configurations, and settings (Grigsby et al., 2005). Accordingly, when assessing telemedicine practices, it is not easy to find out the ground of regionalization empirically. But the diagnostic boundaries associated with regionalized systems of healthcare delivery as the tiered system stated the clue of regionalization in telemedicine and it is reasonable to situate this ambiguous definition in a regional scale before contending with other criteria. In the case of Korea and Japan, major telemedicine technologies have been dispersed to medical institutions for tertiary care because the telemedicine service site assumes the responsibility for regional health care. For example, the online referral system aimed to delivery medical information between medical institutions as tertiary care centers and clinical sites within one diagnostic area based on tertiary medical care level inherently. In addition, telemedicine in Japan has been operated within the sound regional-based health care delivery system expressed in terms of one prefecture and related telemedicine technologies and regulations are under control according to each prefecture's circumstances in health care. It seems reasonable, therefore, to assume that "adequate regional scale" with regard to telemedicine in Korea and Japan means that the potential geographical boundary is controlled at the tertiary care level. Moreover, the core question of this research is associated with the geographical issue as to how telemedicine in Korea and Japan is controlled by such a concept with regard to regionalization faithfully from a practical term and which determinants in the light of telemedicine users as direct and crucial decision-

makers for telemedicine operations impact on geographical characteristics of telemedicine networks.

2. 3 History of Telemedicine in Korea and Japan

In the case of Korea, the modern health care system was developed in 1989 after simultaneous changes to the laws of the medical insurance system and the health care delivery system (Ministry of Health and Welfare in Korea, 1996; Lee and Kim, 1997; Yoon, 1997). The goals of these laws were to prevent an overwhelming number of patients at general hospitals, stabilize public health finances, and develop health services in a balanced manner throughout the country. From a geographical point of view, the Korean health care system is based on 8 diagnostic areas according to population size and living space and medical institutions are classified as primary, secondary or tertiary care levels in each diagnostic area.

The current Japanese health care system traces its origins back to 1961, when the health insurance system was introduced on a national scale (Tatara and Okamoto, 2009). According to the legislation related to the health care system, it was designated to promote the planning of health services for residents in each diagnostic area. In addition, it is closely connected with local governments and each of the 47 prefectures established health care system policies with respect to their own social and economic circumstances. In common, the Korean and Japanese health care systems follow a regional-based diagnostic system and their health care policies aim to promote regional health care under the medical laws and regulations[3)].

Within such a context, the early Korean and Japanese telemedicine experiments focused on providing health care to rural and isolated communities by connecting innovative telemedicine centers with areas that received insufficient care. The beginning of telemedicine in Korea was the result of an experiment by Seoul National University Hospital and Yeoncheon Health Center in the late 1980s; it was gradually adopted by medical communities in the late 1990s, when medical information systems such as Picture Archiving and Communication System (PACS) and Order Communications System (OCS) were utilized by many medical institutions involved with general

hospitals (as medical institutions for tertiary care). Currently, the medical laws related to telemedicine only permit doctors to provide medical information and offer the support of medical technologies. As mentioned before, these same laws stipulate that patients must see medical specialists in person at least once to avoid an incorrect diagnosis through the use of telemedicine alone (due to safety concerns).

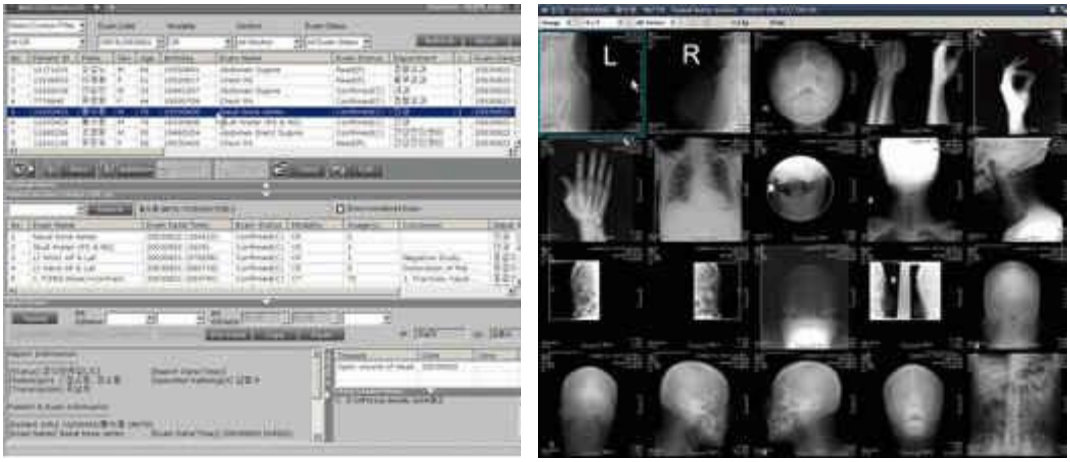


Figure 2-1. The composition of the online referral system in Korea
left – medical records and right – images
Source: Marotech

Even though the history of telemedicine is not very long, major telemedicine types are tele-education on the Web, telemonitoring and teleconsultation (Park, 2004); the online referral system is managed by many medical institutions and allows the sharing of patients' medical records among medical institutions (Figure 2-1). With the online referral system on the Web, doctors are provided with medical records (e.g., images, live video and audio) and can diagnose their patients more easily. Already, the online referral system has been established as a major telemedicine method in Korea and the health care system depends on electronic transmission of these records in most cases. Nationally, there are the 62 medical institutions that participate in the online referral system and they are mainly general hospitals that provide tertiary care. Regrettably, the online referral system does not mean open networks among medical institutions on a nationwide scale. In other words, the telemedicine supply part of each of the 62 medical institutions serving the online referral system is

managed independently and only medical institutions providing or receiving telemedical services can use the system.

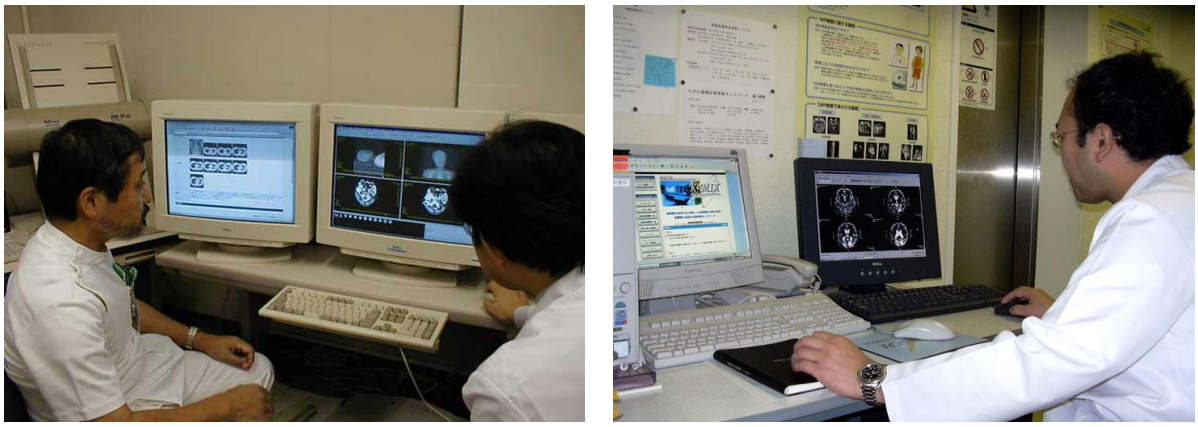


Figure 2-2. The diagnosis of patients through the telemedicine system in Japan
Source: The Kagawa telemedicine system (K-MIX)' homepage

In Japan, the first application of telemedicine was a remote diagnosis conducted in 1971 (Japanese Telemedicine Report, 1997). It was performed by the Medical Association of Wakayama with the cooperation of Wakayama Medical College and Osaka University (Takahashi, 2001). For a long time, telemedicine in Japan was at a standstill; however, telemedicine has rapidly spread throughout the country more recently because of the dramatic expansion of broadband networks after 1997 and because of the Medical Act by the Japanese Ministry of Health, Labor and Welfare (Hasegawa and Murase, 2007). The unique aspect of the Japanese system is that many telemedicine operations are supported by the central government, but they are operated by various groups: local governments, medical institutions (which took charge as telemedicine suppliers) and other operators (companies or universities). The government and other major players in the telemedicine industry regularly meet to help influence and establish laws that will result in a stable system (Hara, 2008). Like Korean telemedicine, Japanese telemedicine only permits information exchanges among doctors or medical specialists by law.

Generally, telemedicine in Japan is divided into three types: teleradiology, telepathology and home telecare (An, 2005; Hasegawa and Murase, 2007). Due to decreases in the number of medical

institutions and medical specialists in pathology and radiology (particularly in local areas), the telemedicine systems related to teleradiology and telepathology are regarded as major countermeasures to combat this shortage and each prefecture invented unique telemedicine technologies according to each prefecture' medical circumstances[4] (Hasegawa and Murase 2007). In this sense, Kagawa's telemedicine system (K-MIX) as the major objective for this research is one of the advanced telemedicine technologies and can provide not only teleradiology and telepathology, but also functions for data storage and online referrals (Figure 2-2). Recently, telemedicine service companies have attracted attention and they are providing online diagnoses not only to domestic customers but to international ones as well.

Telemedicine occupies an important position in the regional health care systems of Korea and Japan, including in urban areas. Its operations are carried out within each diagnostic area and controlled at the tertiary care level; there are 8 diagnostic areas in Korea and 47 diagnostic areas in Japan. Even though telemedicine in Korea has a relatively short history, it has made some important strides. In particular, the online referral system was established to share patients' medical records on the Web among medical institutions. In Japan, telemedicine is used according to each prefecture's social and medical circumstances and most of the prefectures use it to support their regional medical system. In particular, telemedicine is used to assist with the decreasing number of medical institutions and specialists in fields such as radiology and pathology. Korean telemedicine is structured around private medical institutions. Conversely, Japanese telemedicine is led by the central and local governments and various partners.

2. 4 Data and Methods

2. 4. 1 Objects – Online Referrals in Korea

For this discussion, I considered "referral system" in Korea as major objects for this research. The concept of the "referral system" related to health care delivery emerged in 1989 at the same time medical laws were changing in Korea. Policy makers intended for this system to prevent the overflow of patients visiting general hospitals as tertiary medical institutions to stabilize public

health finances, and to develop balanced health services throughout Korea (Ministry of Health and Welfare in Korea, 1996; Lee and Kim, 1997; Yoon, 1997). The plan focused on the relationship between primary or secondary medical institutions and tertiary medical institutions and was structured with the public interest in mind by allowing hospitals and clinics to share medical records in terms of regional health care. In the beginning, the referral system was based on a traditional "hands-on" or "paper-based" health care practice, but there have been several changes to the practice since the mid-1990s such as the advent of the online-referral system. Especially, the online-referral system aimed to promote the transmission of health care delivery via online communication systems within one diagnostic area based on tertiary medical care level and composed by all eight diagnostic areas in Korea originally; accordingly, the original intention was associated with the help of professional health care services toward the clinical sites that patients visit for health care for the first time.

Asan Medical Center, in 1995, was the first health care center to use the online-referral system, and the system's operations have been replicated across the country by medical information technologies such as Picture Achieving Communication System (PACS) and Ordering Communication System (OCS), which paved the way for the dissemination of medical information (Park, 2004). Korean medical laws permit medical interaction among doctors and require patients to go to a hospital or clinic for an in-person diagnosis at least once to avoid misdiagnosis, when practicing online referrals. Moreover, online referrals operate alongside the health care-delivery system in each diagnostic region and the purpose of online referrals is to comply with the potential geographical boundary based on the tertiary care level. Online referrals work well in such contexts, and this system has expanded rapidly across the country because of its technological simplicity and use as one of the major types of telemedicine in Korea conveniently.

Online referral as the transmission of health care delivery in an online format is conducted through both in-person and virtual interactions among patients, physicians, and medical specialists (Figure 2-3). In other words, physicians provide the medical records of patients who require special treatment at tertiary care sites to medical specialists through this system. Patients visit the tertiary

medical institutions without any of their medical records on hand, and medical specialists can diagnose their condition by referring to the patients' Web-based medical records. This protocol can prevent duplicated medical treatment and allow medical specialists to provide only essential medical treatments to patients. Likewise, medical specialists can refer those patients back to their primary care physicians with their updated Web-based medical records, and the patients can receive continuing care from their physicians without the excessive burden of having to keep track of their medical records. This mechanism of online referral can prevent overflow of patients in tertiary medical institutions and promote accessibility to and use of other medical institutions despite the requirement that patients visit in person with a health care provider at least once.

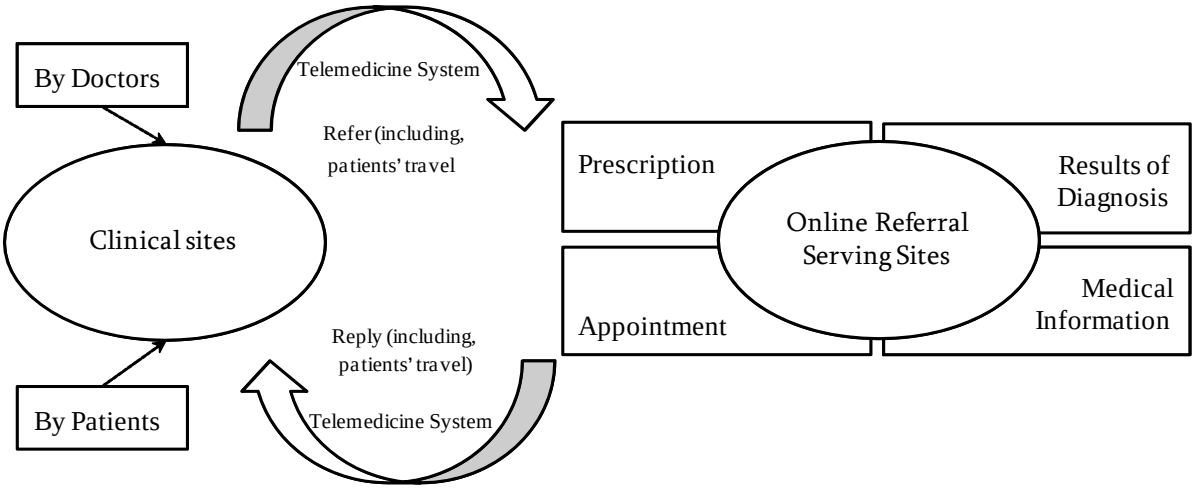


Figure 2-3. General mechanism of online referrals in Korea

The service content of online referral varies according to the technology. This system commonly supports interactive communication between primary or secondary medical institutions and tertiary medical institutions. In other words, doctors use this system to make an appointment with a specialist for their patients or to input patients' medical records. Likewise, tertiary health care sites can offer medical information, including prescriptions and they can share checkup results through images, video, audio, and sound files. Doctors can refer to this information when diagnosing patients referred to them from such institutions. Nationally, there are the 62 medical institutions that participate in the online referral system and they are mainly general hospitals that

provide tertiary care and are managed by huge companies or universities.

In Korea, when considering online referrals, physicians suggest proper tertiary medical institutions to patients according to their condition or other variables, but it is not a final decision. Patients look for tertiary medical institutions, and physicians refer them to the medical institutions from which patients wish to seek medical advice. Referrals from tertiary medical institutions to primary or secondary medical institutions operate the same way, that is, the referral beholden to medical laws, but it is not influenced by legal binding force considerably. In practice patients play an important role in deciding to where they are referred or whether they go directly to medical institutions.

2. 4. 2 Objects – Kagawa Medical Internet eXchange (K-MIX) in Japan

Besides, it is general that the telemedicine system has been invented according to local residences' demand or need on the basis of one diagnostic area (one prefecture) independently. Kagawa as a main area of this study also suggested the telemedicine system for local residences and medical participants. The initial telemedicine system in Kagawa originated from the online transmission for pregnant women and has continued to be expanded with the support from the central governments' strategies such as telecommunication revival and rural health care measure repeatedly, whereupon Kagawa can have the present telemedicine system, what is also know as "Kagawa Medical Internet eXchange (K-MIX, http://www.m-ix.jp/)". At the beginning time of K-MIX, only 35 medical institutions were involved in this system, but now 78 medical institutions, including medical institutions in other prefectures (but, their utilization is limited within data control and storage), utilize telemedicine services and transfer interactive communication data among medical institutions. This system provides the function of online referrals, the transmission of medical images as teleradiology or telepathology, the management of data control and storage, and the additional health care information according to the kind of various diseases.

This telemedicine system in Kagawa is associated with various participants and they constitute the telemedicine council: the local government and the local medical association are dedicated to

support telemedicine and related health care services in terms of political sides. And a core innovator group plays a role as an opinion leader of telemedicine and has close links with the central governments and local demands such as practice physicians or special meetings for health care. Also, central medical institutions as major telemedicine service providers take part in the development of advanced telemedicine technologies along with business sectors with acceding to local demands; moreover, those companies (business sectors) manage medical care data under the control of this unified telemedicine council. These participants have regular meetings or public forums and promote their relations. The other outstanding side of the telemedicine system in Kagawa is discovered in the management of the data center. The high reputation of the data center is acknowledged by others in Japan and such a remarkable management acts multifariously on other domains. Moreover, this data center is utilized for the control, management and analysis of medical records for the provision of clinical, administrative, and educational services. The accumulated medical records compiled thought K-MIX play an important role in health care, e.g. in emergency situations, the analysis of epidemics or chronic diseases for local residences. Moreover, medical records are not only used in medical institutions but also in pharmacies, gyms, schools, companies and other institutions for improving health care services within Kagawa.

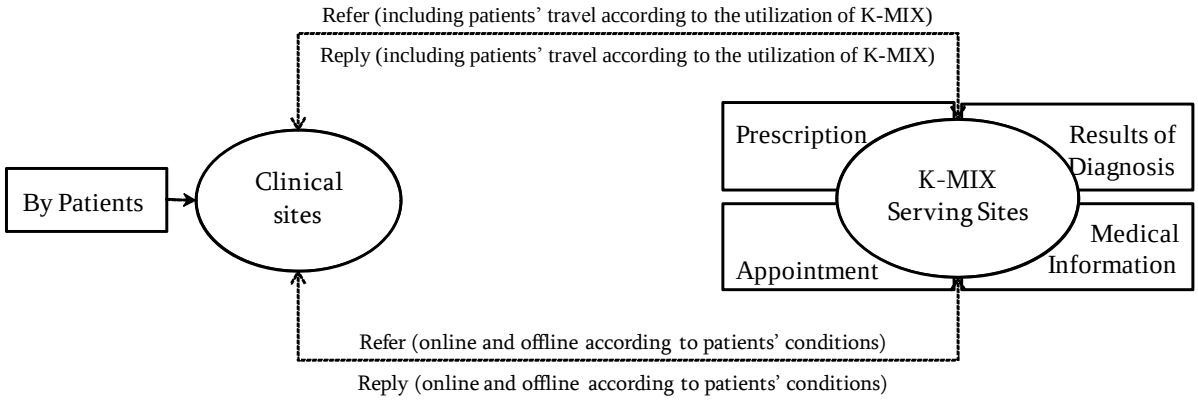


Figure 2-4. General mechanism of K-MIX in Japan

In terms of technologies, health care sites providing telemedicine can offer medical information to health care sites receiving telemedicine and they can share checkup results through images,

video, audio, and sound files like Korean one (Figure 2-4). Basically, this telemedicine system was designated to avoid patients' accessibility to or utilization of medical institutions providing telemedicine. But according to patients' conditions, visiting medical institutions providing telemedicine is needed to patients.

As a result, telemedicine occupies an important position in the regional health care system in Korea and Japan. In terms of telemedicine technologies, although there are differences between the online referral system and K-MIX (the online referral system – for delivering or sharing medical records on the Web, K-MIX – for asking professional (or specialized) diagnosis by medical specialists such as radiology or pathology), they both use telecommunications to transmit data and images between two or more sites remotely located from each other and to share medical records among doctors (American Telemedicine Association, 2010). In common, these telemedicine networks depend on the fixed evaluation such as by general hospitals as medical institutions providing online referrals in Korea and by the telemedicine council, in particular, the Kagawa medical association in Japan. The online referral system has been developed against a backdrop of medical informatization that are based on the integration of medical records within general hospitals and realized on the Web by interlocking various systems of medical informatization. Therefore, although there are various contents of online referrals according to each general hospital's utilization, there are little difference in those basic transmission and use are almost same. Moreover, the approach of general hospitals as tertiary care centers being tinged with private sectors support the systems to physicians of the first medical institutions and it requires the travel or visit of patients to medical institutions directly at least once. While, the function of K-MIX includes online referrals, delivering medical images such as teleradiology and telepathology, and storage and control of data. In practical terms, although there are a lot of trials of delivering medical images such as teleradiology and telepathology in Japan, very a few cases can get fruitful results of the utility on it. Therefore, K-MIX has been devised to use in various directions and can connect various services of health care delivery. Further, the Japanese telemedicine system aims to the integration of medical records based on the telemedicine system, what is called as electronic health

record (EHR); accordingly, K-MIX holds the transition position between simply delivering medical images and integrating various medical records. Also, they are controlled by the health care delivery system based on the potential boundary for diagnosis (or diagnostic areas). In other words, its operations are carried out within each diagnostic area and are controlled at the tertiary care level; there are 8 diagnostic areas in Korea and 47 diagnostic areas in Japan. Therefore, two technologies can contribute to proof the geographical characteristics of telemedicine in Korea and Japan, in particular, telemedicine networks in useful.

2. 4. 3 Data and Methods

As stated previously, both of telemedicine operations in Korea and Japan are under the medical laws and regulations that target to the balanced distribution of medical institutions and are expressed by the diagnostic boundaries. But although telemedicine technically operates in cyberspace as an online system, there are some possibilities that geographical characteristics of telemedicine networks are influenced by different social and medical circumstances in practice. To verify such geographical phenomena in detail, I employed two local areas: Choongbook in Korea and Kagawa in Japan. According to a socially and geographically accepted idea, it is easy that telemedicine networks are generated in or flowed into the metropolitan areas relatively according to the distribution of the potential customers or population. In this sense, identifying the telemedicine networks in the metropolitan areas can't sufficiently explain the question as to how much telemedicine networks in each country correspond with the medical laws and regulations. Accordingly, by looking into local areas, it can contribute to appeal the geographical characteristics of telemedicine networks more clearly, namely, how much telemedicine networks are associated with the original purpose of telemedicine with regard to the potential boundary of the tertiary care level or how telemedicine network exceed one diagnostic area or not. Therefore, two representative areas are valuable to investigate for this geographical issue as major objects.

Both of them are included in local areas and border the major urban areas: Kyunggi, including the capital of Korea, Seoul, in Korea and Okayama, Osaka, Hyogo, and Kyoto in Japan. And

although Choongbook borders Kyunggi, where is the central part of Korea, including the capital of Korea, Choongbook has been ruled out the national land planning in Korea because the planning was centered around the axis between Seoul and Pusan or focused on the metropolitan areas. Therefore, there are a lot of undeveloped areas within Choongbook because Choongbook was included out this national plan. Moreover, because the health care delivery system in Korea was changed from paper-based methods to the online referral system considerably; therefore, a lot of clinical sites as medical institutions receiving online referrals are using this system extensively as one of the supportive methods for transmitting or sharing medical records among medical institutions. For a case of Japan, major telemedicine operations in Japan were conducted in the southern and northern parts of Japan where there are a lot of isolated or remote areas such as the mountain regions or islands, in the main because many local doctors have demanded this technology for the stable regional health care system (Park, 2010). Therefore, the management or operation of telemedicine in Japan is leaded by these areas instead of the metropolitan areas. In this sense, Kagawa started early the introduction of the telemedicine system and now is securing the outstanding telemedicine system according to the residences or medical participants' demands. In addition, the prefectural government supports this telemedicine system and local doctors, who belong to the Kagawa medical association, work on positive lines. Viewed from the other side, according to the social indexes in Choongbook and Kagawa, their positions in Korea and Japan aren't high and are included in local areas.

In dealing with the geographical characteristics of telemedicine in Korea and Japan based on two representative telemedicine technologies as previous mentioned in detail, I have adopted two approaches for this analysis: comprehensive characteristics of telemedicine networks from two research areas, Choongbook in Korea and Kagawa in Japan; doctors and patients as crucial decision-makers for telemedicine networks' decision-making propensities, and their determinants.

The first method examined the comprehensive characteristics of telemedicine networks from Choongbook and Kagawa through data on 243 medical institutions receiving telemedicine in Choongbook and 63 medical institutions receiving telemedicine in Kagawa. In Korea, the online

referral system is in operation in the 62 medical institutions all over the country and 51 of these open their data on the Web to other medical institutions providing telemedicine (Park, 2004). Data from the 51 Korean medical institutions providing telemedicine and the 243 medical institutions in Choongbook of 17,783 nationwide medical institutions receiving telemedicine were used in the analysis (Figure 2-5). The number of medical institutions receiving telemedicine represents 30.8% of the total medical institutions (790 medical institutions including general hospitals, middle size hospitals and clinics) throughout Choongbook in 2007.

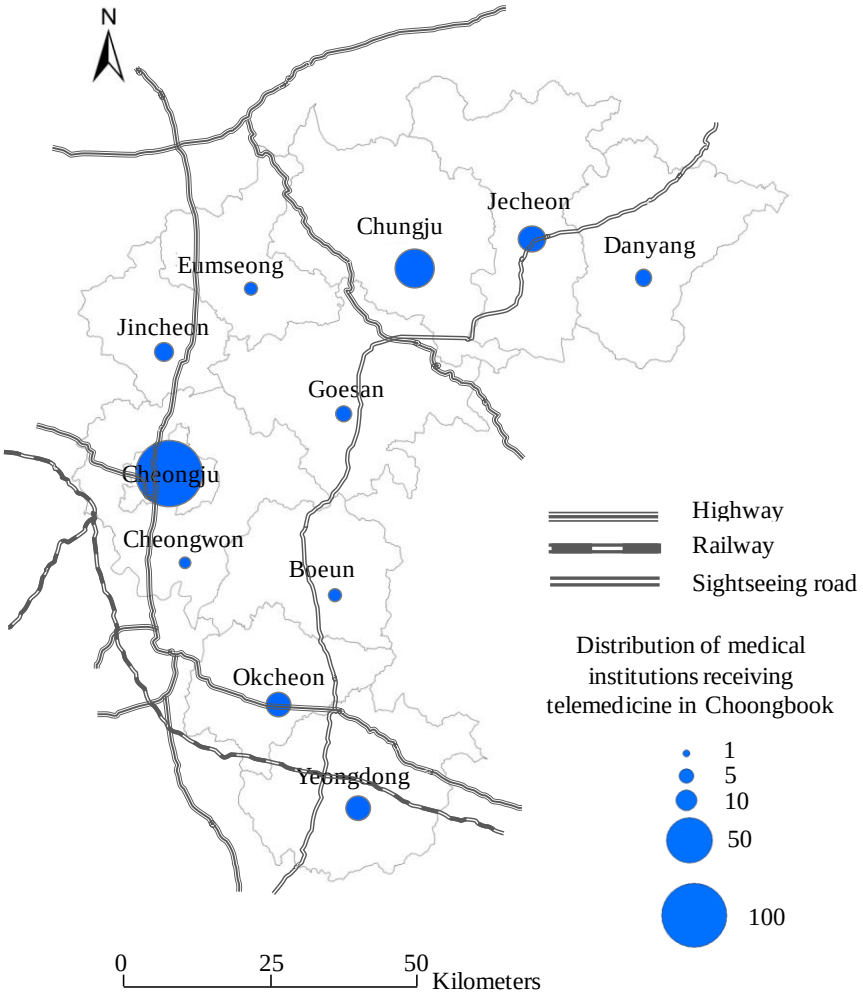


Figure 2-5. Distribution of medical institutions receiving telemedicine of Choongbook in 2007 (*n*=243)

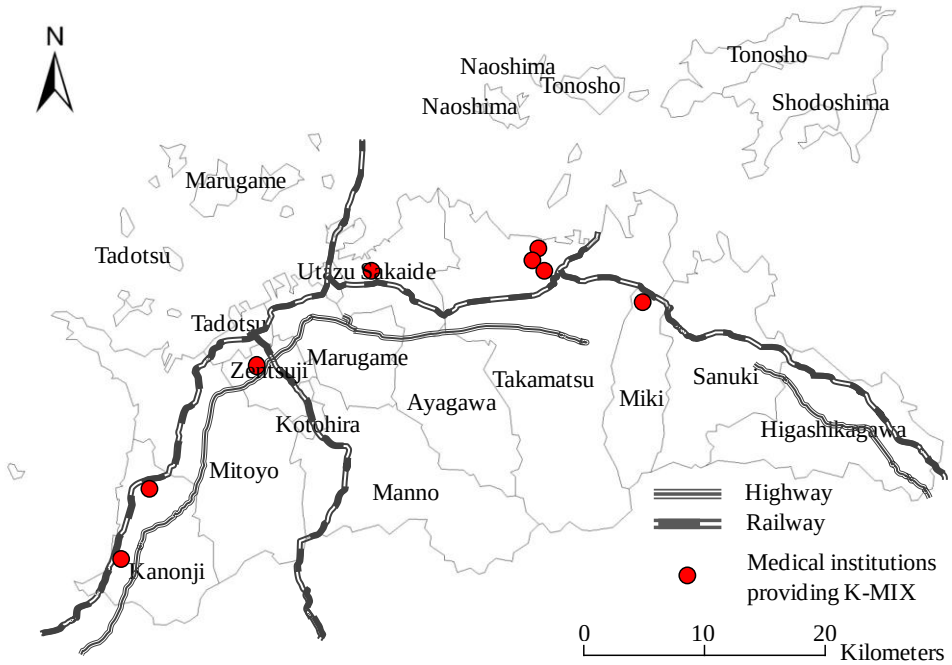


Figure 2-6. Distribution of eight medical institutions providing telemedicine of Kagawa in 2008 (*n*=8)

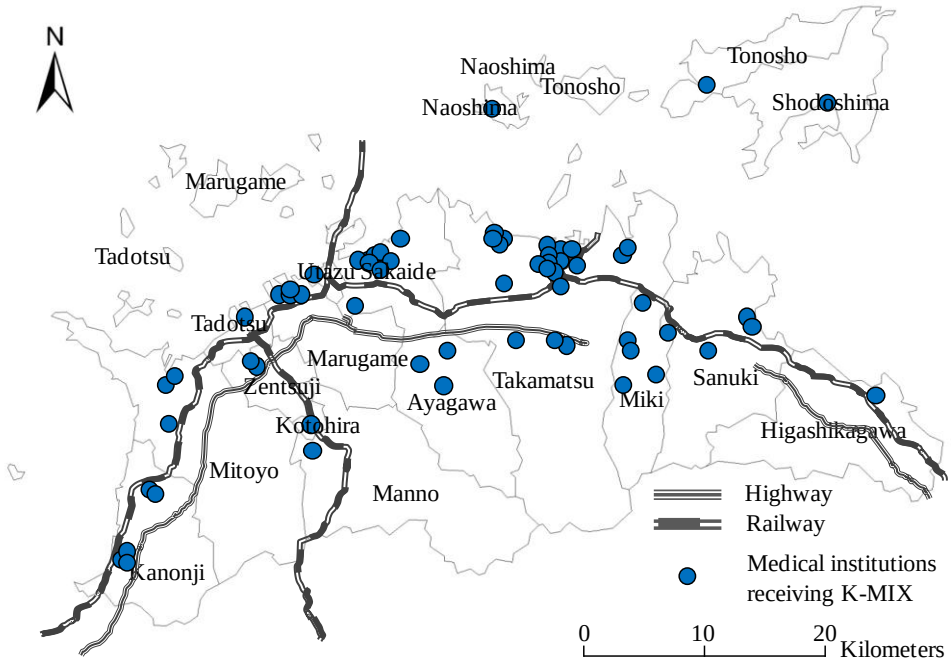


Figure 2-7. Distribution of sixty-three institutions demanding telemedicine of Kagawa in K-MIX in 2008 (*n*=63)

For Japan, the number of medical institutions providing or receiving telemedicine was not very large, mainly because the telemedicine applications in Kagawa are controlled by the telemedicine council. Each telemedicine network is released onto the website of K-MIX. Drawing on homepages that provide information on the telemedicine practices of Kagawa, this study obtained data on the 8 medical institutions providing telemedicine and the 63 medical institutions receiving telemedicine in 2008 (Figure 2-6 and 2-7). In addition, the data center provided the data on telemedicine flow between health care sites providing telemedicine and health care sites receiving telemedicine, too. The first method explained how medical institutions receiving telemedicine are associated with medical institutions providing telemedicine inside or outside comprehensively with regard to regionalization, in other words, an exploration of network patterns contributes to the discussion on how much telemedicine in Korea and Japan is operated faithfully within a regional-based diagnostic system at a tertiary-care level indirectly.

The second method presented doctors and patients (telemedicine users) as crucial decision-makers for telemedicine networks' decision-making propensities and their determinants. For a case of Korea, I conducted the interview with 4 medical institutions receiving telemedicine and those 28 patients being referred by these medical institutions in 2009. While I could get the results of a case of Japan by investigating 3 medical institutions receiving telemedicine and those 25 patients being referred by these medical institutions in 2010. On the basis of the first analysis for this research that looks at comprehensive telemedicine networks in Choongbook and Kagawa, I could get several typical geographical characteristics according to regional characteristics in Choongbook such as online referrals from the southern part of Choongbook, online referrals from the eastern part of Choongbook, and online referrals from the central part of Choongbook in Korea, and in Kagawa, for example, telemedicine networks in Marugame as the mainland and telemedicine networks in Shodoshima as an island considering the utilization of telemedicine, and these case studies with the interviews are based on this categorization.

Although there are similar points in the medial laws and circumstances in Korea and Japan, the key decision-makers show different views: online referrals in Korea are conducted by patients

dominantly, beside K-MIX is for telemedicine networks between physicians and medical specialists outstandingly. In Korea, there the concept of the family medicine system as a fixed consultant of health care is relatively weak in Korea. And crucial decision-makers depend on patients themselves dominantly. Because the legal binding force of online referrals is not strong relatively, patients can go to online referral-service sites without considering the geographic boundary, despite of their travel time and burdens and the medical laws and regulations. In addition, the operational processes of online referrals are not complicate, if there is consensus between medical institutions providing online referrals and those receiving online referrals. Therefore, the major objects of this research in Choongbook are patients. In addition, the online referral system focuses on the introduction of patients to high-level medical institutions, including delivering medical records, rather than consulting medical specialists about professional health care's advice and is a kind of the system at for nothing supported by tertiary care centers in spite of the fixed evaluation. Moreover, doctors or medical staffs didn't give positive aid to this research because of their conservative atmosphere.

Meanwhile, the Japanese medical circumstances are similar to the case of Korea. But the core decisions for telemedicine's operations depend on doctors mainly. Although there are many common points between Korea and Japan such as no family medicine system as a fixed consultant of health care and medical laws and regulations in telemedicine, the suggestion of doctors plays a considerable role in Japan relatively. Especially, the inpatients and outpatients are the customers of the medical institutions that I concocted the interview for a long time and the strong mutual understanding between physicians and doctors have been established in health care of Kagawa. Therefore, physicians can give proper medical treatment to patients fully considering patients' health condition, even social and economic status, and patients follow their opinions naturally. In comparison with some years ago, a lot of patients made the decision of health care by themselves, but this situation has been disappeared nowadays. In addition, the case of K-MIX is for the use of delivering medical information between physicians and medical specialists and physicians pay the monthly bill for the usage of K-MIX; therefore, physicians in practical terms play an important role in the decisions for K-MIX. On the contrary of the case of Korea, K-MIX includes various

functions such as online referrals, introduction of patients, delivering and deciphering medical images as the consultation of specialized diagnosis, and storage and control of data, but the major usage of K-MIX targets on delivering and deciphering medical images. In addition, the interview with patients in Japan was difficult because of privacy. In this sense, this research basically referred to two telemedicine users' opinions as much as possible, but online referrals in Korea were surveyed centering around patients and the major interviewees of K-MIX were for physicians[5].

In addition, the supplement of the interviews are based on testifiers, who can understand the telemedicine circumstances in Korea and Japan individually, in Korea and Japan. The 17 pharmacists in Korea, who introduced the interviewees at the first time, participated in the indirect interviews and the telemedicine council members (K-MIX) in Japan, who played a major role for the selection of the interviewees, gave the testimony to this research.

For a case of Korea, the data of this research are based on 4 medical institutions and those 28 patients as the sample group of the regional health care system in Choongbook according to regional characteristics as to in where online referrals' networks are occurred, that is, dividing into three typical areas: from the southern part of Choongbook, from the eastern part of Choongbook, from the central part of Choongbook as a clinical site, and from the central part of Choongbook as a health care site providing online referrals. Because online referrals mean the vertical relations for delivering medical records between tertiary care centers and clinical sites or other medical institutions, it is natural that the categorization of telemedicine networks in Choongbook is based on regional characteristics. I conducted in-depth interviews of them between July, 22 to August, 3 in 2009 and delivered the questions through face-to-face investigations for one or two hours at least per one doctor or medical staffs and patient in the presence of his or her family members or acquaintances. The criteria for doctors or medical staffs included: (1) understanding of online referrals and its process between primary and secondary medical institutions and tertiary medical institutions; (2) doctors or medical staffs who have ever referred their patients to health care sites providing online referrals within 2009. In addition, selection criteria for patients are based on: (1) residential area and medical insurance address in Choongbook; (2) online referral by doctors of

primary and secondary medical institutions in Choongbook and seen in tertiary medical institutions within 2009; and (3) understanding of online referral and its process between primary and secondary medical institutions and tertiary medical institutions. This study intended to include patient participants who could respond to in-depth and open-ended interviews and whose family or acquaintances could collaborate with the patients on the answers and some interviews used a combination of patient opinions and family members' and acquaintances' observations. For example, one patient was suffering from Alzheimer's disease and did not have the ability to respond to the interview; therefore, his or her family members provided information regarding his or her activities and his or her opinions about the online referral instead.

Before conducting this interview, I asked the collaboration of this interview to the medical specialist group of 17 pharmacists being registered as the members of the pharmaceutical association in each area of Choongbook in advance. By their collaboration, I could meet cooperative interviewees among their acquaintances including 4 doctors or medical staffs of medical institutions and 28 patients in Choongbook according to the criteria as snowball sampling (Mack et al., 2005). Totally, forty-six participants were recommended, but 4 doctors or medical staffs and 28 patients accomplished this interview well to the last. In Korea, in particular, local areas, pharmacists take a very important role as health care experts for local residents and the local residents counsel with the pharmacists frequently rather than doctors. Mostly, pharmacists involve the heart of the lives of the residences deeply and know the private situation of the residences such as their health condition and social status. It is like an advice window for health care instead of doctors. It may be that the characteristics of the Korean society, which are based on close and deep neighborhood relationships, are mirrored in it.

Similarly to the case of Choongbook, the telemedicine networks in Kagawa could be categorized into two telemedicine networks according to regional characteristics; in other words, telemedicine networks in Marugame as the mainland and in Shodoshima as an island. In addition, considering the internal characteristics of telemedicine networks according to its utilization (vertical telemedicine networks, telemedicine networks with an offline meeting, and horizontal

telemedicine networks), I selected 3 medical institutions corresponding with the categorization and conducted the interviews with 3 doctors of three medial institutions and those 25 patients who have ever experienced telemedicine in 2010. The telemedicine council, in particular, the medical association in Kagawa, which controls and participants in the use of telemedicine all the details, collaborated with this research very aggressively and suggested these medical institutions utilizing K-MIX (Kagawa's telemedicine system) that are relevant with top three users of K-MIX in advance. The criteria for doctors as same as Korea ones: (1) understanding of K-MIX and its process among medical institutions; (2) doctors or medical staffs who have ever referred their patients to health care sites providing K-MIX in 2010. As pointed out previously, it was difficult to interview with the patients. Likewise, the Japanese society, in particular, for Kagawa, is based on solid mutual trust and deep human relationships for health care. Therefore, doctors already understood the specific situations of each patient and it is easy to explain patients' inclinations toward K-MIX relatively. When patients could not accede to this interview, doctors as the interviewees stated patients' opinions or determinants instead of them. The criteria are as follows: (1) residential area and medical insurance address in Kagawa; (2) referred by physicians via K-MIX and being diagnosed in medical institutions providing K-MIX within 2010. The interview was conducted from March to May for three months in 2010 and I delivered the questions through face-to-face investigations and spent for one or two hours per each K-MIX participant or medical institution. In particular, one case is managed by a special meeting targeting on stroke or brain disease, therefore I joined the meeting and could refer to more affluent information related to K-MIX from various participants that didn't involve this research as major interviewees.

The questionnaires of this research related to telemedicine users' propensities are divided into two parts: (1) how and to where patients are referred by doctors via the telemedicine system in Choongbook and in Kagawa; and (2) what determinants influence the telemedicine decisions. The former questionnaires are arranged by the following tables (Table 2-3). Above all, the geographical decisions of telemedicine from doctors are location of the health care sites providing telemedicine via online referrals or K-MIX, utilization frequency of the telemedicine system per one month and

medical departments or illness that doctors ask patients' records to health care sites providing telemedicine via the telemedicine system in the main. As previously mentioned, because physicians in Kagawa are involving in K-MIX as major decision-makers, I conducted further questionnaires: satisfaction, detailed processes of K-MIX, opportunity that the medical institution started the telemedicine system and countermeasures, when K-MIX can not contribute to cure their patients.

Table 2-3. Decisions from doctors and medical staffs in Choongbook and Kagawa

- **Common question 1.** Location of the health care sites providing telemedicine via online referrals or K-MIX
- **Common question 2.** Utilization frequency of the telemedicine system per one month
- **Common question 3.** Medical departments or illness that doctors ask patients' records to health care sites providing telemedicine via the telemedicine system
- **Question for Kagawa 1.** Satisfaction
- **Question for Kagawa 2.** Detailed processes of K-MIX
- **Question for Kagawa 3.** Opportunity that the medical institution started the telemedicine system
- **Question for Kagawa 4.** Countermeasures, when K-MIX can not contribute to cure their patients

On the other hand, the geographical decisions of telemedicine from patients are based on patients' behaviors and propensities toward online referrals in Choongbook and K-MIX in Kagawa (Table 2-4): common questions are the first visit primary or secondary medical institutions (location), the location of the health care sites providing telemedicine referred by doctors via online referral or K-MIX, transportation methods are determined and time and disease. And for the case of Choongbook that patients' determinants are strong dominantly, the questions are the length of stay in the health care sites providing telemedicine for the occasion that patients are required direct diagnosis in the health care sites providing telemedicine, reply to primary or secondary medical institutions, seriousness of patients' disease, degree of patients' preference toward online-referral service sites, satisfaction of patients in online-referral service sites and referral and reply frequency

via online referral. I gave variety of the responses according to the interviewees' answerback capabilities. And unfulfilled results were made up for through additional surveys.

Table 2-4. Decisions from patients in Choongbook and Kagawa

- **Common question 1.** The first visit primary or secondary medical institutions (location)
- **Common question 2.** The location of the health care sites providing telemedicine referred by doctors via online referral or K-MIX
- **Common question 3.** Transportation methods are determined and time
- **Common question 4.** Disease
- **Question for Choongbook 1.** Length of stay in the health care sites providing telemedicine for only occasion that patients are required direct diagnosis in the health care sites providing telemedicine
- **Question for Choongbook 2.** Reply to primary or secondary medical institutions
- **Question for Choongbook 3.** Seriousness of patients' disease
- **Question for Choongbook 4.** Degree of patients' preference toward online-referral service sites
- **Question for Choongbook 5.** Satisfaction of patients in online-referral service sites
- **Question for Choongbook 6.** Referral and reply frequency via online referral

It is not yet feasible to make valid generalizations about the effectiveness of telemedicine, including online referrals and K-MIX, across disparate health services, technological configurations, and settings (Grigsby et al., 2005). But the latter was guided by the evaluations from some past researches on criteria in telemedicine, in particular, from clients and patients' perspectives: health improvement, medical effectiveness, satisfaction, health care services and decreased travel including accommodation, transportation and other expenses (Coughlan et al., 2006; Dávalos et al., 2009; Hicks et al., n.d.; Garshnek and Hassell, 2000; Mair and Whitten, 2000; Whitten and Love, 2005). In addition, this research dealt with online referrals in Korea and K-MIX in Japan as a special case that can not clarify through general criteria. Therefore, I added some provisions considering care conditions in Korea and Japan; in particular, for the case of Korea in terms of the

selection of patients toward tertiary care centers: kindness and convenience, good medical facilities including physical subsidiary facilities, health care services' level and quality, recommendations of others, credibility and accessibility (Lee and Jang, 1988; Lee et al., 1998; Kim et al., 2004). General criteria included satisfaction and health care' level or quality, besides criteria related to the selection of patients toward tertiary care centers in Korea are related to quite private reasons or the change of social conditions in the main (Table 2-5).

Table 2-5. Determinants of the decisions from doctors in Choongbook and Kagawa

Private dimensions

- **Provision 1.** Private relationships with medical specialists or staffs (acquaintances) of the health care sites providing telemedicine
- **Provision 2.** Promotion of their own medical institutions' images through telemedicine networks with the health care sites providing telemedicine
- **Provision 3.** Various advantages via telemedicine networks with the health care sites providing telemedicine such as the priority of diagnosis, medical training, etc.

Social and medical dimensions

- **Provision 4.** Good medical services and satisfaction of medical services of the health care sites providing telemedicine
- **Provision 5.** Advantage of the telemedicine system itself, when diagnosing patients. For example, saving burden of patients' accessibility to or utilization of the health care sites providing telemedicine and keeping continual diagnosis for the occasion that patients come back from the health care sites providing telemedicine

Geographical dimensions

- **Provision 6.** Proximity of the health care sites providing telemedicine

Further, in the reference of two directions—general criteria on telemedicine and special ones in Korea according to social and medical circumstances, the criteria for this research in terms of patients were settled into shape. Although these criteria were utilized for two case studies of Choongbook and Kagawa, the patients in Choongbook were focused by these criteria in the main

because the crucial decision-makers are patients in Korea; moreover, patients in Japan didn't participate in this research progressively. Therefore, the questionnaires were based on the Korean case much more and some of them were applied to this research for Kagawa.

Table 2-6. Determinants of the decisions from patients in Choongbook

Private dimensions

- **Provision 1.** Relative seriousness of disease
- **Provision 2.** Satisfaction of medical services
- **Provision 3.** Private preference on tertiary medical institutions without considering seriousness of disease
- **Provision 4.** Private relationships with medical specialists or staffs (acquaintances) of tertiary medical institutions and, accordingly, various advantages

Social and medical dimensions

- **Provision 5.** Image or awareness of tertiary medical institutions in Choongbook or other diagnostic areas associated with the appraisal of tertiary medical institutions
- **Provision 6.** Utilization of tertiary medical institutions (time or cost)
- **Provision 7.** Good medical services or strong attraction of good tertiary care centers in other diagnostic areas
- **Provision 8.** Advantage of the online referral

Geographical dimensions

- **Provision 9.** Proximity of the health care sites providing telemedicine
- **Provision 10.** Development of the transportation system (improved accessibility)
- **Provision 11.** Poor distribution of tertiary medical institutions

From a standpoint of private dimensions, patients make the final decisions and must be included in the discussion. Therefore, it is a key to examine what patients think of online referral such as relative disease seriousness and satisfaction. The following parameter focuses on social and

medical aspects in Choongbook or other diagnostic areas and is applicable to the external influences of online referral: the images patients have and their level of awareness of tertiary medical institutions, the use of tertiary medical institutions, the medical services of tertiary medical institutions and the advantages of online referrals. And the last criteria are based on geographical dimensions such as decrease of accessibility via online referrals. Further, considering care in Korea, private preference on tertiary medical institutions was worth being included. And the Korean society is composed by strong personal connections through school ties, regionalism, kinship, etc. In this sense, it could be predicted that private relationships with medical specialists or staffs of tertiary medical institutions and, accordingly, various advantages influence on patients' decision-making. Moreover, the development of a transportation system through Korea is one of the outstanding geographical changes related to time-space compression. And as previously mentioned, because there is only one online-referral service site in Choongbook, it is reasonable to examine the effects of poor distribution of tertiary medical institutions as online–referral service sites in the area. Further, high population density (42.8%) is identified in Kyunggi including Seoul and its fringe areas that border Choongbook closely. Therefore, the distribution of medical institutions may reflect population and it was also a considerable provision for this research (Table 2-6).

Chapter 3. Telemedicine Networks in Korea: A Case of Choongbook

3. 1 Overview of Choongbook

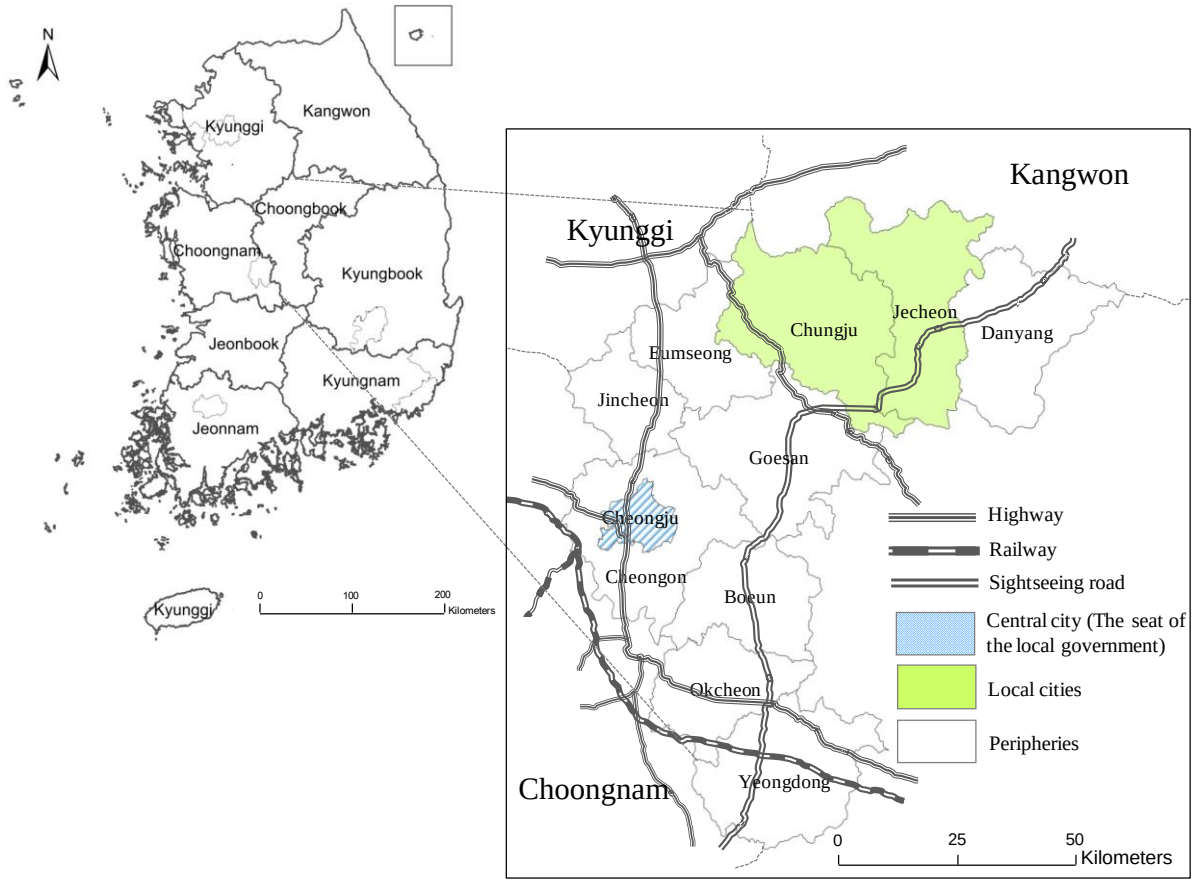


Figure 3-1. The diagnostic areas of Korea and the administrative districts of Choongbook

Choongbook is located in the middle of eight diagnostic areas in Korea that are based on living space and population size. The area closely borders Kyunggi, which includes Seoul, the capital of Korea. Choongbook is comprised of three urban areas (Cheongju, Chungju, and Jecheon) and eight suburban and rural areas, and Cheongju, the major urban area in Choongbook, is the seat of the provincial government (Figure 3-1).

Table 3-1. Social and medical indices in Choongbook (2008)

Category	Scale (Choongbook/8 diagnostic areas)
Population	1,527,478 (7/8)
Gross Regional Domestic Product (one million won)	30,081,514 (6/8)
Medical Institutions	2,306 (7/8)
Medical Workers	4,456 (8/8)
Medical Institutions per 100,000 people	151.0 (5/8)
Medical Workers per 100,000 people	291.7 (8/8)

Note: One million won = ~860 USD

Source: National Statistics in 2008

According to Choongbook's social and medical indices, on a national scale, the regional population and gross domestic product are not notable; moreover, the indices related to medical circumstances are not available for all of Korea (Table 3-1). In Choongbook, there are ten general hospitals located in Cheonju, Chungju, Jecheon, and Okcheon. All of these general hospitals, except for one, are clustered in the urban areas of Cheongju, Chungju, and Jecheon, and the only general hospital providing online referrals is also located in Cheonju. Accordingly, it can be estimated that the regional health care system in Choongbook does not provide affordable health care services to residents compared with the national average because most of the areas in Choongbook are suburban and rural rather than urban areas.

3. 2 Comprehensive Telemedicine Networks in Choongbook

The data on where patients seek care with online referrals from Choongbook show that 158 (65.0%) clinical sites of established telemedicine networks were located in Kyunggi and 41 in Choongbook itself (16.9%), followed by Choongnam (21, 8.6%) and Kangwon (6, 2.5%) (Figure 3-2). Some clinical sites in Choongbook that serve patients with online are members of several online referral networks, e.g., Kyunggi and Choongbook (8, 3.3%), Kyunggi and Choongnam (3, 1.2%), Kyunggi and Kangwon (5, 2.1%), and even Kyunggi, Choongbook and Kangwon at once (1, 0.4%). Although this situation does not alter the flow of online referrals in practice, it provides evidence of the path of the broad and indirect flow of telemedicine networks in Choongbook. Remarkably, it appears that many of the clinical sites in Choongbook serve patients with online referrals who are to utilize health care sites serving patients with online referrals in Kyunggi, an action that disregards both the online referrals and health care delivery systems and breaks medical laws and regulations. The second choice for patients holding online referrals in Choongbook is the outside health care sites, such as those in Choongnam and Kangwon. This evidence is sufficient to conclude that individuals in Choongbook using telemedicine networks frequently seek a diagnosis elsewhere.

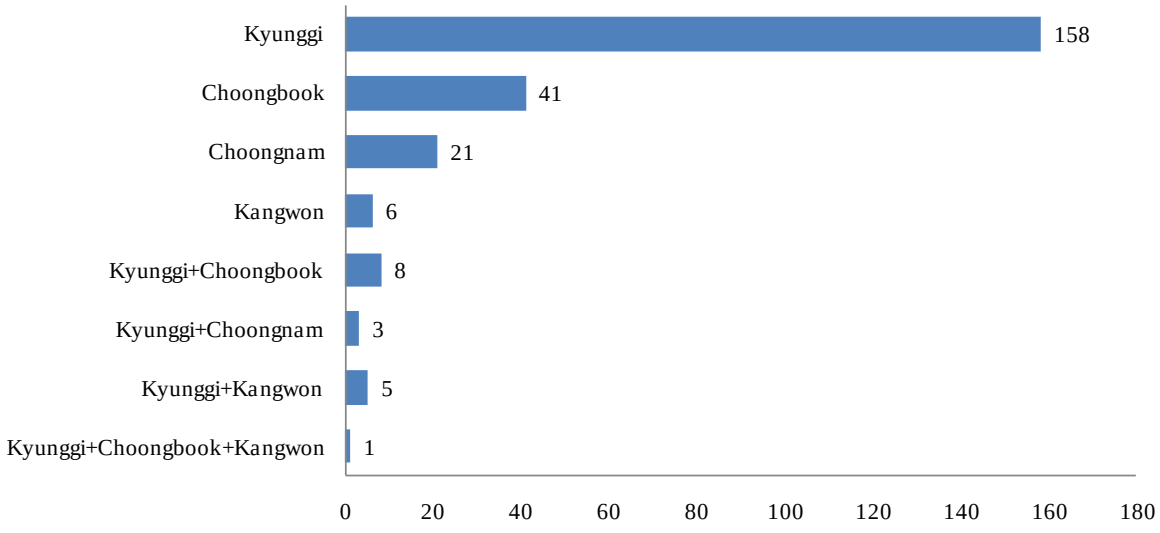


Figure 3-2. Sites of medical institutions treating patients who have online referrals in all diagnostic areas (n=243)

Source: Data on 243 medical institutions in Choongbook

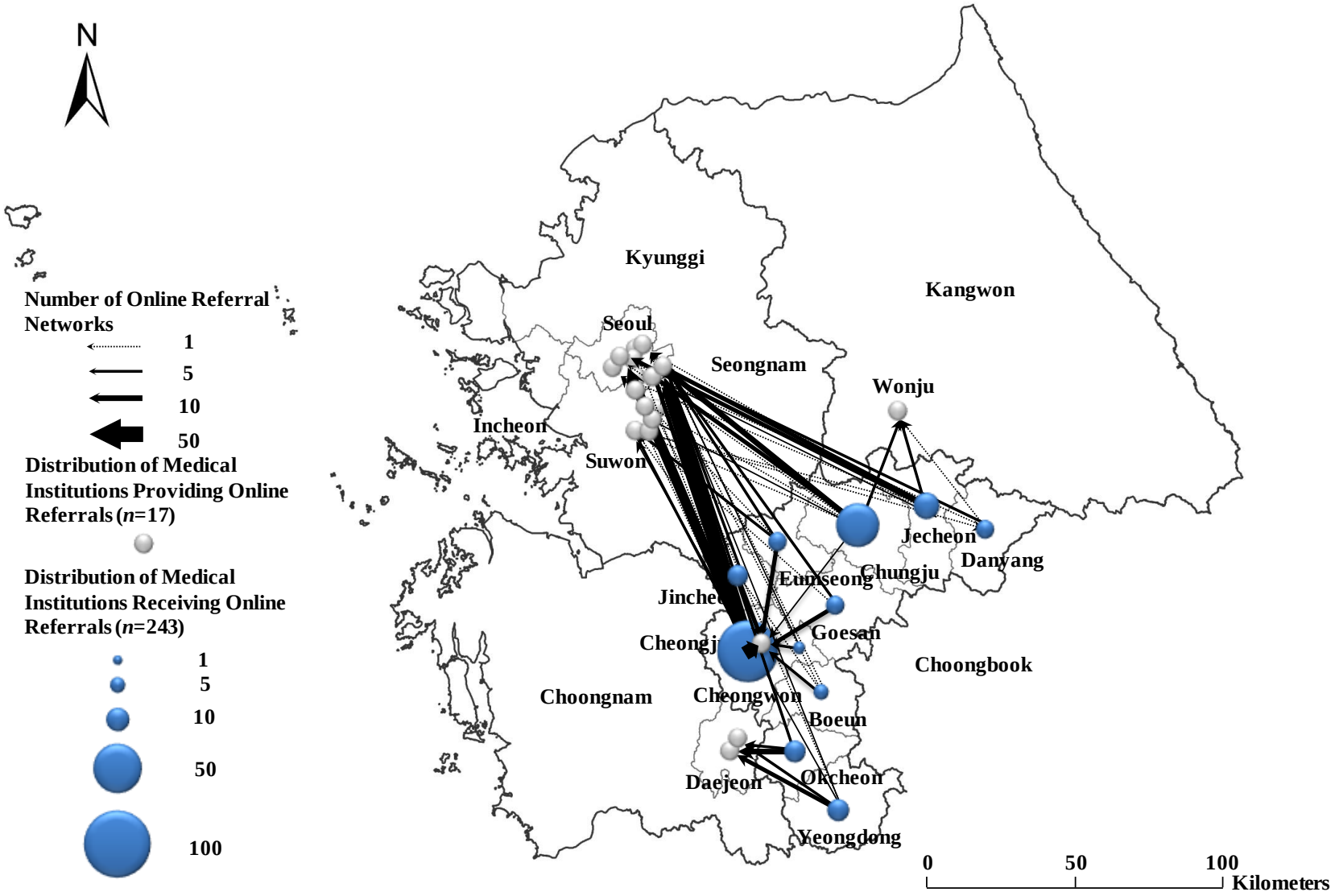


Figure 3-3. Telemedicine networks from Choongbook to Kyunggi (n=158, including 17 plural telemedicine networks), to Choongbook itself (n=50, 9 plural telemedicine networks), to Choongnam (n=21, 3 plural telemedicine networks) and to Kangwon (n=12, 6 plural telemedicine networks)
Source: Data on 243 medical institutions receiving online referrals

A closer inspection of each area in Choongbook may explain the geographical characteristics of the online referral networks more fully. For this reason, the investigation takes note of how many online referrals from Choongbook are seen at each of the four health care sites providing telemedicine: Kyunggi, Choongbook itself, Choongnam and Kangwon (Figure 3-3). Medical institutions requiring online referrals throughout Choongbook are responsible for the proliferation of telemedicine networks toward Kyunggi. Most of the telemedicine networks served by Kyunggi are associated with Cheongju as a major city in Choongbook and the smaller cities of Chungju and Jincheon, but many networks originate from the peripheries of Choongbook. Meanwhile, the telemedicine networks in Choongbook serve institutions located in all areas of Choongbook, except for Danyang, Jechoen, Okcheon, and Yeongdong, which are far away from the urban center in Cheongju. In addition, some telemedicine consumers in Okcheon and Yeongdong (22, 6.9%) use telemedicine suppliers in Choongnam. The telemedicine networks servicing Kangwon are used by telemedicine consumers from Chungju, Jecheon (10, 3.2%), and Danyang (2, 0.6%). Hence, it can be concluded that telemedicine network services are centralized to Kyunggi and that outflows to outlying areas can be observed all over Choongbook.

In general, the online referral networks connect local clinical sites in Choongbook that treat patients who have online referrals and several medical institutions that provide online referrals in Choongbook, Kyunggi, Choongnam and Kangwon. Only one medical institution provides online referrals in Choongbook (Cheongju), as do nine medical institutions in Kyunggi (in particular, Seoul), seven in Kyunggi in the vicinity of Seoul, two in the metropolitan area of Choongnam, and one in Kangwon, specifically in the major city of Wonju.

Given the geographical characteristics, it can be concluded that many clinical sites in Choongbook are associated with outside medical institutions providing online referrals. In addition, the online referral networks show a peculiar result in Choongbook. Geographic characteristics of telemedicine networks in Choongbook depend on their specific location in the southern or eastern parts of Choongbook or in the central part around Cheongju, the seat of the Choongbook provincial government.

Table 3-2. The interviewees of Choongbook

Category		Location	Interviewees (medical staffs)	Interviewees (patients, N)	Patients' Residence	Destinations for online referrals (N)	Frequency of online referrals (per month)
Southern Choongbook		Yeongdong	Doctor and nurses	1	Yeongdong (1)	Choongnam (1) Kyunggi (1)	1-2
Eastern Choongbook		Chungju	Doctor and nurses	6	Chungju (6)	Kyunggi – Seoul (3) Kyunggi (1) Kangwon (1)	5-6
Central Choongbook	Clinical site	Cheongju	Doctor and nurses	6	Cheongju (5) Cheongwon (1)	Kyunggi (2)	4-5
	Health care site providing online referrals in Choongbook	Cheongju	Nurses	15	Goewan (1) Boeun (1) Jincheon (2) Cheongju (11)	Kyunggi (3)	20-30

More specifically, medical institutions treating patients who have online referrals in the southern part of Choongbook are most strongly associated with medical institutions providing online referrals in Kyunggi and Choongnam. The southern part of Choongbook (Okcheon and Yeongdong) is considered to have insufficient medical institutions and health care services, and there are no secondary medical institutions or other comparable medical institutions. Although Choongnam is not located in the same diagnostic area, it seems that many patients from the southern part of Choongbook prefer to visit medical institutions providing online referrals in Choongnam. The Daejeon metropolitan area, where patients can receive high-quality and complex health care services in several tertiary care centers, borders the southern part of Choongbook, and the Daejeon metropolitan area is more accessible than the high-quality medical institutions within Choongbook are. In addition, Chungju and Jecheon, two major cities of Choongbook, are located in the eastern part of Choongbook (centered around these two cities and Danyang); several medical institutions there can provide high-quality health care services, but do not provide online referrals. One medical institution providing online referrals in Kangwon is located in Wonju, which is one of the major cities in Kangwon, but lacks high-quality medical services. The central part of Choongbook centering around Cheongju, the seat of the local government, is associated primarily with medical institutions providing online referrals in Kyunggi and with one medical institution providing online referrals in Choongbook itself.

The follow investigations enabled us to determine telemedicine users' core determinants of where to seek treatment through three typical cases. Moreover, I employed one more case for online referral networks from the central part of Choongbook, namely, one health care site providing online referrals. Therefore, this research can compare an internal health care site providing online referrals with external sites in terms of patients' determinants and investigate how these types of sites differ in terms of their networks with high-level medical institutions. Additionally, as previously mentioned, because the online referral system involves the transmission of medical information online and patients must travel to medical institutions providing online referrals at least once (as an offline aspect), the results are separated into online (delivering medical

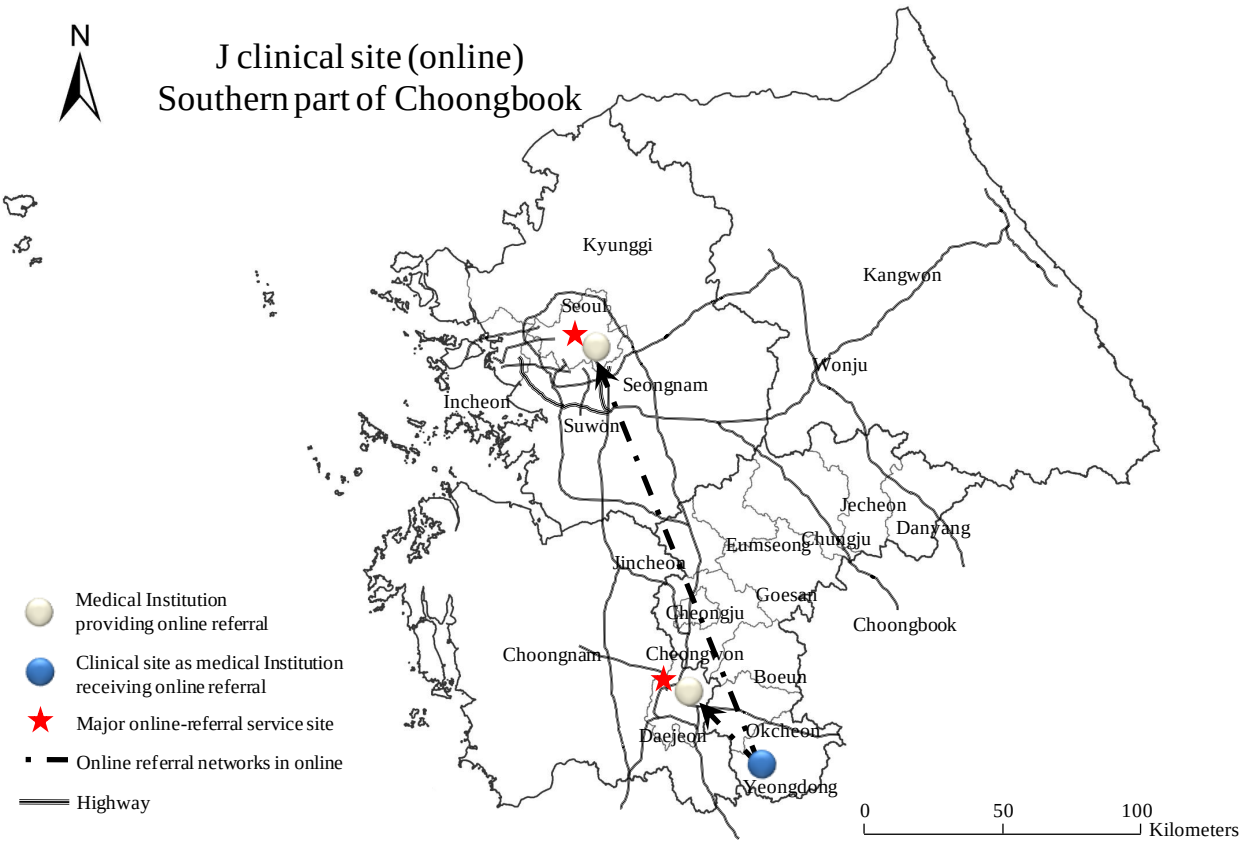
records through the online referral system) and offline (patients' travel to medical institutions providing online referrals) (Table 3-2).

3. 3 Telemedicine Networks from the Southern Part of Choongbook

3. 3. 1 From a Perspective of the J Clinical Site

The J clinical site provides a useful example of telemedicine users' propensities in the southern part of Choongbook. The J clinical site is located in Yeongdong in southern Choongbook, and its primary specialty is internal medicine. According to the medical staff (nurses) of the J clinical site, they refer their patients to two health care sites providing online referrals in Kyunggi (Seoul) and Choongnam once or twice per month; moreover, a core destination for patients with online referrals is a health care site providing telemedicine in Kyunggi (Figure 3-4). Notably, some patients want to be referred to health care sites providing online referrals that can provide high-quality medical treatment of any health condition, but most of the patients being referred to health care sites providing online referrals are serious cases or require surgical treatment by an internal medicine specialist (Table 3-3).

When doctors at the J clinical site determine that a patient's health condition requires more advanced care, doctors and patients show the following propensities. Although doctors suggest appropriate health care sites that can support their patients fully, most patients choose a health care site providing online referrals on their own. Most doctors take patients' requests into consideration. One nurse testified that patients already understand their health conditions and know which medical institutions provide the best care because of TV, the Internet and information from family or acquaintances. Sometimes, patients' knowledge is seen as more important than doctors' opinions. In such cases, patients show strong propensities toward health care sites providing telemedicine in Kyunggi because major medical institutions providing online referrals are located in Kyunggi and it seems that many patients are satisfied with the health care services provided there. Thus, although the original purpose of online referrals was to send patients to the appropriate medical institutions within Choongbook for treatment, few patients follow this course of action. Some patients go to



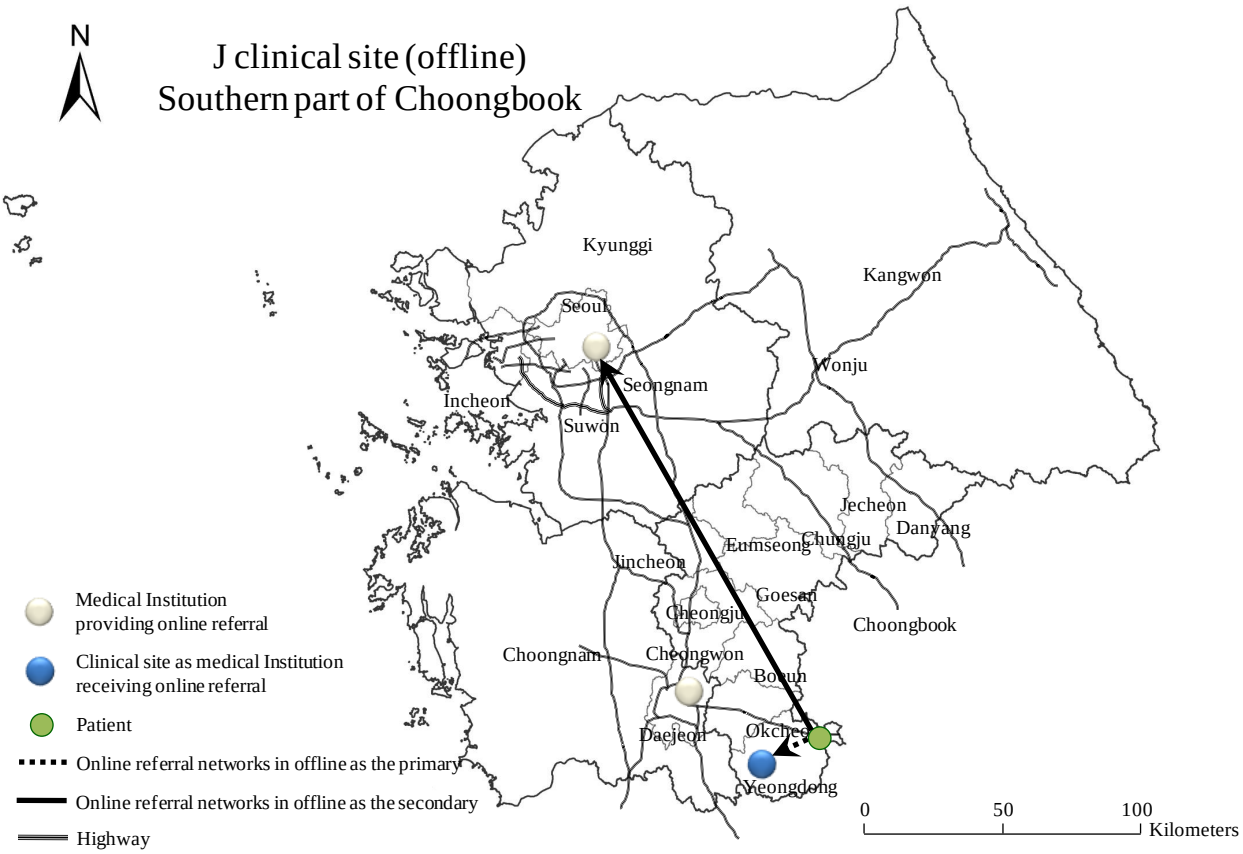


Figure 3-4. Telemedicine networks of the J clinical site and their flow both online (top) and offline (bottom)

medical institutions providing online referrals in Choongnam instead of in Choongbook. Although Choongnam is not located in the same diagnostic area as Choongbook, it is home to several high-quality medical institutions providing online referrals that are managed by good universities. In addition Choongnam is more easily accessible than Cheongju, which has one medical institution providing online referrals to the citizens of Choongbook. Moreover, the southern part of Choongbook has insufficient health care services. Therefore, there is no adequate medical institution in this area to support the residents fully. For this reason, many residents of the southern part of Choongbook see Choongnam as their destination for secondary health care. However, the development of the transportation system and of extremely high-quality medical services at institutions providing online referrals in Kyunggi have led many patients to seek treatment there. In practice, online referrals are one of the methods of transmitting patients' information to other health care practitioners; moreover, patients rarely receive referrals from health care sites providing telemedicine.

Table 3-3. Information on the J clinical site as an example of telemedicine networks in the southern part of Choongbook

Information	J clinical site
Location	Yeongdong
Department	Internal medicine
Number of Referrals	1-2 per month
Referral Locations	Two telemedicine provider sites: 1 in Kyunggi, 1 in Choongnam
Reasons for choosing this clinical site	• Patients' requests and need for proper medical treatment (Provision 4) • Online referrals to health care sites providing telemedicine are evaluated by telemedicine provider sites according to internal regulations

Accordingly, one doctor interviewed in this research acknowledged the convenience of online referrals but pointed out that the utility of online referrals is still a matter of debate. In particular,

online referrals are evaluated by telemedicine provider sites according to internal regulations, and their relationship with online referrals is too changeable. Therefore, local doctors cannot be sure of the advantages or continual utilization of online referrals and regard this system merely as a complementary method. Further, patients rarely return to the first medical institution where they sought treatment for a particular health issue, preferring to seek treatment in medical institutions providing online referrals as much as possible despite the increased travel time and burdens. In this sense, although the online referral system itself provides a valuable service, it seems that the quality of medical institutions providing online referrals has the dominant influence on patients.

3. 3. 2 Perspectives of the Patients Referred by the J Clinical Site

Owing to the recent introduction of the medical specialists group there, I interviewed the only patient who was referred by the J clinical site in 2009. This patient's statements describe the detailed process of seeking treatment from clinical sites and health care sites providing online referrals; in other words, why and how a patient moves from seeking treatment at clinical sites to visiting health care sites providing online referrals (Table 3-4). This patient lives in Yeondong and chose the J clinical site in Yeondong in her first attempt to seek treatment. She was diagnosed with serious digestive trouble requiring an accurate diagnosis, and the doctor suggested that she go to a higher-level hospital. Although the doctor offered medical treatment in a health care site providing online referrals in Choongbook, she and her family chose to go to a health care site providing online referrals in Kyunggi. She visited one health care site providing telemedicine in Seoul, making the two-hour drive there with her son in their own car, and spent a total of one day on travel, diagnosis and treatment. At present, she goes to the health care site providing online referrals in Seoul once per month to receive treatment, even though she could be treated at the J clinical site. She wants to receive the highest quality medical treatment possible, and she and her family view the facility in Seoul as meeting this criterion. They are influenced by the image of this facility and by knowledge of the famous medical specialists who work there. Incidentally, she was once referred to a health care site providing online referrals in Choongnam because of back pain. At that

Table 3-4. Information of one patient who has ever been referred by the J clinical

Number	Department and disease	Sex	Location	Year	The first visiting clinical sites	Location of health care sites providing telemedicine	Transportation methods / time (min)	Length of stay	Reply	Frequency (month)	Seriousness	Preference	Satisfaction	Major reasons
1	Internal medicine/ digestive trouble	F	Yeongdong	62	Yeongdong (J clinical site)	Kyunggi	Private / 120	1	N	1	S	H	H	2, 5, 7

Note.
Seriousness – M: Minor, N: Normal, S: Severe / Preference and Satisfaction – H: High, N: Normal, L: Low
Provision 1. Relative seriousness of disease
Provision 2. Satisfaction of medical services
Provision 3. Private preference on tertiary medical institutions without considering seriousness of disease
Provision 4. Private relationships with medical specialists or staffs (acquaintances) of tertiary medical institutions and, accordingly, various advantages
Provision 5. Image or awareness of tertiary medical institutions in Choongbook or other diagnostic areas associated with the appraisal of tertiary medical institutions
Provision 6. Utilization of tertiary medical institutions (time or cost)
Provision 7. Good medical services or strong attraction of good tertiary care centers in other diagnostic areas
Provision 8. Advantage of the online referral
Provision 9. Proximity of the health care sites providing telemedicine
Provision 10. Development of the transportation system (improved accessibility)
Provision 11. Poor distribution of tertiary medical institutions

time, the proximity of the health care site in Choongnam and the level of services provided were major considerations. For her, the facility in Choongnam is more convenient than one in Choongbook would be, although both are located in the same diagnostic area.

3. 4 Telemedicine Networks from the Eastern Part of Choongbook

3. 4. 1 From a Perspective of the Y Clinical Site

The second case of a telemedicine network is the Y clinical site in the eastern part of Choongbook. The Y clinical site is located in Chungju and specializes in internal medicine. A doctor and nurses at this clinical site explained their online referral mechanism as follows: this clinical site refers patients to five health care sites providing online referrals in Kyunggi, in particular, Seoul and Kangwon (Figure 3-5). Most online referrals are to health care sites providing online referrals in Kyunggi, but online referrals to a health care site providing online referrals in Kangwon are also frequent. On average, the Y clinical site refers its patients to these health care sites five or six times per month. Patients' preferences and expertise with the patient's condition are the most important determinants of the health care site to which a patient receives a referral (Table 3-5). Although the Y clinical site is located in Choongbook, a health care site providing online referrals in Kangwon is closer than other high-level facilities in Choongbook and is managed by one of Korea's largest universities. Therefore, patients show strong preferences that they be referred to this facility in Kangwon. In the case of online referrals to health care sites providing telemedicine in Kyunggi, the strong inclination to provide online referrals to health care sites providing telemedicine in Kyunggi regardless of patients' social status is a serious problem in Chungju; moreover, the standard of living has gradually improved in Chungju, and more patients want to be referred to health care sites providing telemedicine in Kyunggi for their treatment. In particular, Chungju is one of the areas where there are many elderly, and the tacit information through human networks among the elderly also impacts patients' preferences very strongly. In addition, personal connections, such as with medical specialists or employees of health sites providing online referrals, are among the contributing factors considering the characteristics of

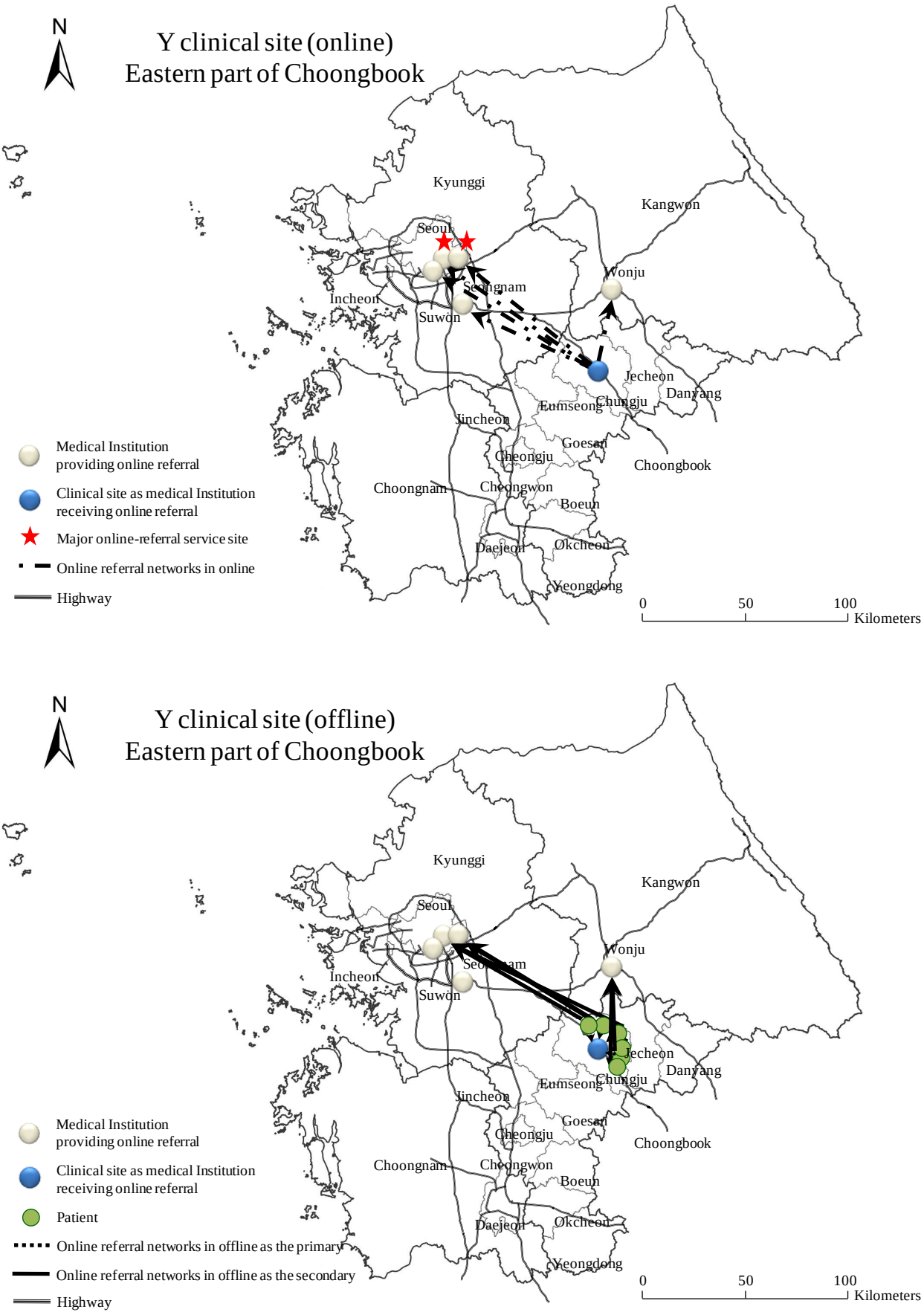


Figure 3-5. Telemedicine networks of the Y clinical site and their flow from online (top) and offline (bottom)

Korean society. The doctor indicated that it is very difficult to know whether the online referral system itself is useful because in practice this system is used for one-way communication, contrary to the original vision of online referrals as a form of two-way communication. Because many of patients want to continue their medical treatment at health care sites providing online referrals, the online referral system is rarely utilized when patients return from health care sites providing online referrals. In addition to online referrals related to medical activities, health care sites providing online referrals provide various additional useful services, such as priorities for diagnosis and medical training. The doctor working at the Y clinical site stated that the present online referral system is utilized as one of the electronic methods to refer patients to medical specialists in health care sites providing online referrals. Further work is needed to ensure that online referrals serve the purpose of promoting regional health care through strategies such as measures to encourage patients who seek care at health care sites providing online referrals to return to local clinical sites.

Table 3-5. Information on the Y clinical site as an example of telemedicine networks in the eastern part of Choongbook

Information	Y clinical site
Location	Chungju
Department	Internal medicine
Number of Referrals	5-6 per month
Referral Locations	Five telemedicine provider sites: • 3 in Seoul (Kyunggi) • 1 in Kyunggi • 1 in Kangwon
Reasons for choosing this clinical site	• Patients' requests and proper medical treatment (Provision 4) • Online referrals to health care sites providing telemedicine are judged by telemedicine providers according to internal regulations

3. 4. 2 Perspectives of the Patients Referred by the Y Clinical Site

Results derived from the patients' decisions and the geographical factors with regard to online referrals are shown in Table 3-6. These data suggest that decisions regarding which health care site providing online referrals to visit for treatment vary by case and describe how this variation influences the major online referral processes. Patients are only referred to health care sites providing online referrals (tertiary medical institutions) when their conditions were serious and required accurate diagnosis by medical specialists regardless of online referrals. The patients who were interviewed for this research varied in age and gender. Almost all of the participants had visited or were visiting health care sites providing online referrals (tertiary medical institutions) after receiving online referrals for inpatient or outpatient medical treatment of chronic or severe conditions.

It takes less than 30 minutes for these patients to travel to medical institutions in Kangwon. In contrast, it takes between 120 minutes and 150 minutes to travel to Kyunggi using private and public transportation methods, respectively. When the patients visited tertiary medical institutions for the first time, they were only required to stay for one day. However, when undergoing surgery or presenting with a serious medical condition, they spent anywhere from 3 to 30 days at the medical institution.

Most of the patients had finished or were continuing their medical treatment in these health care sites providing online referrals without returning to the primary or secondary medical institutions via the online referral system. Overall, it seems that most of the patients do not see a need to return to the first medical institution to which they were referred. For example, although patients incurred monetary and time costs to visit outlying medical institutions providing online referrals, they went there only occasionally for medical treatments necessary for their survival. Therefore, it is natural that they sought out medical institutions that can guarantee high-level health care services. Although one medical institution providing online referrals in Kangwon is located in another diagnostic area, it is more easily accessible than the internal medical institutions in Choongbook and has a good reputation. In addition, some medical institutions providing online referrals limit the

provision of online referrals to patients who want to return to their primary medical institutions to ensure the security of medical information. Therefore, the online referral system has the advantage of delivering online referrals from the clinical site to a health care site providing online referrals in a one-way transmission.

Preference for and satisfaction with online referral service sites are strongly and directly correlated; for example, if preference is high, satisfaction is high, too. Mostly, preferences for and satisfaction with external online referral service sites are high, in particular, for online referral service sites in Kyunggi.

The major determinants of online referrals depend on patients' satisfaction with medical services (provision 2) and high-quality medical services or tertiary care centers (provision 7) in other diagnostic areas in the country. Although health care sites providing online referrals in other diagnostic areas, in particular, in Kyunggi, take longer to reach, patients who visit health care sites providing online referrals that are located close by spend almost the same amount of time because of the number of patients awaiting treatment. Therefore, if patients are referred to health care sites providing online referrals, they seek out those sites that offer the best medical treatment. For example, one patient (No 3) was referred to a health care site providing online referrals in Kyunggi on purpose. Her disease, which she had thought to be a simple cold, was developing into pneumonia. Although she could have received medical treatment at nearby health care sites providing online referrals, she was not satisfied with the quality of health care in Choongbook and finally selected a tertiary medical institution in Kyunggi for her treatment.

Additionally, the selection of a health care site providing online referrals in Kangwon is associated with the costs, in terms of time and medical expenses, of seeking treatment elsewhere. Moreover, the development of the transportation system and improved accessibility of other areas have also accelerated the online referrals to health care facilities in other diagnostic areas. One medical institution providing online referrals in Kangwon serves as a tertiary care center, and the patients in the eastern part of Choongbook indicated that they chose to visit this medical institution for treatment because of its proximity and high-level medical services. But the choice of a medical

Table 3-6. Information of six patients who have ever been referred by the Y clinical site

Number	Department and disease	Sex	Location	Year	The first visiting clinical sites	Location of health care sites providing telemedicine	Transportation methods / time (min)	Length of stay	Reply	Frequency (month)	Seriousness	Preference	Satisfaction	Major reasons
1	Neurology	F	Chungju	61	Chungju (Y clinical site)	Kyunggi	Public / 150	30	N	1	S	H	H	2, 7
2	Obstetric gynecology	F	Chungju	47	Chungju (Y clinical site)	Kyunggi	Private / 120	10	N	1	S	H	H	2, 7
3	Internal medicine	F	Chungju	67	Chungju (Y clinical site)	Kyunggi	Public / 120	3	N	-	N	H	H	2, 3, 7
4	Urology	M	Chungju	36	Chungju (Y clinical site)	Kangwon	Private / 30	1	N	0.5	S	H	H	7
5	Internal medicine	M	Chungju	72	Chungju (Y clinical site)	Kyunggi	Private / 120	1	N	1	S	H	H	7, 10
6	Emergency	F	Chungju	60	Chungju (Y clinical site)	Kangwon	Private / 30	3	N	-	S	H	H	6, 7

Note.
Seriousness – M: Minor, N: Normal, S: Severe / Preference and Satisfaction – H: High, N: Normal, L: Low
Provision 1. Relative seriousness of disease
Provision 2. Satisfaction of medical services
Provision 3. Private preference on tertiary medical institutions without considering seriousness of disease
Provision 4. Private relationships with medical specialists or staffs (acquaintances) of tertiary medical institutions and, accordingly, various advantages
Provision 5. Image or awareness of tertiary medical institutions in Choongbook or other diagnostic areas associated with the appraisal of tertiary medical institutions
Provision 6. Utilization of tertiary medical institutions (time or cost)
Provision 7. Good medical services or strong attraction of good tertiary care centers in other diagnostic areas
Provision 8. Advantage of the online referral
Provision 9. Proximity of the health care sites providing telemedicine
Provision 10. Development of the transportation system (improved accessibility)
Provision 11. Poor distribution of tertiary medical institutions

institution providing online referrals depends on its quality of care. Therefore, although the accessibility and utilization of medical institutions providing online referrals are considerable, when choosing to visit the medical institution providing online referrals in Kagnwon, the intrinsic value of health care services itself is the most important factor for the patients. In addition, regrettably, convenience, utility and the original purpose of online referrals are not observed as determinants of online referrals, perhaps because of the goal of sharing medical records between doctors via online referrals.

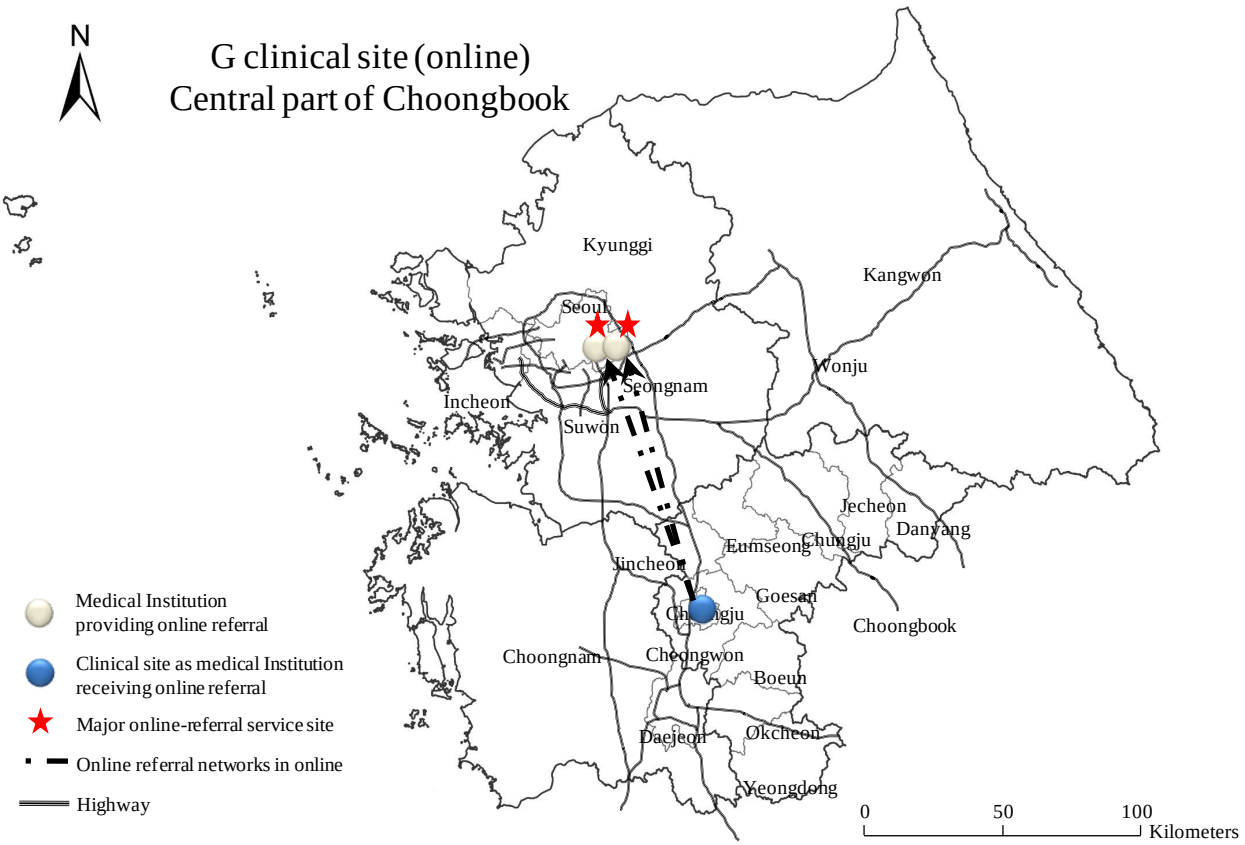
3. 5 Telemedicine Networks in the Central Part of Choongbook

The telemedicine networks in the central part of Choongbook were investigated in two ways: first, from a clinical-level perspective, and second, from the perspective of the health care sites providing online referrals. In particular, by examining a health care site providing online referrals within Choongbook, the latter case helps to clarify the difference between the determinants of online referrals from local clinical sites and those from a health care site providing online referrals within Choongbook.

The investigation of telemedicine networks in the central part of Choongbook was conducted at the G clinical site in Cheongju. This clinical site specializes in internal medicine. If the G clinical site cannot treat a patient's complaints, a doctor refers them to two health care sites providing online referrals in Kyunggi, in particular, in Seoul. According to nurses working at this clinical site, the G clinical site is highly regarded in Cheongju, including its fringe areas; therefore, many patients visit this clinical site, and those with serious medical conditions are given referrals to tertiary care facilities in Seoul. Four to five online referrals are given at this clinical site every month.

3. 5. 1 From a Perspective of the G Clinical Site

Here, as elsewhere, patients' preferences are taken into consideration when determining online referrals' destinations (Figure 3-6). Patients hold various opinions on online referrals, but the major



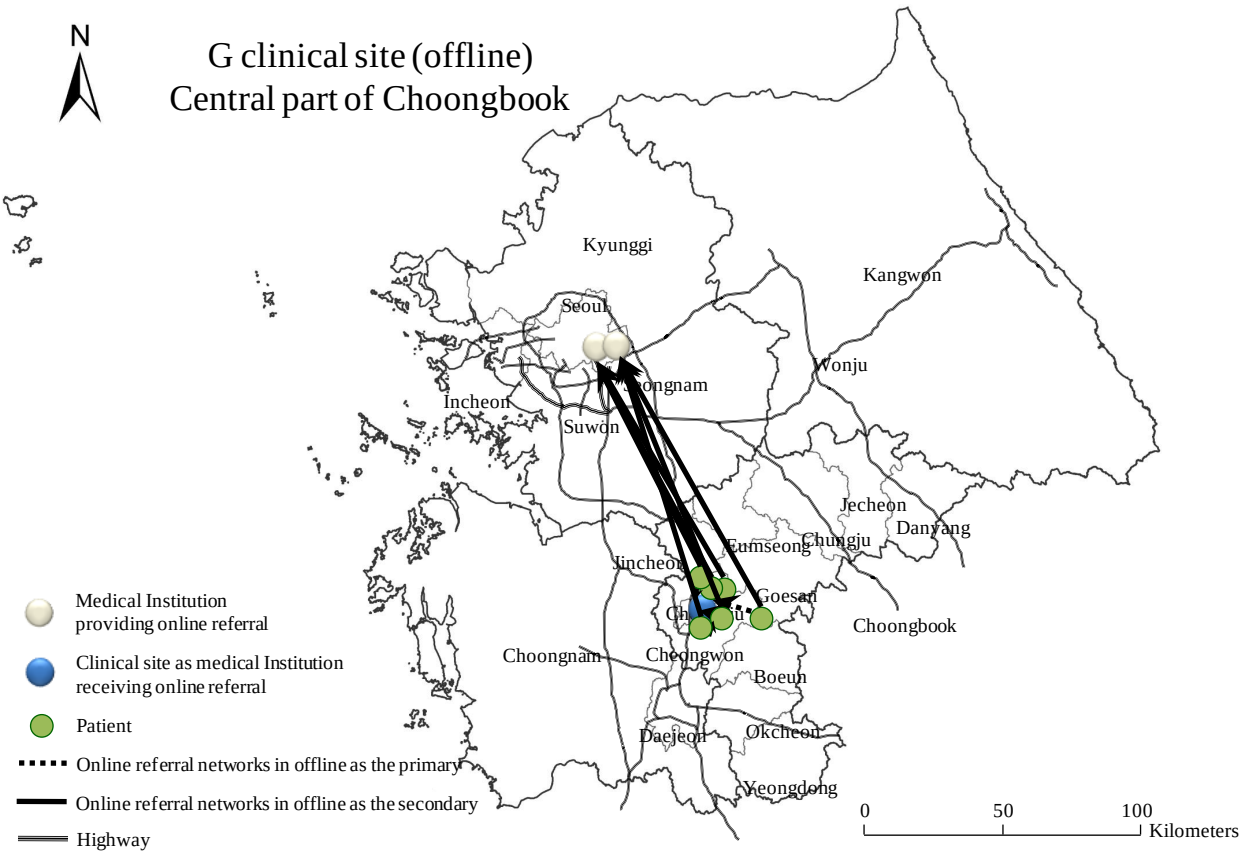


Figure 3-6. Telemedicine networks of the G clinical site and their flow from online (top) and offline (bottom)

reasons why patients want to be referred to health care sites providing online referrals in Kyunggi are an expectation of high-quality health care services in high-level health care sites there regardless of accessibility. Additionally, physicians' considerations are mirrored in online referrals to two health care sites providing online referrals. At the end of the economic crisis in the 1990s, many medical specialists who worked in general hospitals providing online referrals were downsized because of restructuring. At that time, clinical site G opened and began issuing online referrals to major general hospitals providing online referrals when specialized care was needed. The first purpose of online referrals is to track referrals using an electronic system. Also, the connection to specialized health care facilities through online referrals is viewed positively by local residents, enabling this clinical site to attract many patients. Therefore, this clinical site advertises the fact that it utilizes online referrals and has strong relationships with two major health care sites providing online referrals.

Table 3-7. Information on the G clinical site as an example of telemedicine networks in the central part of Choongbook

Information	G clinical site
Location	Cheongju
Specialty	Internal medicine
Number of Referrals	4-5 per month
Referral Destinations	2 telemedicine provider sites in Kyunggi
Reasons for choosing this clinical site	• Patients' requests and proper medical treatment (Provision 4) • Private relationships with medical specialists at health care sites providing online referrals (Provision 1) • Improvement of the clinic's image through telemedicine (Provision 2) • Judged by telemedicine provider sites

The doctor's intention corresponds with patients' determining factors for online referrals, in other words, the doctors' and patients' preferred health care sites are the same, and this clinical site provides online referrals to two major health care sites. Also, the doctor worked at one of the two health care sites providing online referrals in the past; therefore, he understands which medical specialists are proficient. In this sense, his opinion influences patients' preferences somewhat. On a regular basis, the two major health care sites providing online referrals evaluate whether the online referrals from local clinical sites should continue according to the usage of and number of patients referred by each local clinical site. Only clinical sites passing this examination can use the online referral system, although it is mostly used for one-way online referrals from clinical sites to the two major health care sites providing online referrals. Sometimes, patients who finish their core medical treatment at one of the two major health care sites providing online referrals return to this clinical site to continue medical treatment of chronic diseases such as diabetes and cardiac disorders. At that time, the doctors refer to medical records from the two major health care sites providing online referrals to gain more information about the patient's condition and treatment. In practice, even if a doctor cannot use the online referral system, referrals can be sent by fax, e-mail or in writing, so the lack of access is not a serious inconvenience (Table 3-7).

3. 5. 2 Perspectives of the Patients Referred by the G Clinical Site

Six patients visiting the G clinical site were interviewed, with fruitful results (Table 3-8). A diverse group of patients in terms of age, gender and illness are referred from the G clinical site to health care sites providing online referrals in Kyunggi. One patient living in Cheongwon, in another residential district (Cheongju), saw a doctor at the G clinical site. However, most of the patients chose primary or secondary medical institutions within their own residential district before being referred to tertiary medical institutions. All patients chose health care sites providing online referrals in Kyunggi and spent 120 to 180 minutes reaching them by public or private transportation. Most of the patients required one day for their diagnosis or medical treatment in health care sites in Kyunggi, and some of them visited these health care sites regularly. Because the need to visit a

Table 3-8. Information of six patients who have ever been referred by the G clinical site

Number	Department and disease	Sex	Location	Year	The first visiting clinical sites	Location of health care sites providing telemedicine	Transportation methods / time (min)	Length of stay	Reply	Frequency (month)	Seriousness	Preference	Satisfaction	Major reasons
1	Internal medicine	F	Cheongwon	72	Cheongju (G clinical site)	Kyunggi	Private / 150	1	N	-	S	H	H	1, 2, 7
2	General surgery	M	Cheongju	46	Cheongju (G clinical site)	Kyunggi	Private / 120	30	N	1	S	H	H	2, 7
3	Internal medicine	F	Cheongju	29	Cheongju (G clinical site)	Kyunggi	Private / 120	1	N	1	S	H	H	7
4	Internal medicine	F	Cheongju	36	Cheongju (G clinical site)	Kyunggi	Public / 180	1	Y	-	S	H	H	3, 5, 7
5	Internal medicine	F	Cheongju	36	Cheongju (G clinical site)	Kyunggi	Public / 150	1	N	0.5	S	H	H	7
6	Internal medicine	M	Cheongju	41	Cheongju (G clinical site)	Kyunggi	Private / 120	1	N	1	S	H	H	6, 7

Note.
Seriousness – M: Minor, N: Normal, S: Severe / Preference and Satisfaction – H: High, N: Normal, L: Low
Provision 1. Relative seriousness of disease
Provision 2. Satisfaction of medical services
Provision 3. Private preference on tertiary medical institutions without considering seriousness of disease
Provision 4. Private relationships with medical specialists or staffs (acquaintances) of tertiary medical institutions and, accordingly, various advantages
Provision 5. Image or awareness of tertiary medical institutions in Choongbook or other diagnostic areas associated with the appraisal of tertiary medical institutions
Provision 6. Utilization of tertiary medical institutions (time or cost)
Provision 7. Good medical services or strong attraction of good tertiary care centers in other diagnostic areas
Provision 8. Advantage of the online referral
Provision 9. Proximity of the health care sites providing telemedicine
Provision 10. Development of the transportation system (improved accessibility)
Provision 11. Poor distribution of tertiary medical institutions

health care site providing online referrals indicates that a patient's condition requires more advanced diagnostic or treatment tools, these patients have serious and risky illnesses and thus have strong preferences about where to go for treatment. Patients referred to health care sites providing online referrals in Kyunggi were extremely satisfied with their diagnosis and treatment there. One patient who had visited a health care site in Kyunggi returned to the G clinical site. This patient suffers from diabetes and requires regular treatment. Therefore, after finishing treatment of her serious complications in Kyunggi, she returned to the G clinical site.

Major determinants are associated with satisfaction with medical services and high quality of medical services or tertiary care centers. These results are not different from those described above. According to patient interviews, patients have a low opinion of the tertiary medical institution in Choongbook because of its reputation for misdiagnoses and a conservative atmosphere. Additionally, the outside tertiary medical institutions offer various services, such as the online availability to patients of reservation information (i. e., the time and date when a patient is to see a doctor), that lead patients to prefer them over the local tertiary care facility. For example, one patient's mother suddenly passed away because of a misdiagnosis at the tertiary medical institution in Choongbook. In addition, many other patients had received a misdiagnosis in Choongbook, and low opinions about regional health care in Choongbook are predominant. Therefore, patients cannot trust the medical institution in Choongbook anymore and instead seek tertiary medical care elsewhere. Additionally, one patient mentioned that the health care sites providing online referrals in Kyunggi send her information related to her regular medical treatment once a month. Therefore, she prefers these tertiary medical institutions over the local option. In another case, one patient wanted to be referred to the tertiary care site in Kyunggi rather than one closer one in Choongbook for reasons of time and cost. However, the medical institution in Choongbook declined to treat him because they could not understand the medical treatment previously carried out by the health care site providing online referrals in Kyunggi. Hence, the patient now receives treatment regularly at the tertiary care site in Kyunggi and the conservative atmosphere of regional health care is very strong in Choongbook.

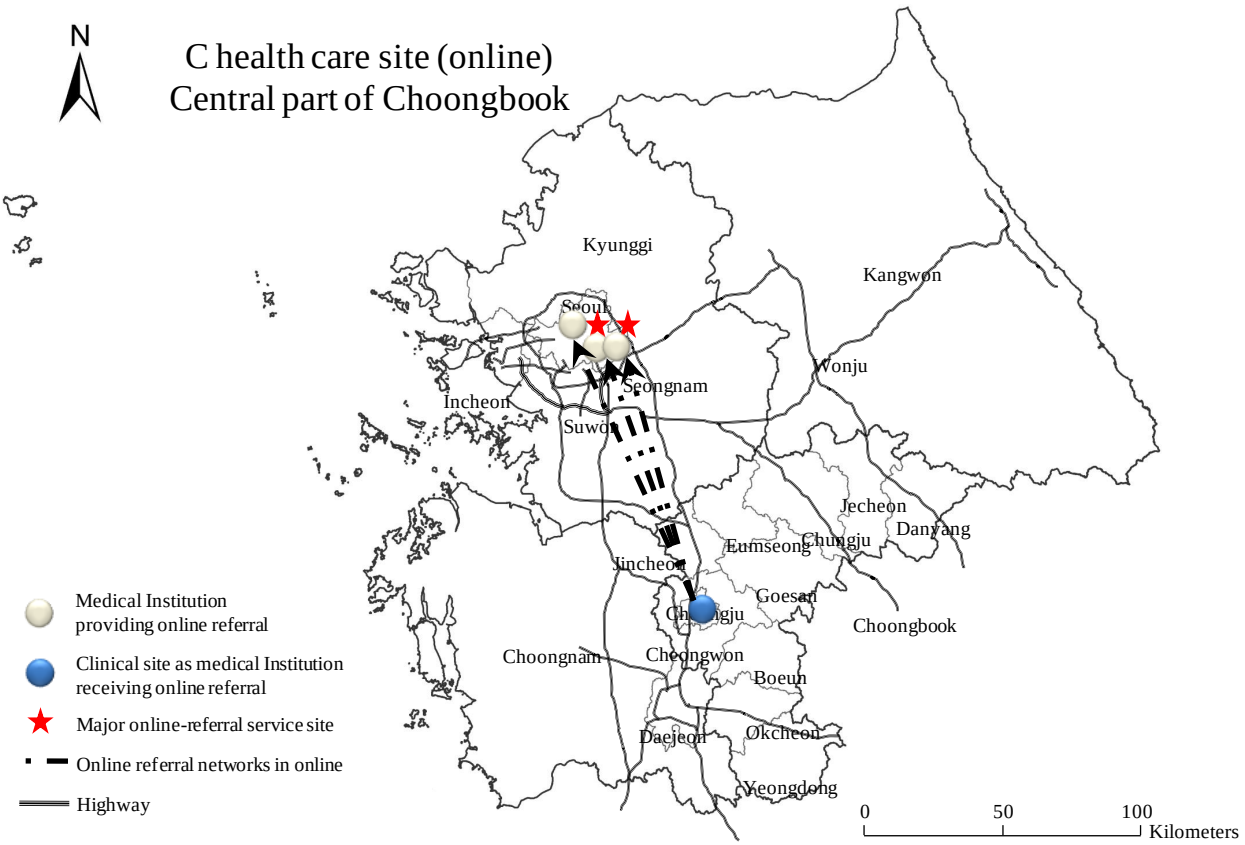
3. 5. 3 From a Perspective of the C Health Care Site Providing Online Referrals

Lastly, the results for a health care site providing online referrals within Choongbook give us more information to consider on online referrals. Various obstacles precluded the interviewing of many members of the medical staff in this medical institution; therefore, one nurse was interviewed with a focus on patients' determinants. According to the interview with the nurse, the C health care site providing online referrals to three health care sites providing online referrals in Kyunggi, in particular, Seoul (Figure 3-7).

Table 3-9. Information on the C health care site providing online referrals as an example of telemedicine networks in the central part of Choongbook

Information	C health care site providing online referrals
Location	Cheongju
Specialty	General hospital
Number of Referrals	20-30 per month
Referral Destinations	3 telemedicine provider sites in Kyunggi
Reasons for choosing this clinical site	• Proper medical treatment (Provision 4) • Patient requests • Judged by telemedicine provider sites

The C health care site providing online referrals itself is one of the largest medical institutions in the region; therefore, patients visit this medical institution and are referred to other medical institutions on average 20-30 times per month. Most patients visiting the C health care site were referred there by primary care physicians, and very serious cases among them are referred to health care sites providing online referrals in Kyunggi. Therefore, it is reasonable that the patients seen at the C health care site are doing poorly and often require high-level medical treatment such as surgery and close monitoring. The C health care site provides online referrals to three health care sites that are known to provide proper medical treatment to their patients. The medical specialists



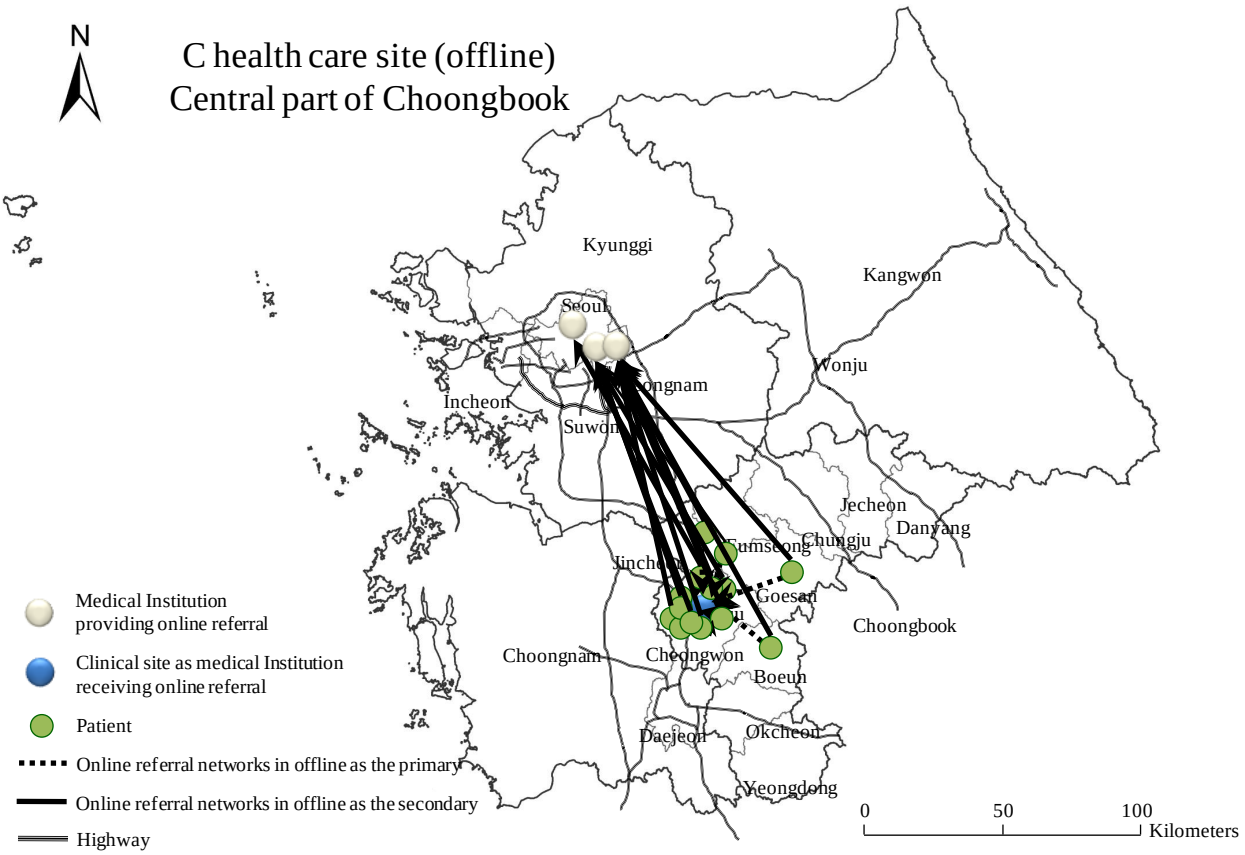


Figure 3-7. Telemedicine networks of the C health care site providing online referrals and their flow from online (top) and offline (bottom)

working at the C health care site providing online referrals can explain to their patients which medical specialists provide good medical treatment. In particular, the three health care sites providing online referrals in Kyunggi are among the top medical institutions in Korea; therefore, it is reasonable both doctors and patients prefer that treatment be carried out at one of these three sites. However, as in the other cases, most patients in Choongbook have a preference for and trust in medical institutions in Kyunggi. Especially, some patients of a high social status do not want to receive medical treatment within Choongbook except in emergency cases although it is difficult for them to access the medical institutions in Kyunggi (Table 3-9).

3. 5. 4 Perspectives of the Patients Referred by the C Health Care Site Providing Online Referrals

As mentioned earlier, the C health care site has a good reputation in regional health care; therefore, many patients are referred from local clinical sites to the C health care site and have visited medical institutions in Kyunggi through online referrals provided by this medical institution. I interviewed fifteen patients. The patients visited this medical institution for treatment of various diseases, such as stroke, cancer, and cardiac disorders. They came from Cheongju, where the C health care site is located, and Boeun and Jincheon on the outskirts of Cheongju. Before being referred to the C health care site, they first sought treatment at their local clinics. At that time, they were referred to the C health care site by the online referral system or traditional methods such as handwritten referrals. Contrary to their expectations, when their conditions were very serious or required immediate surgery, patients were referred straight to tertiary care facilities. To visit the health care sites providing online referrals in Kyunggi, patients spent 120-180 minutes traveling via public or private transportation, and the elderly travel with their families. Patients spent one day there for detailed diagnosis or complete medical examination, but if surgery was necessary, they spent a longer time there for recovery. Most patients finish and their medical treatment in Kyunggi and do not return to medical institutions in Choongbook for further treatment.

I investigated the critical determinants of both patients' choice of a secondary care facility (the

Table 3-10. Information of fifteen patients who have ever been referred by the C health care site providing online referrals

Number	Department and disease	Sex	Location	Year	The first visiting clinical sites	Location of health care sites providing telemedicine	Transportation methods / time (min)	Length of stay	Reply	Frequency (month)	Seriousness	Preference	Satisfaction	Major reasons
1	Internal medicine	F	Goesan	67	Goesan	Kyunggi	Private / 150	1	N	-	S	H	H	1,6
2	Orthopaedic surgery	F	Boeun	40	Boeun	Kyunggi	Private / 180	30	N	1	S	H	H	1
3	General surgery	M	Jincheon	1	Jincheon	Kyunggi	Private / 150	10	N	-	S	H	H	1
4	Internal medicine	F	Jincheon	68	Jincheon	Kyunggi	Private / 150	1	N	1	S	H	H	6
5	Internal medicine	M	Cheongju	47	Cheongju	Kyunggi	Private / 120	1	N	1	S	H	H	1
6	Thoracic surgery	M	Cheongju	62	Cheongju	Kyunggi	Private / 120	14	N	-	S	H	H	1,6
7	Pediatrics	M	Cheongju	9	Cheongju	Kyunggi	Private / 120	7	N	1	S	H	H	6
8	Internal medicine	M	Cheongju	71	Cheongju	Kyunggi	Public / 150	1	N	-	S	H	H	6
9	Internal medicine	F	Cheongju	46	Cheongju	Kyunggi	Private / 120	1	N	0.5	S	H	H	6
10	Internal medicine	M	Cheongju	34	Cheongju	Kyunggi	Private / 120	1	N	1	S	H	H	1,6
11	Orthopedic surgery	F	Cheongju	40	Cheongju	Kyunggi	Private / 120	7	N	-	S	H	H	1
12	Neurology	M	Cheongju	19	Cheongju	Kyunggi	Private / 120	30	N	1	S	H	H	6
13	General surgery	M	Cheongju	66	Cheongju	Kyunggi	Public / 150	3	N	-	S	H	H	6
14	Urology	F	Cheongju	54	Cheongju	Kyunggi	Private / 120	1	N	1	S	H	H	1,6
15	Urology	F	Cheongju	68	Cheongju	Kyunggi	Public / 150	1	N	1	S	H	H	1

Note.
Seriousness – M: Minor, N: Normal, S: Severe / Preference and Satisfaction – H: High, N: Normal, L: Low
Provision 1. Relative seriousness of disease
Provision 2. Satisfaction of medical services
Provision 3. Private preference on tertiary medical institutions without considering seriousness of disease
Provision 4. Private relationships with medical specialists or staffs (acquaintances) of tertiary medical institutions and, accordingly, various advantages
Provision 5. Image or awareness of tertiary medical institutions in Choongbook or other diagnostic areas associated with the appraisal of tertiary medical institutions
Provision 6. Utilization of tertiary medical institutions (time or cost)
Provision 7. Good medical services or strong attraction of good tertiary care centers in other diagnostic areas
Provision 8. Advantage of the online referral
Provision 9. Proximity of the health care sites providing telemedicine
Provision 10. Development of the transportation system (improved accessibility)
Provision 11. Poor distribution of tertiary medical institutions

C health care site providing online referrals) and of online referrals from the C health care site to health care sites providing online referrals in Kyunggi. As stated in Table 3-10, the major determinants of online referrals from local clinical sites to the C health care site providing online referrals are time and cost. Moreover, when patients were referred to the C health care site providing online referrals for the first time, they did not understand the implications of their illness, believing it not to be serious. However, after being given online referrals from the C health care site providing online referrals to one of the three health care sites providing online referrals in Kyunggi, patients considered the level and quality of health care services as the most important aspects of the choice of tertiary care facility. In most cases, patients collected information on which medical institutions to visit for treatment through various media, acquaintances and family members. The results demonstrate that although some patients' medical problems could be treated in the C health care site within Choongbook, they choose to be treated in Kyunggi instead. In most cases, the patients were satisfied with those medical institutions' attractive medical services. Because these tertiary medical institutions are top general hospitals in Korea and are managed by major universities or large companies, they can provide high-quality medical services to patients. In comparison to those medical institutions, the tertiary medical institution in Choongbook operates on a small scale and is the only online referral service site in the area. Accordingly, many patients are more satisfied using the tertiary medical services outside of Choongbook. In addition, patients have a low opinion of the tertiary medical institution in Choongbook because of misdiagnoses and the site's conservative atmosphere, and it is likely that these public sentiments are already widespread in Choongbook.

Chapter 4. Telemedicine Networks in Japan: A Case of Kagawa

4. 1 Overview of Kagawa

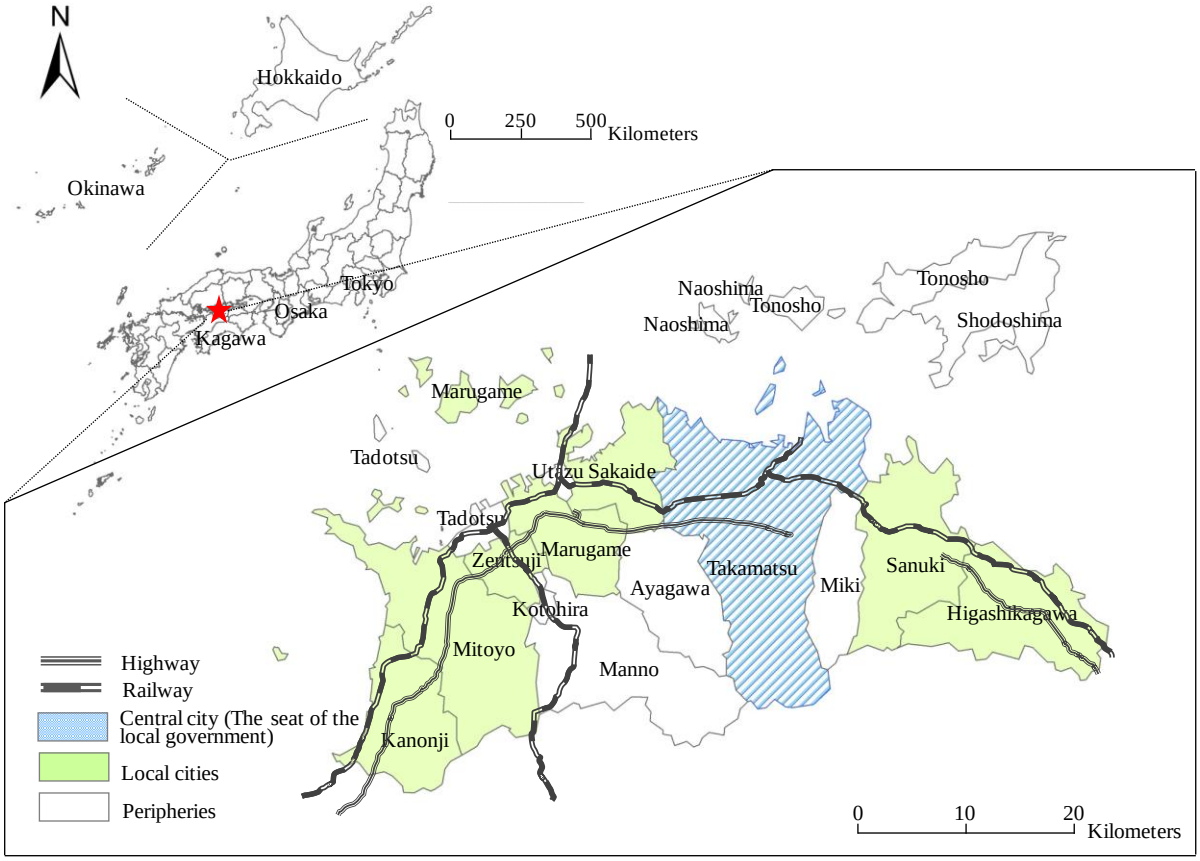


Figure 4-1. The diagnostic areas of Japan and the administrative districts of Kagawa

Kagawa is composed of 8 urban areas and 9 rural areas. Generally, urban areas, including the seat of the local government (Takamatsu), in Kagawa are adequately served with medical institutions (Takamatsu, Marugame, Sakaide, Zentsuji, Kannonji, Sanuki, Higashikagawa and Miyoto), but rural areas in Kagawa have insufficient medical institutions (Tonosho, Shodoshima, Miki, Naoshima, Utazu, Ayagawa, Kotohira, Tadotsu and Manno). Kagawa is close to the larger urban areas of Osaka, Kyoto, Hyogo and Okayama (Figure 4-1).

Table 4-1. Social and medical indices in Kagawa (2008)

Category	Scale (Kagawa/47 diagnostic areas)
Population	773,000 (45/47)
Local Finance According to Revenue (one million yen)	434,538 (45/47)
Medical Institutions	922 (37/47)
Medical Workers	2,531 (37/47)
Medical Institutions per 100,000 people	91.9 (21/47)
Medical Workers per 100,000 people	250.8 (13/47)

Note: One million yen = ~85 USD

Source: National Statistics in 2008

Although the local population and revenue of Kagawa are low compared to all prefectures in Japan, the indices related to medical institutions and medical workers per 100,000 people are approximately average, ranking 21st and 13th, respectively, of 47 prefectures (Table 4-1). Therefore, health care in Kagawa is of high quality at the national level.

4. 2 Comprehensive Telemedicine Networks in Kagawa

Overall, telemedicine networks in Kagawa do not operate outside of Kagawa. By taking a closer look at the flow of telemedicine networks among the regions in Kagawa, we can identify the geographical characteristics of telemedicine with respect to the bidirectional flows of telemedicine

networks. In general, telemedicine networks flow outward in Marugame, Miyoto, Miki and Kotohira in particular, while inflow occurs in Zentsuji. Some outlying medical institutions receiving telemedicine are associated with Kagawa; these medical institutions do not provide diagnoses through telemedicine but are involved in data control. Because the data center in Kagawa is managed by a telecommunications company as well as the management committee of the telemedicine system in Kagawa, which consists of representatives from the Kagawa prefecture government, the Kagawa medical association, and STNet (data control company), telemedicine's focus in Kagawa is on stable regional health care. Its good reputation for information security is acknowledged by many diagnostic areas in Japan, and some medical institutions have asked Kagawa for assistance with data control despite the fact that Kagawa is not directly associated with diagnosis through telemedicine. There have been some experiments in sharing telemedicine services between Kagawa and other diagnostic areas (with the University of Tokyo, Hokkaido University, and other areas in Shikoku), but these have not passed the experimental stage. Because telemedicine technologies are sometimes incompatible, the trial of joint telemedicine services between Kagawa and other diagnostic areas did not attract sufficient medical institutions because of time delays and a lack of profitability. With this in mind, the geographical characteristics of telemedicine networks in Kagawa show decentralization, which means that the telemedicine networks are confined within the potential service areas of tertiary care facilities as determined by medical laws and regulations.

The flow of telemedicine networks in Kagawa is bidirectional, and each direction has unique geographical characteristics (Figure 4-2). Although there is some inflow of telemedicine networks into regions such as Kanonji (130, 4.4%) and Miki (64, 2.2%), most of the inflow of telemedicine networks is into Zentsuji (2,687, 91.5%). Of the eight telemedicine suppliers, three are located in Takamatsu (37.5%), two in Kanonji (25.0%), and one each in Sakaide, Miki, and Zentsuji (12.5% each), which constitute major urban areas in Kagawa, but only the telemedicine supplier in Zentsuji, which does not hold a major position among the eight telemedicine suppliers, operates in Kagawa. institutions receiving telemedicine located in these areas rarely use the Kagawa telemedicine

network. Many medical institutions receiving telemedicine in Kagawa are centralized in Takamatsu (21, 28.4%), Sakaide (8, 10.8%) and Miki and Kanonji (5 and 6.8% each), but the outflow of telemedicine networks in Takamatsu, Sakaide, and Kanonji is minimal. Therefore, there is no direct relation between the number of medical institutions receiving telemedicine and the outflow of telemedicine networks.

On another note, it is interesting to observe that Marugame, Miki, Mitoyo, and Kotohira, which are major regions for the outflow of telemedicine networks, are adequately supplied with medical institutions and medical staff. Generally, telemedicine networks flow out to the rural areas, but the outflow of telemedicine networks within Kagawa does not display this geographical phenomenon. The medical institutions receiving telemedicine consist mainly of general hospitals (12, 19.0%), mid-sized hospitals (20, 31.7%) and clinics (31, 49.2%). The medical department with the most referrals is the internal medicine department (2,552, 86.9%) followed by the surgical, neurology, and radiology departments.

As a result, it is difficult to characterize the flow of telemedicine networks out of Kagawa because most of the telemedicine networks flow into Kagawa, with the exception of some institutions whose main purpose is assistance with data control. There is no clear relationship between the outflow of telemedicine networks and the distribution of institutions demanding telemedicine. Moreover, many institutions demanding telemedicine in urban areas of Kagawa use the Kagawa telemedicine system. Judging from the inflow of telemedicine networks, most of the telemedicine networks flow into Zentsuji. Therefore, geographical characteristics of telemedicine networks in Kagawa are defined by decentralization in conjunction with regionalization. However, geographical characteristics, such as an inadequate number of medical institutions in relation to the inflow or outflow of telemedicine networks, do not determine the flow of telemedicine networks.

It seems that these geographical results come from the utilization characteristics of K-MIX, which are not observed in geographical patterns or characteristics. Moreover, the practical flow of K-MIX among medical institutions is complicated, e.g., some medical institutions receiving telemedicine services play a role as telemedicine suppliers in addition to the eight medical

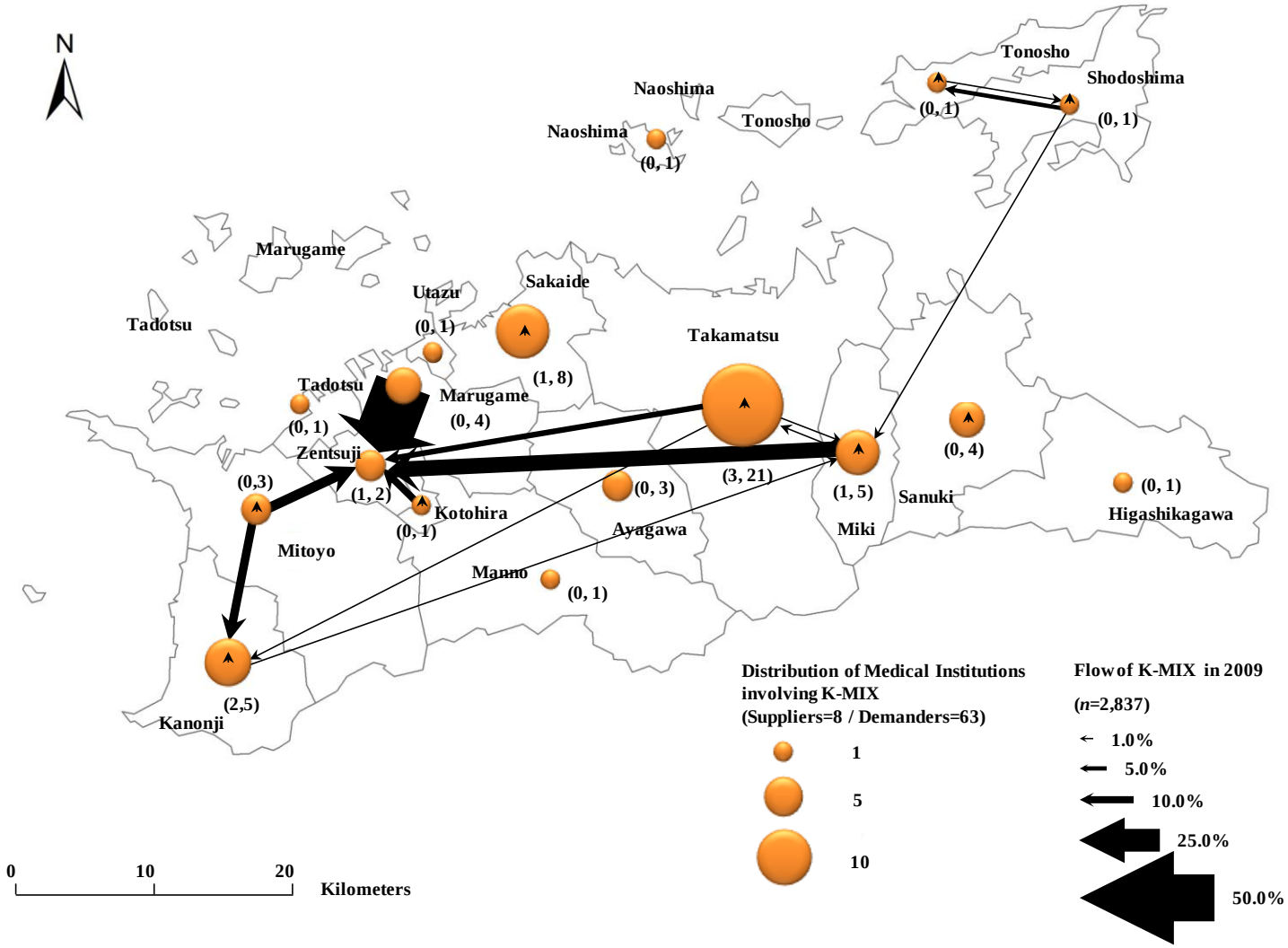


Figure 4-2. Inflow and outflow of telemedicine by regions in Kagawa
Source: Data on 63 medical institutions receiving K-MIX
Note. ▲ indicates when the inflow of telemedicine corresponds with the outflow of telemedicine
(,) means (the number of medical institutions providing K-MIX, the number of medical institutions receiving K-MIX)

institutions providing telemedicine services. Sometimes, core telemedicine suppliers cannot meet the demands of the telemedicine networks because of the internal situations of their own hospitals.

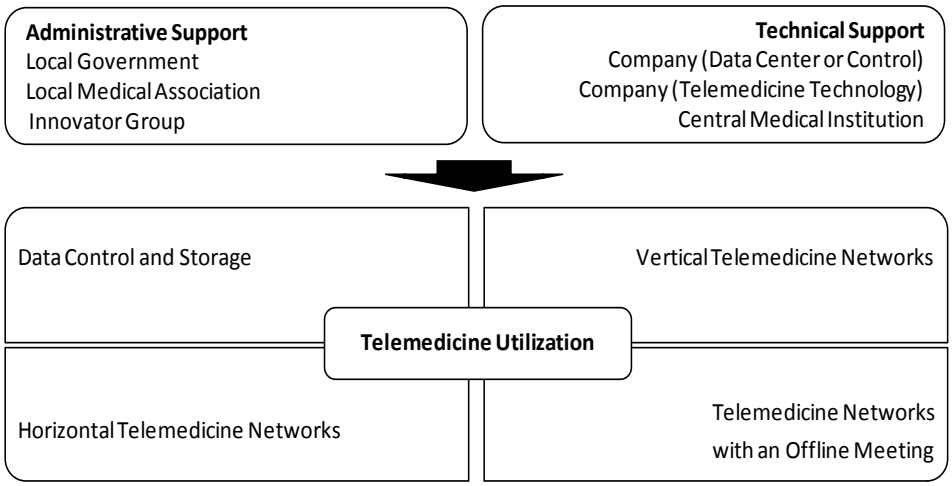


Figure 4-3. Utilization of telemedicine in Kagawa

In practical terms, by examining the detailed processes of K-MIX, the usage of telemedicine in Kagawa can be categorized into four types according to the purpose and function of telemedicine (Figure 4-3): the most important purpose of this telemedicine network is to control and store medical information. The accumulated data is used to exchange medical information among medical institutions or doctors and to document each patient's medical history for diagnostic purposes. Second, telemedicine networks involve vertical relationships between medical institutions providing telemedicine and those receiving telemedicine. In other words, medical institutions centering around clinics, which do not possess specialized medical departments in general, refer to bigger medical institutions for professional advice, i.e., general hospitals or university hospitals that act as telemedicine service providers. By referring to larger medical institutions via the telemedicine system for specialized advice, smaller medical institutions can solve medical problems without requiring that the patient visit the medical institutions that provide telemedicine services. The third reason for the utilization of telemedicine is observed in the horizontal telemedicine networks among medical institutions. Although general hospitals have medical specialists in particular medical departments, if a particular health condition is outside of

their areas of expertise, these hospitals will seek expert advice through the telemedicine system. The last reason for the utilization of the telemedicine system in Kagawa is closely allied with the health of the target population. For example, there is one telemedicine group targeting stroke patients, and a core medical institution providing telemedicine services and treatment facilities (e.g., clinics, rehabilitation centers, care houses) and receiving telemedicine services can use the telemedicine system to share patients' data smoothly. To promote the mutual understanding of the nature and amount of care a patient receives in each facility, medical workers have regular meetings to discuss patients' needs and requests (Hujimoto, 2009; Hayashi, 2010). In Kagawa, the intimate telemedicine relations among doctors and telemedicine council members (participants), and even between medical workers and patients, influences the management of telemedicine considerably. It is likely that such relationships would not be possible if there were no consensus about the operation of telemedicine. The fact that various telemedicine services are offered according to the demands of residents and local health care circumstances is regarded as a chief contributor to successful telemedicine management in Kagawa.

The following section describes specific decision-making processes of telemedicine networks and discusses their determinants concretely in relation to the utilization of K-MIX. To verify the detailed telemedicine mechanism in Kagawa, I selected three medical institutions receiving telemedicine, considering the geographical characteristics of telemedicine networks and the representative telemedicine utilization. In addition, as previously mentioned, the interviewees were selected in cooperation with the telemedicine council and three medical institutions that are major telemedicine users of K-MIX. Therefore, the first investigation focuses on two typical medical institutions receiving telemedicine in Marugame, the mainland of Kagawa, where some telemedicine users use K-MIX frequently: vertical telemedicine networks and telemedicine networks with offline meetings. On the mainland, two main types of K-MIX are used, and it is reasonable that I chose one case for each representative type of K-MIX. In addition, the latter survey is based on the case of Shodoshima, where K-MIX is utilized in horizontal telemedicine networks. In particular, the original purpose of telemedicine in Japan included the support of

Table 4-2. The interviewees of Kagawa

Category		Location	Interviewees (medical staffs)	Interviewees (patients, N)	Patients' Places of Residence (N)	Number and locations of destinations for online referrals (N)	Frequency of online referrals (per month)
Marugame	Vertical telemedicine networks	Marugame	Doctor/director of the hospital and medical staff	9	Marugame (7) Kotohira (1) Sakaide (1)	Marugame (1) Zentsuji (1)	150
	Telemedicine networks with an offline meeting	Marugame	Doctor/director of the hospital and medical staff	6	Marugame (4) Manno (1) Tadotsu (1)	Mitoyo (2) Marugame (2)	20-25
Shodoshima	Horizontal telemedicine networks	Shodoshima	Doctor/director of the hospital and medical staff	10	Tonosho (4) Shodoshima (6)	Shodoshima (1) Miki (1)	30

isolated areas; therefore, the case of Shodoshima could illustrate not only the utilization of K-MIX in horizontal telemedicine networks but also, indirectly, the original intention of telemedicine. By examining three cases in Kagawa, we may come to understand why the distribution of medical institutions involved in telemedicine networks corresponds to the net inflow or outflow of telemedicine networks or how telemedicine operations are conducted by telemedicine participants individually. Moreover, in the same manner used with the Korean telemedicine networks, I express the results in terms of online and offline flows. K-MIX aims to deliver medical records to high-level or collaborative medical institutions in the cases of vertical or horizontal telemedicine networks. In these cases, the online flow entails the transmission of medical records from medical institutions receiving telemedicine to those providing telemedicine. The offline dimension is defined as patients' travel from their homes to seek treatment. Moreover, the telemedicine networks holding offline meetings allowed us to observe the other side of K-MIX. This form of utilization is based on sharing patients' medical records among medical facilities in the context of online referrals. In this case, the online flow means the interchange of medical information between the K general hospital and related facilities; the offline side refers to travel by patients to visit the K general hospital and from the K general hospital to related facilities. In this chapter, telemedicine networks for data control and storage are utilized within one health care site; this case was considered an exception because there was no occurrence of telemedicine networks (Table 4-2).

4. 3 Telemedicine Networks in Marugame as an Example for the Mainland

The geographical characteristics of telemedicine networks indicate that many telemedicine networks exist in Marugame. The representative usage of K-MIX as a vertical telemedicine network could be observed at the M clinical site, and telemedicine networks' meeting offline for the treatment of stroke was observed at the K general hospital. Vertical telemedicine networks are common among medical institutions involving telemedicine networks and are used to deliver medical information to specialists for consultation. The case of the K general hospital serves as an example of how telemedicine networks can be integrated with existing regional health care

meetings for the treatment of a specialized illness.

4. 3. 1 From a Perspective of the M Clinical Site

Vertical telemedicine networks including medical institutions providing telemedicine and those receiving telemedicine are common in Kagawa. To understand the characteristics of vertical telemedicine networks, I focused on the case of one medical institution and characterized its online and offline telemedicine networks (Figure 4-4). Online means how medical institutions receiving telemedicine refer medical records to medical institutions providing telemedicine. Offline refers to how patients visit medical institutions receiving telemedicine.

This medical institution possesses CT and MRI facilities but has no radiologist on staff. Therefore, this medical institution refers its medical images to larger medical institutions that provide telemedicine. Telemedicine networks depend on the mutual understanding between physicians at the M clinical site and medical specialists in the larger medical institutions. Before using this system supported by the telemedicine council in Kagawa, this clinical site sent its medical images to a company specializing in teleradiology. However, this service was expensive, and there was no method of obtaining a second opinion. One of the members of the telemedicine council suggested that the clinic utilize the telemedicine system, and it started referring medical images to the larger medical institutions. However, most of the medical institutions providing telemedicine are affiliated with tertiary medical institutions in Kagawa and are very busy taking care of their own inpatients and outpatients. Therefore, it was at times difficult to obtain a consensus between medical specialists in the larger medical institutions and the physicians at the M clinical site. This problem arrived at an amicable settlement through human networks. One medical specialist, who now works at the larger medical institution, previously worked at the M clinical site and promised that he would represent them in the meeting of the medical association in Kagawa. Today, this clinical site utilizes this telemedicine system at cheap prices and is satisfied with the high-level diagnoses obtained via the online system. Before this system was used, physicians at the M clinical site referred their patients to those larger medical institutions that now provide them with

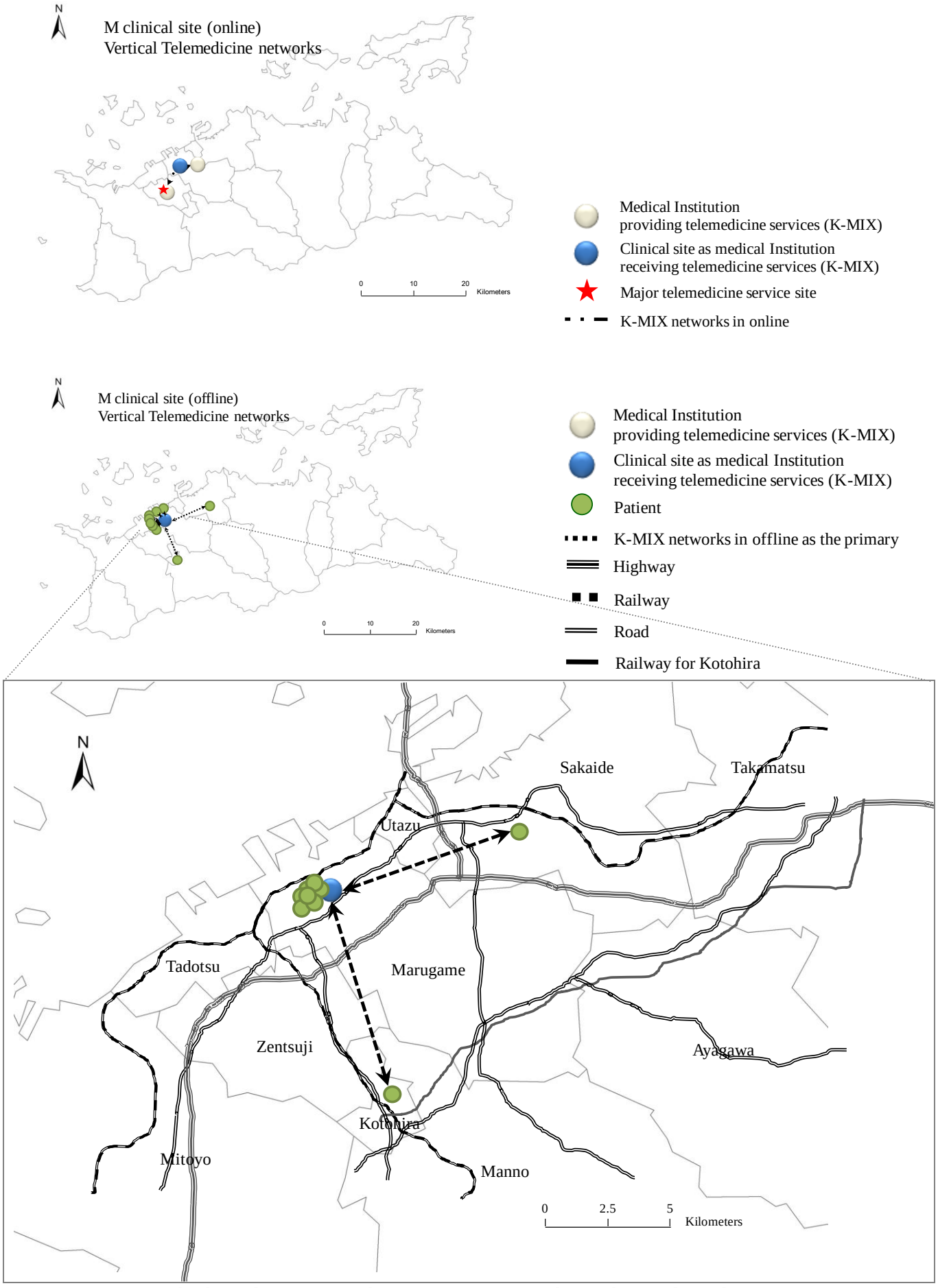


Figure 4-4. Vertical telemedicine networks in Marugame involving the M clinical site

Table 4-3. Information on the M clinical site

Information	M clinical site
Location	Marugame
Specialty	Internal medicine
Referral Numbers	150 per month
Satisfaction	High
Referral Destinations	2 telemedicine providers within Kagawa: • Marugame • Zentsuji
Determinants for operating telemedicine	• Proper diagnosis by medical specialists, in particular, interpreting medical images such as MRI and CT (Provision 4) • Cheap compared to another telemedicine system supported by telemedicine companies (Provision 5) • Private relationships among doctors (Provision 1) • Suggestion of an innovator group (Provision 1)
Countermeasures	• Referring patients to tertiary care centers (related to provision 6) • Visits to this clinical site by medical specialists (related to provision 6)
Reasons for establishment	• Understanding among doctors (related to Provision 1) • Support from the telemedicine council, in particular, an innovator group (related to Provision 1)

Note.
Provision 1. Private relationships with medical specialists or staffs (acquaintances) of the health care sites providing telemedicine
Provision 2. Promotion of their own medical institutions' images through telemedicine networks with the health care sites providing telemedicine
Provision 3. Various advantages via telemedicine networks with the health care sites providing telemedicine such as the priority of diagnosis, medical training, etc.
Provision 4. Good medical services and satisfaction of medical services of the health care sites providing telemedicine
Provision 5. Advantage of the telemedicine system itself, when diagnosing patients. For example, saving burden of patients' accessibility to or utilization of the health care sites providing telemedicine and keeping continual diagnosis for the occasion that patients come back from the health care sites providing telemedicine
Provision 6. Proximity of the health care sites providing telemedicine

telemedicine support. On average, they refer medical images to telemedicine providers for decoding 150 times a month. In most cases, one transmission per patient is sufficient for a diagnosis. If it is difficult to determine the complete diagnosis via the telemedicine system, the physician sends the patient to the larger medical institution for testing. By referring simple cases to the larger medical institutions via the telemedicine system, this clinical site can solve medical problems on the spot without any need for the patient to travel to the larger institutions. If a patient has a medical condition that requires a thorough examination at one of the larger medical institutions, physicians can send transmit the patient's medical records through this telemedicine system or request that medical specialists visit this clinical site. This system allows medical specialists to avoid making unnecessary trips to Kagawa. Such mutual consent is characteristic of vertical telemedicine networks. As stated earlier, there are some limitations to the extent to which telemedicine networks affiliated with major tertiary medical institutions as telemedicine providers can devote time to patients in Kagawa because of the overflow of patients in those medical institutions themselves. The physician who was interviewed pointed out that this problem represents an area for future improvement in regional health care (Table 4-3). However, because the K-MIX system is supportive, but not indispensable, and because there are alternative ways of having diagnostic images interpreted without using this system, the medical staff of the M clinical site agreed that the K-MIX system is convenient but is not an absolute necessity. Moreover, collaboration among medical institutions is a practical consideration for the K-MIX system. At present, the M clinical site is satisfied with the utilization of K-MIX for teleradiology, but physicians pointed out the extension of telemedicine networks to core tertiary care centers as one way of improving the network's utility in the future.

4. 3. 2 Perspectives of Patients Referred by the M Clinical Site

According to the patients referred by the M clinical site, most of the patients there have been treated by physicians in this medical institution for a long time; most live within 30 minutes of the clinic (Table 4-4). In particular, many patients are elderly, and there is a strong mutual

Table 4-4. Information of nine patients who have ever been referred by the M clinical site

Name of hospital	Referral frequency	Age	Sex	Transportation time (Min)	Residence	Medical institution providing telemedicine	Disease	Frequency	Length of stay (days)
M clinical site	150/Month	67	M	15	Marugame	Kagawa Rosai	Cancer	1	0
		73	M	15	Marugame	Kagawa Rosai	Tumor	1	0
		68	M	20	Marugame	Kagawa Rosai	Tumor	1	0
		74	F	15	Marugame	Zentsuji	Skin disease	1	0
		75	F	30	Kotohira	Kagawa Rosai	Cancer	1	0
		82	F	15	Marugame	Kagawa Rosai	Cancer	1	0
		75	M	25	Sakaide	Kagawa Rosai	Cancer	1	0
		63	M	10	Marugame	Kagawa Rosai	Cancer	1	0
		39	M	10	Marugame	Kagawa Rosai	Cancer	1	0

understanding between the physicians and patients at this clinical site. For example, physicians understand each patient's life situation, such as family and social status; therefore, it is easy to get their consent about telemedicine. In addition, patients trust their physicians owing to their long-standing relationship and understand that they can seek treatment at other medical institutions directly if they cannot solve their problems in this clinical site. Regardless of the presence of telemedicine networks, the health care delivery system in Kagawa was designed to avoid a situation in which all patients must access one diagnostic area (Kagawa), and naturally, patients' awareness about regional health care influences telemedicine networks. K-MIX is mostly used for interpreting diagnostic images from CT or MRI; patients' medical records are referred for telemedicine by the M clinical site when the physicians in the M clinical site suspect a diagnosis of cancer or tumor. In addition, if a health problem cannot be treated at the M clinical site, patients may seek treatment at other medical institutions. On the other hand, some patients continue medical treatment at the M clinical site based on medical specialists' diagnosis performed via K-MIX. Diagnosis via K-MIX required only one referral in all cases, and the patients were not required to stay overnight at a medical facility.

4. 3. 3 From a Perspective of the K General Hospital

The second form of utilization of the telemedicine system in Kagawa is closely allied with the care of a target population, and the K general hospital in Marugame, Kagawa, provides a good example of this use (Figure 4-5). Before the current system was developed, there was one telemedicine group targeting stroke in Kagawa, and doctors of the K general hospital, a core health care supplier for stroke patients, and medical staffs of related medical facilities met regularly. A core medical institution providing telemedicine services (the K general hospital) and associated facilities receiving telemedicine services started using the telemedicine system to share patients' data in 2002.

According to the legislation governing medical care in Japan, patients cannot stay in one medical institution for more than 70 days except in special cases and at substantial expense. But in

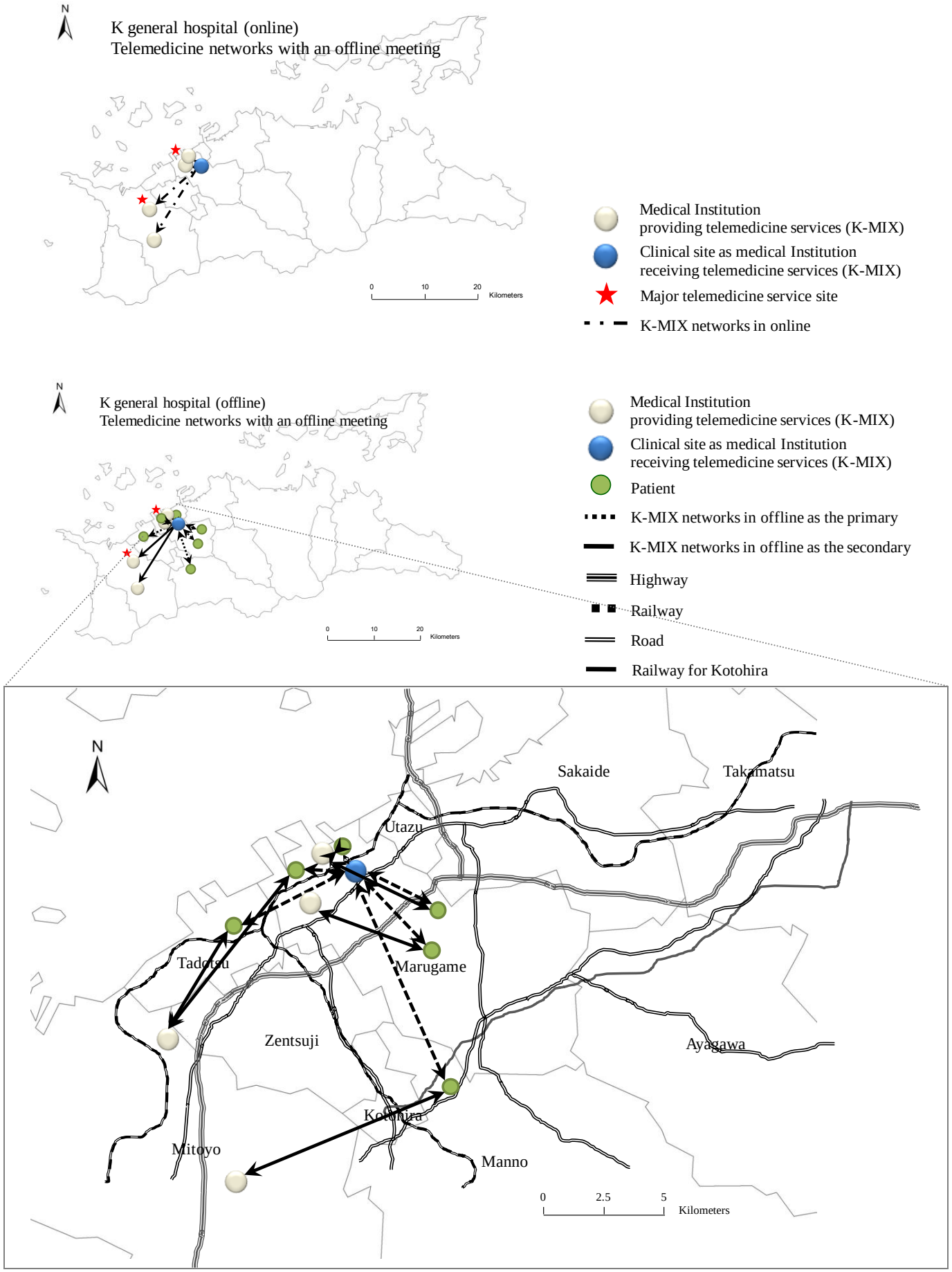


Figure 4-5. Telemedicine networks in Marugame holding an offline meeting through the K general hospital

general, stroke patients have not recovered within 70 days. For this reason, a core medical institution providing telemedicine services and associated facilities receiving telemedicine services started collaborating with each other via the telemedicine system. Moreover, stroke is associated with the risk of complications such as fracture and additional stroke. In other words, patients receive medical treatment for the first 70 days in the medical institution providing telemedicine services. After 70 days, doctors in the K general hospital and patients choose the next medical institution at which they will be treated according to their health condition, medical treatment, medical institutions' location, and other considerations. Before the development of the current telemedicine system, although meetings about stroke treatment were held, participants suffered because of the difficulty of transmitting medical records between facilities.

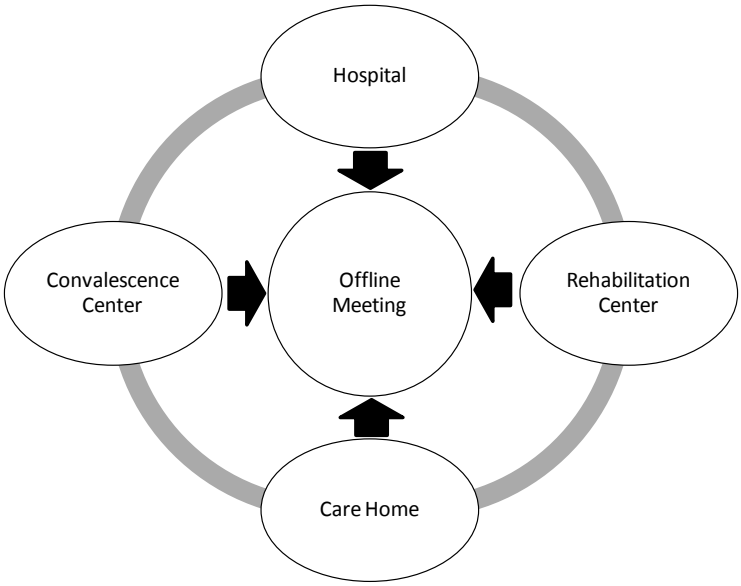


Figure 4-6. Telemedicine network mechanism with an offline meeting

To promote a mutual understanding of how much patients are covered in each facility and of what medical treatment patients need, physicians hold regular meetings with patients to discuss their needs and requests (Hujimoto, 2009; Hayashi et al., 2010). Patients decide on the medical institution where they wish to be treated, and the telemedicine network that will be involved depends on their choice. Because most of the patients suffer from stroke and need continual medical treatment and rehabilitation in other medical institutions, rehabilitation centers,

Table 4-5. Information on the K general hospital

Information	K general hospital
Location	Marugame
Specialty	General hospital for stroke patients
Referral Numbers	20-25 per month
Satisfaction	High
Referral Destinations	4 telemedicine receiving sites within Kagawa: • Mitoyo • Marugame
Determinants for operating telemedicine	• Proper medical treatment, in particular, sending and receiving medical records (Provision 4 and 5) • Human relationships among doctors of this medical institution and related facilities (Provision 1) • Suggestion of the telemedicine council (Provision 1)
Countermeasures	• The K general hospital plays a role as a health care site providing K-MIX. Therefore, other facilities related to the K general hospital through K-MIX send their patients to this medical institution.
Reasons for establishment	• Understanding among doctors (related to Provision 1) • Support by the telemedicine council, in particular, an innovator group (related to Provision 1)

Note.
Provision 1. Private relationships with medical specialists or staffs (acquaintances) of the health care sites providing telemedicine
Provision 2. Promotion of their own medical institutions' images through telemedicine networks with the health care sites providing telemedicine
Provision 3. Various advantages via telemedicine networks with the health care sites providing telemedicine such as the priority of diagnosis, medical training, etc.
Provision 4. Good medical services and satisfaction of medical services of the health care sites providing telemedicine
Provision 5. Advantage of the telemedicine system itself, when diagnosing patients. For example, saving burden of patients' accessibility to or utilization of the health care sites providing telemedicine and keeping continual diagnosis for the occasion that patients come back from the health care sites providing telemedicine
Provision 6. Proximity of the health care sites providing telemedicine

convalescence centers, and care homes, they choose nearby medical institutions whenever possible (Figure 4-6). On average, the K general hospital uses this system 20-25 times a month (Table 4-5).

Figure 4-7. An offline meeting in the K general hospital

This medical institution plays a role as a telemedicine supplier involving offline meetings with associated facilities for stroke, such as other medical institutions, rehabilitation centers, convalescence centers, and care homes. The hospital is associated with four medical institutions located in Mitoyo and Marugame that are part of telemedicine networks in K-MIX, and its relations with other facilities are fluid depending on what other facilities join the networks. Before this system was first established, the director of the K general hospital already led a special meeting for stroke treatment with medical staff in associated facilities. When seeking proper transmission methods, one member of the telemedicine council suggested the use of K-MIX with this meeting. The members of the network have utilized this system along with offline meetings regularly. The biggest consideration governing the use of this system is not only the utility of K-MIX, but the

extent to which the existing medical institutions involved in this offline meeting can guarantee high-quality medical treatment. Therefore, it is reasonable that this system, which is regarded as one of the best online delivery methods, has achieved a dominant position in the K general hospital and related facilities (Figure 4-7).

4. 3. 4 Perspectives of Patients Referred by the K General Hospital

The patients have the following characteristics: first, although all patients had been treated, most of them required continued medical treatment or rehabilitation. Second, stroke patients are likely to return to medical institutions because of complications such as fracture and cerebral hemorrhage. Patients' medical records, therefore, must be delivered via K-MIX. For example, the patients who were interviewed for this research had been hospitalized in a core general hospital and underwent surgery and rehabilitation for their disease. Some of them stayed in this medical institution for 70 days or less, but the rest continued medical treatment in this medical institution beyond 70 days despite the financial burden. They were all then referred to a second medical institution or to a rehabilitation center according to their access to or utilization of medical institutions and proper medical treatment. At that time, doctors in this medical institution transmitted the patients' medical records to medical staff of one telemedicine group targeting stroke, and doctors gave information on facilities to the patients or patients requested information on proper facilities from their doctors (Table 4-6).

Table 4-6. Information of six patients who have ever been referred by the K general hospital

Name of hospital	Referral frequency	Age	Sex	Transportation time (Min)	Residence	Medical institution providing telemedicine	Disease	Frequency	Length of stay (days)
K general hospital	20-25/Month	40s	M	20	Marugame	Nishikagawa	Stroke	1	114
		80s	M	45	Manno	Hashimoto	Stroke	1	103
		70s	M	15	Marugame	Yoshida	Stroke	1	70
		70s	F	30	Tadotsu	Nishikagawa	Stroke	1	89
		50s	M	20	Marugame	Tamura	Stroke	1	44
		80s	F	15	Marugame	Yoshida	Stroke	1	2

4. 4 Telemedicine Networks in Shodoshima as an Example of an Island

4. 4. 1 From a Perspective of the U General Hospital

The third form of utilization of telemedicine is observed in horizontal telemedicine networks among medical institutions (Figure 4-8). Although general hospitals have medical specialists in particular medical departments, when a patient's condition is outside of their areas of specialization, general hospitals seek expert advice through the horizontal telemedicine system.

One major general hospital located in Shodoshima, Kagawa, utilizes this telemedicine system mainly for referring the results of ophthalmic disease diagnostic tests to other medical institutions. Their telemedicine networks are based on mutual trust among doctors. Before creating this telemedicine system, the utilization of this telemedicine system was suggested to the director of U general hospital by one of the members of the telemedicine council in Kagawa. This general hospital is located in Shodoshima, which is one of the biggest islands in Kagawa, and it takes one hour to one hour and a half to access the mainland of Kagawa. This council member had worked at this general hospital and thus already understood this area's health care situation intimately. Therefore, the suggestion was very natural and was the impetus for creating the telemedicine networks. However, U general hospital found it difficult to find appropriate and cooperative medical institutions to become members. At that time, another general hospital located on the same island reached an agreement to collaborate with U general hospital via the telemedicine system, and the collaboration continues today. Recently, the director of U general hospital has been preparing to apply telemedicine to other health care services, such as medical treatment for the elderly, and there are plans to extend the utilization of this telemedicine system more widely.

Basically, the diagnosis takes place within the telemedicine system, and doctors make an effort not to require that the patient visit additional medical institutions. In practice, U general hospital is one of the largest general hospitals; therefore, most medical problems can be solved there. In addition, there is a strong consensus among doctors that they wish to minimize the burdens of travel on patients as much as possible.

In cases where a diagnosis cannot be made via telemedicine, medical specialists from medical

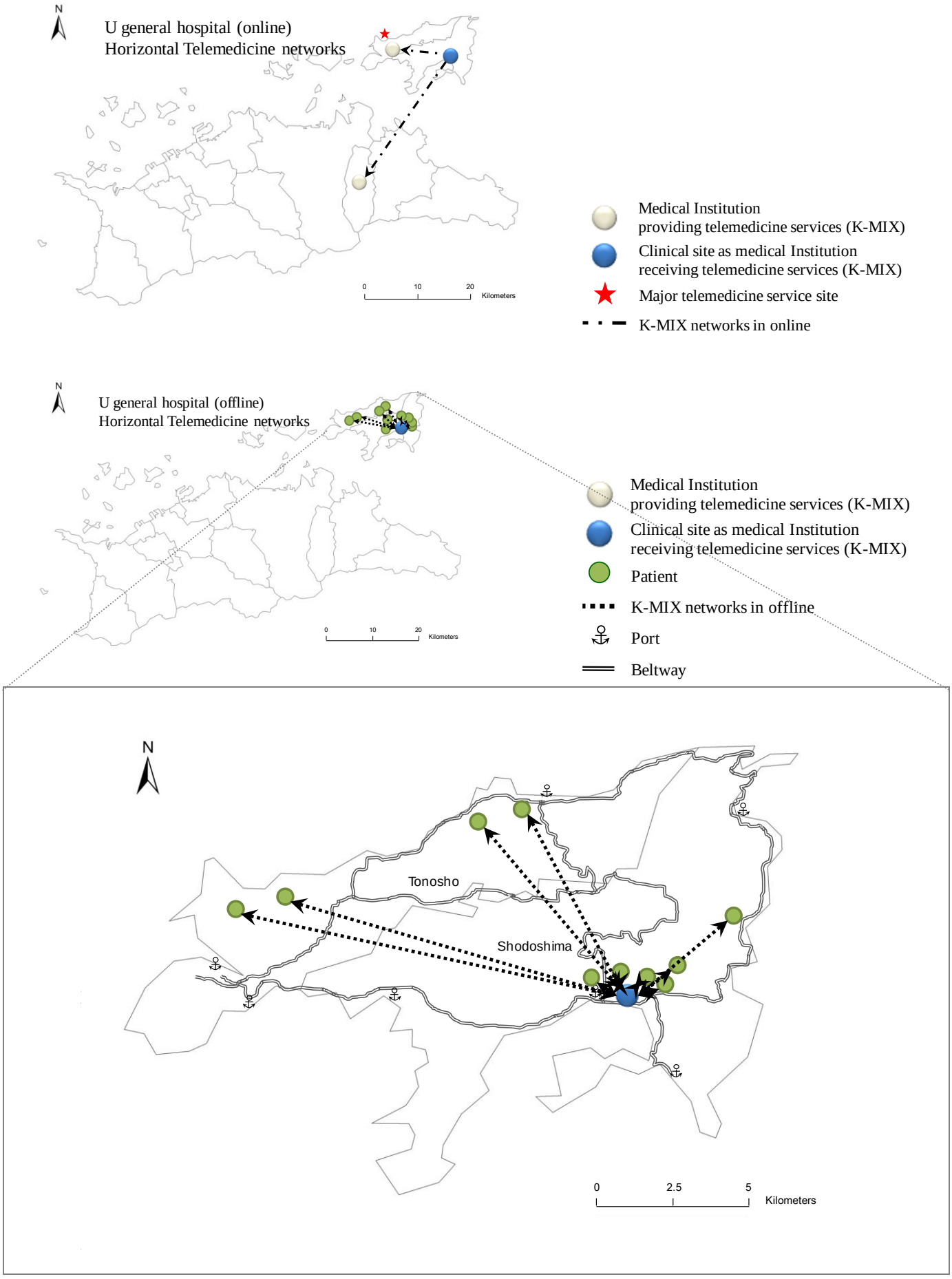


Figure 4-8. Horizontal telemedicine networks in Shodoshima through U general hospital

Table 4-7. Information on the U general hospital

Information	U general hospital
Location	Shodoshima
Specialty	Ophthalmology
Number of Referrals	30 per month
Satisfaction	High
Referral Destinations	2 telemedicine provider sites within Kagawa: • Shodoshima • Miki
Determinants for operating telemedicine	• Proper medical treatment, in particular, diagnosis by medical specialists as complementary telemedicine networks (Provision 4 and 5) • Human relationships among doctors (Provision 1) • Suggestion of an innovator group (Provision 1) • Advantage of the telemedicine system (Provision 6)
Countermeasures	• Referring patients to tertiary care centers (related to provision 6) • Visits by medical specialists to this medical institution • Transporting patients by helicopter or ship in an emergency
Reasons for establishment	• Understanding among doctors (related to Provision 1) • Support by the telemedicine council, in particular, an innovator group (related to Provision 1)

Note.
Provision 1. Private relationships with medical specialists or staffs (acquaintances) of the health care sites providing telemedicine
Provision 2. Promotion of their own medical institutions' images through telemedicine networks with the health care sites providing telemedicine
Provision 3. Various advantages via telemedicine networks with the health care sites providing telemedicine such as the priority of diagnosis, medical training, etc.
Provision 4. Good medical services and satisfaction of medical services of the health care sites providing telemedicine
Provision 5. Advantage of the telemedicine system itself, when diagnosing patients. For example, saving burden of patients' accessibility to or utilization of the health care sites providing telemedicine and keeping continual diagnosis for the occasion that patients come back from the health care sites providing telemedicine
Provision 6. Proximity of the health care sites providing telemedicine

institutions providing telemedicine visit U general hospital and diagnose them directly. When starting the telemedicine network, the director of this general hospital considered easy accessibility and utilization of medical institutions to be an important prerequisite for advising to go to other medical institutions, and the present medical institutions providing telemedicine were designated with regard to these considerations (Table 4-7). Further, the U general hospital plans to begin using K-MIX within the visiting nurse system because many elderly live on this island. This system is being tested by doctors in the U general hospital, supported by the telemedicine council, and practical use will begin soon. Those medical institutions providing telemedicine that are associated with the U general hospital guarantee a valid diagnosis. Moreover, before beginning to use K-MIX, doctors in the U general hospital referred their patients to the same medical institutions that now provide telemedicine. Accordingly, the quality of medical treatment and diagnosis is an important determinant of which facilities become telemedicine providers (Figure 4-9).

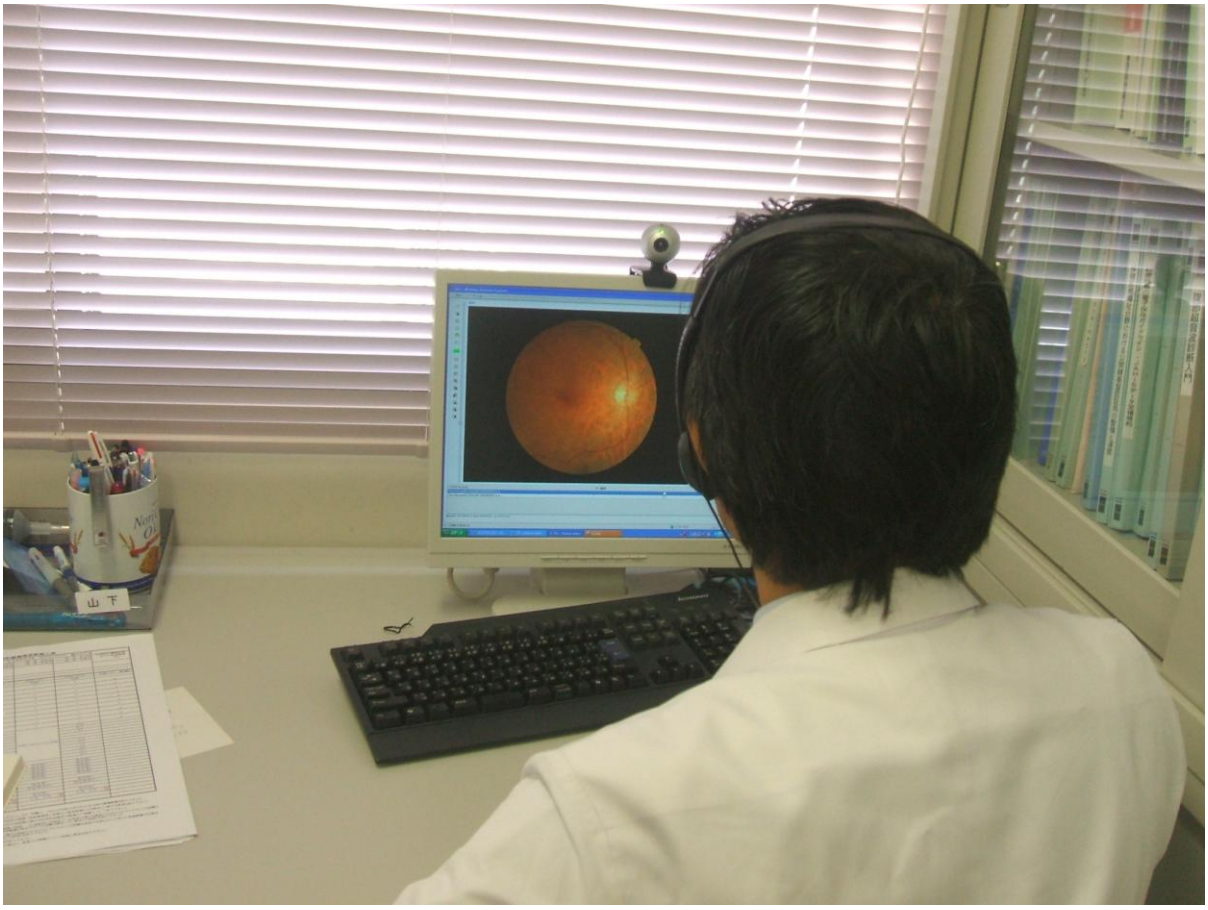


Figure 4-9. Diagnosis through the telemedicine system in the U general hospital

4. 4. 2 Perspectives of the Patients Referred by the U General Hospital

Most of the patients had been treated at this hospital as inpatients or outpatients for a long time and had a deep mutual understanding with the medical staff there (Table 4-8). Many patients acknowledge the convenience of the telemedicine system and support its use. Especially because this medical institution is located on a distant island, patients must spend considerable time and money to visit other medical institutions. Therefore, collaboration via the telemedicine networks is acceptable to patients. In addition, although accessibility to or utilization of other medical institutions is not easy, there are alternative methods of seeking a diagnosis from a specialist, such as visiting medical treatment or transporting patients by helicopter. Mostly, patients, who suffered from cancer or required a medical checkup were referred to Kagawa University Hospital, and ophthalmic disease patients were referred to Tonosho Central Hospital. U general hospital's primary use of K-MIX is to diagnose ophthalmic disease, and one referral is generally sufficient.

Table 4-8. Information of ten patients who have ever been referred by the U general hospital

Name of hospital	Referral frequency	Age	Sex	Transportation time (Min)	Residence	Medical institution providing telemedicine	Disease	Frequency	Length of stay (days)
U general hospital	30/Month	65	M	40	Tonosho	Kagawa University	Cancer	1	0
		85	M	15	Shodoshima	Kagawa University	Cancer	1	0
		79	F	45	Tonosho	Kagawa University	Cancer	1	0
		46	M	10	Shodoshima	Kagawa University	Medical checkup	1	0
		54	M	15	Shodoshima	Tonosho Central	Ophthalmic disease	1	0
		65	F	20	Shodoshima	Tonosho Central	Ophthalmic disease	1	0
		66	M	50	Tonosho	Tonosho Central	Ophthalmic disease	1	0
		57	F	15	Shodoshima	Tonosho Central	Ophthalmic disease	1	0
		53	M	15	Shodoshima	Tonosho Central	Ophthalmic disease	1	0
		68	F	40	Tonosho	Tonosho Central	Ophthalmic disease	1	0

Chapter 5. Geographical Characteristics of Telemedicine Networks in Korea and Japan

5. 1 Telemedicine Networks and Determinants in Choongbook and Kagawa

First of all, the results for the case of Choongbook can be summed up as follows: on the whole, the online referral networks that occur in clinical sites as medical institutions receiving online referrals largely flow into Kyunggi, to medical institutions providing online referrals in Choongbook itself, to Choongnam and to Kangwon in order of preference by doctors and patients. Also, the interview results indicated that patients who suffer from various levels of illness choose tertiary medical institutions outside of Choongbook over those in the area.

According to the interviews with doctors, the primary determinant of online referrals is proper medical treatment, but the requests of patients are also one of the major reasons why doctors refer their patients to health care sites providing online referrals in Kyunggi. In other words, when choosing a health care site to which to refer a patient, the decision depends significantly on patients' preferences and wishes, especially given the costs of traveling to medical institutions providing online referrals. Health care services themselves are the most important consideration among patients. Some doctors utilize the online referral networks exclusively for the purpose of promoting their clinical site's image and attracting patients to their own clinical site in the

competitive health care market in Korea. In addition, the internal rules of health care sites providing online referrals include various parameters: a certain clinical site refers its patients to several appointed health care sites providing online referrals to maintain the online referral network. On some occasions, online referrals are used for support of diagnosis or medical training by health care sites providing online referrals. Finally, additional influences affect doctors' preferences, but no salient factors related to online referrals' technology or related convenience and utility were observed.

As pointed out previously, patients have a strong tendency to prefer health care sites providing online referrals located outside of Choongbook. Given the determinants of their choices, it is clear why many patients want to be referred to outside health care sites. Personal attributes that inform their health care decisions include the relative severity of their disease and their personal satisfaction with the health care sites. Patients also reported that they were dissatisfied with regional health care in terms of the misdiagnosis rate and the conservative medical atmosphere in Choongbook, a point that is relevant as part of the social and medical elements of this study. Lastly, geographic characteristics such as a poor distribution of tertiary medical institutions as online referral service sites and the lack of strong restrictions of the accessibility to online referral service sites also support the patients' preference to visit online referral sites outside of Choongbook. Though the online referral system associated with regional health care in Korea is regarded as an innovative device for the delivery of medical care via telecommunications technology, patients prefer online referrals not for their technological value, convenience, and original purpose, but rather because they are dissatisfied with regional treatment centers. Some patients who were referred by the C health care site providing online referrals within Choongbook went to medical institutions providing online referrals outside of Choongbook at least once for treatment, whether because of dissatisfaction with the care available locally or for other reasons, demonstrating that the relative severity of a patient's condition and the quality of medical services were considerations when patients chose secondary medical institutions (Table 5-1). Similar reasons are observed for the selection of medical institutions providing online referrals in Choongnam and Kangwon.

Table 5-1. Summary of the determinants mentioned by physicians and patients in Choongbook

			Location of medical institution providing online referrals			
			Choongbook	**Choongnam**	**Kangwon**	**Kyunggi**
Southern Choongbook (J clinical site)	**Medical staff**		-	Proper medical treatment Patients' requests	-	Proper medical treatment Patients' requests
	Patients		-	-	-	Satisfaction Image and awareness Good medical services
Eastern Choongbook (Y clinical site)	**Medical staff**		-	-	Proper medical treatment Patients' requests	Proper medical treatment Patients' requests
	Patients		-	-	Utilization (time and cost) Good medical services	Satisfaction Private preference Good medical services
Central Choongbook	**Clinical site (G clinical site)**	**Medical staff**	-	-	-	Proper medical treatment Patients' requests Private relationships Improvement of the clinic's image through telemedicine
		Patients	-	-	-	Relative severity (serious cases) Satisfaction Good medical services
	Health care site providing online referrals (C health care site)	**Medical staff**	-	-	-	Proper medical treatment Patients' requests
		Patients	Relative severity (minor cases) Utilization (time and cost)	-	-	Relative severity (serious cases) Satisfaction Private preference Good medical services

Although those areas are not located within the same diagnostic area (Choongbook), the accessibility of medical institutions providing online referrals in Choongnam and Kangwon is good in terms of time and cost; moreover, those medical institutions can guarantee high-quality health care services. Therefore, many residents of the southern and eastern parts of Choongbook viewed those medical institutions as their preferred tertiary care centers instead of those within Choongbook[6]. But without good health care services, patients cannot choose medical institutions providing online referrals regardless of their location because the quality of care is the most important consideration. Overall, few patients return to the clinical sites where they initially sought treatment; most continue or finish their medical treatment in medical institutions providing online referrals located outside of Choongbook. Therefore, the online referral system has degenerated into a form of one-way transmission, counter to its original purpose.

The development of telemedicine in Kagawa, Japan, took place within a regional-based health care delivery system with regard to the medical laws and regulations associated with regionalization. Moreover, the original purpose of K-MIX was to promote stable regional health care. Within this coincidence of various interests, K-MIX was realized within Kagawa for its residents. Almost all of the telemedicine networks in Kagawa are fully contained within the region. However, there is no correlation between the number of medical institutions providing or receiving K-MIX and the flow of the telemedicine networks via K-MIX. It may be that the usage of K-MIX depends on the conditions of each medical institution and its supportive circumstances with regard to human networks.

On the basis of human networks and mutual agreement, K-MIX is utilized in response to local demand. In other words, each participant in K-MIX, such as medical institutions providing or receiving K-MIX and relevant businesses, is connected to the telemedicine council that is made up of the local government, an innovator group, and the medical association within Kagawa. In particular, an innovator group[7] suggested delivering medical information via K-MIX to local doctors, and the telemedicine council provided proper telemedicine technologies to medical institutions providing or receiving K-MIX according to the demands of local doctors and patients.

Table 5-2. Summary of the determinants mentioned by physicians and patients in Kagawa

			Determinants of medical institutions providing K-MIX
Marugame	**Vertical telemedicine network (M clinical site)**	**Medical staff**	Diagnosis by medical specialists, in particular, interpreting medical images such as MRI and CT scans Cheap compared with another telemedicine system supported by telemedicine companies Personal relationships among doctors Suggestion of an innovator group
		Patients	Suggestion of physicians Long-standing mutual trust and understanding
	Telemedicine network with offline meetings (K general hospital)	**Medical staff**	Sending and receiving medical records Human relationships among doctors of this medical institution and related facilities Suggestion of the telemedicine council
		Patients	Suggestion of physicians Long-standing mutual trust and understanding
Shodoshima	**Horizontal telemedicine network (U general hospital)**	**Medical staff**	Diagnosis by medical specialists in complementary telemedicine networks Human relationships among doctors Suggestion of an innovator group Advantage of the telemedicine system
		Patients	Suggestion of physicians Long-standing mutual trust and understanding

Doctors utilize this system to improve patients' condition and increase their accessibility to and utilization of medical institutions. To develop K-MIX, the help of the telemedicine council and medical institutions providing K-MIX was required. The system can operate with their collaboration. Moreover, owing to mutual trust between physicians and patients, patients accept the purpose of K-MIX, namely, delivering their medical records online, without any resistance, and physicians are preparing various backup systems for occasions when K-MIX encounters technical problems or cannot provide an accurate diagnosis. The most important consideration for using this system was the extent to which this system or the medical institutions providing telemedicine can guarantee high-quality medical treatment or diagnosis. In most cases, physicians or doctors in the medical institutions receiving telemedicine had previously referred their patients to the medical institutions providing telemedicine through traditional health care delivery methods such as handwritten referrals and were aware of the capabilities of the medical facilities providing telemedicine. Therefore, the quality of existing health care services is among physicians' crucial determinants in operating this telemedicine system. Further, there are many alternative ways to refer patients to other medical institutions or deliver or share medical records; therefore, the utility and convenience of this system are acknowledged by telemedicine users, but this system is not regarded as indispensable. In addition, the telemedicine networks via K-MIX are not connected with large general hospitals as telemedicine providers because these facilities have their own large patient populations to treat and have unpredictable profitability. This shortcoming was pointed out by telemedicine users as an area for improvement (Table 5-2). The crucial determinants of telemedicine networks do not differ significantly between regions, such as those in Marugame and Shodoshima. Only the U general hospital, as an example of horizontal telemedicine networks, presently demonstrates the advantage of the telemedicine system and its various potential applications. There may be alternative supportive health care systems such as a visiting nurse system or a system in which doctors pay regular visits to the medical institutions receiving telemedicine.

5. 2 National-Level Telemedicine Networks in Choongbook and Regional-Level Telemedicine Networks in Kagawa

The sharp geographical differences in the implementations of telemedicine in Choongbook and Kagawa are enhanced by centralization and decentralization, respectively. In other words, medical institutions involved in telemedicine operations in Choongbook are concentrated in one specific geographic area (Kyunggi); it is easier to identify telemedicine networks involving national-level medical institutions based in Kyunggi in most cases than it is to find networks involving regional-level facilities. In the case of Kagawa, both medical institutions that receive telemedicine services and their associated telemedicine suppliers are located within Kagawa; most telemedicine networks include regional-level medical institutions.

Concretely, the spatial organization of telemedicine operations in Choongbook is different from the original purpose of online referrals with regard to the medical laws and regulations. Although some medical institutions receiving online referrals are connected to telemedicine networks with a medical institution providing online referrals within Choongbook, most of the medical institutions receiving online referrals prefer to have online-referral relationships with medical institutions providing online referrals in Kangwon, Choongnam, and Kyunggi. In particular, medical institutions providing online referrals in Kyunggi are highly ranked in the Korean health care system and provide high-quality health care on a nationwide scale; therefore, many patients prefer to receive online referrals to facilities in Kyunggi, and many local clinical sites are associated with these facilities. By contrast, only one medical institution providing online referrals exists in Choongbook; thus, the level of health care services available is not high. Further, although medical laws and regulations governing the online referral system stipulate that patients should select medical institutions within the same diagnostic area for secondary medical care, the legal binding is not strong, and there is no way to improve the internal medical institutions of Choongbook so that they are more compatible with patients' preferences. Finally, although the online referral system was designed to deliver medical records within a single facility's service area at the tertiary care level, inter-regional telemedicine networks are common in Choongbook, and it is difficult to find

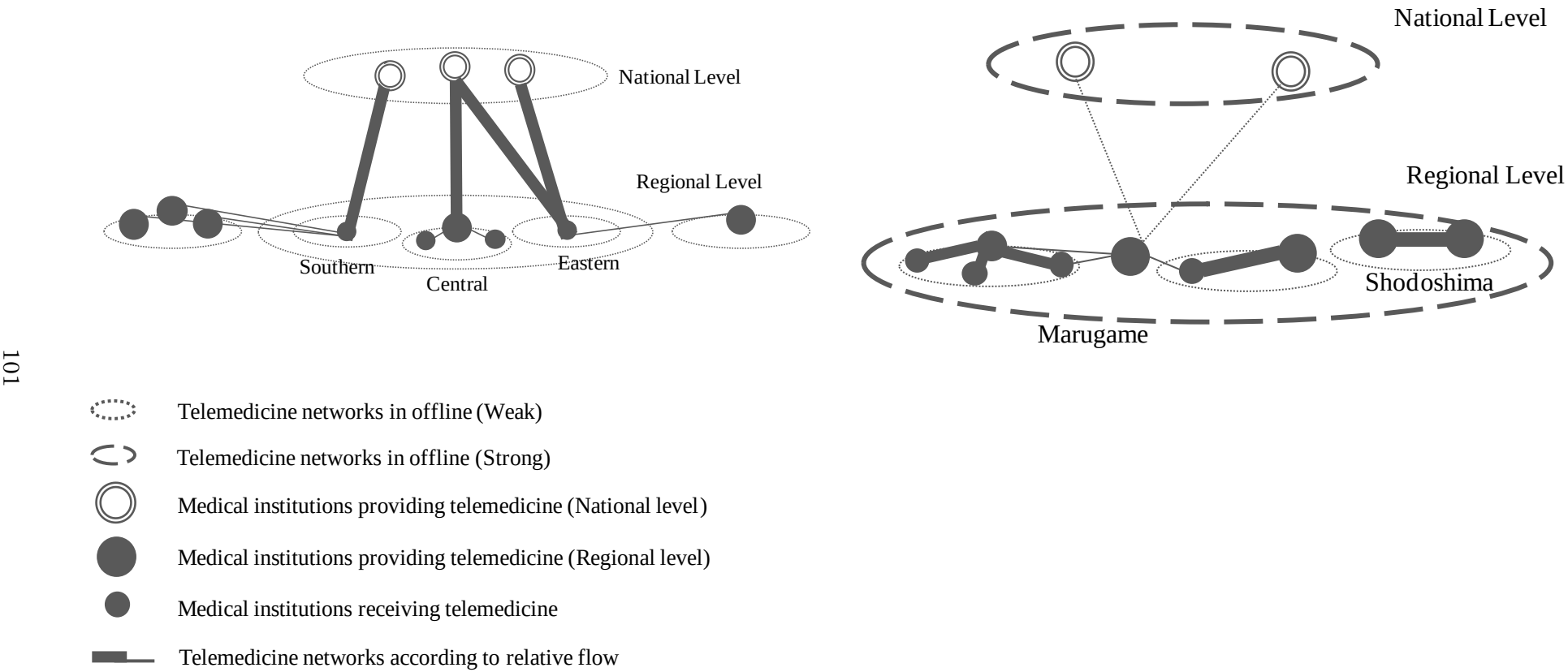


Figure 5-1. National-level telemedicine networks in Choongbook (left) and regional-level telemedicine networks in Kagawa (right)

evidence of online referrals being used for their original purpose. In addition, although Kangwon and Choongnam are separate diagnostic areas from Choongbook, some patients who live in the southern and eastern parts of Choongbook considered medical institutions providing online referrals in Kangwon and Choongnam as their secondary health care site of choice instead of the medical institutions within Choongbook because of the good accessibility to the former group of medical institutions. In particular, the southern part of Choongbook offers insufficient health care services; therefore, many patients seek treatment from several medical institutions providing online referrals in Choongnam, a metropolitan area providing high-quality health care services. Although the eastern part of Choongbook includes some major cities and several medical institutions, one medical institution in Kangwon attracts many patients residing there because of its high-quality medical services.

Overall, telemedicine networks from Choongbook flow toward medical institutions providing online referrals in Kyunggi (Figure 5-1). Finally, an investigation of online referrals shows that the telemedicine networks of Choongnam are centralized networks toward Kyunggi, and it is difficult to determine if the online referral system is being used in the way prescribed by the medical laws and regulations with regard to regionalization. Moreover, the predominant telemedicine networks from clinical sites receiving online referrals in Choongbook come out in openness among diagnostic areas.

The telemedicine networks in Kagawa are confined to one diagnostic area at the tertiary care level and are dominated by regional-level medical institutions. Although some inter-regional telemedicine networks involving core telemedicine suppliers (especially national-level medical institutions) were observed in one diagnostic area, the present telemedicine networks in Kagawa experience difficulties in their operations because no agreement governs the establishment of telemedicine networks among medical institutions, time requirements, profitability, and other considerations. The telemedicine relationships of K-MIX between medical institutions receiving telemedicine and medical institutions providing telemedicine had tacit approval before K-MIX was established, and telemedicine providers do not hold a dominant position among medical institutions.

Because the core medical institutions providing telemedicine are busy treating their own inpatients and outpatients, medical specialists there cannot share enough time to support telemedicine networks in practical terms. Therefore, the same problems observed in telemedicine networks including medical institutions in several diagnostic areas are also observed in this case, and some doctors indicated this problem as an area of improvement for future telemedicine usage in Kagawa.

Regarding the internal characteristics of the telemedicine networks, the utilization of K-MIX is divided into vertical telemedicine networks between medical institutions receiving telemedicine and larger medical institutions providing telemedicine and telemedicine networks including offline meetings among medical institutions the treatment of target populations or patients on the mainland of Kagawa; in addition, the telemedicine networks in Shodoshima, discussed as an example of the use of telemedicine networks on an island, are based on horizontal relations between medical institutions of similar sizes. Telemedicine often allows patients to avoid the burdens of travel to another medical institution for diagnosis by sending medical records or information electronically to medical institutions providing telemedicine or by allowing patients to be evaluated by medical specialists visiting medical institutions receiving telemedicine in person, the exceptions being serious cases or those that require additional medical treatment. A case of a telemedicine network involving offline meetings involves sharing medical records online and patient travel between medical institutions offline. The important consideration of telemedicine operations is the level or quality of health care services they provide, and there are many alternative ways to transfer medical records that do not involve the K-MIX system. Therefore, it is difficult to involve medical institutions with telemedicine networks without a guarantee of high-quality health care services, and telemedicine is commonly regarded as a supportive system in health care. Further, the telemedicine council, in which various participants are involved, plays a role in controlling the telemedicine network services and provides telemedicine users with countermeasures that make it easier to solve medical problems within Kagawa. The K-MIX system is developing in various directions. For example, the accumulated medical records compiled within telemedicine networks play an important role in, e.g., emergency situations and in the analysis of epidemics or chronic

Table 5-3. Comparison of telemedicine usage between Choongbook and Kagawa

	Age	Sex	Range of residential areas	Telemedicine services' destinations	Diseases treated
Choongbook	Varies depending on disease	Both depending on disease	Corresponding with the location of the primary care institutions (mostly, the first diagnostic area)	National-level medical institutions providing online referrals in Kyunggi	Various; the online referral system focuses on sharing medical records among medical institutions
Kagawa	Varies depending on disease	Both depending on disease	Corresponding with the location of the primary care institutions (mostly, the first diagnostic area)	Regional-level medical institutions providing telemedicine services within Kagawa (not major ones)	Various according to purpose, utility, and disease, but mainly used for teleradiology

diseases. Moreover, medical records are not used only in medical institutions but also in pharmacies, gyms, schools, companies, and other institutions for improving health care services within Kagawa (Hara, 2009). In addition, some experiments in Shodoshima are testing the use of telemedicine with the visiting nurse system for the elderly. Thus, the telemedicine networks involving K-MIX show a decentralized pattern, and it is reasonable to say that the geographical characteristics of telemedicine networks in Kagawa are close to the regionalization prescribed by the medical laws and regulations governing the tertiary level of health care.

Comparing telemedicine usage in Choongbook and in Kagawa, the telemedicine systems do not show differences in patients' age and sex because their use is dependent on the kind of illness with which a patient presents. In addition, most of the patients in Choongbook and Kagawa were first seen for treatment of their health conditions at primary care facilities within the same region. As previously mentioned, telemedicine services in Choongbook primarily flow toward national-level medical institutions providing online referrals in Kyunggi. Because the online referral system is used for sharing medical records among medical institutions instead of for medical treatment or diagnosis, this system covers a variety of diseases; therefore, it is relatively easy to connect between clinical sites receiving online referrals and health care sites providing online referrals. Moreover, by virtue of its easy installation, this system can be utilized by many medical institutions on the national scale. Because the telemedicine system in Kagawa was designed for a particular purpose, use, and disease at the initial stage, it can deliver various telemedicine services to patients. Now, this system is used mainly for teleradiology and sometimes for special populations and diseases (Table 5-3).

The present situation of telemedicine in Choongbook and Kagawa is that the telemedicine system is in the initial development phase and is available at little or no cost. There are various alternative methods to transmit medical records or to help patients directly, such as community medicine or domiciliary health care services, without the need for telemedicine. This research suggests that online referrals in Choongbook require many improvements in offline elements, in particular, health care services themselves on a nationwide scale, rather than in online factors

related to technological dimensions of regionalization. The Kagawa telemedicine system encourages the participation of major tertiary care centers, including medical institutions in the metropolitan areas, which can play a role as high-level medical institutions. Further consideration of the assignment of time for telemedicine at these high-level institutions is needed in order to alleviate strong regional-based tendencies that make inter-regional networks almost impossible to realize. Further, the examination of online telemedicine technologies is necessary to realize the telemedicine system on a national scale in the future.

5. 3 Relations between Telemedicine Networks and Social and Medical Circumstances

The affinity between telemedicine and the existing health care services has been discussed in various terms, such as acceptance, utilization, perception of risks and benefits, effectiveness and efficiency according to the target population. Past studies often indicate that the rates of satisfaction expected depend on the traditional forms of health delivery used (Demiris et al., 2004; Whitten and Love, 2005). Namely, there was no difference between a telemedicine group and a traditional group in evaluations of their overall care (Gilmour, 1998). Another finding contends that patients in a rural setting were highly satisfied when consulting with a specialist located in an urban, academic medical center (Frey and Bratton, 2002; Norris et al, 2002). In addition, telemedicine is most often accepted by those practices that are already affiliated with a public tertiary care center showing a high level of telemedicine use (Campbell et al., 2001; Frey and Bratton, 2002). All things considered, although this form of futurist medicine erodes the traditional physician-patient relationship, it is expected to improve patient satisfaction, accessibility to physicians and patient outcomes, and it cannot be realized without considering the satisfaction and useful provision of the traditional forms of health care delivery; moreover, the ways in which care is delivered may change, but the nature of care and medicine remains the same (Frey and Bratton, 2002; Oudshoorn, 2009).

However, telemedicine networks that do not consider their potential service boundaries threaten the feasibility of telemedicine for the aforementioned reasons: technological limitations, future applications and practical profitability and usability; therefore, regionalization of intensive care

units and quality improvement through regional outreach telemedicine (Nguyen et al., 2010). Furthermore, unlike previous telemedicine applications for rural and isolated communities (Reid, 1996; Capalbo and Heggem, 1999; Mihara, 2004), contemporary telemedicine is available everywhere, and the value of regionalization in telemedicine has become apparent. To realize regionalization of telemedicine requires a central authority to implement and regulate the system, as well as specific legislation, investment in information technology, and financial incentives for providers (Nguyen et al., 2010).

Nevertheless, despite the anticipated benefits, the implementation of regionalization in telemedicine in Korea faces serious obstacles related to the coordination and integration of health services in an unstructured environment (Shannon et al., 2002). Namely, only the initial huge investment in online referrals and related medical laws remain now, and health care issues that have existed since the age of paper-based referral services have yet to be solved and must be considered together with patients' decisions (Lee and Kim, 1997; Yoon, 1997; Park, 2004; Park, 2010). Concretely, the imbalance of health care services in Korea encourage patients' notion of preferring external medical institutions to regional ones. Tertiary medical centers are centered around Kyunggi, in particular, Seoul, in proportion to the population (22.5%), and more than half of all online referral service sites (54.9%), which are acknowledged as high-level tertiary care centers, are located in Kyunggi. Moreover, these private-sector medical institutions are managed by large companies and universities and have a relative profit-oriented bias. Although the telemedicine system was suggested by these facilities as a system for regional health care, these online referral service sites accept patients who are willing to travel to their facilities for high-level health care, counter to the original purpose of online referrals. Additionally, extrinsic factors, such as a greater desire among patients to receive a diagnosis from a high-quality medical institution, enhanced quality of life, the development of transportation and communication systems and family members or acquaintances who have experienced high-quality care services stimulate patients to seek the best care. Given these facts, it appears likely to us that although the existing health care system is associated with a considerable number of online referrals, the present phenomenon of online

referrals threatens the balance of health care because online referrals were instituted without ensuring the availability of stable health care services on a national scale in advance. Accordingly, online referrals, which were intended to encourage regionalization, have instead discouraged it. Further, most patients do not return to their primary medical institutions for treatment of their health condition, so the online referral system has been changed from two-way to one-way delivery.

Needless to say, Japanese telemedicine is fully stabilized within regionalization; but in practical terms, it is difficult to form telemedicine networks among medical institutions participating in telemedicine operations. Moreover, regional-based telemedicine is actually regarded as an obstacle to future telemedicine usage (Park, 2010). In other words, as previously mentioned, telemedicine networks in Japan are based strongly on human networks, from their creation to operation and maintenance. More specifically, if the telemedicine council cannot play an integral role, it is very difficult to maintain the system because of steady investment in telemedicine and technological innovation. Therefore, despite great motivation and attention to telemedicine in the early stage of its development, some prefectures' telemedicine operations remain undeveloped because no innovators have come forward, so the gap in telemedicine usage among prefectures can be large. In the case of Kagawa, the telemedicine council's activities are very progressive, and the support from the local government, huge investment and the development of related businesses are important to maintaining that system. In the case of Kagawa, the participation of major tertiary care centers is very difficult because their patient loads leave insufficient time to share diagnoses via the telemedicine system. Further, without consensus among medical institutions ahead of time, telemedicine networks involving all medical institutions cannot be created. Moreover, although medical institutions participating in telemedicine exist everywhere within Japan, most telemedicine networks operate within a single diagnostic area, excepting the experiments with telemedicine between prefectures. Each prefecture has independently developed related technologies; therefore, there are some problems related to compatibility of telemedicine technologies based on each prefecture's medical circumstances. In addition, one considerable problem is that it is very difficult to expect the collaboration of major medical institutions in the metropolitan areas such as Tokyo or

Osaka. The absolute distributional number of medical institutions participating in telemedicine is highest in the metropolitan areas. However, based on internal characteristics, the frequency of telemedicine usage in medical institutions participating in telemedicine in the metropolitan areas is low, and many major telemedicine operations are led by telemedicine companies offering teleradiology services. Further, in the future, some ways to integrate medical records from each prefecture into the nationwide medical information should be developed; moreover, time and space reconfiguration in major medical institutions in one diagnostic area or in Tokyo and Osaka is required to provide telemedicine services. However, Japanese society does not acknowledge this need because the Japanese show a propensity to protect the private sector, and there is no system to enable the seamless integration of telemedicine technologies that can be controlled on a national scale, such as the social security number system. Therefore, it seems that the most pressing agenda for telemedicine is to solve these problems.

5. 4 Local Telemedicine Networks in Korea and Japan

Having shed light on telemedicine networks in local areas of Korea and Japan by examining the geographical characteristics of telemedicine networks in Choongbook and Kagawa, we can consider telemedicine networks in local areas of Korea and Japan more broadly.

In practical terms, medical institutions involved with telemedicine practices in Korea are concentrated particularly in Kyunggi. In addition, medical institutions in Japan are concentrated in metropolitan areas, but institutions that provide and receive telemedicine are not concentrated in these areas, unlike the Korean case; therefore, most of the telemedicine operations in Japan center around the southern and northern areas because of their isolated or remote situations. In this sense, the centralization of telemedicine networks in Kyunggi is a significant characteristic throughout Korea, regardless of the original purpose of telemedicine based on the medical laws and regulations in Korea; moreover, the centralization of the telemedicine networks in Kyunggi is an outstanding phenomenon in the country, and such a geographical characteristic is caused by the lower quality of clinics and medical institutions in rural areas of Korea. Similar to the case of Choongbook,

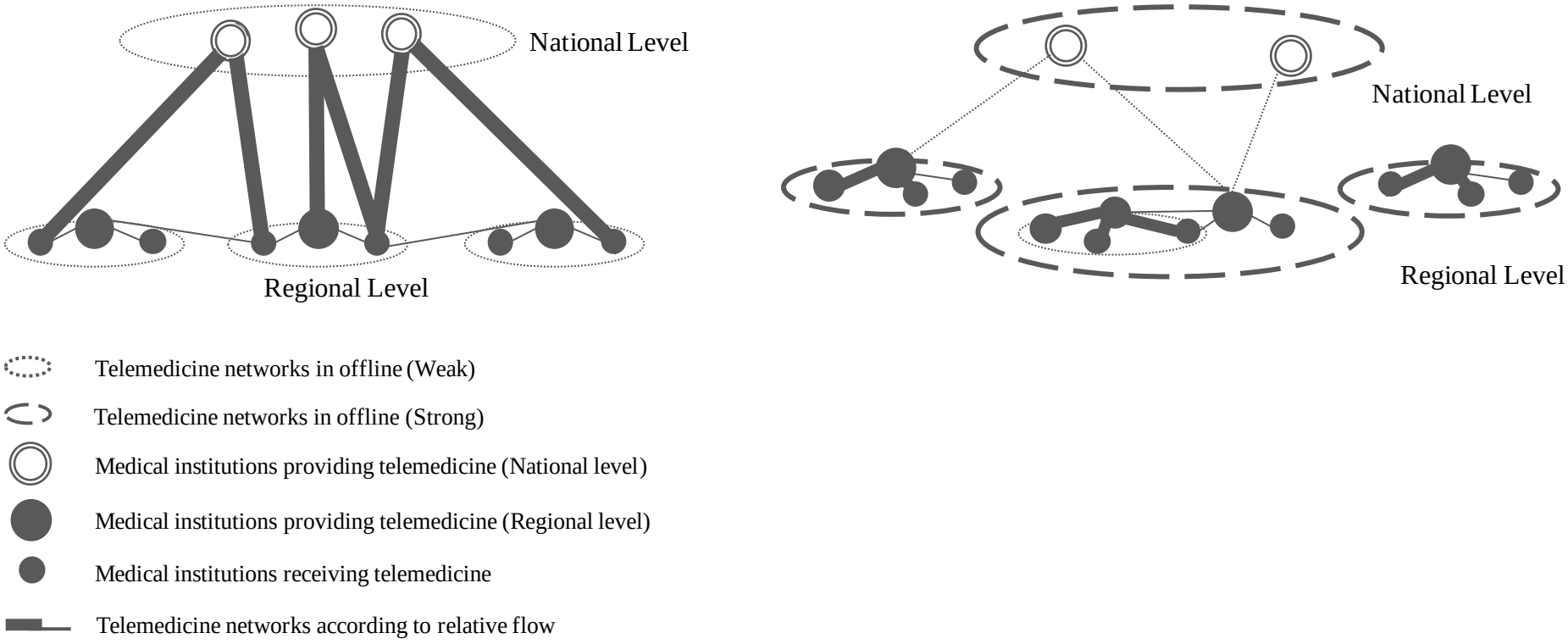


Figure 5-2. Telemedicine networks of local areas in Korea (left) and Japan (right)

telemedicine networks throughout Korea conduct considerable operations on an inter-regional scale. It seems reasonable to conclude that most of the medical institutions receiving telemedicine are associated with medical institutions providing telemedicine and that both are located in the same diagnostic area, and this geographical phenomenon is especially observed in the northern and southern parts of Japan. Otherwise, if medical institutions receiving telemedicine refer patients' information to another medical institution providing telemedicine for diagnosis, they mostly rely on facilities located in other diagnostic areas, not medical institutions providing telemedicine in metropolitan areas (Figure 5-2). To build telemedicine networks, mutual understanding or agreement among medical institutions is necessary, and the telemedicine council, which is composed of the prefectural government, the medical association, and the core university as the innovator, plays an important role in the management of telemedicine operations. Especially, each diagnostic area (i.e., one prefecture) in local areas of Japan determines the proper telemedicine technologies according to the needs of its regional health care services (Park, 2010).

The telemedicine networks in Korea and Japan are marked by the following distinctions. Telemedicine networks in Korea are led by national-level private medical institutions located in

Kyunggi, which are managed by private universities or large companies, and comprehensive health care services, including telemedicine, follow a top-down administrative model. In Japan, the participation of regional-level medical institutions is prominent; moreover, the spontaneous leadership of the various interested parties in local areas influences the management of telemedicine. In addition, most of the telemedicine operations are supported by central and local governments as the part of their IT strategies or regional health care policies. In this sense, telemedicine services in Korea provide a simple way to deliver medical records between institutions without the limitation of medical departments; moreover, these medical records are utilized as a reference when diagnosing patients in cases of serious health conditions. In Korea, the telemedicine system uses the online referral system as one of several transmission methods; therefore, its influence on the health care system is not strong. Accordingly, the determinants of telemedicine in Korea depend on good health care services and patient preference, just as the

Table 5-4. Comparison of telemedicine usage in local areas of Korea and Japan

	Major providers	Purpose of using telemedicine	Major medical departments	Major determinants	Degree of openness
Korea	National-level medical institutions (private approach, top-down)	Medical records	All medical departments (for serious diseases)	Good health care services and patient preference	Openness among diagnostic areas and strong compatibility of telemedicine technologies
Japan	Regional-level medical institutions (public approach, bottom-up)	Medical records, in particular, teleradiology or telepathology, and various health care services	According to patients' or doctors' needs	Mutual understanding and health care services level (practical usage and various or divided telemedicine services)	Closed telemedicine networks within diagnostic areas and low compatibility of telemedicine technologies

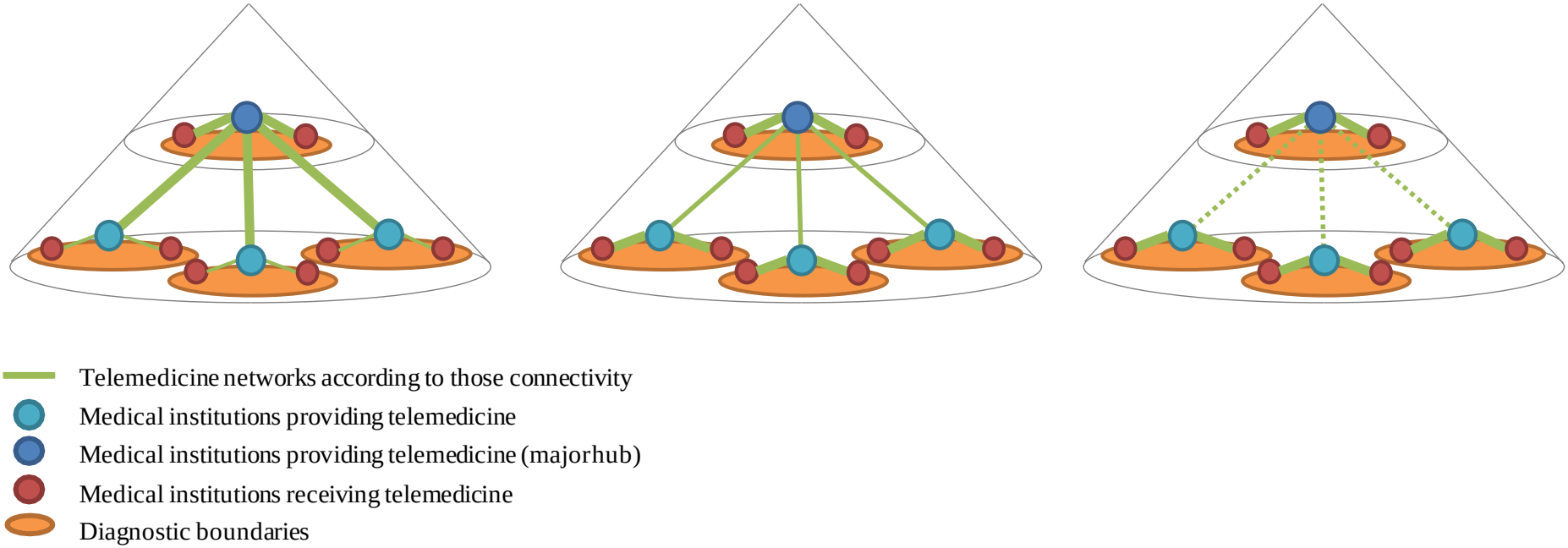


Figure 5-3. Future telemedicine networks in local areas with regard to regionalization (middle), the present condition of telemedicine networks in local areas in Korea (left), and the present condition of telemedicine networks in local areas in Japan (right)

selection of medical institutions in traditional health care does (Table 5-4). Telemedicine services vary according to the needs or demands of regional health care, but the major demand of telemedicine is associated with professional diagnosis, such as pathology or radiology. Retired doctors played an important role in suggesting these services at the initial stage of telemedicine, and telepathology and teleradiology have become the mainstream of telemedicine services. Moreover, because the telemedicine system involves a huge initial cost, changing it is not a simple task. For this reason, the early form of the telemedicine system has remained mostly unchanged. Recently, various trials of telemedicine services involving new telemedicine technologies have been undertaken; in this way, telemedicine services can adjust to the demands of medical and social circumstances in each local area. Mostly, under the control of the telemedicine council, including the public sector, an agreement for the provision of telemedicine services among medical institutions can be achieved easily, and proper health care services for special population or diseases can be realized. However, each diagnostic area has independent telemedicine technologies, so it is difficult to integrate these telemedicine technologies among diagnostic areas or on the national scale.

The rapid development of telecommunication technologies has impacted the theories of spatial organization, leading to several predictions. In this sense, telemedicine, which is based on telecommunication technologies, is also illuminated in terms of the context of the spatial theories (Cutchin, 2002; Kim et al., 2002). As previously mentioned, the regionalization of telemedicine composed of strong regional-level telemedicine networks (horizontal dimension) and national-level telemedicine networks (hierarchy dimension) is regarded as an ideal spatial organization of telemedicine (Figure 5-3). According to the results of this research and considering the past research on regionalization, telemedicine is likely to develop a dual structure: first, the national-level telemedicine networks that support the referral of patients among medical institutions or the interchange of medical records, and second, the regional-level telemedicine networks that are divided into various telemedicine services according to the needs or demands of regional health care. Regional-level telemedicine networks are difficult to identify in local areas in Korea because

these networks are usually connected with national-level medical institutions in Kyunggi. Recently, various experiments with telemedicine in local areas have been conducted through private-public cooperation at the regional level, and customized telemedicine services for special diseases and population groups have been introduced in regional health care. By contrast, although strong regional-level telemedicine networks are observed in local areas of Japan, especially the southern and northern areas, in most cases, national-level telemedicine networks with major medical institutions in the metropolitan areas suffer from low profitability and utility. In Japan, some companies provide telemedicine services centering around teleradiology at competitive prices; moreover, the movement for integrating electronic medical records on the national scale is being encouraged by the central government. To achieve this goal, data control on the national scale is required because there is no system in place to control patients' data nationally. In this sense, this research, which scrutinizes two comparative cases of local areas in Korea and Japan, provides geographical clues on the dual structure of telemedicine networks for the foreseeable future and documents the present condition of telemedicine networks in local areas of Korea and Japan.

Chapter 6. Conclusions

The results of the research can be summarized as follows. First, the analysis scrutinized the decision-making characteristics of patients given online referrals in Choongbook. On the whole, the patients did not enjoy their experiences at the local tertiary medical institution. Most patients showed a strong inclination to visit tertiary medical institutions located outside of Choongbook. Psychological considerations about the quality and level of health care services, personal stakes in online referral service sites, acceptability and credibility of good tertiary care centers and easy access to and use of medical institutions were overwhelmingly associated with their preferences. The original purpose of online referrals with regard to regionalization, technological value, convenience and utility has not been fulfilled at this stage of telemedicine in Korea. Patients who want to receive good medical care emphasize this preference in their decision making about online referrals.

The decentralized telemedicine networks in Kagawa are outstanding. In addition, the interviews with doctors and their patients gave us further information about the system in Kagawa. Both the existing health care system and the telemedicine system contribute to the maintenance of stable regional health care within each diagnostic area. Moreover, the convenience of reducing patients' travel time and burdens and the transmission of medical records for high-quality and appropriate

medical treatment are the top considerations. Personal and geographical dimensions, in other words, personal relationships and proximity of the health care sites providing K-MIX, were observed to be important when telemedicine is first developed and when patients cannot solve their problems via K-MIX. These determinants were associated with the original purpose of telemedicine with regard to promoting regional health care in Kagawa as well. In practice, though, it was difficult for regional telemedicine networks to become connected to major tertiary care centers. In this sense, telemedicine networks were observed in only a few medical institutions with mutual consensus to use K-MIX.

Given the results, it is reasonable to say that telemedicine networks in Choongbook do not comply with the medical laws and regulations with regard to regionalization; on the other hand, telemedicine in Kagawa shows the dispersed pattern compatible with the original purpose of telemedicine based on the tertiary care level. The major reason why telemedicine networks have unique geographical characteristics in Korea and Japan in spite of the common medical laws and regulations with regard to regionalization is that the operation of telemedicine in Choongbook and Kagawa is influenced considerably by social and medical circumstances in terms of the existing health care services.

Acknowledgements

In writing my dissertation, I have contracted many debts. First of all, my highest appreciation goes to Prof. Murayama who supervised my doctoral work in University of Tsukuba. He has overseen the planning of this research and has given my work minute consideration for five years. And I send gratitude separately to my previous academic advisors, Prof. Huh of Seoul National University, Prof. Lee of Sangmyung University, and Dr. Lee of STEPI. Also, invaluable help was furnished by Prof. Hara of Kagawa University and Prof. Hasegawa of Gunma University, distinguished scholars of telemedicine in Japan, who acted as my consultants. They not only caught many errors and awkward expressions but were willing to discuss with me points of telemedicine. As always, all laboratory members, including the members in human geography department and juniors and seniors who have already graduated from the University of Tsukuba, have been there, providing all sorts of tangible and intangible support. My friends, including many seniors and juniors, in the world, especially, Jeongsook, have assisted me in innumerable ways. Lastly, I want to take this opportunity to thank my family members, my parents, my older brother, my sister-in-law, my younger brother, and my niece; most of all, this dissertation is dedicated to the memory of my grandmother who wanted to pray to God for all my things before the moment of death and always show her mild smile to me in the picture.

Appendices

1) In terms of health care, regionalization can be substituted for decentralization, although decentralization lays emphasis on the political approach.

2) According to the legislation of the health care system in Korea and Japan, the diagnostic area is divided into three boundaries: the primary medical care level, the secondary medical care level and the tertiary medical care level. The diagnostic boundary at the primary medical care level plays a central role in the local community and clinics are involved in it. And the diagnostic area at the secondary medical care level is the service provided by medical specialists. Lastly, the diagnostic area at the tertiary medical care level indicates specialized consultative care, usually on referral from primary or secondary medical care personnel, by specialists working in a center that has personnel and facilities for special investigation and treatment.

3) The diagnostic areas in Korea are composed of 8 areas. Jeju Island, in which is the southern part, is included in Kyunggi. In addition, the diagnostic areas in Japan are based on each prefecture.

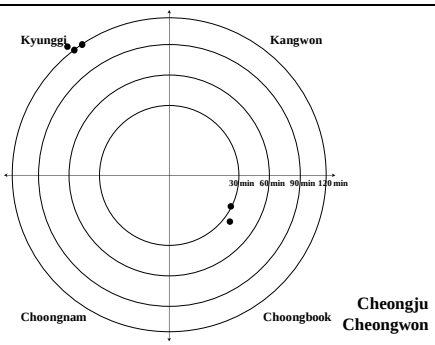
4) By taking a closer look at more detailed geographical characteristics of telemedicine in Japan, obvious contrasts in terms of its utilization are observed according to regional differences: local area, urban fringe and the metropolitan area, although telemedicine in local areas is regarded as the mainstream of Japan.

Regional differences	Main agents of telemedicine		Regional boundaries of telemedicine	Purpose of telemedicine
	Major service providing side	Major service receiving side		
Local area	General hospitals	Other general hospitals, clinics, gyms, health centers, care houses for the age, etc.	Based on the boundary of the tertiary medical care level	Regional medical care or telecommunication's policies
Urban fringe	General hospitals	Clinic as the primary medical care facility	Boundary at the secondary medical care level that is included in the tertiary medical care level	Regional medical care's policies
Metropolitan area	Companies	Clinic as the primary medical care facility	Excess boundary at the tertiary medical care level, but centering around the metropolitan area	Business strategies

Source: The results of interviews with telemedicine participants, e.g. telemedicine council members such as doctors as opinion leaders, inventors for telemedicine technologies, governors, etc. (for local area and urban fringe) and delegates in the telemedicine business (for the metropolitan area).

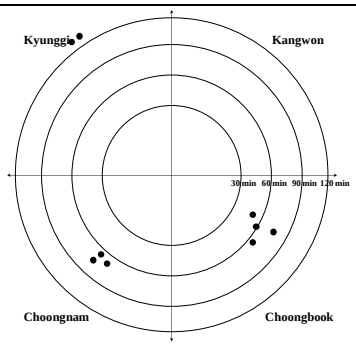
5) Until now, there are very few references with regard to the question as to who select medical institutions or medical institutions providing telemedicine in health care and telemedicine fields, including social scientific approaches. Therefore, I referred to the opinions of the medical specialist group of 17 pharmacists in Choongbook and the members of the telemedicine council in Kagawa. Their opinions correspond with the criteria of this research, in other words, online referrals determined by patients and K-MIX decided by doctors. In addition, I conducted the separate interviews with 46 patients in Choongbook and 43 patients and 10 doctors in Kagawa for formulating the decision of medical institutions as the secondary medical treatment. According to the results of the interviews, forty-six patients in Choongbook pointed out themselves as crucial decision-makers, while patients in Kagawa depended on the suggestion of physicians considerably.

6) As previously mentioned, the determinants of the choice of medical institutions providing online referrals is strongly associated with the selection of existing medical institutions. According to the results of interviews with forty-six patients in Choongbook, patients in the central part of Choongbook (Cheongju, Cheongwon, Eumseong, Jincheon, and Goesan) frequently visit medical facilities in Kyunggi and Choongbook. Residents of the eastern part of Choongbook (Choongju, Jecheon, and Danyang) visit the medical institutions in Kyunggi, Choongbook and Kangwon. In the eastern part of Choongbook, there are several medical institutions providing good health care services, although they do not service online referrals. Lastly, the citizens in the southern part of Choongbook select medical institutions in Choongbook and Choongnam. Therefore, the opinions of the residents of Choongbook about the selection of medical institutions differ by region. This awareness of health care services quality already controls the selection of medical institutions providing online referrals among the residents, and this result implies that many patients are influenced by the existing health care system when deciding where to go when given online referrals. This investigation aimed to understand this choice and its coverage of health care sites as the secondary medical institutions, but the highest frequency of visiting health care sites is observed in medical institutions in Kyunggi.



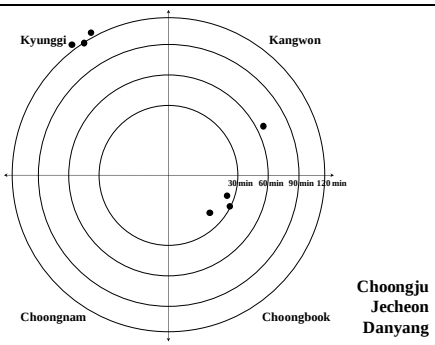
Cheongju
Cheongwon

(n=3 in Kyunggi, 2 in Choongbook)



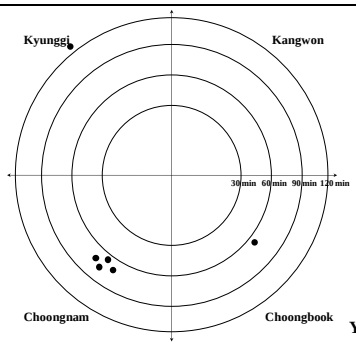
Eumseong
Jincheon
Goesan

(n=2 in Kyunggi, 3 in Choongnam, 4 in Choongbook)



Choongju
Jecheon
Danyang

(n=3 in Kyunggi, 1 in Kangwon, 3 in Choongbook)

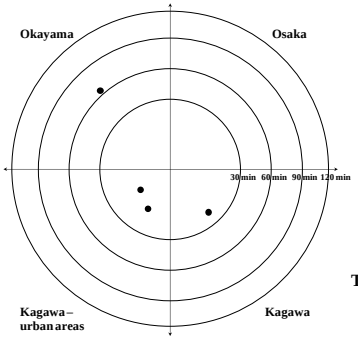


Boeun
Okcheon
Youngdong

(n=1 in Kyunggi, 4 in Choongnam, 1 in Choongbook)

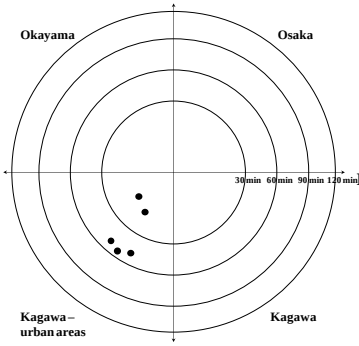
Note. This investigation aimed to examine opinions about health care sites that the residents of Choongbook visited frequently for secondary medical treatment regardless of the involvement of online referrals. Each dot represents one health care site. In addition, each diagram indicates the travel time to the medical institutions (access time) in 30-minute increments.

7) I interviewed 43 patients and 10 doctors in Kagawa on the matter of which medical institutions the residents of Kagawa select for secondary medical treatment. The first choice was medical institutions located in urban areas such as Takamatsu and Marugame. The second choice medical institution is the Kagawa University medical center located in Miki (Kagawa, except for urban areas), and a few residents favored the medical institutions in Okayama and Osaka. According to one doctor, unlike in the past, most patients are not referred to the medical institutions in Okayama and Osaka because most patients' conditions can be treated within Kagawa. Doctors refer only patients with very serious conditions to the medical institutions in Okayama and Osaka. Therefore, the boundary of selection for the medical institutions for secondary medical treatment does not exceed the potential boundary for diagnosis within Kagawa.



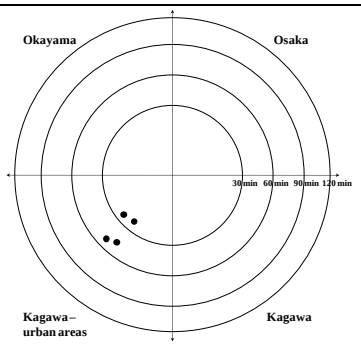
Takamatsu
Miki
Naoshima

(n=2 in Kagawa-urban areas, 1 in Kagawa, 1 in Okayama)



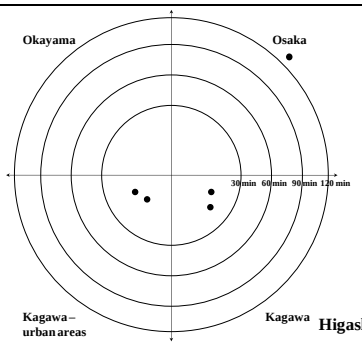
Marugume
Sakaide
Zentsuji
Utazu
Ayagawa
Kotohira
Tadotsu
Manno

(n=5 in Kagawa-urban areas)



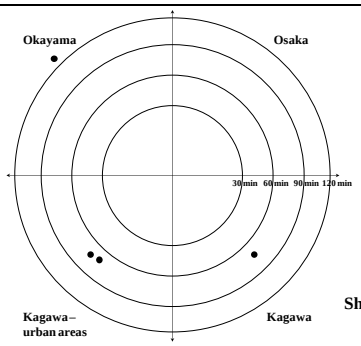
Miyoto
Kanonji

(n=4 in Kagawa-urban areas)



Sanuki
Higashikagawa

(n=2 in Kagawa-urban areas, 2 in Kagawa, 1 in Osaka)



Shodoshima
Tonosho

(n=2 in Kagawa-urban areas, 1 in Kagawa, 1 in Okayama)

Note. This investigation aimed to examine the opinions about health care sites the residents of Kagawa visit frequently for secondary medical treatment regardless of the operation of K-MIX. Each dot represents one health care site. In addition, each diagram indicates the travel time to the medical institution (access time) in 30-minute units.

References

Abou-Shaaba, Rafiq R. A. and Niazy, Esmail M. (1991). Telemedicine and telepharmaceutical services: a model to improve maldistribution of medial resources between regions and urban/rural sectors in the Kingdom of Saudi Arabia. *GeoJournal, **25***, 401-412.

American Telemedicine Association. (2010). About telemedicine. http://www.atmeda.org/news/library.htm (last accessed Augusts 31, 2010).

Andrews, G., and Kitchin, R. (2005). Geography and nursing: convergence in cyberspace?. *Nursing Inquiry, **12***, 316-324.

An, M. U. (2005). Tele-health around the world: history, current status and implications (in Korea). *Health and Welfare Forum*, **8**, 36-50.

Bashshur, R. L. (1997). Telemedicine and the health care system. In Bashshur, R.L., Sanders, J.H., and Shannon, G.W. (Ed.), *Telemedicine: theory and practice*. Illinois, America Thomas Books.

Bashshur, R. L., Reardon, T. G., and Shannon, G. W. (2000). Telemedicine: A New Health Care Delivery System. *Annual Review of Public Health*, **21**, 613-637.

Braa, J., and Hedberg, C. (2002). The struggle for district-based health information systems in South Africa. *The Information Society, **18***, 113-127.

Campbell, J. D., Harris, K. D., and Hodge, R. (2001). Introducing telemedicine technology to rural

physicians and settings. *The Journal of Family Practice, **50***, 419-424.

Capalbo, S. M., and Heggem, C. N. (1999). Innovation in the delivery of health care services to rural communities: telemedicine and limited-service hospital. *Rural Development Perspectives, **14***, 8-13.

Choo, S. J. (1999). The utilization of telemedicine for a plan of land development (in Korean). *Planning and Policy, **February***, 32-35.

Committee on Evaluating Clinical Applications of Telemedicine and Institute of Medicine. (1996). Telemedicine: A Guide to Assessing Telecommunications for Health Care. Washington, The National Academies Press.

Coughlan, J., Eatock, J., and Eldabi, T. (2006). Evaluating telemedicine: A focus on patient pathways. *International Journal of Technology Assessment in Health Care, **22***, 136-142.

Cutchin, M. (2002). Virtual medical geographies: Conceptualizing telemedicine and regionalization. *Progress in Human Geography*, **26**, 19-39.

Dávalos, M. E., French, M. T., Burdick, A. E., and Simmons, S. C. (2009). Economic evaluation of telemedicine: review of the literature and research guidelines for benefit-cost analysis. *Telemedicine and e-Health, **15***, 933-948.

Demiris, G., Speedie, S. M., and Hicks, L. L. (2004). Assessment of patients' acceptance of and satisfaction with teledermatology. *Journal of Medical Systems, **28***, 575-579.

DeVerteuil, G. (2000). Reconsidering the legacy of urban public facility location theory in human geography. *Progress in Human Geography, **24***, 47-69.

Dyb, K., and Halford, S. (2009). Placing globalizing technologies: telemedicine and the making of difference. *Sociology, **43***, 232-249.

Frey, K. A. and Bratton, R. L. (2002). Role of Telemedicine in the Health Care Delivery System. *Journal of the American Board of Family Medicine, **15***, 170-171.

Gilbert, M. R., Masucci, M., Homko, C., and Bove, A. A. (2008). Theorizing the digital divide: information and communication technology use frameworks among poor women using a telemedicine system. *Geoforum, **39***, 912-925.

Gilmour, E. (1998). Comparison of teleconsultations and face-to-face consultations: preliminary results of a United Kingdom multicentre teledermatology study. *British Journal of Dermatology, **139***, 81-87.

Glasgow, A. (2002). Locating telemedicine satellite hub sites in the Gulf of Mexico. *ESRI Map Book Gallery*, 18. http://gis.esri.com/library/userconf/proc02/pap0171/p0171.htm (last accessed Augusts 31, 2010).

Graham, S., and Marvin, S. (1996). Telecommunications and the city – electronic spaces, urban places. New York, Routledge.

Garshnek, V., and Hassell, L. H. (2000). Rethinking telemedicine evaluation for a new technological ear, *International Journal of Healthcare Technology and Management, **2***, 271-280.

Grigsby, J., Brega, A. G., and Devore, P. A. (2005). The evaluation of telemedicine and health services research, *Telemedicine and e-Health*, ***11***, 317-328.

Grimson, J. (2001). Delivering the Electronic Healthcare Record for the 21st Centaury', *International Journal of Medical Informatics, **64***, 111-127.

Hara, K. (2008). Development from K-MIX to the Japanese EHR (in Japanese). *Japanese Journal of Telemedicine and Telecare, **4***, 166-169.

Hara, K. (2009). The present condition of models in telemedicine (in Japanese). *Japanese Journal of Telemedicine and Telecare, **5***, 80.

Hayashi, N. (2005). Regional theories for urban services (in Japanese). Tokyo, Harashobo.

Hayashi, H., Takagi, Y., and Kitaura, M. (2010). Revision for caring stroke patients (in Japanese). *The Japanese Journal of Clinical Nursing, **36***, 136-158.

Hasegawa, T. and Murase, S. (2007). Distribution of telemedicine in Japan. *Telemedicine and e-Health*, ***13***, 695-702.

Hicks, L., Boles, K., Hudson, S., Kling, B., Tracy, J., Mitchell, J., and Webb, W. (n.d.). Development of a telemedicine evaluation model. http://collab.nlm.nih.gov/tutorialspublicationsandmaterials/telesymposiumcd/6A-1.pdf (last accessed Augusts 31, 2010).

Hujimoto, J. (2009). Critical path for the regional networks (in Japanese). Tokyo, Medical Review.

Japanese Telemedicine Report. (1997). History of telemedicine in Japan. http://square.umin.ac.jp/~enkaku/96/Enkaku-RepSoukatu-nof-eng.html (last accessed 31 October 2009).

Kim, H. S., Jin, Y. P., Lee, Y. A., and Kang, H. S. (2002). Changing urban structure and policy issues in information society (in Korean). Anyang, Korea Research Institute for Human Settlements (KRIHS).

Kim, Y. H., Yoo, S. H., Lee, J. J., and Yoon, S. J. (2004). A study for the factors on choosing hospitals and patients satisfaction between geriatric hospitals and general hospitals (in Korean). *Korean Journal of Hospital Management, **9**,* 46-75.

Lee, H. K., and Jang, L. W. (1988). Effect on the non-medical services on attitude to hospital utilization (in Korean). *Korean Journal of Preventive Medicine, **21***, 442-450.

Lee, K. T., and Kim, Y. M. (1997). A study on the current medical liver system and its measures for improvement (in Korean). *The 77th anniversary of essays in celebration of Dr. Cho, Y.S.*, 325-351.

Lee, S. H., Kim, J. I., Cho, W. H., Lee, J. J. (1998). A study on the patient satisfaction survey at the general hospitals in Korea (in Korean). *Journal of Korean Society of Quality Assurance in Health Care, **5***, 42-57.

Lucas, H. (2008). Information and communications technology for future health systems in developing countries. *Social Science and Medicine, **66***, 2122-2132.

Mack, A., Woodsong, C., MacQueen, K. M., Guest, G., and Namey, E. (2005). Qualitative research methods: A data collector's field guide. North Carolina, Family Health International.

Mäenpää, T., Suominen, T., Asikainen, P., Maass, M., and Rostila, I. (2009). The outcomes of regional healthcare information systems in health care: A review of the research literature. *International Journal of Medical Informatics, **78***, 757-771.

Mair, F. S., and Whitten, P. (2000). Systematic review of studies of patient satisfaction with telemedicine. *British Medical Journal, **320***, 1517-1520.

Mihara, M. (2004). *Telemedicine and Accessibility: A case of Hukushima prefecture* (in Japanese). Proceedings of The Association of Japanese Geographers, Tokyo.

Ministry of Health and Welfare in Korea (1996). *White book of ministry of health and welfare* (in Korean). Seoul, Ministry of Health and Welfare in Korea.

Mitchell, W. J. (1999). E-topia. Massachusetts, The MIT press.

Mills, A. (1990). Decentralization concepts and issues: A review. In Mills, A., Vaughan, J.P., Smith, D. L., and Tabibzadeh, I. (Eds.), *Health system decentralization: concepts, issues and country experience*. Geneva: World Health Organization.

Nguyen, Y. L., Kahn, J. M., and Angus, D. C. (2010). Reorganizing adult critical care delivery: the role of regionalization, telemedicine, and community outreach. *American Journal of Respiratory and Critical Care Medicine, **181***, 1164-1169.

Norris, A. C. (2002). *Essentials of telemedicine and telecare*. New York, John Wiley and Sons.

Norris, T. E., Hart, G. L., and Larson, H. (2002). Low-bandwidth, low-cost telemedicine consultations in rural family practice. *The Journal of the American Board of Family Medicine, **15***, 123-127.

NTT. (2008). Types and organization of telemedicine (in Japanese). http://www.mhlw.go.jp/shingi/2008/04/dl/s0425-13c.pdf (last accessed 31 October 2010).

Oudshoorn, N. (2009). Physical and digital proximity: emerging ways of health care in face-to-face and telemonitoring of heart-failure patients. *Sociology of Health and Illness, **31***, 390-405.

Park, S.K. (2004). Telemedicine in Korea: spatial characteristics of the referral system between hospitals and clinics (in Korean). *Journal of Geography, **41***, 81-100.

Park, S.K. (2010). Geographical characteristics of telemedicine in Korea and Japan. *Geographical Review of Japan*, forthcoming.

Reid, J. (1996). *A Telemedicine primer: understanding the issues*. New York: Innovative Medical Communications.

Shannon, G. W. (1997). Telemedicine: restructuring rural medical care in space and time. In Bashshur, R.L., Sanders, J.H., and Shannon, G.W. (Ed.), *Telemedicine: theory and practice*.

Illinois, America Thomas Books.

Shannon, G. W., Nesbitt, T., Bakalar, R., Kratochwill, E., Kvedar, J., and Vargas, L. (2002). Organization models of telemedicine and regional telemedicine networks. *Telemedicine and e-Health, **8***, 61-70.

Smith, D. M. (1977). *Human geography: A welfare approach*. London, Edward Arnold.

Solomon, M. R. (2007). Regional health information organizations: A vehicle for transforming health care delivery?. *Journal of Medical Systems, **31***, 35-47.

Takahashi, T. (2001). The present and future of telemedicine in Japan. *International Journal of Medical Informatics*, **61**, 131-137.

Tanriverdi, H., and Iacono, C.S. (1999). Diffusion of telemedicine: A knowledge barrier perspective. *Telemedicine Journal, **5***, 223-244.

Tatara, K. and Okamoto, E. (2009). Japan – health system review. http://www.euro.who.int/Document/E92927.pdf (last accessed 31 October 2009).

Virk, P. (2007). Model of Healthcare Delivery. http://www.nextgenmd.org/vol3-7/models_healthcare_delivery.html (last accessed 31 October 2009).

Wang, H., Xiong, W., Hupert, N., Sandrock, C., Siddiqui, J., and Bair, A. (2009). *Concept of operations for a regional telemedicine hub to improve medical emergency response*. Proceedings of the 2009 Winter Simulations Conference, Texas.

Warf, B. (2000). Compromising positions – the body in cyberspace. In Wheeler, J.O., Aoyama, Y., and Warf, B. (Ed.), *Cities in the telecommunications age – the fracturing of geographies*. New York, Routledge.

Whitten, P., and Love, B. (2005). Patient and provider satisfaction with the use of telemedicine: overview and rationale for cautions enthusiasm. *Journal of Postgraduate Medicine, **51***, 294-300.

WHO (World Health Organization). (1998). Health-for-all policy for the twenty-first century: "health telematics", Executive Board 101st Session.

WHO (World Health Organization). (n.d.). eHealth for health-care delivery - strategy 2004-2007.

http://www.who.int/eht/en/eHealth_HCD.pdf (last accessed October 31, 2009).

Yoon, B.S. (1997). A study for the improvement of the medical transfer system in Korea (in Korean). *Research on Welfare Administration, **13***, 137-158.

Yoo, T.W. (1997). *The advent of telemedicine's age in Korea* (in Korean). Abstracts: Medical Information Association, Seoul.

Yoo, T.W. (1999). Telemedicine based on primary medical care (in Korean). *Family Medicine, **20***, 13-22.