A Thesis for the Degree of Doctor of Philosophy

Analysis of the level for demand for u-Healthcare System following Health Promotion Model

Young-Bae Yang

DEPARTMENT OF MANAGEMENT INFORMATION SYSTEM

GRADUATE SCHOOL

JEJU NATURAL UNIVERSITY

February 2011

Analysis of the level for demand for u-Healthcare System following Health Promotion Model

Young-Bae Yang

(Supervised by Professor Doo-Gyung Kim, Min-Cheol Kim)

A Thesis submitted in partial fulfillment of requirement for the degree of Doctor of Management Information Systems

February 2011

This thesis has been examined and approved.

.....

.....

.....

.....

.....

.....

DEPARTMENT OF MANAGEMENT INFORMATION SYSTEM

GRADUATE SCHOOL

JEJU NATURAL UNIVERSITY

건강증진모형에 따른 u-Healthcare 시스템 요구도 분석

指導敎授 金 斗 京, 金 民 哲

梁 榮 培

이 論文을 經營情報學 博士學位 論文으로 提出함

2011 年 2 月

梁榮培의 經營情報學 博士學位 論文을 認准함

審査委員長 _____

委 員 _____

委 員 _____

委 員 _____

委 員 _____

濟州大學校 大學院

2011 年 2 月

CONTENTS

List of Tables

List of Figures

Ⅰ. Introduction

1. Need for the research

In an aging society, the expectation levels towards health for enhanced quality of life increase, and demand for medical services increases drastically. The u-Health system prevents illness and enables people to cope with illness immediately. Moreover, it is characterized by customized health management, differentiated for each individual. The basic framework of the u-Health system's domain is to apply diverse ubiquitous technologies to the healthcare domain to provide a new business model (Schrenker, 2006). u-Health refers to a service system or environment where IT is combined with the medical industry so that users can benefit from prevention, diagnosis, treatment and follow-up management of public sanitation medical services any time, any where (Kim et al 2007). u-Health even includes services for the maintenance, enhancement and prevention of the general public's health ranging from a service that manages patients' illness remotely by leveraging networks. Individual body signals and health information are measured, transmitted and analyzed using sensors and it also consists of a feedback process. Due to the emergence of u-Health, existing services offered by hospitals on an ad-hoc basis can be offered to all domains of everyday life at home and so on. Likewise, services are now rolled out, paying no heed to time and space limitations. u-Health came about due to the consumers' increased need for medical services and due to the increased need for the government and health insurance to reduce medical costs (Kang Sung-wook, Kim Jae-yoon, 2007). In this situation, when u-Healthcare is vitalized, users do not need to visit hospitals or medical service institutions in person to manage their health or to receive medical services. Instead, they can benefit from an innovative healthcare service that enables them to check their health during their everyday life. Accordingly, u-Healthcare can play an important role in preventing illness, and managing and enhancing health (Lee Jung-jin, 2009).

Along with the aging of the worldwide population, middle-aged adults and senior citizens including baby boomers in Korea made up 27% of the total population in

2005. People aged 65 years or older comprise 9% of the total population while Korea' s average age is 35.6 years (Statistics Korea, 2010). This change in the population structure can be considered a phenomenon that stems from an increase in the average lifetime due to an increase in income along with the low birth rate phenomenon. In particular, a drastic increase in the number of middle-aged adults and senior citizens can lead to an increase in chronic illnesses. This means that the medical costs to be covered by the National Health Service is continuing to increase. Along with the increase in income, middle-aged adults and senior citizens' interest in health management is increasing to the point that 53.9% have health check-ups and 37.2% exercise regularly, which in turn increases medical consumption. However, the satisfaction level towards medical services is relatively low (Asia Economy, 2010.4.11). According to the statistics on the number of deceased and the death rate in 2008, people in their 40s and 50s made up the highest percentage at 89%. Causes of death were malignant neoplasm (cancer), liver disorders, cerebrovascular disorders, heart disorders and diabetes in the order listed (Statistics Korea, 2010). These people are the ones who need to play a central role both in their respective families as well as in society. Likewise, there is a need to manage their chronic disorders. Chronic disorders are a result of the individual's improper everyday lifestyle. In the case of the US, over 50% of deaths are caused by improper everyday lifestyles. Thus, a healthy lifestyle is critical (Pender, 1987). An increase in the number of people afflicted with chronic disorders leads to an excessive burden from medical costs. This in turn may give rise to marginalized people whose health management is poor and who cannot obtain appropriate medical service. In this situation, the emergence of u-Healthcare is expected to be very helpful in increasing the general public's health, quality of life and in reducing health and treatment costs. Moreover, it is expected to play an important role from the aspect of the government's efforts to reduce medical costs (Yoon et al., 2006 ; Ho et al., 2005).

The computer technology, information and communications technology and ubiquitous technology recently is introduced, so technological innovation over all industries and consumers demand about quality improvement continually are on the decrease. Under these circumstances, it is important to grasp user requirements for the quality improvement what they are.

If supply and demand about technological development and quality improvement appropriately achieve, the industries of the same field can be the region which is given high confidence to consumers. Owing to application expansion to health insurance, income increase, concern increase about health, and social and economic circumstance change, Because consumers who stayed passive patients in the past actively need quality improvement about medical service. The paradigms of medical service is changing by it. The requirements of u-Healthcare service which operate ubiquitous technology in general is increasing with change like this(Lee JY, 2008). To establish health care system on the basis of this technology reasonably will ,above of all, have to rasp what system user's quality requirements practically are with effort to develop high quality u-Healthcare system and clear comprehension about the system quality. Therefore this study is getting to present other approach method for developing effective u-Healthcare system. Following this trend, numerous researches related to u-Healthcare are being conducted these days, but they are mostly researches conducted from the suppliers' viewpoint. Accordingly, research conducted from the consumers' viewpoint is rather lacking. In particular, it is even more difficult to find research conducted on the development of a healthcare system that adheres to the consumers' demands. Moreover, research was conducted on diverse topics and directions from 1980 to 1990 when it comes to u-Healthcare, but most focused on the combination of IT technology and u-Healthcare, and on the possibility of using the system. Starting from the 2000s, researches were conducted on the Ubiquitous health services from medical, biological and psychological viewpoints. However, these too were not conducted from a business management aspect, but from a technological health model aspect. Accordingly, this research factored in this situation to analyze the correlation between the variables of all the models that were studied based on Pender's Health Promotion Model and middle-aged people and senior citizens' level of demand for u-Healthcare services. For this objectives, this study examines medical consumers' quality requirements to ensure competitive superiority in the field of medical service and on the basis of this, chooses main attributes which can effectively apply to quality measurement of medical service and quotation. On the basis of preexistence various studies, this study elicits attributes of consumers,

requirements, divides medical consumers into the public and group experts and conduct a survey. After choosing main quality attributes on the basis of survey results, this study analyzes the interrelationship of quality character and attributes and elicits main quality character by using QFD(Quality Function Deployment) method to change customers' subjective requirements about service into a concrete medical service.

This study aims at exploring evaluation methods and alternative models to assess objectively and evidently quality characteristics of u-Healthcare Service that Korean adults expect through the analysis of these procedures. Moreover, the main motives of this research are to suggest ways of providing necessary information to build a system in competing with other services and ways of planning goods capable of considering customer satisfaction.

2. Research purpose

The purpose of this research lies in maximizing customer satisfaction by examining the relation between variables of Pender's Health Promotion Model(HPM) and customers' demand of u-Healthcare Service and then, by suggesting methods applicable to u-Healthcare System design. Especially, it verified the suitability of research model to health promotion model variables and made use of confirmatory factor analysis to prove causal significance between potential variables with customers who have used u-Healthcare Service or intend to use it later as subjects. After identifying performance levels and influence coefficients of every variable and applying them to QFD to find out the relation between the requirements of u-Healthcare System Service, it sets the main goal in determining what are important system service characteristics for effective quality improvement by using the result. For the goal, the following research processes are chosen.

First, this study introduced main evaluative factors of Pender's Health Promotion Model in order to draw out objective requirements from customers on u-Healthcare for the development of u-Healthcare System. Also, it suggested a structural equation model in order to figure out a method of evaluation capable of accommodating the multi-dependency causality between assessment factors and a

optimal causality between them.

Second, the structural equation model examined the validity of the composition of potential variables and observation variables of the health promotion model through a confirmatory factor analysis and whether it is suitable or not is assessed.

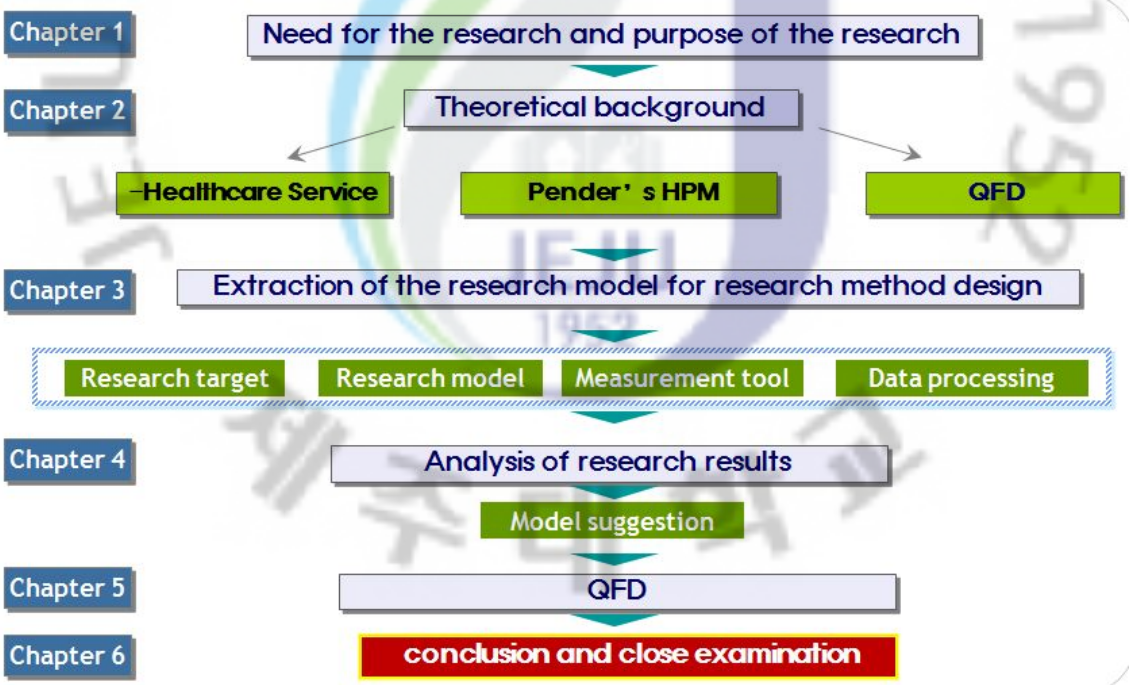
Third, in order to consider the correlation between evaluation norms and factors of service quality characteristics for the customer satisfaction of u-Healthcare system users, I figured out the influence of multiple dependency causality by using partial least squares. In addition, I rated significant health promotion models on the basis of the standardization discriminant function and applied it to the evaluation norms as a weighted value (Hyejung Chang & Dohoon Kim, 2010). Using this, I suggested an evaluation model to determine the order of priority in consumer quality characteristics.

Fourth, I carried out a survey of experts on the correlation between system development difficulty and characteristics of both u-Healthcare system and service quality. I finally drew out a value weight on system service characteristics by adding the result of the order of priority in consumer quality characteristics to the above survey and determined the practical order of priority in u-Healthcare system service characteristics. And then, at last, Suggested a model to be applied to the development of goods focused on customer satisfaction by taking into consideration the real difficulty of the system development.

3. Research Organization Scheme

This research paper is composed as follows. Chapter 2 covers the theoretical background to identify the concept and current status pertaining to u-Healthcare. Moreover, theories related to Pender's Health Promotion Model and previous researches are examined. In Chapter 3 and 4, I created the research method design and research model in order to figure out the system quality characteristics suitable to the consumer requirements by using the health promotion model and quality function deployment. Chapter 6 identifies the results of the research issues presented in this research paper, and reaches a conclusion while presenting ensuing problems and implications.

<Figure 1> research configuration diagram



Ⅱ. Theoretical background

1. u-Healthcare service

1.1. Concept of u-Healthcare and Feature

Ubiquitous was suggested by Mark Weiser of Xerox' s PARC (Palo Alto Research Center) in the US in 1988. Ubiquitous computing refers to the intelligent environment that is comprised of a huge number of computers that can provide necessary information to human beings at the right timing (Mark Weiser, 1993). In other words, it refers to a computing environment that can be used anywhere, and computers of diverse types and forms are attached to the human beings and objects so that they are connected organically, creating a computing environment that pays no heed to time and space (Kim Gyeong-woo, 2004).

Ubiquitous era such as a health assurance system, automobile network system, educational learning system, environment social system and others. Among these, the health assurance system directly affects human life. The share of the medical costs among the social costs is increasing every day (Park Wu-kyung et al., 2003). These medical costs can be reduced drastically, not by treating the illness after it occurs, but by preventing the illness from occurring. From this respect, u-Healthcare is one of the areas that can be utilized most actively in the Ubiquitous society.

u-Healthcare is an acronym for Ubiquitous Healthcare, and it refers to the adoption of a Ubiquitous environment in the medical field using IT technology to provide medical and health management services that can be used for diagnosis, treatment, follow-up management and illness prevention management regardless of time and space. u-Health is the paradigm that developed e-Health, which emerged due to the advancement of IT in the industrial area centered on public sanitation and medical service consumers (Park Rae-woong et al., 2005). If and when e-Health refers to the electronic exchange of public sanitation and medical information among citizens, patients, public sanitation medical service providers, IT service providers and solution companies, u-Health is not limited to the exchange

of public sanitation and medical information. Instead, it is a concept where cutting-edge public sanitation and medical technology's electronic space are connected with physical space and networks that include the targets of public sanitation and medical service and institutions that provide the service(Kim Sun-ra, 2006).

The scope of medical services is not limited to hospitals alone. Instead, this is rolled out even to the patient's home and space while moving, growing into a concept of u-Health that can be used any time and anywhere. Through u-Health, the general public, patients, disabled people and senior citizens can benefit from periodical inspection of their health state by leveraging diverse communication networks via wired and wireless networks while at their home or from medical protection institutions.

Likewise, they can maintain their health by preventing in advance. Moreover, public sanitation medical service providers' medical devices are connected via networks. Thus, medical professionals can carry out increasingly convenient and precise diagnosis, treatment and follow-up management. However, all these are merely a glimpse of what u-Health can do in the future since it is likely to grow significantly due to technological advances, revamping of related systems and changes in the culture of using public sanitation and medical services.

When the cases in which u-Healthcare is applied today are examined in detail, u-Health measurement sensors are leveraged to measure body signals such as blood pressure, pulse, electrocardiogram, body fat and others, and the measured body signal is transmitted via a gateway such as WPAN. Then, suitable hospitals or u-Healthcare centers monitor the information about the body transmitted based on guidelines for the data. An Individual's health state is checked according to the monitoring information, and patients are taken care of to aid the doctor's diagnosis. Moreover, when abnormal symptoms are observed from the monitoring information, information is sent to the applicable specialized hospitals so the doctors can take action (Stut, 2006). Data, recorded, stored and accumulated during this process becomes important data for data mining. Likewise, besides patients' everyday life patterns, their health state is monitored continually to carry out increasingly active and effective health management, illness prevention and feedback (Lee Byung-moon et al., 2008).

Likewise, u-Health's foremost feature is that it can realize many of the goals pursued by public sanitation and medical services. Through u-Healthcare, public sanitation and medical services can be provided any time, anywhere at the right time with utmost safety. Both public sanitation and medical service providers and users can benefit from reduced time and costs, and focus on hospitals has now shifted to the users, accelerating changes in the medical environment, and it is expected that this system can advance all public sanitation and medical services processes ranging from prevention to diagnosis, treatment and follow-up management in a balanced manner (Park Chang-geol et al., 2005).

1.2. User centered u-Healthcare system

While society's environment is changing rapidly these days, interest in health is increasing as well, which in turn increase healthcare costs. In particular, the share of those using u-Healthcare services is increasing as well. When healthcare services are provided in a Ubiquitous environment, it is possible to use medical services easily in our everyday life environment. Likewise, it is possible to minimize the intervention of medical professionals whose labor costs are high, realizing health management from home that enables mass supply. Moreover, it is possible to provide customized health management services to individuals for illness prevention, early detection and follow-up management as well as increased health.

When perceived from the service supplier's point of view, a Ubiquitous environment enables accurate diagnosis and treatment of illness and customized health management home service using treatment information. Moreover, it is possible to check the quality of the health management home service offered based on periodical health check-ups and to improve when necessary. From this respect, u-Healthcare system development is most important to provide high-quality u-Healthcare. This u-Healthcare system needs to play the role of integrating service components.

A health assurance system as a u-Healthcare system refers to a system that offers a concierge function that provides services related to health during everyday life and assurance in a comprehensive manner while using the

Ubiquitous Network. When implemented in a full-fledged manner, benefits such as citizens' 'health and lifetime' extension, decreased burden of medical costs, care-taking (care-taking at home) and anxiety alleviation can be expected. This is based on the mental and physical care service. The mental and physical care services includes health maintenance and management services (health diagnosis at home, health management during exercise, etc.), body signal care-taking service, emergency service during emergency situations, remote communication service and support service while moving. These services are usually provided by private companies. What is most important when it comes to the u-Healthcare system components is that each u-Healthcare system needs to be user-friendly and they should prevent illness by managing health in detail. Moreover, they should be easy-to-use both at home and at work. In addition, they should be composed in a way that they are well suited for the purpose of customized medical devices for the prevention and treatment of each illness because it is necessary to apply technologies such as electrocardiogram, abdominal electromyogram, pulse and others that suit the system development depending on the need. Moreover, it is necessary to continue to introduce technological innovation and to improve quality according to user demand in order to enhance citizens' health. This is the direction for the u-Healthcare service.

2. Trend of the researches conducted both in and out of Korea on the u-Healthcare services

Information, knowledge, output, service and others related to public sanitation and medical services are transforming the public sanitation and medical services industry and the overall public sanitation and medical service system in line with the demands of the era as information is exchanged in digital form thanks to the digitalization and communication's innovative advancements. The trend of researches conducted both inside and outside Korea on u-Healthcare services is mainly classified into Ubiquitous applied areas, the portable body signal measurement device field, and the field of standardization for medical information transmission (Daegu Regional Innovation Agency, 2007).

2.1. Trend of overseas u-Health research

To ensure the advancement of the medical information industry, key foreign nations are increasing their investment in computerization, standardization, legal system, human resources cultivation and the formation of the basis for R&D. Moreover, they are actively entering into the u-Healthcare business in line with the aging of the population worldwide and the increase in the number of patients afflicted with chronic illnesses.

In the United States of America, as the government conducts the medical information policy, their medical information and u-Healthcare industry is based on a large-scale medical market, they keep a considerable competitiveness in the u-Healthcare field with original medical technology and they, especially American Telemedicine Association(ATA) takes the lead, make an active investment in development research. IBM provides a u-Health solution related to tele-monitoring and personal health checkups by using a mobile terminal as a part of Pervasive, mobile wearable computing research. Vivo-metrix attempts to apply recent information and communications technology to the u-Health field as it develops and commercializes a wearable bio signal monitoring system like Life-Shift that can measure and analyze vital signs through a remote physical checkup system and smart accessories. Moreover, Intel vigorously leads the

proactive life-care development research that can sense the patient's condition beforehand using a micro-system for biomedical information and communications application(American u-Health industry trend, 2009, Recent American u-Health trend , 2008).

Japan promotes future-oriented projects including tele-diagnosis and telemedicine by launching Healthcare Information in 2001 and Medical Network Project in 2006 as a part of Grand Design(Recent trend of u-Health industry, Korea IT Industry Promotion Agency). Especially, the growth of health care service field using mobile terminals is striking. The feature of Japan's research in the biometric perception field lies in its applied researches including the improvement research to measure bio-metric data through telecommunications network and satellites centered on Hokkaido University. Japan has a large potentiality in commercializing bio-metric sensors and so, it has an advantage in commercializing goods and conducting related researches(2008 Analytical Report of Medical Devices Industry, 2008).

International organizations of medical information standardization are HL7, ISO/TC 215, and CEN/TC 251. Recently, these three organizations agreed on Standard Harmonization to spur standard development in cooperation with ISO/TC 215 taking the lead(ICT Standardization Road map 2009). HL7 is the first organization in the field of health information delivery standards as it was launched in University of Pennsylvania in 1987 by medical institutions and related organizations to create standardized designs for electronic exchange of health and medical information.

2.2. Trend of the u-Health researches conducted in Korea

Domestic u-Health research and development is being actively conducted in the u-Healthcare service concerning blood pressure, pulse, blood sugar, and body fat (Promotion Situation and Implications of Domestic u-Healthcare Demonstration Project, 2008).

Seoul National University's Advanced Biometric Research Center is conducting research to develop body measurement technology that can diagnose human body functions continually on a real-time basis while maintaining normal everyday life

without limiting the human body' s activities, by attaching various sensors on the bed when users are sleeping in order to measure the breathing signals through an electrocardiogram and body signals, and to monitor the ballistocardiogram that manifests changes in body weight that accompanies the amount of feces and urine released every day, body fat, blood pressure measurements together with heart beat by using the toilet seat (Medical Observer, 2007).

Yonsei University Medical School' s research center on the portable integrated measurement system for emergency patients developed a wireless electrocardiograph and portable integrated measurement system for emergency patients that enables an ambulance that is transporting a patient to transmit electrocardiogram, blood pressure, X-ray photos and other information to the hospitals on a real-time basis and that can monitor the patient's state. These were developed with support from the Ministry for Health and Welfare. They are now in the pilot program (News Wire, 2005. 1). Moreover, a research center for the home health management system is conducting research on a multi-dimensional body signal detection system, multi-dimensional body signal information processing device, system for experts to promote health management at home, communication/DB/diagnosis server that do not require disabled people and senior citizens living alone to visit hospitals in person by offering them diagnoses and medical service at home, and a standardization method and interface specs that enable effective data exchange among work stations for medical experts and that effectively process and manage the re-use of data, analyses, search, and statistical information, etc (Ministry for Health and Welfare, 2008).

A ubiquitous-oriented appliance solution development project which the Ministry of Commerce, Industry and Energy has been conducting for a number of years due to the increase in the number of super fast network users, includes the development of Ubiquitous applied solution technologies including Ubiquitous support network chip set, additional smart network module, Ubiquitous supported networking middleware and medical/health solution technology, and it is launching products accordingly.

The u-Healthcare Research Team of the Samsung-ICU joint industry-academic research center established by the Information and Communications University (ICU) is developing u-Healthcare applied programs concerning ECG, stress,

obesity, blood sugar level and others as well as research on the u-Healthcare service platform that leverages mobile phones as the medium. LG recently built-in a stress and blood sugar level sensor into a mobile phone, together with the Healthpia, launching the product on the domestic market.

Some of the measurement equipment such as an electrocardiograph, electroencephalograph, patient monitoring device, myotome device, hemadynamometer, sonometer, and a child birth detection device that diagnoses the changes taking place in the body, are being developed by venture companies in Korea as well. However, efforts to develop a cutting-edge body state measurement device are rather lacking due to the lack of cutting-edge technology in the precision electronics field and lack of source technology for body state measurement devices. Thus, they are focused on the production of simple measurement devices and on information devices and analyzing devices(u-Health Industry Trend, 2009).

Moreover, whereas hospitals need diverse medical devices, there is a limit to the types of products that are developed or produced in Korea. Thus, these products lag behind those from foreign countries in terms of quality and technological ability. Likewise, the reality is that more often than not, they rely on products from overseas. These days, national institutions' research centers and academic communities and private companies' research centers are developing diverse forms of high-end body signal measurement equipment, but it is true that they lag behind those companies from advanced nations.

In Korea too, there is a generally accepted perception that it is necessary to secure reliability of data that is received from each remote device to enable remote diagnosis and that the standard interface composition is important. However, there are still many medical institutions in Korea including hospitals that have not digitalized their medical records. Moreover, codes and terms that are used are not standardized. As a result, when there is a need to exchange patients or medical information with other institutions, general diagnosis charts or simple file formats are transmitted. Thus, the receiver has to conduct analysis once again.

Main assumptions of the Pender model suggest that the effect of health promotion act will be high as positive feelings about past experiences, benefits of

health promotion act, level of self-efficacy, and behavior-related emotions are high and further, as behavior-related emotions and interpersonal relationship are affirmative.

Meanwhile, DICOM (Digital Imaging Communication in Medicine) is serving as the standard for medical images today. Accordingly, almost all the programs and systems support this. Thus, efforts to realize DICOM are being carried out actively centered on the universities' research centers or related companies.

As for the current status of the HL7 (Healthcare Level 7), there are attempts to adopt this in some of the hospitals in Korea, but it is still in the beginning stage. Going forth, the standard that is enacted in the HL7 will likely be used widely in Korea as well.

3. Pender's Health Promotion Model

3.1. Pender's Health Promotion Model

As for the forecasting model to analysis health behavior, there are four main models; Health Belief Model, Health Promotion Model, Theory Planned Behavior and Precede model. Among these, Bandura' s Society Perception Theory and Pender' s Health Promotion Model drawn out from Health Belief Model are the ones that are used most frequently to explain the Health Promotion behavior (Pender, 1982).

Theory Planned Behavior was developed by Ajzen(1991). This is a theory that focuses on the individuals' intention rather than on their behavior itself. This is applied to the health behavior forecasting, but it is not used as the analysis model for treatment or preventive behavior. Precede model was developed during the 1970s by Green. This theory presumes that it necessary to define what the health behaviors that are needed to maintain and to improve health are, and to know how these behaviors take place. This model claims that it is possible to reduce health related problems by transforming health behavior, and that the human beings' quality of life can be enhanced.

Society Perception Theory was developed to overcome the defects of the traditional behaviorism learning theory. In the traditional behaviorism learning theory, human behavior is determined entirely and manually by artificial stimulation, and the effect of perception by individuals, who are the main parties of behavior are not factored in at all. Meanwhile, Society Perception Theory is the viewpoint that claims that human behavior is determined by environment stimulation, recognition and interaction of actions. Self efficacy refers to confidence. It is core concept of Bandura' s theory that says that confidence can successfully lead to recommended behavior. In other words, this is clearly distinguished from the conviction of the personal that says that given behavior will lead to a certain result.

Health Belief Model was developed and modified by Rosenstok, Hochbaun, Kegeles and Becker. It analyzes health behavior based on the individuals' perception towards health and illness in order to forecast (Pender, 1987). This

model was developed during 1950s to explain preventive health behavior based on Lewin's theory on the societal psychology. Lewin claimed that the individuals' behavior towards health is affected by the strength level of the value that human beings have towards specific results. That is, the behavior is affected by the possibility of reaching specific results when it comes to specific behaviors and by the disorder elements when it comes to specific behavior(Becker, 1974). Health Belief Model is used for forecasting behavior for illness prevention and patients afflicted with chronic illness' s therapeutic behavior execution. This model was found to be valuable through numerous researches(Choi Young-hee, 1984). However, Health Belief Model is inappropriate for forecasting Health Promotion behavior since it merely forecasts behavior related to specific illness. Thus, it merely explains about illness prevention and therapeutic aspect.

Pender presented health protection and Health Promotion behavior as the components of Healthy life style. In particular, he suggested Health Promotion Model to explain about the Health Promotion behavior (Pender, 1987). Health Promotion Model is the model used by Pender by developing on the notion of self efficacy, a core concept of Bandura(1986)' s theory (Pender, 1982). Pender(1982, 1987, 1996) leveraged the Health Promotion behavior as the guideline for explaining about the complex physiological, psychological and societal processes that are assumed in a direction that maintains or increase individuals' self realization or achievement and that strengthens individuals or groups' health. Health Promotion Model(1987) during the initial stage defined Cognitive Perceptual, adjustment elements and turning point for behavior as the determinants of the Health Promotion behavior (Pender, 1987). If Health Belief Model explains behavior related to the prevention of illness, Health Promotion Model explains behaviors related to the health enhancement such as eating habit, regular exercise etc. Cognitive Perceptual includes importance of health, perceived health control behavior, perceived self efficacy, definition of health, perceived health behavior' s perceived benefit, perceived health behavior' s perceived pathic and others to gain and to maintain Health Promotion behavior. The same elements affect Cognitive Perceptual. As for the elements that affect Health Promotion behavior, directly or indirectly include demographic characteristics, biological characteristics, interpersonal relation characteristics, situational elements,

behavioral elements and so forth (Kim Young-im et.al., 2007).

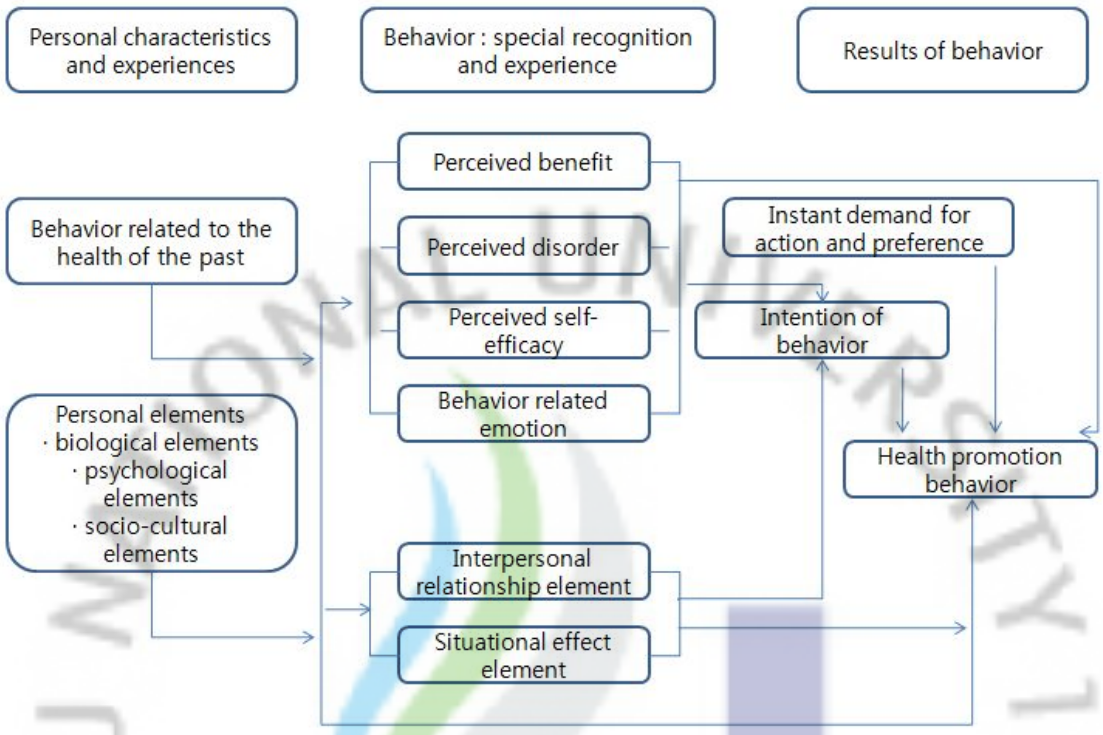
In the 2nd model, concept of interaction with the environment is replaced with self efficacy while concept of perceived pathic was added onto the Cognitive Perceptual. Cognitive Perceptual and self respect presented in the 1st model were excluded due to the difficult of concept measurement and due to the lack of actual evidence.

Pender(1996)' s the 3rd model is comprised of expectation-value theory and Cognitive Perceptual theory. As for the elements that affect Health Promotion behavior, they include perceived benefit, perceived pathic, perceived self efficacy, behavior related emotion or personal characteristics and experiences that are like the situation elements, behavior related perception and results of behavior(Pender, 1996).

Contents revised on the 3rd model include perceived benefit, perceived pathic, perceived self efficacy, emotion related to behavior with the behavior related perception and emotion instead of the Cognitive Perceptual which is the element of Health Promotion behavior that precedes. These three elements are the direct elements of the Health Promotion behavior, and they are explained as the indirect elements that influence Health Promotion behavior through behavior intention. When the Pender' s Health Promotion Model(HPM) revised for the third time is organized, and presented in the form of a diagram, it is as shown on the [Diagram 2] below.

Pender model' s key assumption is that the degree of acting on the Health Promotion behavior will be greater when there is positive and resourceful emotion towards past experiences. Likewise, Health Promotion behavior in the Health Promotion Model can be considered the behavior that brings out positive health experience in the life of human beings and the final result of the behavior. Accordingly, diverse Health Promotion behaviors are explained from the behavior related to the prevention of illness and use of the Health Promotion Model is considered viable and most effective as the model that can forecast.

<Figure 2> Pender(1996)'s Health Promotion Model revised for the third time



3.2. Elements that influence Health Promotion behavior

Among the variables that affect Health Promotion behavior of middle aged adults and senior citizens based on Pender's the 3rd Health Promotion Model(HPM), researches conducted on the society's support, self respect, self efficacy, perceived benefit and perceived pathic will be examined.

A. Society's support

Society's support is a composite and multi-dimensional concept that includes the attributes concerning the emotional, information related and physical and evaluative support through the society's support entities. Thus, it is known to exert positive influence on the health state such as acting on the health behavior and stress alleviation effect (Park Ji-won, 1985; Baek Yoon-mi, 2005).

Society's support refers to the support that can satisfy individuals' desire in

a society through societal bonding. This is physical and mental help that can be received through the interaction with the spouse, family, friends and neighbors. Moreover, it refers to all the positive resources that can be gained from interpersonal relations. Appropriate social support exerts positive influence on the health promotion behavior. Society's support is closely related to the individuals' psychological and physical health according to numerous individuals, and it was studied as the element that alleviates individuals' negative elements (Kim Sung-hee, 2007 Norbeck, 1981). Numerous researches reported the finding that society's support acts as an element that influences Health Promotion behavior (Kim Su-kyung, 2008; Moon Sung-mi, 2000; Baek Yoon-mi, 2005; McManus, 1996; Padula, 1997). Likewise, this research too selected society's support element as the element that influence middle aged adults and senior citizens' Health Promotion behavior.

B. Self respect

Self respect is an element for evaluating the concept of the self, and this entails perceiving oneself as the human being who accepts oneself in a positive and valuable individual. In other words, this refers to the degree in which one believes that one is important, successful and valuable. This is one of the personality traits that is gaining considerable attention of various academic fields. It is the self recognition that is formed last in the ego formation stage. Stuart, Colin & Larry(1984) conducted analysis to examine self respect in terms of how effectively one aligns one's capability, success, value, importance and other value with the standard set by oneself. They said that the findings are then compared to those of others to assess one's performance.

Relationship between self respect and Health Promotion behavior was proven in various researches(Kim Su-kyung, 2008; Bae Jin-soon, 2005; Baek Yoon-mi, 2005; Hanner, 1986; Yarche & Mahon, 1989). When self respect is higher, Health Promotion behavior is higher as well. Thus, this research too selected self respect element as an element that affects middle aged adults and senior citizens' Health Promotion behavior.

C. Self efficacy

Self efficacy is the conviction that one can successfully carry out the behavior required to produce positive result. It plays the role of connecting the relationship of subjective perception and behavior that is carried out in actuality. Thus, it is emphasized as a key determinant of the change in behavior in the recent times (Bandura, 1986). Self efficacy can change according to situation, and it affects behaviors in all areas such as new behavior selection, continuity, and behavior resumption. In addition, it affects emotional reaction such as thinking pertaining to behavior, capability or anxiety (Strecher & DeVellis, Becker & Rosenstock, 1986). When coping with environment demand, human beings with low self efficacy get stressed since they perceive their difficulties bigger than the reality and are unable to use their capability effectively. However, human beings with high self efficacy focus their interest and capability in line with situational demand, and make even more effort to overcome the problems (Bandura, 1986). Various researches(Kim Geum-ja, 2000; Kim Su-kyung, 2008; Baek Yoon-mi, 2005; Ali, 1999; Conn, 1988; Martinelli, 1999) confirmed self efficacy as Health Promotion behavior' s important forecasting element. Thus, this research too set the self efficacy element as an element that influences middle aged adults and senior citizens' Health Promotion behavior.

D. Perceived benefit and perceived pathic

Perceived benefit is the expected gain that one expects when carrying out Health Promotion behavior. It reacts as the element that continues Health Promotion behavior. When behavior itself is repeated, this is perceived as strengthening of the trust towards resourcefulness. When resourcefulness is higher, level of Health Promotion behavior execution is higher(Pender, 1996). This is because of the tendency to invest time and resources to the activities that can increase the experiences that brought out positive results to the human beings.

Perceived gain suggested in the Health Promotion behavior model determines the scope of the behavior plan so that it is possible to participate in the behavior that can bring about expected gain. It some times motivates behavior, directly or indirectly. Previous researches(Kim Su-kyung, 2008; Baek Yoon-mi, 2005; Lim Mi-young, 1998) conducted in Korea identified perceived benefit as one of the

key influencing factors.

Perceived pathic is one of the concept that comprises Becker(1974)' s Health Belief Model. It was applied in most of the researches on the health behavior. Difficulty or obstacle that one perceives when conducting Health Promotion behavior is called the disorder or roadblock to carrying out Health Promotion behavior. When it is difficult to carry out the given behavior or if the pathic is high, behavior does not result. Assumption was made that the Health Promotion behavior decreases when pathic increases (Pender, 1996). In other words, pathic affects the intention to participate in specific behavior or the intention. It was defined as the negative aspect of health behavior that impedes execution of Health Promotion behavior.

Relationship among perceived pathic and Health Promotion behavior is proven by various domestic and foreign researches(Kim Su-kyung, 2008; Park Hyun-jung, Kim Hwa-joong, 2000; Baek Yoon-mi, 2005; Yoon Soon-nyeong and Kim Jung-hee, 1999; Chung Mi-sung, 1999; Pender, 1996). Thus, this research too set the perceived benefit and pathic as the elements that affect middle aged adults and senior citizens' Health Promotion behavior

4. Concept and Application of Quality Function Deployment for the Analysis of Users' Requirements

4.1. Outline of System Users' Requirements Analysis

The requirements as chief goals of the system analysis stage in system development are significant elements to determine the success of the system (Gung Sang-hwan et al, 2008). And as the users' requirements are very abstractive and non-programmed, the job of extracting and programming the requirements of system is not that easy. The requirements area document defining what functions the system should be equipped with. This is the step defining what to process rather how to process in the system design stage. Then, it moves into the design stage. As the result of requirement analysis is the basis of the design stage, there are overlapping parts between two stages (Andirole & Stephen, 1990). Moreover, the requirements include not only users' requirements but the scope of realizable possibility as objects of requirement analysis (Galletta et al, 1999). And, requirement analysis is the stage defining clearly what functions the system should be equipped with and solutions to the system problems before creating objects of development suitable to the users' opinions and starting to develop the system. Here, ways or tools for the identification of stake holders affecting the success or failure of the system (Leite & Julio, 1987). Requirements should be collected and provided from the viewpoint of diverse users who are related to the system. These viewpoints are divided into user requirements and system requirements. While user requirements are the viewpoint on Problem Domain, system requirements are on Solution Domain. In detail, requirements are extracted from problem domain and arranged going through the processes of acquirement and analysis, specification, verification and maintenance into the promotion scope of future project and an important document referred to in every stage of system design(Park Su-yong, 2002).

The extraction of requirements is a basic job to create a useful system. Therefore, the ways how to extract requirements and how to concretize them from each stakeholder's requirements specification are used while defining the purposes the system pursues and then, subdividing and actualizing them in order

to draw out requirements (Gung Sang-hwan et al, 2008).

For high-quality requirements, efficiency, flexibility, integrity, correct, maintainability, unambiguous, complete, consistent, ranked for importance and stability, verifiable, modifiable, traceable, understandable elements are needed. It is important to analyze requirements from diverse viewpoints and in a systematic way for the purpose of maintaining the quality of suggested requirements. The methods to do this are Data Flow Diagram(DFD) introduced by DeMarco in 1979, Data Dictionary(DD), and Structured System Analysis(SSA) using Mini-Spec. In addition, Dynamic Modeling applied to Real-Time System, Information Modeling, Object-Oriented Modeling, and Domain Analysis are used(Heo Won-sil, 2006).

4.2. Concept of Quality Function Deployment and Deployment Process

Quality Function Deployment is a measure to maximize customer satisfaction for the purpose of faithfully reflecting consumer requirements in final goods and services through every stage from building the concept of new products, designing, planning parts, process and production to sales(Kim Yeon-seong et. al., 2000). The objective of Quality Function Deployment is to provide objective and structuralized formats in diverse functions of design and production process to customers by drawing out various customer requirements in concrete and practicable designs and types. As this kind of Quality Function Deployment includes the process investigating customer requirement attributes in the stage of product planning, it needs more time than other general product planning. Once the product is planned, however, Quality Function Deployment has an advantage to create a competitive product as it can figure out customer requirements according to their attributes. Quality Function Deployment structuralizes and documents experiences and information in relation to customer requirement attributes and product properties through the house of quality model. The house of quality model provides numerous experiences and pieces of information in a clear way and thus, has an advantage to consider a variety of occasions.

Among domestic case studies, the study of Ryu Jae-hyeok and Byeon Seung-nam (2005)attracts attention. This study explored the way to satisfy users' needs by applying their emotional elements to products after analyzing

them through sensibility ergonomics as a way to put diverse user requirements into product designs as the users' interest moves from products themselves to the mental and psychological area. Kim Jin-hun(2007) conducted a research that actually applies the model of Quality Function Deployment to an automobile development project. This paper drew out a comprehensive solution measure from requirements concerning products, process and organizational integration in order to define the development project and created an integrated development project model to design to compromise conflicting goals in the course. This study made it possible to analyze for compromise not only products but development process and development project objectives as well for the purpose of defining development project. And it is confirmed that a complementary synergy effect is created by combining the system engineering design process and the analytical method of Quality Function Deployment both in process and methodology. Hyejung Chang, Dohoon Kim(2010) divided user service attributes into those of user satisfaction group and those of user dissatisfaction group using discriminant analysis and then, applied them to QFD in their research on the customer service quality concerning diverse kinds of health and medical information with the Internet as a medium. Hans Jorn Juhl introduced a case that applies applicable factors to QFD by using structural equations.

There is a study that utilizes Quality Function Deployment in the field of medicine. Jeong Yong-yeop(2005) proposed a measure for civil liability and legislative reformation in the implementation of telemedicine. As he suggested diverse doers and aspects by using the model suggested by Quality Function Deployment, he proposed a task to solve legal and institutional problems in the course in which telemedicine firmly takes root. In reality, however, case studies on the possibility and expansion of medical industry using Quality Function Deployment are not enough. As it is expected that telemedicine and medical practices on the ubiquitous basis will expand, we need to propose how to approach and analyze diverse factors arising in the process.

Ⅲ. Research Methods

1. Survey Methods

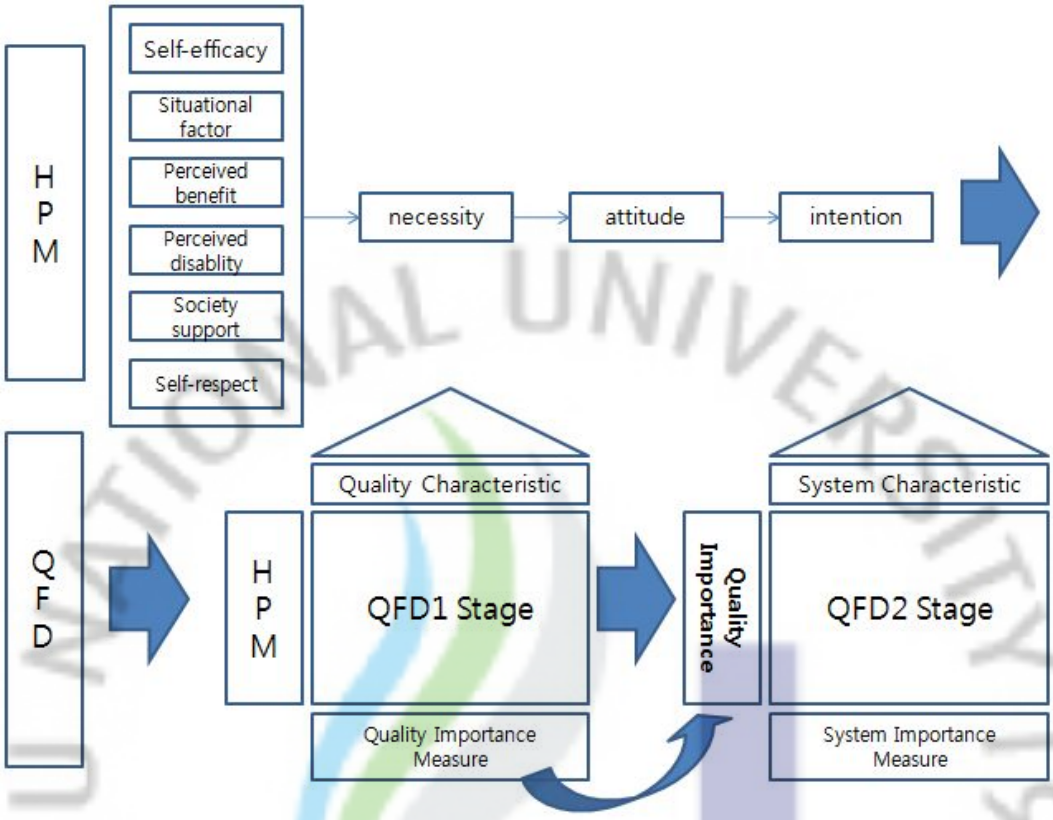
This study conducts a positive survey of consumers who have experienced or want to experience u-Healthcare service now as it aims at figure out the relation between health promotion model and not only consumers' requirements of u-Healthcare service but also system service characteristics. Korean adults tend to be greatly concerned with healthcare and suffer from some chronic diseases so that they might have a high interest in u-Healthcare service, too. Thus, this study takes Korean adults as subjects.

2. Research Model

Pender's Health Promotion Model tries to explain diverse human characteristics in relation to the health for quality of life enhancement and its theoretical framework derives from the subjective value expectancy theory and the social cognition theory arguing individual cognition and behaviors will affect future actions to some extent (Kim Yeong-im et. al., 2007). Therefore, the patterns of individual healthcare are affected by HPM variables. I want to select in the HPM part research model health promotion model variables that will be applicable to QFD later and use then in the analysis of QFD by figuring out the relation between consumers' intention to use u-Healthcare service and HPM variables.

Though, at this point of time when the interest in u-Healthcare is on the increase, a lot of related researches are being conducted, most of them are done separately by focusing on HMP verification or QFD analysis. Thus, this study attempts to find out practical implications including a suggestion of evaluation method to assess objectively and evidently the system quality characteristics of u-Healthcare service by connecting two models of HPM and QFD. The research model based on the above-mentioned intent is shown in <Figure 3>.

<Figure 3> Research Model



3. Measuring Instruments

3.1. The Concept of u-Healthcare in this Research

As the whole world turns into the period of aging society, chronic patients are rapidly increasing. In this aging society, the level of health expectancy as a part of quality of life enhancement rises and medical demands soars. On this basis, Industry-Academic Cooperation Foundation, Gachon University of Medicine and Science is expected to provide a cutting-edge solution service to chronic patients to prevent diseases and manage health in any place and time. This foundation is conducting researches on health management technology and service to find out a solution for people's health by focusing on patient-centered, evolutionary, and integrated type contents for chronic patients to improve their living habits and maintain thorough self-management through IT Convergence Technology

Development Center for Chronic Disease Control that was selected by Ministry of Knowledge Economyto take charge of an industrial original technology development project (Industry-Academic Cooperation Foundation, Gachon University of Medicine and Science, 2010).

The first generation healthcare means that a patient goes to hospital in person to consult a doctor and get medical treatments with instruments. Then, with the spread of Internet use, as diverse digitalized health service-related systems are developed, there emerges e-Health in which telediagnosis and electronic management of medical records are possible. E-Health is defined as a combination of information technology and healthcare to facilitate the exchange of medical information between individuals, medication institutions and solution companies. u-Healthcare is the concept connecting not only physical and electronic spaces including patients and service institutions but the exchange of medical information in the distributed environment based on a variety of networks as telecommunications technology grows (Lee Jeong-jin, 2008).

u-Healthcare can continue to monitor patients' health information including workout time and rapidly cope with an emergency situation by using mobile terminals and various sensors due to their development (Stut, 2006). For the vitalization of u-Healthcare, the government also endeavors to carry out system reformation and development in earnest. Thus, this study will suggest a way to provide necessary information in building u-Healthcare systems and to plan a product with customer satisfaction taken into account. <Figure 4> is a conceptual diagram of a high blood pressure patient using u-Healthcare.

<Figure 4> conceptual diagram of a high blood pressure patient using u-Healthcare

(research material : Gachon University of Medicine and Science, http://www.cdmservice.kr/)

3.2. Outline of Health Promotion Model

1) Social Support

As an instrument to measure perceived social support, Interpersonal Support Evaluation List(ISEL) developed by Cohen & Hoberman , revised by Seo Mun-ja and proved to be trustworthy by Baek Yun-mi(2005) is used. This instrument is composed of 18 4-point questions in total and the higher the score is, the higher is social support. At the time of development, the reliability coefficient of this instrument was 90. As the instrument reliability in this study, Cronbach's α figure was .878 and 9 5-point questions in total were used.

2) Self-esteem

As a measure to gauge self-esteem, the self-esteem measurement instrument developed by Rosenberg(1965), adapted by Jeon Byeong-jae(1974) and proved to

be trustworthy by Baek Yun-mi(2005) was used. This instrument is a 10-question, 4-point measure and the higher the score is, the higher is self-esteem. The reliability coefficient in the study of Baek Yun-mi was .75. As the instrument reliability in this study, Cronbach's α figure was .849 and 5 5-point questions in total were used.

3) Self-efficacy

As an instrument to measure self-efficacy, the self-efficacy measure in common situations developed by Sherer & Maddux(1982) and proved to be trustworthy by Baek Yun-mi was used. It is a measure of 17 5-point questions in total and the higher the score is, the higher is perceived self-efficacy. The reliability coefficient in the study of Baek Yun-mi was .89. As the instrument reliability in this study, Cronbach's α figure was .894 and 5 5-point questions in total were used.

4) Perceived Disability

As an instrument to measure perceived disability, 10 questions based on the health trust measurement instrument developed by Moon Jeong-sun(1990), revised by Seo Hyeon-mi and used by Baek Yun-mi(2005) was used. The higher the score of these questions is, the higher perceived disability is. The reliability coefficient of the instrument in Seo Hyun-mi' s study (2001) was .72. As the instrument reliability in this study, Cronbach's α figure was .816 and 5 5-point questions in total were used.

5) Perceived Benefit

As for perceived benefit, 11 questions based on the perceived benefit measurement instrument developed by Moon Jeong-sun(1990) and revised by Baek Yun-mi(2005) were used. The higherthe score of these questions is, the higher perceived benefit is. The reliability coefficient in Baek Yun-mi' s study was very high as .94. As the instrument reliability in this study, Cronbach's α figure was .863 and 5 5-point questions in total were used.

6) Necessity

As the u-Healthcare necessity, 9 questions developed and proved to be trustworthy by Lee Jeong-jin (2009) were used. In Lee Jeong-jin's study, the reliability coefficient of service necessity was .87 and that of significance was .86. As the instrument reliability in this study, Cronbach's α figure was .928 and 9 5-point questions in total were used.

3.3. Outline of QFD

1) u-Healthcare Service Quality Characteristics

In this study, the quality characteristic measurement instrument is composed of 17 items revealed by the research of Natalia et al. (2005) in order to select user requirements for efficient u-Healthcare system development with QFD. Detailed components are 4 items of Network, Device, User Interface, and Operating System. As the way to gauge each item, 5-point measure of 1=completely not important, 2=not important, 3=neutral, 4=important and 5=very important is used.

2) u-Healthcare System Service Requirements

As the measurement instrument of u-Healthcare System Service composition, 25 items extracted from 39 items used in Hwang's study (2008) with unsuitable items not included is selected. Detailed components are 4 items of Platform and External Interface, Device and Service Management, Network Connectivity, and Health Device. As the way to gauge each item, 5-point measure of 1=completely not difficult, 2=not difficult, 3=neutral, 4=difficult and 5=very difficult is used. And the degree of connectivity combining consumer requirements and service components is examined as 1=weak correlation, 3= medium correlation and 9=very strong correlation.

4. Way of Data Collection

Survey subjects of this study are users who are interested in u-Healthcare System. In order to fill in customer requirement attributes as the column of HOQ, the survey was conducted three times: 250 copies of preliminary survey were first collected at Jeju International Airport for two days from August 7, 2010, and then 50 copies in September 27, and 300 copies of main survey were distributed and collected from October 9 to 10. Korean adults who use Jeju International Airport are subjects and the survey was performed by self administered questionnaire survey method in which subjects filled in their questionnaire in person and assistants collected them. 291 questionnaires were used for the positive analysis among 300 copies with 9 insincere copies excluded and the analysis was carried out with SPSS 12.0 for window.

The requirement chart necessary to u-Healthcare system as the horizontal axis of HOQ was conducted simultaneously with the main survey and 291copies among 300 were used for the positive analysis. In addition, 20 copies of u-Healthcare system service measurement items and difficulty survey were distributed to Healthcare-related data processing experts and 18 of them were collected. Total 14 copies among them were used for the this study as 4 copies with weak response reliability were ruled out. Ordinary citizens were asked to answer the importance of system requirements and with experts, the connectivity between difficulty in service composition system building, requirements and service components was measured.

Ⅳ. Analysis Findings

1. General Characteristics of Survey Subjects

General characteristics of survey subjects for this study are as follows.

<Table 1> General Characteristics of Survey Subjects

variable	division	frequency(person)	rate(%)
sex	male	138	47.4
	female	151	51.9
	didn't answer	2	.7
age	20s	50	17.2
	30s	118	40.5
	40s	77	26.5
	50s	46	15.8
education	under middle school graduation	1	.3
	under high school graduation	78	26.8
	in college	31	10.7
	college graduation	168	57.7
	over graduate school	13	4.5
job	students	25	8.6
	housewives	59	20.3
	white-collar workers	70	24.1
	blue-collar workers	12	4.1
	self-employed people	19	6.5
	professionals	49	16.8
	teachers	2	.7
	owner-operators	33	11.3
	unemployed	3	1.0
	medical workers	7	2.4
	others	12	4.1
family types	singles	68	23.4
	spouses	55	18.9
	parents-children	156	53.6
	family members	8	2.7
	didn't answer	4	1.4
the children's school grade	no children	28	9.6
	preschool	35	12.0
	elementary school	42	14.4
	middle and high school	39	13.4
	college and graduate	55	18.9
	no answer	92	31.6

income per month	below 2 million won	23	7.9
	2 to 3 million won	48	16.5
	3 to 4 million won	62	21.3
	4 to 5 million won	60	20.6
	5 to 6 million won	70	24.1
	below 7 million won	21	7.2
	no answer	7	2.4
residential types	apartment	170	58.4
	apartment with stores	7	2.4
	detached house	47	16.2
	multiplex housing	57	19.6
	officetel	6	2.1
	other types	4	1.4
residence	Seoul	77	26.5
	Gyeonggi-do	66	22.7
	Gyeongsangnam-do	26	8.9
	Gyeongsangbuk-do	18	6.2
	Jeollanam-do	13	4.5
	Jeollabuk-do	6	2.1
	Chungcheongnam-do	9	3.1
	Chungcheongbuk-do	7	2.4
	Jeju-do	68	23.4
	didn't answer	1	.3
total		291	100.0

Total 291 valid responses were collected. Divided into genders, male subjects are 47.4% and female 51.9%. 0.7% didn't answer. Classified into age groups, 17.2% are in their twenties, 40.5% in their thirties, 26.5% in their forties and 15.8% in their fifties.

In education, it is revealed that 0.3% of them are under middle school graduation, 26.85 under high school graduation, 10.7% in college, 57.7% college graduation, and 4.5% over graduate school.

In jobs, 8.6% of them are students, 20.3% are housewives, 24.1% white-collar workers, 4.1% blue-collar workers, 6.5% self-employed people, 16.8% professionals, 0.7% teachers, 11.3% owner-operators, 1.0% unemployed, 2.4% medical workers, and 4.1% others.

In family types, it is found out that 23.4% of them are singles, 18.9% are spouses, 53.6% parents-children, 2.7% extended family members, and 1.4% no answer.

For the children' s school grade, 9.6% of them have no children, 12.0% are in preschool, 14.4% in elementary school, 13.4% in middle and high school, 18.9%in

college and graduate school, and 31.6% no answer.

In income per month, 7.9% of the subjects earn below 2 million won, 16.5% 2 to 3 million won, 21.3% 3 to 4 million won, 20.6% 4 to 5 million won, 24.1% 5 to 7 million won, and 7.2% below 7 million won.

In residential types, 58.4% of them live in apartment, 2.4% in apartment with stores, 16.2% in detached house, 19.6% in multiplex housing, 2.1% in officetel, and 1.4% in other types of residence.

In residence, 26.5% of them live in Seoul, 22.7% in Gyeonggi-do, 8.9% in Gyeongsangnam-do, 6.2% in Gyeongsangbuk-do, 4.5% in Jeollanam-do, 2.1% in Jeollabuk-do, 3.1% in Chungcheongnam-do, 2.4% in Chungcheongbuk-do, 23.4% in Jeju-do, and 0.3% didn't answer.

2. Validity and Reliability Analysis of the Measure

In this chapter, a reliability analysis with factor analysis and internal consistency as norms was carried out by using Cronbach's α coefficient in order to analyze the validity and reliability of independent variables, dependent variables and moderating variables put into this study.

2.1. Validity and Reliability Analysis of Exogenous Variables

First of all, the findings of validity and reliability analysis of exogenous variables are as follows.

<Table 2> Validity and Reliability Analysis of Variables

question	factor1	factor2	factor3	factor4	factor5	factor6
society's support4	**.748**	.169	.075	-.002	.097	.085
society's support5	**.744**	.104	.213	.044	-.054	-.034
society's support2	**.729**	.102	.267	.143	-.030	.121
society's support3	**.724**	.100	.012	.161	.069	.058
society's support8	**.710**	.004	.313	.113	.043	-.072
society's support6	**.673**	.082	.090	.123	.096	.075
society's support1	**.629**	.133	.378	.118	.012	.127
society's support9	**.616**	-.115	.319	.066	.070	-.196
efficacy2	.065	**.842**	.052	.178	.034	.122
efficacy4	.045	**.822**	.081	.226	.101	.080
efficacy3	.089	**.819**	.038	.216	.036	.062
efficacy5	.134	**.775**	.094	.239	.073	.055

efficacy1	.165	**.688**	.111	.258	.053	−.070
self−esteem5	.149	.067	**.788**	.036	.127	.108
self−esteem4	.198	.087	**.784**	.091	−.034	.120
self−esteem2	.214	.080	**.759**	.085	−.061	.073
self−esteem3	.283	.085	**.689**	.081	.023	−.056
self−esteem1	.473	.066	**.660**	.073	.009	.014
benefit4	.142	.242	.069	**.802**	.079	.082
benefit5	.271	.200	.030	**.801**	−.024	−.005
benefit2	.174	.300	.085	**.761**	.031	−.141
benefit1	.150	.354	.151	**.685**	−.034	−.199
benefit3	−.048	.244	.110	**.667**	.189	.239
disability1	.109	.076	−.075	.040	**.803**	.146
disability5	.085	.056	.037	−.092	**.800**	−.032
disability2	.090	−.081	−.044	.095	**.789**	.221
disability3	−.123	.022	.077	−.003	**.720**	.268
disability4	.067	.230	.074	.208	**.601**	−.103
situational factor2	.027	.005	.079	.015	.222	**.854**
situational factor3	.142	.205	.156	−.030	.193	**.748**
eigen−value	4.588	3.744	3.325	3.219	2.996	1.725
explanation	15.294	12.480	11.084	10.731	9.986	5.752
cumulative explanation	15.294	27.775	38.858	49.590	59.576	65.328
Cronbach's α	0.877	0.894	0.849	0.863	0.816	0.743

The findings are made up of 6 factors in total. Among them, 3 questions of social support item 7, situational factor item 1 and item 4 are excluded as they show factor loading simultaneously high in two factors to harm the discrimination validity. As a result, accumulated explanation rate is revealed as 65.5%.

Factor 1 is made up of 8 social support questions, 5 self−efficacy questions, 5 self−esteem questions, 5 benefit questions, 5 disability questions and 2 situational factor questions repectively.

In addition, reliability coefficient is all as high as over 0.70 when internal consistency among items of each factor is examined.

2.2. Validity and Reliability Analysis of Necessity

Then, factor analysis on necessity was carried out and the findings are as follows.

<Table 3> Validity and Reliability Analysis of Necessity

question	factor1
necessity8	.853
necessity4	.844
necessity3	.830
necessity6	.830
necessity7	.816
necessity9	.805
necessity1	.760
necessity5	.729
necessity2	.712
eigen-value	5.748
explanation	63.870
cumulative explanation	63.870
Cronbach's α	0.928

As the result of factor analysis, necessity is proved to be a single factorand the whole explanation rate is high as 63.9%. And as the result of reliability analysis, reliability coefficient is high as 0.928, so that I think it proper to compose 9 necessity questions as a single factor.

2.3. Validity and Reliability Analysis of Attitude

And, a factor analysis on attitude was conducted and the findings are as follows.

<Table 4> Validity and Reliability Analysis of Attitude

question	factor1
attitude3	.904
attitude1	.895
attitude2	.892
eigen-value	2.413
explanation	80.448
cumulative explanation	80.448
Cronbach's α	0.877

As the result of factor analysis on 3 attitude questions, attitude is also found out to be a single factor and explanation rate is very high as 80.4%. As reliability coefficient is also high as 0.877, it is judged to be desirable that 3 questions compose a single factor of attitude.

2.4. Validity and Reliability Analysis of Intention

Finally, a factor analysis on intention was conducted and the findings are as follows.

<Table 5> Validity and Reliability Analysis of Intention

question	factor1
intention1	.947
intention2	.947
eigen-value	1.793
explanation	89.671
cumulative explanation	89.671
Cronbach's α	0.885

As the result of final factor analysis on 2 questions of behavior intention, it is proved to be a single factor and explanation rate is revealed very high as 89.7%. As reliability coefficient is also high as 0.885, it is judged to be desirable that 2 questions compose a single factor of behavior intention.

3. Confirmatory Factor Analysis

3.1. Single Factor Confirmatory Factor Analysis

After conducting reliability analysis, Confirmatory Factor Analysis (CFA) will be carried out in next constructs stage by stage. This analysis aims at removing items that hurt single dimensionality. The optimal conditions of constructs in each factor will be evaluated through the following Goodness-of-Fit Index. P value(=0.05 is desirable) on GFI(Goodness-of-Fit Index: over 0.90 desirable), AGFI(Adjusted Goodness-of-Fit Index over 0.90 desirable), RMR(Root Mean Square Residual: smaller than 0.05 desirable) and NFI(Normed Fit Index over 0.90 desirable) is used.

Confirmatory factor analysis findings in each factor are shown in the following Table.

<Table 6> Confirmatory factor analysis findings in each factor

	χ^2	df	p	GFI	AGFI	NFI	RMR	RMSEA
self-efficacy	6.946	2	0.031	0.998	0.942	0.988	0.014	0.092
situational factor	saturated model							
perceived benefit	saturated model							
perceived disability	5.231	2	0.073	0.991	0.954	0.988	0.028	0.075
society's support	19.775	9	0.019	0.977	0.945	0.970	0.021	0.064
self-esteem	0.469	2	0.791	0.999	0.996	0.999	0.004	0.000
necessity	30.172	14	9,997	0.971	0.942	0.977	0.016	0.063
attitude	saturated model							
intention	saturated model							

As the result of analysis, every factor is satisfactory in goodness of fit norms. However, question 5 of self-efficacy, questions 1 and 3 of perceived benefit, question 4 of perceived disability, questions 1 and 9 of social support, question 4 of self-esteem and questions 2 and 3 of necessity are too highly correlated with other questions to harm goodness of fit. So questions asking important contents are selected and overlapping questions are removed.

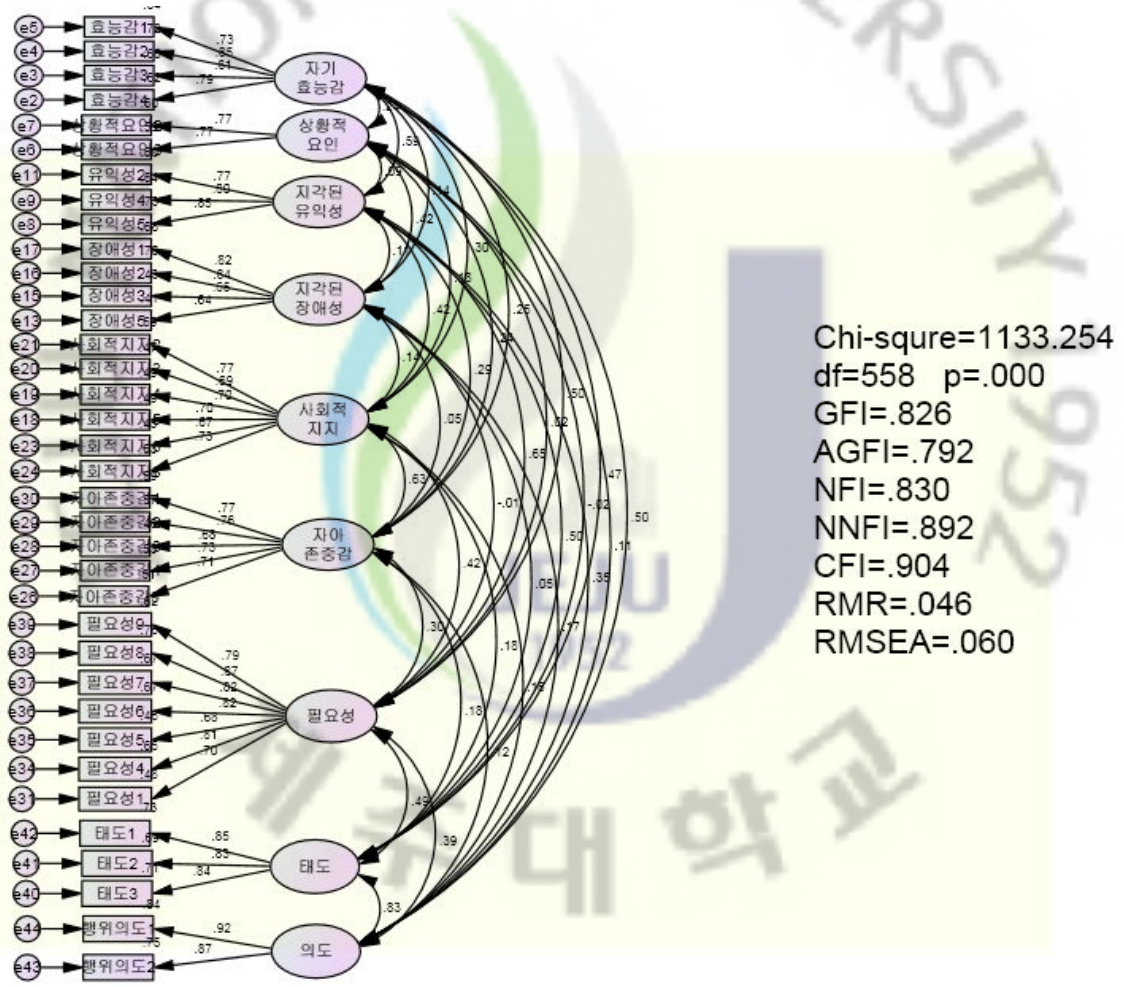
In addition, as situational factor, perceived benefit, attitude and intention have below 3 questions to be saturated models, they cannot create goodness of fit index. GFI, AGFI, RMR, NFI value in other factors are proved to be satisfactory.

3.2. Whole Factor Confirmatory Factor Analysis

Before structural equation model analysis set in this study, the suitability and validity of potential variables and observation variables that compose them are verified through Confirmatory Factor Analysis. Through this analysis, questions of observation variables hurting the composition of potential variables are selected and reliability will be raised. Moreover, to securing unidimensionality of each construct is for observation variables to show acceptable goodness of fit by each factor model. It is difficult to see that unidimensionality between observation variables and potential variables used in structural equation model is secured even

though Cronbach's α mainly used in reliability analysis is high. This analysis aims at finding out questions hurting reliability by identifying Squared Multiple Correlation that explains whether significant causal relationship exists between potential variable and observation variables or not and potential variables by observation variables.

<Figure 5> Result of Whole Confirmatory Factor Analysis



As the result of analysis, model goodness of fit through confirmatory factor analysis is as follows: GFI 0.826, AGFI 0.792, NFI 0.830, RMR and RMSEA are 0.046 and 0.060respectively. And course significance between potential variables and observation variables is as follows.

<Table 7> course significance between potential variables and observation variables

			표준화	비표준화	S.E.	C.R.	P
efficacy4	<-	self-efficacy	.789	1.000			
efficacy3	<-	self-efficacy	.814	.977	.067	14.608	.000***
efficacy2	<-	self-efficacy	.849	1.002	.066	15.281	.000***
efficacy1	<-	self-efficacy	.733	.823	.064	12.905	.000***
situational factor2	<-	situational factor	.774	1.063	.150	7.078	.000***
situational factor3	<-	situational factor	.768	1.000			
benefit5	<-	perceived benefit	.854	1.000			
benefit4	<-	perceived benefit	.801	.967	.064	15.041	.000***
benefit2	<-	perceived benefit	.772	.952	.066	14.410	.000***
disability5	<-	perceived disability	.644	1.000			
disability3	<-	perceived disability	.655	.991	.106	9.318	.000***
disability2	<-	perceived disability	.836	1.116	.101	11.015	.000***
disability1	<-	perceived disability	.824	1.196	.109	10.947	.000***
society's support5	<-	society's support	.702	1.000			
society's support4	<-	society's support	.697	1.025	.095	10.763	.000***
society's support3	<-	society's support	.687	1.114	.105	10.629	.000***
society's support2	<-	society's support	.766	1.114	.095	11.719	.000***
society's support6	<-	society's support	.668	1.108	.107	10.348	.000***
society's support8	<-	society's support	.725	1.112	.100	11.169	.000***
self-esteem5	<-	self-esteem	.711	1.000			
self-esteem4	<-	self-esteem	.727	1.063	.095	11.194	.000***
self-esteem3	<-	self-esteem	.675	.965	.092	10.452	.000***
self-esteem2	<-	self-esteem	.756	1.086	.094	11.590	.000***
self-esteem1	<-	self-esteem	.766	1.066	.091	11.721	.000***
necessity4	<-	necessity	.809	1.120	.087	12.916	.000***
necessity5	<-	necessity	.680	.986	.090	10.946	.000***
necessity9	<-	necessity	.786	1.152	.092	12.574	.000***
attitude3	<-	attitude	.843	1.000			
attitude2	<-	attitude	.831	1.032	.062	16.779	.000***
attitude1	<-	attitude	.852	1.112	.064	17.375	.000***
intention2	<-	intention	.866	1.000			
intention1	<-	intention	.916	1.062	.056	18.997	.000***
necessity6	<-	necessity	.819	1.125	.086	13.061	.000***
necessity7	<-	necessity	.819	1.253	.096	13.067	.000***
necessity8	<-	necessity	.872	1.346	.097	13.832	.000***
necessity1	<-	necessity	.696	1.000			

* p<0.05 ** p<0.01 *** p<0.001

First, causal significance between potential variables and observation variables is proved to be all statistically significant (p<0.05). Therefore, all observation variables are judged to be applicable to structural equation model.

4. Structural Equation Model Analysis

In this paragraph, I first evaluate whether structural equation model is suitable to the data set in this study, confirm revised final model and conduct a verification of hypothesis by finding out the significance of course coefficient between factors

In the following figure, the measurement model that introduced measuring variables into the conceptual research model is turned into Structural Equation Model with Amos 5.0. Structural equation is a useful method in that it can verify theoretical suitability of the research model to be studied and the significance between all the variables.

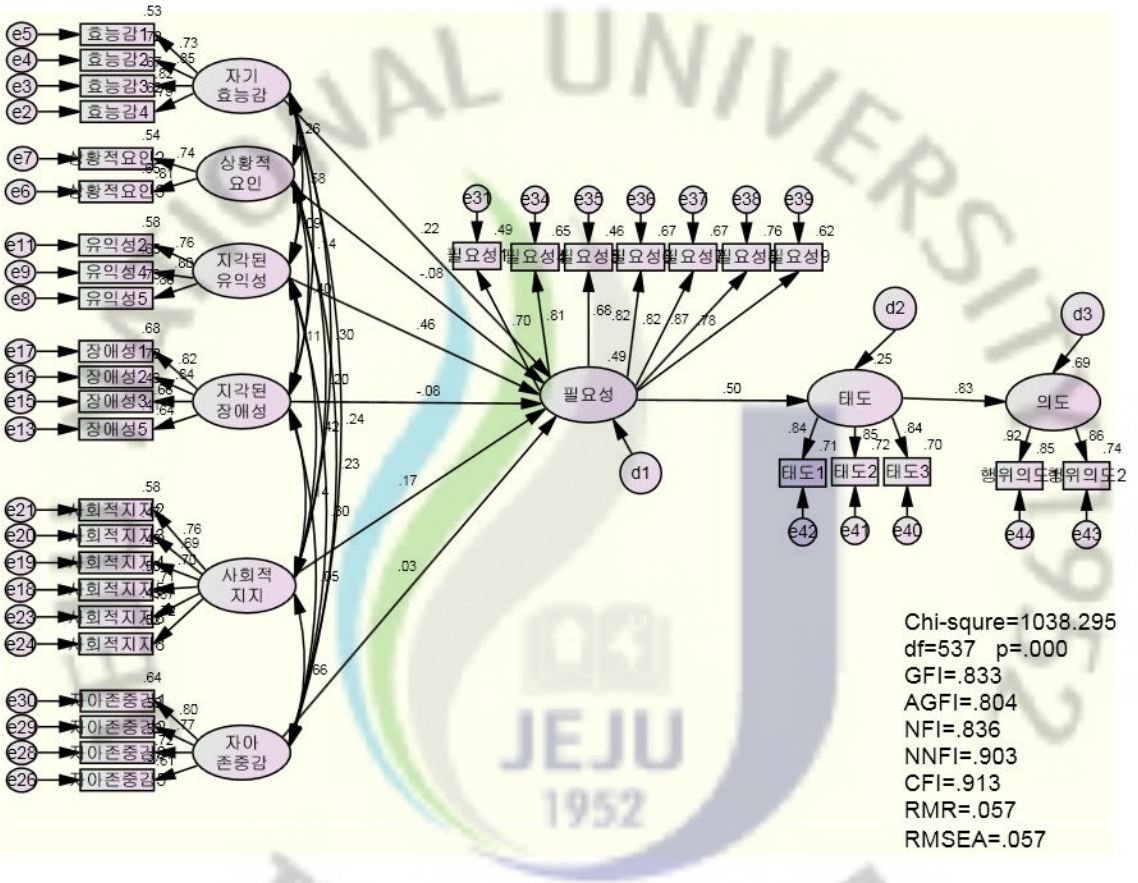
As the value of chi-squared test used to prove null hypothesis that covariance matrix of parameter and supposed covariance matrix are the same is smaller and p-value is over 0.05, it is evaluated as a good model. That is, when null hypothesis that covariance matrix of parameter and supposed covariance matrix are the same is chosen, it means a good model.

In general, chi-square(x^2), GFI, AGFI, and RMR show model goodness of fit in absolute index. In reality, even verifying conditions are met in the suitable model, chi-square probability value is low in case of large sample. This is because chi-square distribution has a weak point to change depending on the sample size. When the sample is very large, it signals even a slight difference between model and reality though the sample explains reality properly. What researchers want is not a model explaining reality completely but a simple one already suffered in a degree. The simple model in case of large sample is very small in chi-square probability value without exception. Though the researcher rejects null hypothesis due to low probability value, his rational judgment is certainly significant (Kang Byeong-seo 1999). Thus, in this paper, due to the large number of samples, goodness of fit will be evaluated by taking GFI, AGFI, RMR into consideration simultaneously with chi-square and probability value as the basis for goodness of fit judgment.

4.1. Verification of the Basic Model

First, I built a structural equation model for the basic model set in this study and examined its goodness of fit. The findings are as follows.

<Figure 6> Findings of the Basic Model Analysis

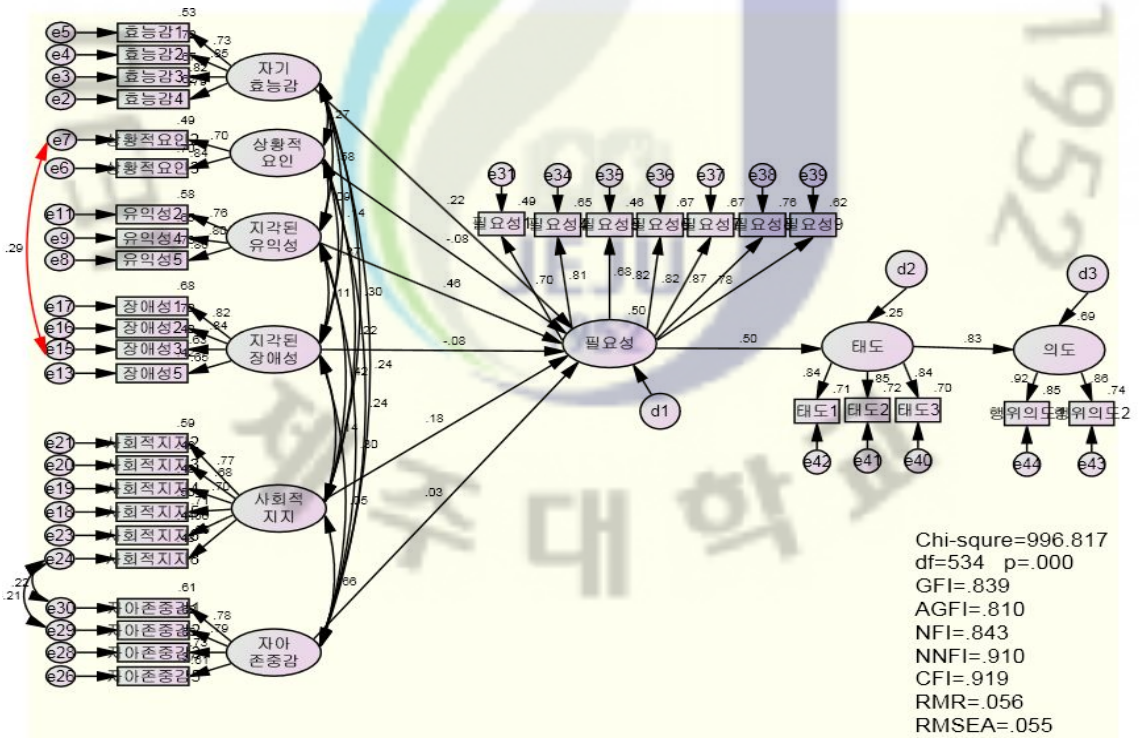


On the basis of GFI, AGFI, NFI, TLI, RMR, and RMSEA used mainly to assess model goodness of fit, I evaluated the goodness of fit of the basic model. When GFI, AGFI, NFI, and TLI are from 0.8 to over 0.9, and RMR and RMSEA are from 0.05 to below 0.08, it is regarded as a good model(R. Bagozzi and Y. Yi, 1998). The findings show that chi-square value in the basic model was 1038.295 and p-value was 0.000. And GFI was 0.833, AGFI 0.804, and NFI 0.836. In addition, RMR was 0.051, and RMSEA 0.057. Thus, the model was not unsuitable as a whole. But, it is judged that I need to modify the model on the basis of Modification Indices (MI) in order to build a more suitable model.

4.2. Verification of the Modified Model

In covariance structural analysis, it is possible to modify the basic model (conceptual research model) to enhance reliability. In Amos, as mentioned above, supporting functions are provide to develop a modified model by using the modified indices. This modified model must have a logical foundation and goodness of fit will be enhanced to make covariance free by assuming the probability that covariance exists among error terms. For this, model modification was carried out focusing on covariance among error terms showing positive (+) value of par change in modified indices[1]. As a result, chi-square value in the modified model was sharply lowered to 508.532and GFI was about 0.90, AGFI 0.849, NFI 0.892, and RMSEA 0.056. Thus, model goodness of fit was improved to a more favorable direction as a whole.

<Figure 7> Structural Model Analysis Result of the Modified Model



The following is the result arranged into a diagram of analyzing the modified model with the basic model as a norm.

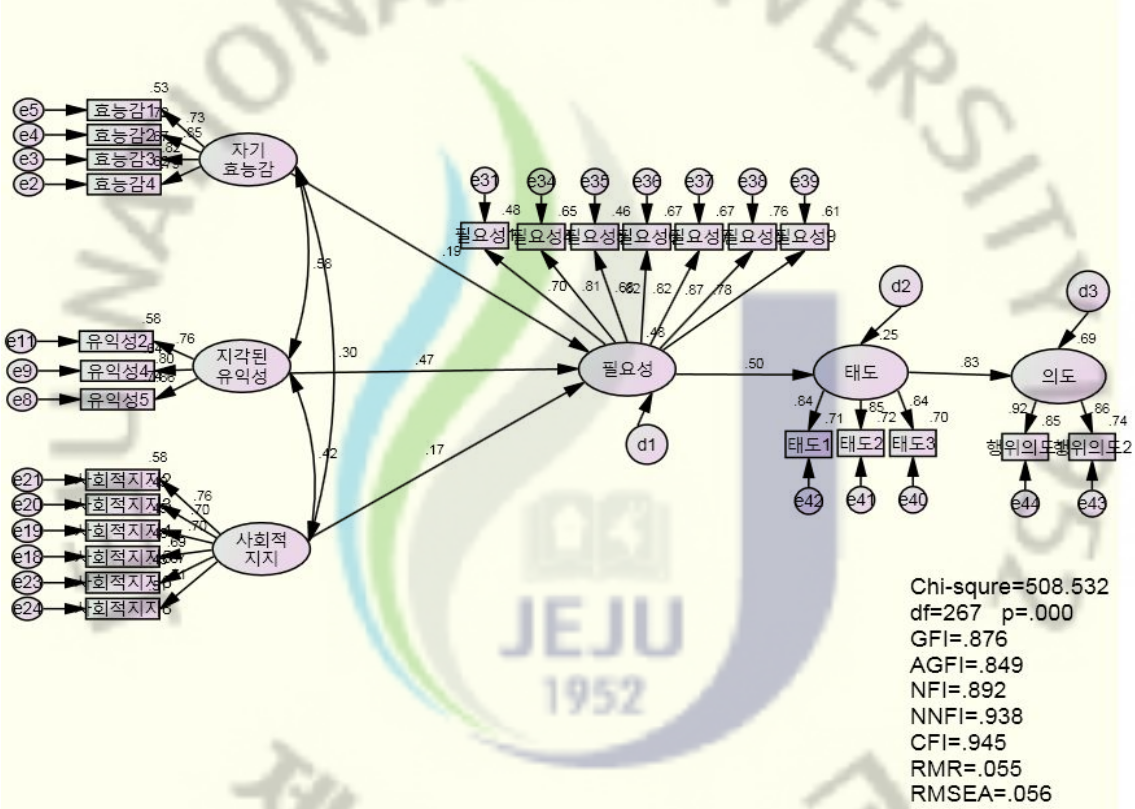
1) e5↔e7, e3↔e5, e14↔e15, e3↔e6, e17↔e18, e2↔e4 e8↔d2

<Table 8> the basic model and the modified model's goodness of fit

모형	χ^2	D.F.	p	GFI	AGFI	NFI	TLI	RMR	RMSEA
basic	1038.295	537	0.000	0.833	0.804	0.836	0.903	0.057	0.057
modify	996.817	534	0.000	0.838	0.810	0.843	0.910	0.056	0.055
difference	41.478	3	0.000***						

* p<0.05 ** p<0.01 *** p<0.001

<Figure 8> Structural Model Analysis Result of the Final Modified Model



<Table 9> the basic model and the final modified model's goodness of fit

모형	χ^2	D.F.	p	GFI	AGFI	NFI	TLI	RMR	RMSEA
basic	1038.295	537	0.000	0.833	0.804	0.836	0.903	0.057	0.057
modify	508.532	267	0.000	0.876	0.849	0.892	0.938	0.055	0.056
difference	529.763	270	0.000***						

* p<0.05 ** p<0.01 *** p<0.001

If the number of samples to analyze in this study becomes a little larger, it is generally appropriate to examine model goodness of fit with such goodness of fit indices as GFI rather than chi-square. In case of the final modified model, GFI is about over 0.90 and other goodness of fit indices are favorable. So it is regarded as a valid model. In view of statistics to assess each goodness of fit, first of all, when GFI and AGFI are over 0.90, the model is assessed as good. As TLI is revealed as near to 0.90 in the modified model, model goodness of fit is thought to be excellent.

Moreover, The difference of chi-square value between the basic research model and the modified model is 529.763 and in case degree of freedom is 267, there emerged a statistically significant difference between two models in goodness of fit ($p<0.05$). Therefore, the modified model is thought to be more excellent in goodness of fit that the basic model and so it is selected as the final model.

4.3. Result of Path Significance Verification

The result of verifying path significance between potential variables examined in the above-mentioned final model is as follows.

<Table 10> Result of Path Significance Verification between potential variables

			standardization	β	S.E.	C.R.	P
self-efficacy	→	necessity	.220	.221	.072	3.084	.002**
situational factor	→	necessity	-.081	-.048	.039	-1.251	.211
perceived benefit	→	necessity	.457	.388	.068	5.740	.000***
perceived disability	→	necessity	-.077	-.063	.047	-1.345	.179
society's support	→	necessity	.180	.194	.088	2.192	.028*
self-esteem	→	necessity	.030	.037	.096	.386	.700
necessity	→	attitude	.495	.636	.086	7.372	.000***
attitude	→	intention	.829	.919	.069	13.323	.000***

* p<0.05 ** p<0.01 *** p<0.001

<Table 11> Result of Path Significance Verification between modified potential variables

			standardization	β	S.E.	C.R.	P
necessity	←	self-efficacy	.190	.191	.068	2.788	.005
necessity	←	perceived benefit	.473	.400	.067	5.959	.000
necessity	←	society's support	.167	.183	.065	2.791	.005
attitude	←	necessity	.495	.637	.086	7.367	.000
intention	←	attitude	.829	.920	.069	13.326	.000

First of all, variables having a significant effect on necessity are 3 factors such as self-efficacy, perceived benefit and social support ($p<0.05$).On the other hand, situational factor, perceived disability and self-esteem do not have a significant effect ($p>0.05$). That is, it is found out that as self-efficacy is higher, benefit of u-Healthcare service is highly recognized, and the degree of social support is higher, necessity of u-Healthcare is highly recognized. In addition, necessity has a significant positive (+) effect on attitude and in turn, attitude on intention. As attitude is positive, it affects behavioral intention.

Ⅴ. Quality Function Deployment(QFD)

1. Analysis for the QFD Application

QFD is a technique to determine how to satisfy customers' needs with limited resources by listening to customers' opinions and finding out what they want(Lee Sang-bok & Shin Dong-seol, 2008). QFD turns customer-experienced quality factors revealed in customer satisfaction into technological quality and analyzes them, selects quality improvement tasks according to importance and priority of customers and make customer-oriented products through quality improvement(Hauser & Clausing, 1988; Sullivan, 1986). Applicable fields of QFD is not limited to product designs, but it is used even to decide on priority and optimal goals of How's for What's.

In this study, I want to apply health promotion model to QFD. That is, health promotion model, u-Healthcare service quality characteristics and system service characteristics are built into a causal relationship, a center of HOQ. Finally, chief result of HOQ is the priority of system service characteristics. By using this, I determine important system service characteristics for the effective quality improvement.

1.1. Calculation of Importance Measure of Health Promotion Model

In this study, I identified three pivotal factors of self-efficacy, perceived benefit and social support through confirmatory factor analysis in order to select an effective u-Healthcare system development using QFD. Contents of each factor are shown in <Table 12>. In order to calculate importance measure of individual variables of each factor applicable to HOQ, I divided necessity of u-Healthcare with a mean into upper and lower groups and extracted important elements in judging upper and lower groups of self-efficacy, perceived benefit and social support and then, conducted discriminant analysis to figure out order of importance priority(Hyejung Chang & Dohoon Kim, 2010). It is suitable to draw out order of importance on the basis of standardized discriminant function. The

result is shown in the following <Table 13>.

<Table 12> Contents of each factor

factor	content
efficacy1(B1)	Using u-Healthcare Service, I can carry out necessary health acts to improve my health.
efficacy2(B2)	Using u-Healthcare Service, I can maintain a balanced diet.
efficacy3(B3)	Using u-Healthcare Service, I feel confident to overcome difficulties in healthcare.
efficacy4(B4)	Using u-Healthcare Service, I can exercise regularly.
benefit2(D2)	Ubiquitous Healthcare will be effective to cope with emergency immediately.
benefit4(D4)	Ubiquitous Healthcare will be helpful to save time for health care.
benefit5(D5)	Ubiquitous Healthcare will be convenient as it is possible to measure and manage it.
society's support2(E2)	I have people to have a good time with me.
society's support3(E3)	I have people to help me to the hospital when sick.
society's support4(E4)	I have people to tell me right and wrong without hesitation.
society's support5(E5)	My relatives and friends think that I am helpful for them.
society's support7(E7)	I feel satisfied with my life more than others do.
society's support8(E8)	I can find friends who will gladly join me when I want to have dinner or drink with them.

<Table 13> standardization discriminant function

요소	필요성_상하		순위
	하	상	
efficacy1(B1)	1.164	1.243	7
efficacy2(B2)	1.260	1.110	8
efficacy3(B3)	1.266	1.942	5
efficacy4(B4)	0.203	0.340	12
benefit2(D2)	0.518	0.407	11
benefit4(D4)	0.989	1.587	6
benefit5(D5)	2.961	3.585	1
society's support2(E2)	1.720	2.309	2
society's support3(E3)	0.385	0.301	13
society's support4(E4)	0.944	0.675	10
society's support5(E5)	2.144	2.163	4
society's support7(E7)	1.964	2.274	3
society's support8(E8)	0.916	0.877	9
(상수)	-29.654	-38.591	

Fisher's linear discriminant function

As the result, in judging the upper and lower part of necessity, 'perceived benefit 5(I think it most important to be able to carry out physical checkup and management at home)' item is the highest as 3. 585 and then 'social support 2

and social support 7' items follow. That is, to think highly of benefit of u-Healthcare service is the most important service factor in recognizing necessity and then, as user's self-efficacy is higher, he or she recognizes necessity highly. On the other hand, social support reveals relatively low importance in recognizing necessity. Case-by-case statistics of each group are provided in <Appendix 4>.

1.2. u-Healthcare Service Quality Characteristic

I made up of a measuring instrument for quality characteristics with 17 items revealed by Natalia V. Em, Yu Gi-dong and Seo Ui-ho (2005). Detailed constructs are classified into 4 factors of Network, Device, User Interface and Operating System. Contents of each factor are shown in <Table 14>. In order to analyze validity and reliability of each item, a reliability analysis was conducted by using Cronbach's α coefficient based on factor analysis and internal consistency.

<Table 14> u-Healthcare Service Quality Characteristic

	Feature	Description
NETWORK	Mobility	Ability to operated in mobile environment
	Security	Ability to protect users' personal information
	Accessibility	Ability to be easily accessed
	Scalability	Ability to provide stable and scalable work even if the system is overloaded
	Interoperability	Connects various kinds of devices
DEVICE	Invisibility	Ability to provide service calmly, namely, without users' recognition
	Durability	Ability to maintain 'Power-on' status all the time
	Embeddedness	Ability to be embedded into physical environment and be unseen
	Portability	Ability of being used hands-free or with one hand
USER INTERFACE	Customizability	Ability to provide information to users according to their profile and preferences
	Nomadicity	Ability to be used while a user moves from place to place
	Usability	Ability to underpin input and output with by various user interfaces
	Versatility	Ability to be operated as a user moves from place to place and be manipulated using different physical objects
OPERATING SYSTEM	Contextinference	Ability to provide users with service fairly correlated with their current context
	Agility	Ability to complete operations on real-time basis
	Personalization	Ability to remember users' common patterns and use them later
	Pro-activeness	Ability to provide users with the service they are likely to require in the nearest future depending on their current situation

<Table 15> Service Quality validity and reliability analysis

	component			
	1	2	3	4
Invisibility	0.755	0.209	0.279	0.077
Durability	0.717	0.329	0.205	0.162
Embeddedness	0.678	0.275	0.189	0.248
Interoperability	0.658	0.203	0.266	0.257
Customizability	0.609	0.164	0.125	0.485
Portability	0.564	0.196	0.303	0.300
Scalability	0.518	0.273	0.513	0.142
Personalization	0.219	0.816	0.208	0.197
Pro-activeness	0.294	0.711	0.151	0.328
Contextinference	0.342	0.702	0.253	0.160
Agility	0.457	0.553	0.291	0.216
Mobility	0.157	0.091	0.771	0.303
Security	0.300	0.293	0.735	0.014
Accessibility	0.424	0.267	0.691	0.143
Nomadicity	0.307	0.113	0.121	0.824
Usability	0.217	0.298	0.204	0.660
Versatility	0.105	0.490	0.135	0.626
eigen-value	3.842	2.888	2.497	2.342
explained variance	22.600	39.587	54.277	68.052
Cronbach's ∝	0.933	0.934	0.935	0.936

Analysis result shows 4 factors in total. Every measurement variable used principle component analysis to extract structural factors and used varimax to simplify factor loading. Each factor loading is revealed very high as over 0.50. By examining internal consistency between questions composing each factor, I found out that reliability coefficient is high as over 0.9.

1.3. Correlation between Health Promotion Model and Service Quality Characteristics

In order to find out how much systematic correlation exists between health promotion model and u-Healthcare service quality characteristics, I conducted a correlation analysis. <Table 17 and 18> show the correlation between health promotion model and quality characteristics. By using this, I can build first HOQ(House of Quality). Correlation is marked below 0.01(**) and 0.05(*)in significant level between all the variables. As the result of correlation analysis, all

showed consistent correlation except ‘portability. This means that most quality characteristics have high correlation with variables of health promotion model. And this fact is the foundation to compose HOQ 1 quality chart(Hyejung Chang & Dohoon Kim, 2010).

<Table 16> the correlation between HPM and quality characteristics

	Mobility	Security	Accessibility	Scalability	Interoperability	Invisibility	Durability	Embeddedness
efficacy1	0.362**	0.288**	0.310**	0.303**	0.325**	0.335**	0.309**	0.287**
efficacy2	0.238**	0.176**	0.236**	0.267**	0.175**	0.190**	0.197**	0.160**
efficacy3	0.207**	0.135*	0.206**	0.160**	0.163**	0.138*	0.191**	0.191**
efficacy4	0.222**	0.136*	0.227**	0.140*	0.111	0.121*	0.158**	0.147*
benefit2	0.282**	0.227**	0.296**	0.204**	0.148*	0.231**	0.242**	0.181**
benefit4	0.260**	0.231**	0.292**	0.263**	0.259**	0.267**	0.247**	0.257**
benefit5	0.301**	0.323**	0.341**	0.229**	0.256**	0.297**	0.263**	0.291**
society's support2	0.248**	0.245**	0.260**	0.235**	0.285**	0.292**	0.341**	0.328**
society's support3	0.143*	0.174**	0.212**	0.214**	0.176**	0.239**	0.240**	0.208**
society's support4	0.108	0.059	0.133*	0.277**	0.192**	0.163**	0.220**	0.206**
society's support5	0.168**	0.217**	0.214**	0.227**	0.184**	0.290**	0.270**	0.245**
society's support6	0.181**	0.311**	0.247**	0.204**	0.144*	0.193**	0.285**	0.241**
society's support8	0.204**	0.185**	0.196**	0.257**	0.223**	0.250**	0.303**	0.248**

<Table 17> the correlation between HPM and quality characteristics

Portability	Customizability	Nomadicity	Usability	Versatility	Contextinference	Agility	Personalization	Pro-activeness
0.358**	0.280**	0.329**	0.308**	0.287**	0.283**	0.338**	0.327**	0.367**
0.293**	0.250**	0.270**	0.218**	0.115	0.192**	0.266**	0.309**	0.321**
0.216**	0.140*	0.248**	0.152**	0.186**	0.176**	0.215**	0.251**	0.263**
0.215**	0.221**	0.200**	0.170**	0.144*	0.116*	0.166**	0.234**	0.260**
0.269**	0.257**	0.303**	0.258**	0.277**	0.264**	0.288**	0.242**	0.281**
0.273**	0.306**	0.335**	0.232**	0.205**	0.285**	0.343**	0.312**	0.353**
0.341**	0.283**	0.336**	0.263**	0.286**	0.344**	0.365**	0.300**	0.351**
0.182**	0.258**	0.310**	0.327**	0.280**	0.362**	0.326**	0.309**	0.352**
0.089	0.185**	0.202**	0.273**	0.186**	0.251**	0.199**	0.265**	0.336**
0.091	0.233**	0.135*	0.172**	0.190**	0.179**	0.201**	0.216**	0.234**
0.152**	0.281**	0.195**	0.194**	0.164**	0.232**	0.228**	0.183**	0.282**
0.146*	0.233**	0.210**	0.216**	0.178**	0.200**	0.230**	0.198**	0.237**
0.186**	0.258**	0.270**	0.266**	0.210**	0.282**	0.283**	0.171**	0.297**

2. Calculation of Importance Measure of u-Healthcare Service Quality Characteristics: First Stage QFD

The method of calculating importance to determine order of priority in practicing service quality characteristics for each customer requirement in QFD is to use importance of HPM and correlation coefficients between HPM and service quality characteristics that customers evaluated. Relative importance of service quality characteristics in the process of quality improvement is calculated as follows.

$$AI_j = \sum_{i=0}^{m} R_{ij} W_{i,\ldots j} = 1,2,\ldots,n$$

(AI_j : service quality characteristics $(j = 1,2,\ldots,n)$: relative importance, W_i : HPM_i importance, R_{ij} : degree of correlation between HPM and service quality characteristics)

According to the size obtained from the calculation of AI_j order of priority in service quality characteristics is determined(Wasserman, 1993).

By using correlation coefficient and importance measure weight in <Table 17 and 18>, I built first HOQ. Here, I draw out importance measure on the relationship between HPM and system service characteristics. I use discriminant coefficient of HPM as weight and utilize Simple Weighted Summethod widely used in Quality Function Deployment. As the result, requirement order of priority necessary for u-Healthcare system is drawn out. Data are shown in the following <Table 18>. In <Table 19>, the result of system quality characteristics (simple FC) produced in HOQ is recorded as importance measure.

The result of first HOQ is shown as follows. The importance of Operating System is 5.83~4.92 and tends to be highest in importance measure. In detail, the importance of "leading action" is the highest as 5.83. That is, ordinary users recognize leading action of operating system as most important. And then, "speed" is 5.37 in importance measure. "Situational Inference" and "Individualization" are relatively low in importance measure as 4.98 and 4.92 respectively.

About the importance of User Interface, survey subjects' answers are 4.98 and 4.92 as a whole and this tendency is also high in importance measure. In detailed items, "Mobility" is the highest in importance measure as 5.12 and "User

Specificity" is the second as 4.75. "Multi-functionality" shows 4.0 in importance measure. This means that users recognize the mobility of devices as the most important.

Survey subjects' total responses to Device are 4.97~4.27 as they recognize the importance of it as somewhat high. In detail, the importance of "Durability" is the highest in importance measure as 4.97 and "Embeddedness" is the second as 4.73. As a result, users think of the durability of device as the most important.

In Network, all 5 items show over 4 points in importance measure. Especially, the importance of "Accessibility" is the highest as 4.88, and "Security" is 4.43 and "Interoperability"is 4.07 respectively. That is, users in general recognize the importance of network as high and especially, the accessibility for the convenience of use as the most important element.

<Table 18> Calculation of Importance Measure of u-Healthcare Service Quality Characteristics: QFD

		Network					Device				User Interface				Operating System				
		Mobility	Security	Accessibility	Scalability	Interoperability	Invisibility	Durability	Embeddedness	Portability	Customizability	Nomadicity	Usability	Versatility	Context inference	Agility	Personalization	Pro-activeness	
Self efficacy	B1	0.362	0.288	0.310	0.303	0.325	0.335	0.309	0.287	0.358	0.280	0.329	0.308	0.287	0.283	0.338	0.327	0.367	1.243
	B2	0.238	0.176	0.236	0.267	0.175	0.190	0.197	0.160	0.293	0.250	0.270	0.218		0.192	0.266	0.309	0.321	1.110
	B3	0.207	0.135	0.206	0.160	0.163	0.138	0.191	0.191	0.216	0.140	0.248	0.152	0.186	0.176	0.215	0.251	0.263	1.942
	B4	0.222	0.136	0.227	0.140		0.121	0.158	0.147	0.215	0.221	0.200	0.170	0.144	0.116	0.166	0.234	0.260	0.340
Perceived benefit	D2	0.282	0.227	0.296	0.204	0.148	0.231	0.242	0.181	0.269	0.257	0.303	0.258	0.277	0.264	0.288	0.242	0.281	0.407
	D4	0.260	0.231	0.292	0.263	0.259	0.267	0.247	0.257	0.273	0.306	0.335	0.232	0.205	0.285	0.343	0.312	0.353	1.587
	D5	0.301	0.323	0.341	0.229	0.256	0.297	0.263	0.291	0.341	0.283	0.336	0.263	0.286	0.344	0.365	0.300	0.351	3.585
Society"s support	E2	0.248	0.245	0.260	0.235	0.285	0.292	0.341	0.328	0.182	0.258	0.310	0.327	0.280	0.362	0.326	0.309	0.352	2.309
	E3	0.143	0.174	0.212	0.214	0.176	0.239	0.240	0.208		0.185	0.202	0.273	0.186	0.251	0.199	0.265	0.336	0.301
	E4			0.133	0.277	0.192	0.163	0.220	0.206		0.233	0.135	0.172	0.190	0.179	0.201	0.216	0.234	0.675
	E5	0.168	0.217	0.214	0.227	0.184	0.290	0.270	0.245	0.152	0.281	0.195	0.194	0.164	0.232	0.228	0.183	0.282	2.163
	E7	0.181	0.311	0.247	0.204	0.144	0.193	0.285	0.241	0.146	0.233	0.210	0.216	0.178	0.200	0.230	0.198	0.237	2.274
	E8	0.204	0.185	0.196	0.257	0.223	0.250	0.303	0.248	0.186	0.258	0.270	0.266	0.210	0.282	0.283	0.171	0.297	0.877
Simple FC		4.365	4.438	4.881	4.326	4.068	4.660	4.969	4.736	4.271	4.754	5.118	4.493	4.007	4.975	5.371	4.919	5.826	
Overall Rank		13	12	7	14	16	10	5	9	15	8	3	11	17	4	2	6	1	
Section Rank		3	2	1	4	5	3	1	2	4	2	1	3	4	3	2	4	1	

<Table 19> Importance Measure of u-Healthcare Service Quality Characteristics

	Feature	Description	중요도
NETWORK	Mobility	Ability to operated in mobile environment	4.365
	Security	Ability to protect users' personal information	4.438
	Accessibility	Ability to be easily accessed	4.881
	Scalability	Ability to provide stable and scalable work even if the system is overloaded	4.326
	Interoperability	Connects various kinds of devices	4.068
DEVICE	Invisibility	Ability to provide service calmly, namely, without users' recognition	4.660
	Durability	Ability to maintain 'Power-on' status all the time	4.969
	Embeddedness	Ability to be embedded into physical environment and be unseen	4.736
	Portability	Ability of being used hands-free or with one hand	4.271
USER INTERFACE	Customizability	Ability to provide information to users according to their profile and preferences	4.754
	Nomadicity	Ability to be used while a user moves from place to place	5.118
	Usability	Ability to underpin input and output with by various user interfaces	4.493
	Versatility	Ability to be operated as a user moves from place to place and be manipulated using different physical objects	4.007
OPERATING SYSTEM	Contextinference	Ability to provide users with service fairly correlated with their current context	4.975
	Agility	Ability to complete operations on real-time basis	5.371
	Personalization	Ability to remember users' common patterns and use them later	4.919
	Pro-activeness	Ability to provide users with the service they are likely to require in the nearest future depending on their current situation	5.826

3. Extraction of u-Healthcare Service Quality Characteristics: Second Stage QFD

Technical characteristic is one of the two main elements of QFD. One of the essential objectives of QFD is to determine how to cope with customer needs technically. QFD is the process to transform qualitative customer needs into quantitative technical characteristics. One of these methods is to fill in required quality deployment chart that transforms customer needs into concrete requirements. And then, you can extract technical characteristics by drawing up technical characteristic chart. Finally, calculation of quality chart reflects opinions of technical characteristic experts and judges the degree of relationship between customer requirements and technical characteristics.

In this study, the multiplied values in the relation of importance of required quality and technical characteristics by using simple weighted sum method are calculated, and then, the value of technical characteristics is calculated by adding them vertically. When relative importance of required quality as a line of HOQ is $D_{i,\,i}=1,.....,m$ and the value indicating the degree of relevance is $R_{ij,\,i}=1,...,m\ _{j}=1...n$, absolute weight is expressed like the following equation.

$$W_j = \sum_{i=1}^{m} D_i R_{ij}$$

3.1. u-Healthcare System Service Characteristics

The measurement instrument for u-Healthcare system service composition is made up of 25 items among 39 items used in Hwang Hui-jeong' s study(2008) with unsuitable ones excluded. Detailed constructs are classified into 4 factors of Platform and External Interface, Device and Service Management, Network Connectivity, and Health Device. In addition, by connecting customer requirements (service quality characteristics) and system service composition, the degree of connectivity is investigated as 1= weak correlation, 3= medium correlation and 9= very strong correlation. On the basis of this, 20 questionnaires were distributed to u-Health experts as survey subjects of this study and 18 copies were collected. Among them, 4 copies of weak response reliability were excluded. Thus, total 14 copies of expert responses were used. <Table 20> is the expert

questionnaire tabulation on system service characteristics.

<Table 20> the expert questionnaire tabulation on system service characteristics

Characteristics		Service platform & External-interface									Device and service management									Network connectivity		Health Device				
		Biometric information Gathering/store/ management	Biometric analysis	Contents management	Personal healthcare information	Service feedback management	Network remote management	Biometrics information monitors	CDSS management	Emergency management	User authentication	Terminal management /authentication	Network security	Communication control	Enterprise management	Charging management	Session management	System management	Cause management	External net	Internal net	Treadmill/sporting	Personal identification system	Blood sugar measuring instrument	Sleep monitoring	Electrocardiogram
Network	Mobility	4.571	3.357	3.929	4.857	4.786	6.143	4.571	4.357	6.857	5.000	5.643	5.429	5.714	4.500	4.571	5.071	4.357	3.929	3.714	4.143	3.143	3.786	5.071	4.214	4.000
	Security	7.357	4.357	5.000	6.643	4.071	5.786	6.643	4.571	5.857	8.643	7.786	8.786	7.071	4.929	5.857	5.357	5.571	3.929	6.000	6.000	3.500	4.214	3.714	3.714	3.714
	Accessibility	6.000	3.786	5.571	6.857	4.714	4.929	6.000	5.571	6.500	6.429	6.143	5.714	5.286	4.500	5.071	4.786	5.143	4.143	3.643	3.857	4.286	5.357	4.929	4.929	4.929
	Scalability	6.286	3.071	3.643	4.000	4.786	6.000	5.071	4.929	5.857	7.286	6.857	7.286	7.286	4.357	4.643	5.857	7.500	5.143	5.429	5.357	4.286	4.929	4.500	4.571	4.571
	Interoperability	4.000	1.929	3.357	3.429	3.357	4.143	3.786	2.214	4.357	4.357	3.643	5.000	4.643	3.500	3.500	4.500	4.857	3.500	4.143	4.143	2.500	3.714	4.429	3.286	4.429
Device	Invisibility	6.429	3.500	3.929	5.286	3.357	3.214	4.714	3.786	4.357	4.214	4.071	3.571	3.429	3.571	3.000	3.643	3.000	2.929	2.500	2.714	7.357	7.143	7.143	7.571	7.571
	Durability	6.643	4.571	4.571	4.929	4.500	5.571	5.357	3.929	6.429	4.214	3.929	4.571	5.571	3.429	3.571	4.286	5.786	5.357	3.929	4.786	4.929	6.000	6.000	5.571	6.429
	Embeddedness	6.286	4.143	3.929	4.714	4.143	6.429	5.929	4.714	7.071	3.786	4.786	4.786	5.429	3.286	4.429	4.500	5.643	4.714	4.286	4.714	5.071	5.286	6.000	5.571	6.429
	Portability	4.286	2.214	3.786	3.429	2.500	2.500	2.857	2.714	4.643	3.571	3.143	2.000	2.429	2.214	3.143	2.643	2.357	2.214	1.929	2.071	4.286	4.500	6.071	5.214	6.071
User Interface	Customizability	5.071	5.429	5.429	6.786	3.714	2.571	5.429	6.714	6.143	4.143	2.500	2.143	3.000	2.857	2.929	2.357	2.286	2.643	1.929	1.714	3.286	4.143	3.143	3.071	3.071
	Nomadicity	5.929	3.929	4.714	4.429	4.357	4.357	5.429	5.143	7.071	5.429	4.929	3.429	3.857	3.643	3.786	4.714	3.857	4.071	5.000	3.571	2.571	4.500	5.286	2.786	5.143
	Usability	4.643	4.571	4.071	4.929	4.786	2.857	3.714	4.357	6.500	4.214	3.571	2.571	3.000	2.857	3.357	2.714	2.429	2.643	2.571	1.929	2.286	2.500	3.071	3.071	2.714
	Versatility	5.000	3.929	3.000	3.429	3.500	3.500	3.929	3.929	5.214	4.643	3.571	3.000	4.214	3.357	3.643	3.571	3.143	3.357	2.500	2.500	3.571	4.357	4.857	3.571	5.000
Operation system	Context inference	4.500	6.071	3.857	4.000	4.357	2.286	5.000	5.571	7.286	3.643	2.214	2.214	3.143	2.714	3.786	3.571	3.000	4.286	3.357	2.929	3.000	3.500	3.214	3.429	3.643
	Agility	5.000	5.500	5.429	4.643	4.929	4.071	5.429	6.429	7.071	5.786	3.000	3.214	4.357	2.857	3.786	4.286	6.286	4.071	3.857	4.286	3.929	4.714	4.500	4.357	4.714
	Personalization	4.643	6.500	5.214	5.714	5.643	2.214	3.857	5.429	5.071	3.786	2.071	2.000	3.000	2.857	4.286	4.286	3.571	3.286	2.714	3.143	2.143	4.643	3.214	3.214	3.214
	ProActiveness	4.857	5.571	4.500	4.000	4.500	2.286	4.214	6.857	6.714	3.571	3.071	2.643	3.571	3.286	3.571	3.429	3.429	3.857	3.286	3.143	2.286	3.500	2.929	3.000	3.071
Sum		91.500	72.429	73.929	82.071	72.000	68.857	81.929	81.214	103.000	82.714	70.929	68.357	75.000	58.714	66.929	69.571	72.214	64.071	60.786	61.000	62.429	76.786	78.071	71.143	78.714

3.2. Degree of u-Healthcare System Service Difficulty

<Table 21> is the result of expert responses on degree of u-Healthcare system service composition difficulty. As the degree of Difficulty on Service Platform and External Interface is 2.6~4.0, the gap is rather wide. The highest degree of difficulty is the construction of "Treatment Decision Support System Management" and "Emergency Situation Management" system as 4.0. "Biometric Information Collection/Storage/Management" and "Biometric Information Analysis" is the next as 3.6 degree of difficulty. That is, to build these systems is recognized as very hard.

<Table 21> System Service Difficulty

Service Constitution		Degree of difficulty
Service platform & External-interface	Biometric information Gathering/store/management	3.6
	Biometric analysis	3.6
	Contents management	2.3
	Personal healthcare information	2.6
	Service feedback management	2.7
	Network remote management	3.4
	Biometrics information monitors	3.1
	CDSS management	4.0
	Emergency management	4.0
Device and service management	User authentication	2.6
	Terminal management/authentication	2.7
	Network security	3.7
	Communication control	3.4
	Enterprise management	2.6
	Charging management	2.3
	Session management	3.0
	System management	2.9
	Cause management	3.2
Network connectivity	External net(PSTN, CDMA, kDSL)	3.2
	Internal net(ZigBee, RS-232, Blutooth)	2.6
Health Device	Treadmill/sporting	2.9
	Personal identification system	3.1
	Blood sugar measuring instrument	2.9
	Sleep monitoring	2.4
	Electrocardiogram	3.1

<Table 22> Importance Measure of u-Healthcare System Service Quality Characteristics

What's list	Characteristics		Service platform & External-interface									Device and service management									Network connectivity		Health Device				
			Biometric information Gathering/store/management	Biometric analysis	Contents management	Personal healthcare information	Service feedback management	Network remote management	Biometrics information monitors	CDSS management	Emergency management	User authentication	Terminal management /authentication	Network security	Communication control	Enterprise management	Charging management	Session management	System management	Cause management	External net	Internal net	Treadmil/sporting	Personal identification system	Blood sugar measuring instrument	Sleep monitoring	Electrocardiogram
4.88	Network	Mobility	4.571	3.357	3.929	4.857	4.786	6.143	4.571	4.357	6.857	5.000	5.643	5.429	5.714	4.500	4.571	5.071	4.357	3.929	3.714	4.143	3.143	3.786	5.071	4.214	4.000
4.44		Security	7.357	4.357	5.000	6.643	4.071	5.786	6.643	4.571	5.857	8.643	7.786	8.786	7.071	4.929	5.857	5.357	5.571	3.929	6.000	6.000	3.500	4.214	3.714	3.714	3.714
4.88		Accessibility	6.000	3.786	5.571	6.857	4.714	4.929	6.000	5.571	6.500	6.429	6.143	5.714	5.286	4.500	5.071	4.786	5.143	4.143	3.643	3.857	4.286	5.357	4.929	4.929	4.929
4.88		Scalability	6.286	3.071	3.643	4.000	4.786	6.000	5.071	4.929	5.857	7.286	6.857	7.286	7.286	4.357	4.643	5.857	7.500	5.143	5.429	5.357	4.286	4.929	4.500	4.571	4.571
4.07		Interoperability	4.000	1.929	3.357	3.429	3.357	4.143	3.786	2.214	4.357	4.357	3.643	5.000	4.643	3.500	3.500	4.500	4.857	3.500	4.143	4.143	2.500	3.714	4.429	3.286	4.429
4.66	Device	Invisibility	6.429	3.500	3.929	5.286	3.357	3.214	4.714	3.786	4.357	4.214	4.071	3.571	3.429	3.571	3.000	3.643	3.000	2.929	2.500	2.714	7.357	7.143	7.143	7.571	7.571
4.97		Durability	6.643	4.571	4.571	4.929	4.500	5.571	5.357	3.929	6.429	4.214	3.929	4.571	5.571	3.429	3.571	4.286	5.786	5.357	3.929	4.786	4.929	6.000	6.000	5.571	6.429
4.74		Embeddedness	6.286	4.143	3.929	4.714	4.143	6.429	5.929	4.714	7.071	3.786	4.786	4.786	5.429	3.286	4.429	4.500	5.643	4.714	4.286	4.714	5.071	5.286	6.000	5.571	6.429
4.27		Portability	4.286	2.214	3.786	3.429	2.500	2.500	2.857	2.714	4.643	3.571	3.143	2.000	2.429	2.214	3.143	2.643	2.357	2.214	1.929	2.071	4.286	4.500	6.071	5.214	6.071
4.75	User Interface	Customizability	5.071	5.429	5.429	6.786	3.714	2.571	5.429	6.714	6.143	4.143	2.500	2.143	3.000	2.857	2.929	2.357	2.286	2.643	1.929	1.714	3.286	4.143	3.143	3.071	3.071
5.12		Nomadicity	5.929	3.929	4.714	4.429	4.357	4.357	5.429	5.143	7.071	5.429	4.929	3.429	3.857	3.643	3.786	4.714	3.857	4.071	5.000	3.571	2.571	4.500	5.286	2.786	5.143
4.49		Usability	4.643	4.571	4.071	4.929	4.786	2.857	3.714	4.357	6.500	4.214	3.571	2.571	3.000	2.857	3.357	2.714	2.429	2.643	2.571	1.929	2.286	2.500	3.071	3.071	2.714
4.01		Versatility	5.000	3.929	3.000	3.429	3.500	3.500	3.929	3.929	5.214	4.643	3.571	3.000	4.214	3.357	3.643	3.571	3.143	3.357	2.500	2.500	3.571	4.357	4.857	3.571	5.000
4.98	Operation system	Context inference	4.500	6.071	3.857	4.000	4.357	2.286	5.000	5.571	7.286	3.643	2.214	2.214	3.143	2.714	3.786	3.571	3.000	4.286	3.357	2.929	3.000	3.500	3.214	3.429	3.643
5.37		Agility	5.000	5.500	5.429	4.643	4.929	4.071	5.429	6.429	7.071	5.786	3.000	3.214	4.357	2.857	3.786	4.286	6.286	4.071	3.857	4.286	3.929	4.714	4.500	4.357	4.714
4.92		Personalization	4.643	6.500	5.214	5.714	5.643	2.214	3.857	5.429	5.071	3.786	2.071	2.000	3.000	2.857	4.286	4.286	3.571	3.286	2.714	3.143	2.143	4.643	3.214	3.214	3.214
5.83		ProActiveness	4.857	5.571	4.500	4.000	4.500	2.286	4.214	6.857	6.714	3.571	3.071	2.643	3.571	3.286	3.571	3.429	3.429	3.857	3.286	3.143	2.286	3.500	2.929	3.000	3.071
Sum			432.117	348.080	352.207	388.551	342.238	321.971	388.505	390.371	490.065	388.205	330.906	317.820	351.240	275.824	315.180	327.465	340.909	303.891	286.903	287.635	293.220	362.537	365.893	334.419	369.695
Overall Rank			2	12	10	4	13	18	5	3	1	6	16	19	11	25	20	17	14	21	24	23	22	9	8	15	7
Section Rank			2	7	6	4	8	9	5	3	1	1	4	6	2	9	7	5	3	8	1	2	1	3	4	2	5
Degree of difficulty			3.6	3.6	2.3	2.6	2.7	3.4	3.1	4.0	4.0	2.6	2.7	3.7	3.4	2.6	2.3	3.0	2.9	3.2	3.2	2.6	2.9	3.1	2.9	3.4	3.1
Result			Difficulty	OK	OK	OK	OK	OK	OK	Difficulty	Difficulty	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

3.3. Quality Attribute Result of u-Healthcare System Service Characteristics

In <Table 22>, "Emergency Situation Management" takes the highest place in arranging all quality characteristics in rank and "Enterpriser Management" does the lowest. Dividing them into each subcategory reveals as follows.

In the rank of Service Platform and External Interface, "Emergency Situation Management" is the highest as the first and "Biometric Information Collection/Storage/Management" is the next. And "Treatment Decision Support System Management" , "Individual Health Information Management", "Biometric Information Monitoring Management", "Contents Management" and "Biometric Information Analysis" are placed in the following order respectively. "Network Telemanagement" is the lowest in order. Compared with the degree of difficult, "Emergency Situation Management" is first in order but its degree of difficulty is 4.0, so its system building is proved to be very hard. And next in order, "Biometric Information Collection/Storage/Management" and "Treatment Decision Support System Management" are 3.6 and 4.0 in the degree of difficulty respectively. Thus, they are also hard tobe built in system. On the other hand, though "Network Telemanagement"is the lowest in order, its system can be easily built as its degree of difficulty is 3.4. "Biometric Information Analysis" is 7th in order and its degree of difficulty is 3.6. In building its system, much caution is needed.

In the rank of Operation Management Platform, "User Authentication" is first, "Communications Control" second, "System Management" third and then, "Terminal Management/Authentication", "Session Management", "Network Security", "Cost Management", and "Cause Management" follow the order. "Enterpriser Management" is the lowest as the 9th in order. On the other hand, the degree of difficulty of this characteristic is generally easy level. The degree of difficulty of first-order "User Authentication" is 2.6 and its system building is proved to be easy. As a whole, the degree of difficulty is 2.3~3.2and its system building is not that hard. Here, the fact that User Authentication and Terminal Management/Authentication is high in order reflects the phases of the times in which personal information is regarded as important.

In Network Platform, "Internal Network" is first in order and "External Network"

is second. Their degrees of difficulty are 3.2 and 2.6 respectively. That means their system building is relatively easy regardless of their order. In Measurement Terminal, "Treadmill/Exercise Facilities"is first in order and Sleep Monitoring, Individual Identifier and Blood Glucose Sensor follow it. The degree of difficulty as a whole is also easy level as 2.9~3.4.

Ⅵ. Conclusion

1. Summary and Conclusion

Researches on how to evaluate u-Healthcare system correctly and how to satisfy users' requirements are not enough though the interest in u-Healthcare service is on the increase these days. One of the solutions to the seproblems is to build methods of standardized and systematic deployment to accept u-Healthcare users' quality requirements as system requirements. In addition, main motives of this study are to suggest methods of providing information necessary for the system building in product competition and to inform ways of planning products in consideration of consumer satisfaction.

For this study, survey was carried out on the basis of quality model extracted from the previous research. From the survey findings, both consumer requirements and degree of difficulty as well as importance measure in building service system are drawn out. And, by using QFD technique, system characteristics of high correlation with quality characteristics and consumer requirements are extracted and by evaluating these characteristics with degree of difficulty added as suitable or not in real system development, much time and effort can be saved and efficient evaluation procedures are suggested.

Concretely, this study first introduced main evaluation factors of Pender's Health Promotion Model in order to draw out consumers' objective requirements about u-Healthcare for u-Healthcare system development. In addition, it suggested structural equation model for the purpose of examining evaluation methods to accommodate multiple dependency causal relationship between evaluation factors and finding out optimal causality between them.

Second, I examined structural equation model with the validity in composing potential variables and observation variables of Health Promotion Model through confirmatory factor analysis and evaluates its goodness of fit.

Third, in order to consider the correlation between evaluation norms and factors of service quality characteristics for the satisfaction of u-Healthcare system users, I figured out the influence of multiple dependency causality by using partial

least squares. In addition, I rated significant health promotion models on the basis of the standardization discriminant function and applied it to the evaluation norms as a weighted value. Using this, I suggested an evaluation model to determine the order of priority in consumer quality characteristics.

Fourth, I carried out a survey of experts on the correlation between the degree of difficulty in system development and characteristics of both u-Healthcare system and service quality. I finally drew out a value weight on system service characteristics by adding the result of the order of priority in consumer quality characteristics to the above survey and determined the practical order of priority in u-Healthcare system service characteristics. And then, at last, I suggested a model to be applied to the product development focused on customer satisfaction by taking into consideration the real difficulty of the system development.

The subjects of this study are adults who have experienced or want to experience u-Healthcare service now. In order to consider the importance and degree of difficulty in system characteristics, u-Healthcare experts are surveyed. As the data collection method, questionnaire survey was carried out. 300 copies were distributed and among them, 291 copies in total were used for the analysis in this study with insincere questionnaires excluded. And 20 expert survey questionnaires were distributed but only 14 copies of them were used in the study.

For data analysis, I used SPSS 12.0,Microsoft Office Excel, and Amos 5.0 programs. In order to verify the validity and reliability of the extracted contents, I carried out exploratory and confirmatory factor analyses.

As the result of QFD analysis, with expert degree of difficulty applied, of "Emergency Situation Management"in Service Platform and External Interface, "User Authentication" in Operation Management, "External Network" in Network Platform with a lot of users' requirements, "Emergency Situation Management"is 4.0 in the degree of difficulty and important part in the system. But in reality, its system building is judged to be technically hard. But "User Authentication" and "External Network" are 2.6 and 3.2 respectively and are easy in building system in agreement with users' high needs. Though "Treatment Decision Support System Management" and "Biometric Information Collection/Storage/Management" are 4.0 and 3.6 respectively and have received a lot of users' requirements, their

system building will be considerably hard. In case of Measurement Terminal, as an important factor of the system with a lot of users' requirements, its system building is also easy as the degree of difficulty is easy level. As examined above, this study will apply quality attributes selected by suggested process not only tosystem quality evaluation but also to new u-Health system development reflecting users' quality requirements.

With the findings, I suggest the following. This study has its significance in suggesting techniques applicable to the u-Healthcare system development using QFD. Concretely, by investigating u-Healthcare users' direct requirement attributes and extracting u-Healthcare system service characteristics with customer requirement reflected by using QFD model, I figured out the order of priority in the importance of system service characteristics that must be dealt with most importantly. Through this, I attempted to suggest system service characteristics that should be considered first in developing u-Healthcare system. In addition, by differentiating u-Healthcare service quality characteristics transformed from customer requirement attributes and systematically written in HOQ, I made system designers use them as a reference to enhance the degree of completion of u-Healthcare system. As a conclusion, this study proposed an application method of QFD to satisfy customer requirements for the development of u-Healthcare system development. Moreover, I enhanced the reliability of service quality characteristics by using the correlation between HPM and service quality characteristics and provided evaluation norms to measure effectively and trust u-Healthcare system features by examining the correlation between relevant experts' system characteristics. Also, I suggested important features to improve users' requirements by using this.

2. Limits of Research

Through this study, by applying QFD techniques in order to find out service system characteristics according to u-Healthcare service types, I attempted to provide more improved system environment to u-Healthcare users. But this study has the following limits.

First, on u-Healthcare system characteristics, the correlation between service characteristics and the degree of difficulty in system building, I conducted qualitative survey of 20 u-Healthcare experts and applied the result to the study. But I must be careful in interpreting the findings due to their representative problem. In future researches, opinions from more experts should be collected.

Second, Iwished to avoid regional partiality in selecting subjects at Jeju International Airport. But, due to airport traffic, the survey tended to lean towards a few regions such Seoul (26.5%), Gyeonggi-do (22.7%) and Jeju (23.4%). The representation of the survey was also in question.

Third, we need to pay attention to the limits in product improvement and product design by using QFD. One of the important factors the company should consider in developing products is to define customers. We must be more careful in selecting customers applicable to the relevant research. And, as customer requirements, the first factor of the House of Quality, tend to be qualitative and obscure, we must be cautious in defining customer groups and selecting customer requirements.

Fourth, this study didn't provide the correlation between technical characteristics. The correlation between technical characteristics corresponds to the roof of HOQ. It has an advantage to easily find out the dependency and contradiction between system service characteristics. The relation between system service quality characteristics can be positive and negative. If you can find out this correlation between system service characteristics beforehand, you will prevent diverse problems that would happen at the beginning of system design or production as you can avoid contradictions among service features.

References

2008 Health Industry White Paper(2009). Korea Health Industry Development Institute.

2008 Medical Instrument Industry Analysis Report(2008). Korea Health Industry Development Institute.

Ajzen, I., and Fishbein, M.(1980). Understanding attitudes and predicting social behavior. Englewood Cliffs, NJ: Prentice-Hall Inc.

American u-Health Industry Trend(2009). Electronics Information Center.

American u-Health Industry Trend(2008). Electronics Information Center.

Andirole, and Stephen, J.(1990). Command and Control Information Systems Engineering: Progress and Prospects, Advances in Computers. *Academic Press*, 31: 1-98.

Bae, J. S.(2005). Factors and Prediction Model Related to Rural Elementary Pupils' Oral Cavity Health Promotion Act. Doctoral Dissertation, Graduate School, Chungnam National University.

Baek, Y. M.(2005). Prediction Model of White-collar Male Workers Health Promotion Act. Doctoral Dissertation, Graduate School, Ehaw Woman's University.

Bandura, A.(1986). Social foundation of thought and action: A social cognition theory. Englewood Cliffs, NJ: Prentice-Hall, Inc.

Bandura, A.(2004). Health Promotion by Social Cognitive Means. Health education & behavior, 31(2).

Becker, M. H.(1974). The health belief model and sick role behavior, In M. H. Becker(ed). The health belief model and personal health behavior.

Choe, Y. H.(1984). A Study of Supportive Nursing Mediation that Influences on Family Support Act and Patient Role Act. Doctoral Dissertation, Graduate School, Yonsei University.

Conn, V. S.(1998). Older adults and exercise. Nursing Research, 47(3): 180-189.

HL7 Implementation Guide: CDA Release 2-Continuity of Care.

Davis, F. D.(1993). User acceptance of information technology: system

characteristics, user perceptions and behavioral impacts. International Journal of Man-Machine Studies, 38: 3.

Document(CCD).(2007). A CDA implementation of ASTM E2369-05. Health Level 7.

Gachon University of Medicine and Science. http://www.cdmservice.kr/

Galletta, D. F., and Sampler, J., L., and Teng, J. T.(1999). Strategies for integrating creativity principles into the systems development process. Proceedings of the twenty-fifth Hawaii international conference on: 268-275.

Gung, S. H., Lee, J. G., & Nam, G. H.(2008). Analysis and Verification of Glory Requirements Using UML. *Korea Contents Association Journal,* 8(5).

Hans, J. J.(1995). Structuring Latent consumer needs using LISREL.

Hauser, J. R., and Clausing, D.(1988). The house of quality. Harvard Business Review, 66(3): 63-73.

Heo, W. s.(2006). *System Analysis and Design.* Hanvit Media Inc.

Ho, C. S., Shiao, L. J., and Liu, L.(2005). An efficient solution to ubiquitous healthcare system from clinics to patients: Enterprise networking and Computing in Healthcare Industry. HEALTHCOM 2005, Proceedings of 7th International Workshop: 150-155.

Hwang, H. J.(2008). Application Framework to Secure Ubiquitous Healthcare Service Co-operation. Doctoral Dissertation, Graduate School, Incheon University.

Hyejung, C. and Dohoon, K.(2010). A Quality Function Deployment Framework for the Service Quality of Health Information Websites. The Korean Society of Medical Information.

Hyoung Ki So.(2002). Quality Improvement of Barrack Life in Republic of Korea Army and Comparison of Missing Data Imputation Methods for SEM Estimation. Yonsei University.

Jang, J. H., Jeong, C. W., Shin, C. S., and Ju, S. J.(2005). Suggestion of Healthcare Home Service System Based on Distributed Object Group Framework. *Korea Information Processing Society,* 12(6).

Jang, H. J., and Gwak, Y. S.(2001). Health Level Seven and HL7 Korea Branch Introduction. *Korean Society of Medical Informatics Journal,* 7(2).

Jeon, B. J.(1974). A Study on Self-concept Measurement Possibility. *Yonsei Nonchong,* 11: 107~129.

Jeon, Y. S.(2009). Comparison of Korean Senior Citizens' Health Conditions according to their Family Conditions. Master Thesis. Graduate School, Ehwa Woman's University.

Jeong, Y. Y.(2004). A Study on Civil Responsibility and Legislative Reform of Telemedicine. Doctoral Dissertation, Graduate School, Kyeonhui University.

Kang, S. U., & Kim. J. Y.(2007). Economic Effect and Growth Strategy of u-Health. Samsung Economic Research Institute Research Report.

Kim. E. Y., and Lee, M.(2007). Multi-agent-based U-healthcare System for Managing Hypertention. International Conference on Convergence Information Technology: 1694-1699.

Kim, G. J.(1995). Quality Improvement at the Design Stage through QFD. *Korea Institute of Industrial Engineers,* 2(1).

Kim, G. J.(2000). Health Promotion Act Prediction Model of Middle-Aged Male Adults. Doctoral Dissertation, Graduate School, Hanyang University.

Kim, G. U.(2004). A Study on the Entity and Development of Ubiquitous Computing. *Korea Society of Computer Information Journal,* 9(4).

Kim, H. C.(2005). U-Healthcare and Sensor. *The Institute of Electronics Engineers of Korea Journal,* 32(12).

Kim, H. C., and Kang, J. M.(2008). Technological Conditions and Perspective of u-Healthcare. *Information Technology Society Journal,* 26(1): 38-50.

Kim, J. H.(2005). A Study of the Ubiquitous Healthcare Service Provision Using Goal-Based Agent. Master Thesis. Graduate School, Seoul National University.

Kim, J. H.(2007). Product, Process and Team Integrated Design Model for Complicated Development Project. Doctoral Dissertation, Graduate School, Aju University.

Kim, M. C., and Yang, Y. B.(2010). On Extracting the User Requirements of a u-Healthcare System Using QFD Technique. *An International Journal of Research and Surveys,* 4(6A).

Kim, S. G.(2008). Model Development of Elementary Pupils' Oral Cavity Health

Promotion Act. Doctoral Dissertation, Graduate School, Hanyang University.

Kim, S. H.(2007). Preschool Children' s Health Promotion Act Prediction Model. Doctoral Dissertation, Graduate School, Ehwa Woman's University.

Kim, S. R.(2006). Present Conditions of u-Health Service and Customer Preference Analysis in the Ubiquitous Period. Master Thesis, Graduate School, Sungkyunkwan University.

Kim, Y. S., Park, S. C., Park, Y. T., Park, H. J., and Seo, Y. H.(2004). Quality Management. Pakyeonsa.

Kim, Y. I., Jeong, H. S., and Bae, G. H.(2007). Health Promotion: Theory and Application. KNOU Press.

Kwon, G. R., Kim, M. N., and Park, H. J.(2009). U-Healthcare Service Trend. *Korea Multimedia Society Journal,* 13(2).

Kwon, S. M.(2006). A Way to Introduce u-Health into the Public Sector. Information and Communications Policy, 18(23).

Lee, B. M., and Lim, Y. S.(2008). U-Healthcare and u-Emergency Medicine. *Institute of Electronics Engineers of Korea Journal,* 35(12).

Lee, S. B., and Sin, D. S.(2008). *QFD Theory and Cases.* Eretec (Inc).

Lee, J. J.(2009). U-Healthcare Service Requirement Analysis and Optimal Model Study according to Healthcare Types. Doctoral Dissertation, Graduate School, Yonsei University.

Lee, J. Y.(2008). Promotion Situation and Implications of Domestic u-Health demonstration project. *Information and Communication Policy,* 20(21).

Leite. and Julio. Cesar,(1987). A Survey on Requirement Analysis. Advanced Software Engineering Project, TR RTP-071. University of California at Irvine, Department of Information and Computer Science.

Lim, M. Y.(1998). Building Prediction Model of Korean College Students' Health Promotion Act. Doctoral Dissertation, Graduate School, Yonsei University.

Mark, Weiser.(1993). Hot topic: Ubiquitous Computing. IEEE Computer: 71-72.

Martinelli, A. M.(1999). An explanatory model of variables influencing health promotion behaviors in smoking and nonsmoking college students. Public Health Nursing, 16(4): 263-269.

McManus, E. M.(1996). Health Promotion and Social Support for

Community-based clients with chronic mental illness. Nursing connections, Winter, 9(4): 49-55.

Moon, S. M.(2000). A Study on the Relation Between Socio-psychological Adaption and Self-efficacy Social Support of Epilepsy Patients. *Korean Society of Nursing Science Journal.* 30(3): 694-708.

Moon, J. S.(1990). A Study on the Development of Adult Health Belief Measurement Device. Doctoral Dissertation, Graduate School, Yonsei University.

Natalia, V. Em., Yu, G. D., and Seo, U. H.(2005). Requirement Analysis of Ubiquitous Computing Based Information System Using Factor Analysis. *Korean Operations Research and Management Science Society/Korea Institute of Industrial Engineers Spring Joint Symposium.*

Neuberger, G. B., Kasal, S., Smith, K. V., Hassanein, R. and DeVincey, S.(1994). Determinants of exercise and aerobic fitness in outpatients with arthritis. Nursing research, 43(1): 11-17.

Padula, C. A.(1997). Predictors of participation in health promotion activities by elderly couples. Journal of Family Nursing, 3(1): 88-106.

Park, C. G., Park, R. W., and Jeon, Suing. P.(2005). U-Health: Issues of Health Service Providers in u-Health Environment. *Korean Institute of Science and Technology Information*: 2.

Park, H. S.(2008). A Study on Work Contents of u-Healthcare Management Personnel. Doctoral Dissertation, Graduate School, Kyongwon University.

Park, J. W.(1985). A Study on Work for the Development of Social Support Measure. Doctoral Dissertation.

Park, U. G., and Kim, U. I.(2003). *Ubiquitous Network and New Society System.* ET NEWS.

Pender, N. J.(1996). Health Promotion in Nursing Practice, 3rd. ed, Appleton and Lange Stanford, Connecticut.

Pender, N. J.(1987). Health Promotion in Nursing Practice, 2nd Edition, Appleton and Lange Stamford, Connecticut.

Pender, N. J., and Pender, A. R.(1982). Health Promotion in Nursing Practice. Norwalk, CT: Appleton & Lange.

Pender, N. J.(1987). The Health-Promoting lifestyle profile: Development and

Psychometric characteristics. Nursing research.

Park, S. Y.(2002). *Requirement Analysis, Recent Software Technique.* VILAND.

Park, Y. M., and Park, J. H.(2005). A Way to Provide Healthcare Service for Ubiquitous Environment. *Korea Contents Society Fall Academic Forum Journal,* 3(2).

Present Conditions and Implications of Domestic u-Health Demonstration Project Promotion(2008). National Information Society Agency.

Rosenberg, H.(1965). Society and the Adolescent Self-Image, NJ : Princeto University Press.

Rosenstock IM.(1974). Historical origins of the health belief model, Health Educ Monogr 2:328-335.

Ryu, J. H., and Byeon, S. N.(2005). A Study on the Sensibility Ergonomic Design of Mobile Communications Device Applying QFD Technique. *2005 Korea Institute of Industrial Engineers Fall Academic Forum Journal.*

Schrenker, R. A.(2006). Software Engineering for Future Healthcare and Clinical Systems. Computer, 39(4): 26-32.

Seo, M. J.(1988). An Analytical Study on Adjustment Condition and Related Factors of Partial Paralysis Patients After Leaving the Hospital. Doctoral Dissertation, Graduate School, Seoul National University.

Seo, H. M.(2001). Senior Citizens' Health Promotion Act Prediction Model. Doctoral Dissertation, Graduate School, Seoul National University.

Sherer, M. & Maddux, J. E.(1965). The self-efficacy scale: construction & validation, Psychological Reports, 51, pp.663-667.

Stut, W., Wartena, F., and Steen, M.(2006). A distribution shared data space for personal health systems. Ubiquity; Technologies for Better Health in Aging Societies. IOS Press, 2006 & 2006 Organizing Committee of MIE: 57-62.

Sullivan, L. P.(1986). Quality function deployment. Quality Progress, 19(6): 39-50.

u-Health Industry Recent Trend. National IT Industry Promotion Agency.

u-Health Industry Trend(2009). Electronics Information Center.

u-Health Industry Trend Analysis(2009). Electronics Information Center.

Wasserman, G. S.(1993). On how to prioritize design requirements during the QFD

process. IIE Transaction, 25(3): 59-65.

Yoon, D. H., Park, M. J., Kim, D. H., Park, J. H., Choi, S. H., Choi, S. Y., Jeong, I. K., Sim. W. H., Shin, C. S., Cho, S. H., and Oh, B. H.(2006). NSC(New Songdo City : Newly Developed City as Free Economic Zone in South Korea) Ubiquitous Healthcare Project Developing Prospective Health Management Model, Integrating On-line and Off-line Healthcare Service. AMIA Annu Symp Proc: 1152.

Yu, Y. G., and Lee, J. M.(2001). Acquirement of Package Software Quality Requirements using QFD Techniques. *Korea Society for Quality Management Journal,* 29(2): 120-130.

Yun, M. S.(2002). A Study on the Method to Acquire Software Quality Improvement Requirements using QFD. *Korea Society of Management Information Systems,* Fall Academic Forum.

Yun, S. Y., and Kim, J. H.(1999). Manufacturing Female Workers Health Promotion Act Related Factor Analysis: Pender' s Health Promotion Model Application. *Korea Society of Industrial Nursing Science Journal,* 8(2): 130-140.

<Appendix 1> Questionnaire

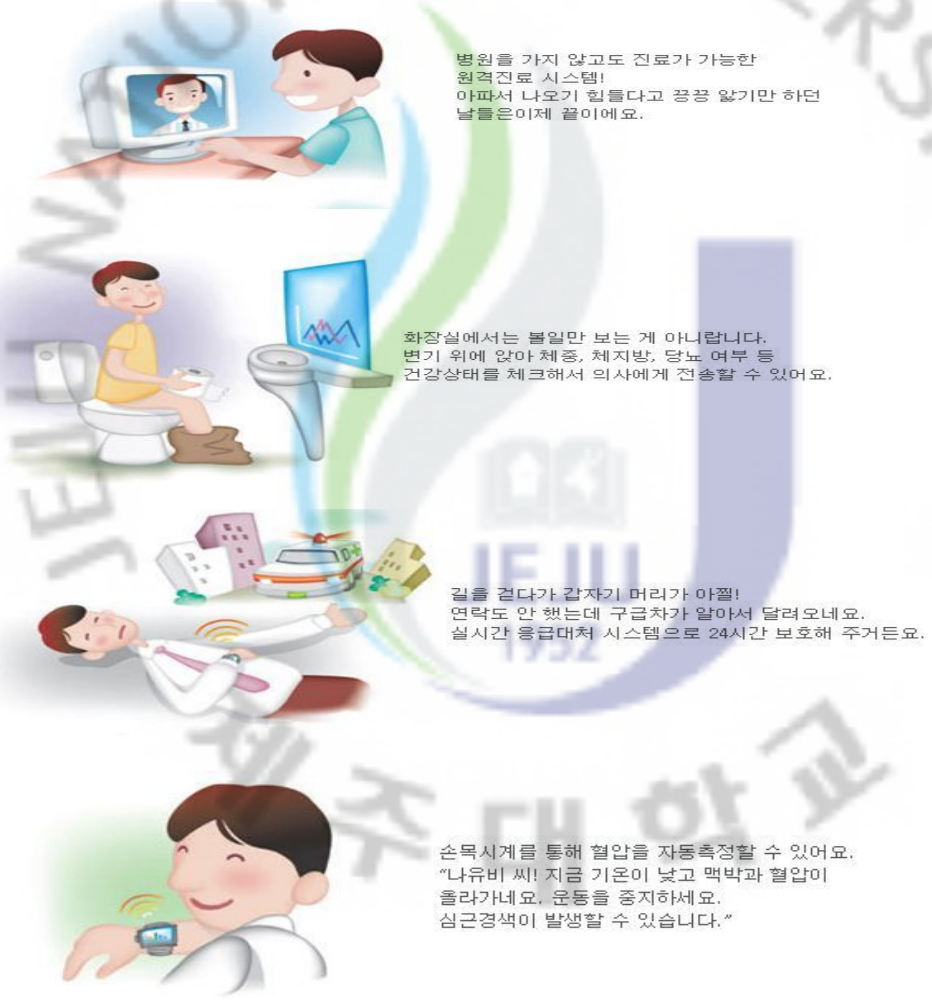
성인의 건강증진모형에 따른 u-Healthcare서비스 요구도 분석 및 모델안 연구

안녕하십니까?

본 설문지는 성인의 건강증진에 영향을 주는 요인이 무엇인지를 파악하기 위해 작성된 것입니다. 응답 내용에 대한 귀하의 생각을 선택하시면 됩니다. 본 설문지는 단지 통계적 목적으로만 사용됩니다. 시간을 내 주셔서 대단히 감사합니다.

제주대학교 경영정보학과 박사과정 양 영 배. 지도교수 김 두 경, 김 민 철

☺ 유비쿼터스 헬스케어(예시) ☺



자료 : 가천의대 길병원(U-헬스케어 라이프)

A. 아래 문항을 보시고 자신의 생각과 일치한다고 생각되는 정도를 골라 √표 해 주시기 바랍니다.

(태도)	그렇지 않다	보통이다	매우 그렇다
1. 유비쿼터스 헬스 서비스는 좋은 아이디어라고 생각한다.	①	② ③ ④	⑤
2. 유비쿼터스 헬스 서비스를 이용하는 것은 내 스스로가 재미있다.	①	② ③ ④	⑤
3. 유비쿼터스 헬스 서비스를 이용하면 건강관리가 더욱 재미가 있을 것 같다.	①	② ③ ④	⑤

(행위의도)	그렇지 않다	보통이다	매우 그렇다
4. 지금 유비쿼터스 헬스 서비스를 이용할 수 있다면 나는 서비스를 사용하려고 한다.	①	② ③ ④	⑤
5. 지금 유비쿼터스 헬스 서비스를 이용할 수 있다면 나는 서비스를 자주 사용할 것이라고 예상해 본다.	①	② ③ ④	⑤

B. 자신의 건강관리에 대해 느끼는 바를 골라 √표 해 주시기 바랍니다.

(자기 효능감)	그렇지 않다	보통이다	매우 그렇다
1. 유비쿼터스 헬스케어를 이용하면 나는 건강상태를 증진시키기 위해 필요한 건강 행위를 할 수 있다.	①	② ③ ④	⑤
2. 유비쿼터스 헬스케어를 이용하면 나는 균형 잡힌 식생활을 할 수 있다.	①	② ③ ④	⑤
3. 유비쿼터스 헬스케어를 이용하면 나는 건강관리를 행함에 있어 어려움이 있어도 극복할 수 있는 자신감이 있다.	①	② ③ ④	⑤
4. 유비쿼터스 헬스케어를 이용하면 나는 운동을 규칙적으로 할 수 있다.	①	② ③ ④	⑤
5. 유비쿼터스 헬스케어를 이용하면 나는 체중을 알맞게 유지할 수 있다.	①	② ③ ④	⑤

C. 건강관리를 행하는 데 있어 상황적요인 입니다.

(아래 문항을 보시고 자신의 생각되는 정도를 골라 √표 해 주시기 바랍니다.)

(상황적 요인)	그렇지 않다	보통이다	매우 그렇다
1. 나는 건강관리 행위 실천을 도와주거나 함께 할 가족이나 친구가 있다.	①	② ③ ④	⑤
2. 현재 나의 건강을 체크해주는 개인 관리자(의사, 상담사 등)가 있다.	①	② ③ ④	⑤
3. 건강행위 실천을 위한 지원 시스템이 있다(인력, 센서, 프로그램, 운동시설 등).	①	② ③ ④	⑤
4. 나는 규칙적인 건강관리를 할 시간적 여유가 있다.	①	② ③ ④	⑤

D. 유비쿼터스 헬스케어에 대한 당신의 견해입니다.

(아래 문항을 보시고 자신의 생각되는 정도를 골라 √표 해 주시기 바랍니다.)

(지각된 유익성)	그렇지 않다	보통이다	매우 그렇다
1. 유비쿼터스 헬스케어는 실시간 건강 체크가 가능하므로 질병 예방과 조기 발견에 매우 유용할 것이다.	①	② ③ ④	⑤
2. 유비쿼터스 헬스케어는 응급 발병 시 즉각적으로 대처하는 데 효과적일 것이다.	①	② ③ ④	⑤
3. 유비쿼터스 헬스케어는 의료비 절감에 도움이 될 것이다.	①	② ③ ④	⑤
4. 유비쿼터스 헬스케어는 건강관리를 위해 투자하는 시간 절약에 도움을 줄 것이다.	①	② ③ ④	⑤
5. 유비쿼터스 헬스케어는 집에서 측정이나 관리가 가능하므로 편리할 것이다.	①	② ③ ④	⑤

(지각된 장애성)	그렇지 않다	보통이다	매우 그렇다
6. 유비쿼터스헬스케어를 사용하는데 있어서 센서의 오동작이나 서비스의 지연 등으로 인한 금전적 · 시간적 손해는 별로 문제될 것이 없다.	①	② ③ ④	⑤
7. 유비쿼터스 헬스케어를 사용하는데 있어서 서비스의 이용에 관련된 기기나 통신비 등은 별로 문제가 되지 않는다.	①	② ③ ④	⑤
8. 유비쿼터스 헬스케어를 사용하는데 있어서 개인정보 유출가능성을 별로 걱정하지 않는다.	①	② ③ ④	⑤
9. 유비쿼터스 헬스케어 사용법은 별 어려움이 없을 것이다.	①	② ③ ④	⑤
10.유비쿼터스 헬스케어를 사용하는데 있어서 정확하지 않은 정보로 인한 건강상의 위해는 걱정할 필요가 없다.	①	② ③ ④	⑤

E. 다음 각 문항을 읽은 후 귀하의 상태를 잘 표현하는 바를 √표 해 주십시오.

(사회적 지지)	그렇지 않다	보통이다	매우 그렇다
1. 내 주변에는 내가 하는 일을 잘 한다고 인정해주는 사람이 있다.	①	② ③ ④	⑤
2. 내 주변에는 나와 같이 즐겁게 시간을 보낼 수 있는 사람이 있다.	①	② ③ ④	⑤
3. 몸이 아파서 병원에 가야할 때 나를 데려다 줄 사람이 있다.	①	② ③ ④	⑤
4. 내가 하는 일에 있어서 잘잘못을 분명하게 말해줄 사람이 있다.	①	② ③ ④	⑤
5. 내 친지나 친구들은 내가 그들에게 필요한 존재라고 생각한다.	①	② ③ ④	⑤
6. 자신이 아끼는 물건(자동차 등)응 흔쾌히 빌려줄 사람이 있다.	①	② ③ ④	⑤

7. 나는 다른 사람보다 내 생활에 만족한다.	①—②—③—④—⑤
8. 내가 식사나 술을 마시고 싶을 때 흔쾌히 응해줄 사람을 찾을 수 있다.	①—②—③—④—⑤
9. 나는 정기적으로 가족이나 친구들과 연락을 주고 받는다.	①—②—③—④—⑤

F. 다음 각 문항을 읽은 후 귀하의 상태를 잘 표현하는 바를 √표 해 주십시오.

(자아존중감)	그렇지 않다 보통이다 매우 그렇다
1. 나는 나 자신이 가치 있는 사람이라고 생각한다.	①—②—③—④—⑤
2. 나는 좋은 성품을 많이 가지고 있다고 생각한다.	①—②—③—④—⑤
3. 나는 대부분의 사람들과 같이 일을 잘 할 수 있다.	①—②—③—④—⑤
4. 나는 나 자신을 좋게 생각한다.	①—②—③—④—⑤
5. 나는 나 자신에 대하여 만족한다.	①—②—③—④—⑤

G. 유비쿼터스 헬스케어 서비스가 귀하의 댁에서 이루어진다고 할 때 각 항목의 필요성에 대해 생각하시는 바를 √표 해 주십시오.

(필요성)	그렇지 않다 보통이다 매우 그렇다
1. 유비쿼터스 헬스케어에서 다양한 건강 관련 정보제공 서비스는 필요하다.	①—②—③—④—⑤
2. 유비쿼터스 헬스케어에서 이용자 간 또는 전문가와의 의사소통이나 정보교환을 위한 동호회활동은 필요하다.	①—②—③—④—⑤
3. 유비쿼터스 헬스케어에서 신속한 응급구호 서비스는 필요하다.	①—②—③—④—⑤
4. 유비쿼터스 헬스케어에서 병원 진료 예약 및 각종 정보 시스템이나 의료 서비스간의 연계 서비스는 필요하다.	①—②—③—④—⑤
5. 유비쿼터스 헬스케어에서 건강 및 의료와 관련된 온라인, 오프라인 구매 시스템은 필요하다.	①—②—③—④—⑤
6. 유비쿼터스 헬스케어에서 개인별 맞춤형 프로그램, 영양이나 운동에 대한 건강관리 프로그램은 필요하다.	①—②—③—④—⑤
7. 유비쿼터스 헬스케어에서 건강 상태 실시간 자동체크 및 이상 징후 발생 시 자동 감지 시스템은 필요하다.	①—②—③—④—⑤
8. 유비쿼터스 헬스케어에서 생체 정보 측정 센서들의 편리성이 필요하다.	①—②—③—④—⑤
9. 유비쿼터스 헬스케어에서 개인 건강정보유출방지 보호 시스템이나 정확하지 않은 정보에 대한 검증시스템 구축은 필요하다.	①—②—③—④—⑤

H. 유비쿼터스 헬스케어 시스템에서 필요한 요구사항리스트입니다.

(귀하께서 생각하시는 중요도 정도를 √표 해 주십시오.)

특 징	설 명	그렇지 않다 보통이다 매우 그렇다
1.이동성(Mobility)	u-헬스케어는 모바일 환경에서 운영할 수 있어야한다.	①—②—③—④—⑤
2.보안성(Security)	u-헬스케어에서 사용자의 개인정보 보호능력은 중요하다.	①—②—③—④—⑤
3.접근성(Accessibility)	u-헬스케어 시스템은 사용자 접속이 편리해야 한다.	①—②—③—④—⑤
4.확장성(Scalability)	u-헬스케어 시스템은 사용자수의 증대에 유연하게 대응할 수 있어야 한다.	①—②—③—④—⑤
5.상호운용성(Interoperability)	u-헬스케어 시스템은 다양한 종류의 기기와의 접속성이 중요하다.	①—②—③—④—⑤
6.불가시성(Invisibility)	u-헬스케어 시스템은 사용자의 거부감 없는 자연스러운 측정 능력이 중요하다.	①—②—③—④—⑤
7.내구성(Durability)	u-헬스케어 시스템은 기기의 지속적인 가동상태 유지 능력이 중요하다.	①—②—③—④—⑤
8.착근성(Embeddedness)	u-헬스케어 시스템은 물리적 환경 변경 시 기기의 안정적 작동능력이 중요하다.	①—②—③—④—⑤
9.휴대성(Portability)	u-헬스케어 시스템은 한 손으로 조작 가능여부 또는 어디서나 쉽게 사용 가능해야 한다.	①—②—③—④—⑤
10.사용자특화성(Customizability)	u-헬스케어 시스템은 사용자에 따라 특화된 정보 제공이 되어야한다.	①—②—③—④—⑤
11.이동성(Nomadicity)	u-헬스케어 시스템은 이동 중 사용가능해야 한다.	①—②—③—④—⑤
12.사용성(Usability)	u-헬스케어 시스템은 다양한 방법으로 정보에 대한 입출력 가능해야 한다.	①—②—③—④—⑤
13.다기능성(Versatility)	u-헬스케어 시스템은 다른 물리적 목적으로 사용 가능해야 하고, 사용자가 장소 이동시에도 운영이 가능해야 한다.	①—②—③—④—⑤
14.상황추론(Context inference)	u-헬스케어 시스템은 현재 상황과 관련된 서비스 제공 능력이 중요하다.	①—②—③—④—⑤
15.속도성(Agility)	u-헬스케어 시스템은 실시간 환경에서 안정적으로 운영되어야 한다.	①—②—③—④—⑤
16.개인화(Personalization)	u-헬스케어 시스템은 사용자의 공통적인 패턴을 기억하고, 그것들을	①—②—③—④—⑤

	나중에 사용하는 능력이 중요하다.	
17.주도적인 행동(Pro-activeness)	u-헬스케어 시스템은 현재 상황에 맞는 서비스를 선행적으로 사용자에게 제공되어야 한다.	①——②——③——④——⑤

I. 아래의 각 항목에 대하여 해당되는 곳에 √표 해 주시기 바랍니다.

1. 성별 ① 남 ② 여
2. 연령 ① 20 대 ② 30 대 ③ 40 대 ④ 50 대 ⑤ 60 대 이상
3. 학력 ① 중졸 이하 ② 고졸 이하 ③ 대학 재학 ④ 대학 졸업 ⑤ 대학원 졸업 이상
4. 직업 ① 학생 ② 주부 ③ 근로자(사무직) ④ 근로자(생산직) ⑤ 근로자(영업직) ⑥ 전문직 ⑦ 교사 ⑧ 자영업 ⑨ 무직 ⑩ 의료인 ⑪ 기타(_____)
5. 가족형태 ① 독신 ② 부부 ③ 부부와 자녀(5-1문항으로 가세요) ④ 3대 동거
5-1. 5번에서 ③번으로 응답한 경우 자녀의 학년은? (첫째 자녀기준) ① 미취학 ② 초등학교 재학 ③ 중·고등학교 재학 ④ 대학재학 이상
6. 가족의 월 평균소득 ① 200만 원 이하 ② 200~300만 원 이하 ③ 300~400만 원 이하 ④ 400~500만 원 이하 ⑤ 500~700만 원 이하 ⑥ 700만 원 이상
7. 거주형태 ① 아파트 ② 주상복합 ③ 단독주택 ④ 다세대주택 ⑤ 오피스텔 ⑥ 기타(_____)
8. 거주지 ①서울특별시 ②경기도 ③경상남도 ④경상북도 ⑤전라남도 ⑥전라북도 ⑦충청남도 ⑧충청북도 ⑨제주도

<Appendix 2> Expert Questionnaire

작성자 성명:

(*) 다음은 u- Healthcare 시스템에서 필요한 서비스 구성 내용입니다. 그러면 귀하께서 생각하시기에 이러한 시스템을 구축하는데 있어서 난이도를 5점 척도로 측정하여 주시기 바랍니다.

(1 = 전혀 어렵지 않다, 2 = 어렵지 않다, 3 = 보통이다, 4 = 어렵다, 5 = 매우 어렵다.)

서비스 구성		난이도 척도
서비스 플랫폼 및 외부 인터페이스	생체정보 수집/저장/관리	
	생체정보 분석	
	컨텐츠 관리	
	개인별 건강정보 관리	
	서비스 피드백 관리	
	네트워크 원격 관리	
	생체 정보 모니터링 관리	
	CDSS(치료의사결정지원 시스템) 관리	
	위급상황 관리	
운영관리 플랫폼 (Device and service 관리)	사용자 인증	
	단말관리/인증	
	네트워크 보안	
	통신 제어	
	기업자 관리	
	요금관리	
	세션관리	
	시스템관리	
	원인관리	
네트워크 플랫폼 (Network connectivity)	외부망	
	내부망	
측정 단말 (Health device)	트레드밀/운동기구	
	개인 식별기	
	혈당기	
	수면 모니터링	
	심전도	

<Appendix 3> Expert Questionnaire

(*) 전문가 설문지는 요구사항들의 리스트들과 필요한 서비스 구성들을 서로 연계하여 작성한 표입니다. 그러면 귀하께서 생각하시기에 각 요구사항들과 서비스 구성들과의 연계성 정도를 다음 척도로 측정하여 주시기 바랍니다.

1= 약한 상관성(연계성) 3= 중간정도의 상관성 (연계성) 9= 아주 강한 정도의 상관성 (연계성)

Characteristics		서비스 플랫폼 및 외부인터페이스									운영관리플랫폼									네트워크 플랫폼		측정 단말				
		생체정보수집/저장/관리	생체정보분석	컨텐츠관리	개인별건강정보관리	서비스피드백관리	네트워크원격관리	생체정보모니터링관리	치료의사결정지원시스템 관리	취급상황관리	사용자인증	단말관리/인증	네트워크보안	통신제어	기업자관리	요금관리	세션관리	시스템관리	원인관리	외부망	내부망	트레드밀/운동기구	개인식별기	혈당기	수면모니터링	심전도
Network	이동성																									
	보안성																									
	접근성																									
	범위성																									
	상호운용성																									
Device	불가시성																									
	내구성																									
	착근성																									
	휴대성																									
User Interface	사용자특화성																									
	이동성																									
	사용성																									
	다기능성																									
Operation system	상황추론																									
	속도성																									
	개인화																									
	주도적인행동																									

<Appendix 4> Case-by-case statistics

케이스 수	실제 집단	최대집단					두 번째로 큰 최대집단			판별점수
		예측 집단	P(D>d | G=g) 확률	자유도	P(G=g | D=d)	중심값까지의 제곱 Mahalanobis 거리	집단	P(G=g | D=d)	중심값까지의 제곱 Mahalanobis 거리	함수 1
1	2	1	0.610	1	0.539	0.261	2	0.461	0.577	-0.266
2	2	1	0.730	1	0.591	0.119	2	0.409	0.856	-0.432
3	2	1	0.876	1	0.648	0.024	2	0.352	1.241	-0.621
4	2	2	0.278	1	0.899	1.178	1	0.101	5.547	1.578
5	2	2	0.606	1	0.812	0.266	1	0.188	3.188	1.009
6	2	2	0.861	1	0.642	0.031	1	0.358	1.197	0.318
7	1	2	0.558	1	0.825	0.343	1	0.175	3.442	1.078
8	2	2	0.925	1	0.665	0.009	1	0.335	1.382	0.399
9	2	2	0.792	1	0.616	0.069	1	0.384	1.013	0.230
10	1	1	0.000	1	0.997	15.842	2	0.003	27.563	-4.757
11	1	2	0.740	1	0.595	0.110	1	0.405	0.879	0.161
12	1	1	0.691	1	0.575	0.158	2	0.425	0.761	-0.380
13	1	2	0.815	1	0.625	0.055	1	0.375	1.074	0.260
14	2	2	0.028	1	0.973	4.846	1	0.027	12.049	2.694
15	2	2	0.864	1	0.643	0.029	1	0.357	1.207	0.322
16	2	1	0.764	1	0.605	0.090	2	0.395	0.940	-0.476
17	2	2	0.997	1	0.690	0.000	1	0.310	1.603	0.490
18	2	2	0.965	1	0.679	0.002	1	0.321	1.503	0.449
19	1	2	0.944	1	0.672	0.005	1	0.328	1.438	0.422
20	2	1	0.826	1	0.629	0.048	2	0.371	1.103	-0.557
21	2	2	0.933	1	0.714	0.007	1	0.286	1.833	0.577
22	2	1	0.971	1	0.701	0.001	2	0.299	1.706	-0.813
23	1	1	0.772	1	0.764	0.084	2	0.236	2.431	-1.066
24	1	1	0.925	1	0.665	0.009	2	0.335	1.382	-0.682
25	2	2	0.491	1	0.843	0.474	1	0.157	3.834	1.181
26	1	1	0.385	1	0.871	0.753	2	0.129	4.570	-1.645
27	1	2	0.831	1	0.746	0.045	1	0.254	2.199	0.706
28	2	1	0.571	1	0.522	0.321	2	0.478	0.494	-0.210
29	2	2	0.549	1	0.512	0.358	1	0.488	0.451	-0.105
30	2	2	0.650	1	0.800	0.206	1	0.200	2.973	0.947
31	1	1	0.742	1	0.773	0.109	2	0.227	2.559	-1.106
32	1	2	0.624	1	0.546	0.240	1	0.454	0.609	0.004
33	1	1	0.611	1	0.540	0.259	2	0.460	0.578	-0.267
34	1	1	0.896	1	0.726	0.017	2	0.274	1.961	-0.907
35	2	2	0.847	1	0.741	0.037	1	0.259	2.138	0.686
36	1	1	0.711	1	0.782	0.137	2	0.218	2.689	-1.147
37	1	1	0.585	1	0.528	0.298	2	0.472	0.524	-0.230
38	2	2	0.680	1	0.570	0.170	1	0.430	0.735	0.081
39	1	1	0.952	1	0.707	0.004	2	0.293	1.768	-0.836
40	1	2	0.749	1	0.771	0.102	1	0.229	2.528	0.813
41	2	2	0.902	1	0.657	0.015	1	0.343	1.316	0.370

케이스수	실제집단	최대집단					두 번째로 큰 최대집단			판별점수
		예측집단	P(D>d | G=g) 확률	P(D>d | G=g) 자유도	P(G=g | D=d)	중심값까지의 제곱 Mahalanobis 거리	집단	P(G=g | D=d)	중심값까지의 제곱 Mahalanobis 거리	함수 1
42	2	2	0.873	1	0.733	0.026	1	0.267	2.045	0.653
43	2	2	0.735	1	0.593	0.115	1	0.407	0.867	0.155
44	2	1	0.582	1	0.818	0.303	2	0.182	3.315	-1.328
45	1	1	0.745	1	0.772	0.106	2	0.228	2.545	-1.102
46	2	2	0.071	1	0.957	3.248	1	0.043	9.438	2.295
47	2	2	0.716	1	0.585	0.132	1	0.415	0.821	0.129
48	1	1	0.027	1	0.974	4.894	2	0.026	12.125	-2.989
49	1	1	0.062	1	0.960	3.478	2	0.040	9.826	-2.642
50	1	1	0.051	1	0.964	3.803	2	0.036	10.369	-2.727
51	1	1	0.636	1	0.803	0.223	2	0.197	3.037	-1.249
52	2	2	0.377	1	0.873	0.780	1	0.127	4.636	1.376
53	1	2	0.657	1	0.560	0.197	1	0.440	0.682	0.049
54	1	1	0.962	1	0.704	0.002	2	0.296	1.734	-0.824
55	2	2	0.499	1	0.841	0.458	1	0.159	3.789	1.170
56	2	2	0.861	1	0.642	0.031	1	0.358	1.197	0.318
57	2	1	0.668	1	0.794	0.184	2	0.206	2.887	-1.206
58	1	1	0.117	1	0.942	2.451	2	0.058	8.040	-2.342
59	1	1	0.550	1	0.827	0.357	2	0.173	3.486	-1.374
60	2	2	0.885	1	0.729	0.021	1	0.271	2.002	0.638
61	2	2	0.319	1	0.888	0.993	1	0.112	5.136	1.489
62	2	1	0.665	1	0.564	0.187	2	0.436	0.701	-0.344
63	2	2	0.128	1	0.939	2.312	1	0.061	7.786	2.014
64	1	1	0.655	1	0.559	0.200	2	0.441	0.677	-0.330
65	2	2	0.888	1	0.728	0.020	1	0.272	1.992	0.635
66	2	2	0.651	1	0.558	0.204	1	0.442	0.669	0.041
67	2	2	0.760	1	0.767	0.093	1	0.233	2.480	0.798
68	2	2	0.323	1	0.887	0.977	1	0.113	5.100	1.482
69	2	1	0.588	1	0.817	0.293	2	0.183	3.282	-1.318
70	1	1	0.629	1	0.548	0.233	2	0.452	0.619	-0.294
71	1	1	0.778	1	0.762	0.080	2	0.238	2.410	-1.059
72	1	1	0.435	1	0.858	0.609	2	0.142	4.203	-1.557
73	1	1	0.650	1	0.557	0.206	2	0.443	0.665	-0.322
74	1	1	0.147	1	0.934	2.100	2	0.066	7.393	-2.226
75	2	2	0.441	1	0.856	0.595	1	0.144	4.166	1.264
76	1	2	0.594	1	0.532	0.285	1	0.468	0.542	-0.041
77	2	2	0.581	1	0.819	0.305	1	0.181	3.321	1.046
78	1	1	0.225	1	0.913	1.473	2	0.087	6.168	-1.990
79	1	1	0.957	1	0.706	0.003	2	0.294	1.752	-0.831
80	2	2	0.527	1	0.833	0.401	1	0.167	3.622	1.126
81	2	2	0.992	1	0.694	0.000	1	0.306	1.639	0.503
82	2	1	0.960	1	0.678	0.002	2	0.322	1.489	-0.727

케이스수	실제집단	최대집단					두 번째로 큰 최대집단			판별점수
		예측집단	P(D>d | G=g) 확률	자유도	P(G=g | D=d)	중심값까지의 제곱 Mahalanobis 거리	집단	P(G=g | D=d)	중심값까지의 제곱 Mahalanobis 거리	함수 1
83	1	2	0.586	1	0.529	0.297	1	0.471	0.526	-0.052
84	1	1	0.828	1	0.630	0.047	2	0.370	1.109	-0.560
85	1	1	0.231	1	0.911	1.436	2	0.089	6.092	-1.975
86	1	1	0.430	1	0.859	0.623	2	0.141	4.239	-1.566
87	1	2	0.218	1	0.914	1.516	1	0.086	6.255	1.724
88	2	2	0.852	1	0.639	0.035	1	0.361	1.173	0.307
89	2	2	0.642	1	0.554	0.216	1	0.446	0.647	0.028
90	1	2	0.723	1	0.588	0.126	1	0.412	0.837	0.138
91	1	1	0.308	1	0.891	1.040	2	0.109	5.243	-1.797
92	2	2	0.992	1	0.694	0.000	1	0.306	1.639	0.503
93	1	1	0.011	1	0.983	6.455	2	0.017	14.520	-3.317
94	2	1	0.860	1	0.737	0.031	2	0.263	2.091	-0.953
95	2	1	0.547	1	0.511	0.362	2	0.489	0.446	-0.175
96	1	2	0.816	1	0.625	0.054	1	0.375	1.074	0.260
97	2	2	0.551	1	0.827	0.355	1	0.173	3.482	1.089
98	2	2	0.675	1	0.568	0.176	1	0.432	0.723	0.073
99	2	2	0.413	1	0.864	0.670	1	0.136	4.361	1.312
100	2	1	0.611	1	0.540	0.259	2	0.460	0.578	-0.267
101	2	1	0.796	1	0.617	0.067	2	0.383	1.022	-0.518
102	1	1	0.884	1	0.729	0.021	2	0.271	2.005	-0.923
103	2	2	0.725	1	0.778	0.124	1	0.222	2.630	0.845
104	1	2	0.816	1	0.625	0.054	1	0.375	1.074	0.260
105	1	1	0.622	1	0.545	0.243	2	0.455	0.603	-0.283
106	2	1	0.811	1	0.752	0.057	2	0.248	2.276	-1.016
107	1	1	0.884	1	0.729	0.021	2	0.271	2.005	-0.923
108	1	1	0.782	1	0.612	0.077	2	0.388	0.985	-0.500
109	2	1	0.743	1	0.596	0.107	2	0.404	0.888	-0.449
110	2	2	0.393	1	0.869	0.728	1	0.131	4.508	1.346
111	1	1	0.322	1	0.887	0.979	2	0.113	5.105	-1.766
112	1	1	0.782	1	0.612	0.077	2	0.388	0.985	-0.500
113	2	1	0.743	1	0.596	0.107	2	0.404	0.888	-0.449
114	2	2	0.950	1	0.708	0.004	1	0.292	1.776	0.556
115	2	2	0.338	1	0.883	0.918	1	0.117	4.963	1.451
116	2	2	0.485	1	0.845	0.489	1	0.155	3.877	1.192
117	2	2	0.126	1	0.940	2.346	1	0.060	7.848	2.025
118	2	2	0.507	1	0.839	0.440	1	0.161	3.737	1.157
119	2	2	0.158	1	0.931	1.990	1	0.069	7.186	1.904
120	2	2	0.741	1	0.773	0.109	1	0.227	2.561	0.823
121	2	2	0.812	1	0.752	0.057	1	0.248	2.274	0.731
122	2	2	0.873	1	0.733	0.026	1	0.267	2.044	0.653
123	1	1	0.527	1	0.501	0.400	2	0.499	0.406	-0.144

케이스수	실제집단	최대집단					두 번째로 큰 최대집단			판별점수
		예측집단	P(D>d | G=g) 확률	P(D>d | G=g) 자유도	P(G=g | D=d)	중심값까지의 제곱 Mahalanobis 거리	집단	P(G=g | D=d)	중심값까지의 제곱 Mahalanobis 거리	함수 1
124	2	1	0.662	1	0.562	0.191	2	0.438	0.693	-0.340
125	1	2	0.285	1	0.897	1.145	1	0.103	5.476	1.563
126	2	2	0.901	1	0.724	0.015	1	0.276	1.943	0.617
127	2	2	0.969	1	0.702	0.001	1	0.298	1.711	0.531
128	2	2	0.520	1	0.835	0.414	1	0.165	3.659	1.136
129	2	2	0.271	1	0.901	1.211	1	0.099	5.618	1.593
130	2	1	0.944	1	0.672	0.005	2	0.328	1.438	-0.706
131	2	2	0.354	1	0.879	0.857	1	0.121	4.822	1.419
132	2	2	0.881	1	0.649	0.023	1	0.351	1.254	0.343
133	1	1	0.678	1	0.791	0.172	2	0.209	2.840	-1.192
134	1	1	0.056	1	0.962	3.664	2	0.038	10.138	-2.691
135	2	1	0.793	1	0.757	0.069	2	0.243	2.346	-1.039
136	2	2	0.809	1	0.753	0.059	1	0.247	2.287	0.735
137	1	2	0.764	1	0.604	0.091	1	0.396	0.939	0.192
138	1	1	0.826	1	0.748	0.048	2	0.252	2.220	-0.997
139	1	1	0.662	1	0.562	0.191	2	0.438	0.693	-0.340
140	2	2	0.752	1	0.770	0.100	1	0.230	2.515	0.809
141	2	2	0.651	1	0.799	0.205	1	0.201	2.966	0.945
142	2	2	0.947	1	0.709	0.004	1	0.291	1.786	0.560
143	2	2	0.732	1	0.776	0.117	1	0.224	2.598	0.835
144	2	2	0.744	1	0.597	0.107	1	0.403	0.889	0.166
145	2	2	0.432	1	0.859	0.616	1	0.141	4.223	1.278
146	2	2	0.869	1	0.645	0.027	1	0.355	1.220	0.328
147	1	1	0.009	1	0.984	6.813	2	0.016	15.055	-3.387
148	1	2	0.764	1	0.604	0.091	1	0.396	0.939	0.192
149	1	1	0.662	1	0.562	0.191	2	0.438	0.693	-0.340
150	2	2	0.610	1	0.540	0.260	1	0.460	0.577	-0.017
151	2	2	0.577	1	0.524	0.311	1	0.476	0.507	-0.065
152	2	2	0.648	1	0.800	0.209	1	0.200	2.982	0.950
153	2	1	0.632	1	0.549	0.230	2	0.451	0.625	-0.298
154	1	2	0.589	1	0.530	0.293	1	0.470	0.531	-0.048
155	2	2	0.720	1	0.779	0.129	1	0.221	2.652	0.852
156	1	2	0.885	1	0.651	0.021	1	0.349	1.265	0.348
157	2	1	0.611	1	0.540	0.259	2	0.460	0.578	-0.267
158	2	2	0.833	1	0.631	0.045	1	0.369	1.121	0.282
159	2	2	0.979	1	0.698	0.001	1	0.302	1.680	0.520
160	2	2	0.595	1	0.815	0.283	1	0.185	3.247	1.025
161	1	2	0.538	1	0.506	0.379	1	0.494	0.428	-0.122
162	1	2	0.633	1	0.804	0.228	1	0.196	3.053	0.970
163	2	2	0.067	1	0.958	3.351	1	0.042	9.612	2.324
164	1	1	0.897	1	0.655	0.017	2	0.345	1.299	-0.647

케이스 수	실제 집단	최대집단					두 번째로 큰 최대집단			판별점수
		예측 집단	P(D>d | G=g) 확률	P(D>d | G=g) 자유도	P(G=g | D=d)	중심값까지의 제곱 Mahalanobis 거리	집단	P(G=g | D=d)	중심값까지의 제곱 Mahalanobis 거리	함수 1
165	2	2	0.809	1	0.753	0.059	1	0.247	2.287	0.735
166	2	2	0.563	1	0.824	0.335	1	0.176	3.419	1.072
167	2	1	0.618	1	0.543	0.249	2	0.457	0.594	-0.278
168	2	2	0.485	1	0.845	0.489	1	0.155	3.877	1.192
169	2	2	0.087	1	0.952	2.926	1	0.048	8.882	2.204
170	2	2	0.654	1	0.798	0.201	1	0.202	2.952	0.941
171	2	1	0.597	1	0.814	0.280	2	0.186	3.235	-1.306
172	1	2	0.644	1	0.554	0.214	1	0.446	0.651	0.030
173	1	1	0.704	1	0.580	0.144	2	0.420	0.792	-0.397
174	2	2	0.815	1	0.751	0.055	1	0.249	2.261	0.727
175	2	2	0.322	1	0.887	0.982	1	0.113	5.112	1.484
176	2	2	0.805	1	0.754	0.061	1	0.246	2.302	0.741
177	2	2	0.710	1	0.782	0.139	1	0.218	2.697	0.865
178	2	2	0.187	1	0.923	1.743	1	0.077	6.708	1.813
179	2	2	0.441	1	0.856	0.593	1	0.144	4.160	1.263
180	2	2	0.600	1	0.535	0.274	1	0.465	0.557	-0.031
181	2	1	0.828	1	0.630	0.047	2	0.370	1.109	-0.560
182	2	2	0.582	1	0.818	0.303	1	0.182	3.313	1.044
183	2	2	0.414	1	0.863	0.668	1	0.137	4.356	1.310
184	1	2	0.605	1	0.812	0.268	1	0.188	3.195	1.011
185	1	2	0.675	1	0.568	0.176	1	0.432	0.723	0.073
186	1	2	0.679	1	0.791	0.171	1	0.209	2.835	0.907
187	1	2	0.757	1	0.769	0.096	1	0.231	2.496	0.803
188	2	1	0.915	1	0.719	0.011	2	0.281	1.894	-0.883
189	2	2	0.867	1	0.644	0.028	1	0.356	1.216	0.326
190	1	1	0.402	1	0.867	0.703	2	0.133	4.444	-1.615
191	2	2	0.533	1	0.503	0.389	1	0.497	0.417	-0.131
192	2	2	0.294	1	0.895	1.102	1	0.105	5.381	1.543
193	1	1	0.174	1	0.926	1.845	2	0.074	6.908	-2.135
194	2	2	0.089	1	0.951	2.886	1	0.049	8.812	2.192
195	1	2	0.849	1	0.637	0.036	1	0.363	1.165	0.303
196	2	2	0.146	1	0.934	2.116	1	0.066	7.424	1.948
197	2	2	0.923	1	0.717	0.009	1	0.283	1.869	0.590
198	1	1	0.840	1	0.634	0.041	2	0.366	1.141	-0.575
199	1	1	0.072	1	0.957	3.247	2	0.043	9.435	-2.579
200	2	2	0.871	1	0.646	0.026	1	0.354	1.227	0.331
201	2	2	0.263	1	0.903	1.254	1	0.097	5.710	1.613
202	2	1	0.574	1	0.523	0.315	2	0.477	0.502	-0.215
203	1	1	0.866	1	0.735	0.029	2	0.265	2.070	-0.946
204	1	1	0.379	1	0.872	0.773	2	0.128	4.618	-1.656
205	2	2	0.834	1	0.745	0.044	1	0.255	2.187	0.702

케이스 수	실제 집단	최대집단					두 번째로 큰 최대집단			판별점수
		예측 집단	P(D>d | G=g)		P(G=g | D=d)	중심값까지의 제곱 Mahalanobis 거리	집단	P(G=g | D=d)	중심값까지의 제곱 Mahalanobis 거리	함수 1
			확률	자유도						
205	2	2	0.834	1	0.745	0.044	1	0.255	2.187	0.702
206	2	2	0.943	1	0.710	0.005	1	0.290	1.800	0.565
207	1	2	0.937	1	0.712	0.006	1	0.288	1.820	0.572
208	2	2	0.582	1	0.818	0.304	1	0.182	3.316	1.044
209	2	2	0.793	1	0.758	0.069	1	0.242	2.349	0.756
210	2	1	0.001	1	0.994	11.490	2	0.006	21.711	-4.166
211	1	1	0.435	1	0.858	0.609	2	0.142	4.203	-1.557
212	2	2	0.608	1	0.539	0.263	1	0.461	0.573	-0.020
213	2	2	0.390	1	0.870	0.739	1	0.130	4.535	1.353
214	1	1	0.405	1	0.866	0.695	2	0.134	4.424	-1.610
215	2	2	0.847	1	0.637	0.037	1	0.363	1.160	0.300
216	1	1	0.295	1	0.894	1.095	2	0.106	5.365	-1.823
217	2	2	0.738	1	0.594	0.112	1	0.406	0.876	0.159
218	2	2	0.475	1	0.847	0.510	1	0.153	3.937	1.207
219	2	2	0.885	1	0.651	0.021	1	0.349	1.266	0.348
220	2	2	0.988	1	0.695	0.000	1	0.305	1.650	0.508
221	1	1	0.687	1	0.789	0.162	2	0.211	2.799	-1.180
222	2	1	0.873	1	0.646	0.026	2	0.354	1.231	-0.617
223	2	1	0.841	1	0.635	0.040	2	0.365	1.144	-0.577
224	2	2	0.933	1	0.714	0.007	1	0.286	1.833	0.577
225	2	2	0.362	1	0.877	0.830	1	0.123	4.756	1.404
226	1	1	0.944	1	0.710	0.005	2	0.290	1.795	-0.847
227	1	1	0.025	1	0.975	5.017	2	0.025	12.318	-3.017
228	2	1	0.920	1	0.664	0.010	2	0.336	1.368	-0.677
229	2	2	0.926	1	0.666	0.009	1	0.334	1.386	0.400
230	1	1	0.938	1	0.712	0.006	2	0.288	1.816	-0.854
231	2	2	0.293	1	0.895	1.105	1	0.105	5.387	1.544
232	2	2	0.872	1	0.646	0.026	1	0.354	1.231	0.333
233	2	1	0.562	1	0.518	0.336	2	0.482	0.476	-0.197
234	1	1	0.542	1	0.829	0.371	2	0.171	3.532	-1.386
235	1	1	0.655	1	0.798	0.199	2	0.202	2.946	-1.223
236	2	2	0.784	1	0.760	0.075	1	0.240	2.384	0.767
237	2	2	0.794	1	0.616	0.068	1	0.384	1.017	0.232
238	2	2	0.601	1	0.813	0.274	1	0.187	3.216	1.016
239	1	1	0.435	1	0.858	0.609	2	0.142	4.203	-1.557
240	2	1	0.691	1	0.788	0.158	2	0.212	2.779	-1.174
241	2	2	0.346	1	0.881	0.890	1	0.119	4.898	1.436
242	2	2	0.988	1	0.687	0.000	1	0.313	1.575	0.478
243	2	2	0.273	1	0.900	1.203	1	0.100	5.601	1.590
244	1	1	0.161	1	0.930	1.961	2	0.070	7.131	-2.177
245	2	2	0.072	1	0.956	3.226	1	0.044	9.400	2.289

케이스 수	실제 집단	최대집단				두 번째로 큰 최대집단			판별점수
		예측 집단	P(D>d | G=g) 확률	자유도	P(G=g | D=d)	중심값까지의 제곱 Mahalanobis 거리	집단	P(G=g | D=d)	중심값까지의 제곱 Mahalanobis 거리	함수 1
246	1	1	0.258	1	0.905	1.304	**	0.095	5.817	-1.919
247	2	2	0.836	1	0.745	0.043	1	0.255	2.182	0.700
248	2	2	0.821	1	0.749	0.051	1	0.251	2.288	0.719
249	1	2	0.552	1	0.558	0.203	1	0.442	0.671	0.042
250	2	2	0.866	1	0.876	0.818	1	0.124	4.729	1.698
251	2	2	0.578	1	0.819	0.809	1	0.181	3.683	1.049
252	2	2	0.597	1	0.814	0.280	1	0.186	3.285	1.022
253	1	1	0.598	1	0.533	0.281	2	0.467	0.547	-0.248
254	2	2	0.718	1	0.780	0.130	1	0.220	2.660	0.854
255	2	2	0.999	1	0.692	0.000	1	0.308	1.816	0.494
256	2	2	0.089	1	0.951	2.886	1	0.049	5.814	2.192
257	1	2	0.579	1	0.525	0.305	1	0.475	0.511	-0.082
258	1	1	0.631	1	0.549	0.230	2	0.451	0.624	-0.297
259	1	1	0.616	1	0.809	0.252	2	0.191	3.141	-1.279
260	1	2	0.222	1	0.913	1.489	1	0.087	6.200	1.716
261	1	1	0.806	1	0.755	0.062	2	0.245	2.309	-1.026
262	1	1	0.868	1	0.843	0.030	2	0.357	1.205	-0.606
263	1	1	0.840	1	0.834	0.041	2	0.366	1.139	-0.574
264	1	1	0.639	1	0.553	0.220	2	0.447	0.642	-0.306
265	2	1	0.872	1	0.848	0.028	2	0.354	1.228	-0.616
266	2	2	0.772	1	0.808	0.064	1	0.392	0.980	0.203
267	2	2	0.510	1	0.838	0.435	1	0.162	3.722	1.153
268	2	2	0.546	1	0.510	0.364	1	0.490	0.444	-0.110
269	1	1	0.740	1	0.776	0.110	2	0.227	2.564	-1.108
270	1	1	0.985	1	0.688	0.000	2	0.314	1.585	-0.758
271	2	1	0.930	1	0.715	0.008	2	0.285	1.844	-0.885
272	2	1	0.762	1	0.767	0.092	2	0.233	2.476	-1.079
273	2	1	0.900	1	0.656	0.016	2	0.344	1.608	-0.651
274	2	2	0.726	1	0.588	0.126	1	0.412	0.887	0.188
275	1	2	0.606	1	0.538	0.268	1	0.462	0.588	-0.026
276	1	1	0.486	1	0.845	0.487	2	0.155	3.871	-1.475
277	2	2	0.881	1	0.842	0.031	1	0.358	1.197	0.618
278	1	2	0.921	1	0.664	0.010	1	0.336	1.871	0.694
279	2	1	0.702	1	0.580	0.148	2	0.420	0.788	-0.695
280	2	1	0.657	1	0.560	0.198	2	0.440	0.681	-0.532
281	2	1	0.611	1	0.540	0.259	2	0.460	0.578	-0.287
282	2	1	0.716	1	0.585	0.133	2	0.415	0.820	-0.418
283	1	1	0.552	1	0.827	0.353	2	0.173	3.475	-1.371
284	1	1	0.616	1	0.809	0.253	2	0.191	3.141	-1.279
285	2	2	0.778	1	0.783	0.081	1	0.237	2.417	0.778
286	1	1	0.948	1	0.673	0.005	2	0.327	1.445	-0.709
287	2	2	0.416	1	0.864	0.670	1	0.136	4.681	1.612
288	2	2	0.955	1	0.676	0.003	1	0.324	1.471	0.486
289	1	2	0.927	1	0.668	0.008	1	0.334	1.889	0.402
290	2	2	0.704	1	0.784	0.145	1	0.216	2.724	0.874
291	1	1	0.221	1	0.914	1.497	2	0.086	6.218	-2.000

ABSTRACT

Analysis of the level for demand for u-Healthcare System following Health Promotion Model

Young-Bae Yang
Department of Management Information System
The Graduate School of Jeju National University

The purpose of this study lies in maximizing customer satisfaction by examining the relation between variables of Pender's Health Promotion Model(HPM) and customers' demand of u-Healthcare Service and then, by suggesting methods applicable to u-Healthcare System design. Especially, it verified the suitability of research model to health promotion model variables and made use of confirmatory factor analysis to prove causal significance between potential variables with customers who have used u-Healthcare Service or intend to use it later as subjects. After identifying performance levels and influence coefficients of every variable and applying them to QFD to find out the relation between the requirements of u-Healthcare System Service, it sets the main goal in determining what are important system service characteristics for effective quality improvement by using the result. For the goal, the following research processes are chosen.

Concretely, this study first introduced main evaluation factors of Pender's Health Promotion Model in order to draw out consumers' objective requirements about u-Healthcare for u-Healthcare system

development. In addition, it suggested structural equation model for the purpose of examining evaluation methods to accommodate multiple dependency causal relationship between evaluation factors and finding out optimal causality between them.

Second, I examined structural equation model with the validity in composing potential variables and observation variables of Health Promotion Model through confirmatory factor analysis and evaluates its goodness of fit.

Third, in order to consider the correlation between evaluation norms and factors of service quality characteristics for the satisfaction of u-Healthcare system users, I figured out the influence of multiple dependency causality by using partial least squares. In addition, I rated significant health promotion models on the basis of the standardization discriminant function and applied it to the evaluation norms as a weighted value. Using this, I suggested an evaluation model to determine the order of priority in consumer quality characteristics.

Fourth, I carried out a survey of experts on the correlation between the degree of difficulty in system development and characteristics of both u-Healthcare system and service quality. I finally drew out a value weight on system service characteristics by adding the result of the order of priority in consumer quality characteristics to the above survey and determined the practical order of priority in u-Healthcare system service characteristics. And then, at last, Isuggested a model to be applied to the product development focused on customer satisfaction by taking into consideration the real difficulty of the system development.

As the result of QFD analysis, with expert degree of difficulty applied, of "Emergency Situation Management"in Service Platform and External Interface, "User Authentication" in Operation Management, "External Network" in Network Platform with a lot of users' requirements, "Emergency Situation Management"is 4.0 in the degree of difficulty and

important part in the system. But in reality, its system building is judged to be technically hard. But "User Authentication" and "External Network" are 2.6 and 3.2 respectively and are easy in building system in agreement with users' high needs. Though "Treatment Decision Support System Management" and "Biometric Information Collection/Storage/Management" are 4.0 and 3.6 respectively and have received a lot of users' requirements, their system building will be considerably hard. In case of Measurement Terminal, as an important factor of the system with a lot of users' requirements, its system building is also easy as the degree of difficulty is easy level. As examined above, this study will apply quality attributes selected by suggested process not only tosystem quality evaluation but also to new u-Health system development reflecting users' quality requirements.

With the findings, I suggest the following. This study has its significance in suggesting techniques applicable to the u-Healthcare system development using QFD. Concretely, by investigating u-Healthcare users' direct requirement attributes and extracting u-Healthcare system service characteristics with customer requirement reflected by using QFD model, I figured out the order of priority in the importance of system service characteristics that must be dealt with most importantly. Through this, I attempted to suggest system service characteristics that should be considered first in developing u-Healthcare system. In addition, by differentiating u-Healthcare service quality characteristics transformed from customer requirement attributes and systematically written in HOQ, I made system designers use them as a reference to enhance the degree of completion of u-Healthcare system. As a conclusion, this study proposed an application method of QFD to satisfy customer requirements for the development of u-Healthcare system development. Moreover, I enhanced the reliability of service quality characteristics by using the correlation between HPM and service quality characteristics and provided evaluation

norms to measure effectively and trust u-Healthcare system features by examining the correlation between relevant experts' system characteristics. Also, I suggested important features to improve users' requirements by using this.

감사의 글

내 나이 이제 오십 초반, 세계적으로 진행되고 있는 고령화 시대에서 아직은 인생의 초년생이란 생각이 듭니다. 삶의 중반기에서 내 인생 목표의 한 가지로 박사학위의 길을 선택하였습니다. 이 시점에서 뒤를 돌아보니 그동안의 학위과정은 나 자신의 인격수양의 과정이었다는 생각이 듭니다. 드디어 학위의 모든 과정을 마치고 마무리하는 글을 남기려 하니, 부족한 나 자신의 학위를 위하여 너무 많은 분들의 도움을 받았다는 생각에 주체할 수 없는 감격과 동시에 어떻게 보답을 해야 할지 걱정이 앞섭니다. 우선 일일이 찾아뵙고 감사드리지 못한 점 용서를 구합니다.

우선 저에 대해서 무한한 기대와 희망을 가지고 계셨던 하늘에 계신 부모님께 이 글을 바치도록 하겠습니다. 감사합니다. 아버지, 어머니.

또한, 부족한 저를 학문의 길로 이끌어 주신 저의 정신적인 스승이신 김두경 교수님의 은혜에 고개 숙여 깊은 감사를 드립니다. 그리고 저의 논문 심사를 해주시고 소중한 충고와 조언을 해주신 현정석 교수님, 김근형 교수님, 이동철 교수님, 김도현 교수님의 노고에 고개 숙여 감사를 드립니다.

특히, 교수님 본인의 연구에 정신없이 바쁘신 가운데도 진심으로 열과 성을 다하여 초라한 저의 논문의 틀을 갖추고 완성될 수 있도록 전 과정에 대해 수없이 많은 조언과 격려, 지도를 아끼지 않으시고, 진정한 학자의 자세가 무엇인지를 몸소 실천하시는 김민철 교수님께 진심으로 감사를 드립니다. 아마 교수님의 지도가 없었다면 학위과정을 무사히 마치지 못했을 지도 모릅니다. 그리고 10여년 전 대학원 진학을 고민하고 있을 때 과감하게 나의 진로를 결정하게 해주신 강동식 교수님께도 진심으로 감사의 마음을 전합니다.

논문을 작성하는 과정에서 많은 시간동안 가정과 내 조그만 가게에 충실하지 못했던 나를 대신하여 묵묵히 나의 자리를 대신해주었던 나의 사랑하는 아내에게 정말 고맙다는 말을 전합니다. 나의 목숨보다도 더 소중한 나의 딸 수영, 서영에게도 아빠로서의 조그만 등불이 되었으면 한다.

마지막으로 나의 아내를 세상에 있게 하고, 키워주신 장인, 장모님께도 진심으로 감사드립니다. 건강하십시오.

지면을 통해 일일이 언급하지 못한 많은 저를 아끼고 격려 해주시는 모든 분들께 진심으로 감사의 말을 전합니다.

진심으로 고맙습니다.

2010 년 12 월 양 영 배