International Journal of Bio-Science and Bio-Technology
Vol.6, No.4 (2014), pp.1-12
http://dx.doi.org/10.14257/ijbsbt.2014.6.4.01

A Study on Willingness to Pay of Diabetic Patients for Nursing Intervention Using Telecommunication

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Abstract

This research is to find out the satisfaction level of the nursing service through telephone counseling and willingness to pay for the service. Nurses investigated willingness to pay for the service after supporting self-management through telephone counseling over 185 diabetic patients in small cities in K region and C-region. As a result, male survey respondents were 124 (67%) and female respondents were 61 (33%). The age of 50s was the largest. Recommendation by medical staff as the main reason for participation in the study was 153(82.7%) and the need for managing chronic disease was 181(98%). The willingness to pay for the telephone nurse counseling was 70(37.8%). The awareness of need for managing chronic disease was 98% and the willingness to pay for the service because of the recommendation of medical staff rather than the usability of the service was 80%.The self-management rate was highest in the satisfaction rate and managing counseling service and managing by medical staff were in rank. They were willingness to pay 30% of KW 15,000 among the total monthly charge for nursing intervention service using telecommunication technology. Therefore, the result can be used as a basic data in determining insurance coverage, and it is expected to be conducive to decision-making for reasonable charge of medical treatment.

Keywords: *Telecommunication, Nursing intervention, Diabetic disease, Willingness to pay*

1. Introduction

Prevalence of diabetes patients for adults aged over 30 are 11.3% for male and 9.0% for female [1]. Proportion of the national medical expenditure for such chronic diseases is over 10% of the total national medical expenditure and is increasing due to an increasing aging Korean population [2]. Recently, advancements in information technology have prompted the growth of a diverse range of technical applications for Telecommunication, a trend that has been buoyed by a rapidly increasing user base for based mobile gateway such as Tablet PCs and smartphone [10]. However there have been no successful business models, and the clinical efficacy and cost effectiveness of Mobile-based solutions have not yet been systematically validated [10]. With the recent economic development and improvement in the standard of living, diabetes has been an important national disease, not any more a personal disease. Also, self-management through exercising and telephone counseling for diabetic patients is becoming more significant along with IT technological development. U-Health is a

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ISSN: 2233-7849 IJBSBT

business where healthcare services such as prevention, diagnosis, treatment, and follow-up management are available anywhere, whenever by combining the traditional healthcare with IT and the Internet, which was chosen as a new growth engine industry for higher value-added [3]. As a part of them, researches on telephone counseling provided by a nurse have been increasing because it can improve blood sugar management and enable an effective self-management by means of u-Healthcare. According to Diabetes Control and Complication Trail Research Group (DCCT), strict self-management can reduce complications in 1993 [7]. Therefore, telephone counseling started to use patients' medical data by using mobile phones based on wireless network or u-Healthcare system based on the fixed terminal in home [3-4]. However, despite these trials, the important reason for those services' non-commercialization is that analysis on the effect and costs of the services was not systematically implemented. In this regard, this research provided the telephone counseling as a way to support diabetic patients' self-management based on the u-Healthcare in which a nurse can monitor the patients' status and as a way to provide telephone counseling and to know the satisfaction rate, willingness to pay and the amount for the payment for the service. Therefore assuming that the nursing intermediary service through telephone supporting self-management of chronic disease will be provided as an opportunity in the future.

2. Method

2.1. Research Design

This research is to help diabetic patients in self-management by applying a telephone counseling program, which can be used by fixed telecommunication device (which nurses use) or portable device. This research was done by telephone survey to find out about the effect of the service, awareness, and acceptance, satisfaction level.

2.2. Research Procedure and Data Collection

The data collection for this research was conducted for 3 years from 2010 to 2013 by the Ministry of Knowledge and Economy as a subject of national policy, and it was conducted without any IRB approval. It was conducted for those who were diagnosed with diabetes at the first medical clinic and who participated in "Smartcare" using the service in K-region and C-region. The survey was conducted for those who got the service for 6 months from June, 2012 to December, 2012 from May 3rd to 9th. The participants were informed about the objective of the research and about that the results will only be used for the purpose of the research. They were also informed that their personal information will be kept secret and that they can always drop out when needed. They filled out the consent form for the research.

The "Smartcare" has been underway in South Korea over the last two years. 691 applicants in the "Smartcare" program were asked to choose a gateway device from three categories. After screening the applicants for certain criteria (such as internet service availability and acknowledgement of several disclaimers concerning the privacy and information security), 185 final participants were selected. Participant data was collected and categorized according to demographic detail (age, gender, and region), device usage frequency, and history of nurse's call center inquiries. Additionally, a telephone survey was conducted to elicit more detailed responses.

2.3. About the Service

The fixed or portable device (figure 1) sends personal information about blood sugar and blood pressure to the telecommunication center. The nurses at the center will check

the data of the patients and will provide information about the right exercise, diet and daily habits that they need to do to improve their health. This will help patients to improve their health by themselves through this nursing telecommunication service (Figure 2).

Figure 1. Dedicated Terminal-based Fixed Gateway (Left), Tablet PC-based Mobile Gateway (Center), Smartphone-based Mobile Gateway (Right)

The "Smartcare" solution provides easy self caring methods to patients by simple measurement, associated feedback linked with mobile device and also supports health professional's clinical decision through convenient patient monitoring and remote consultation function.

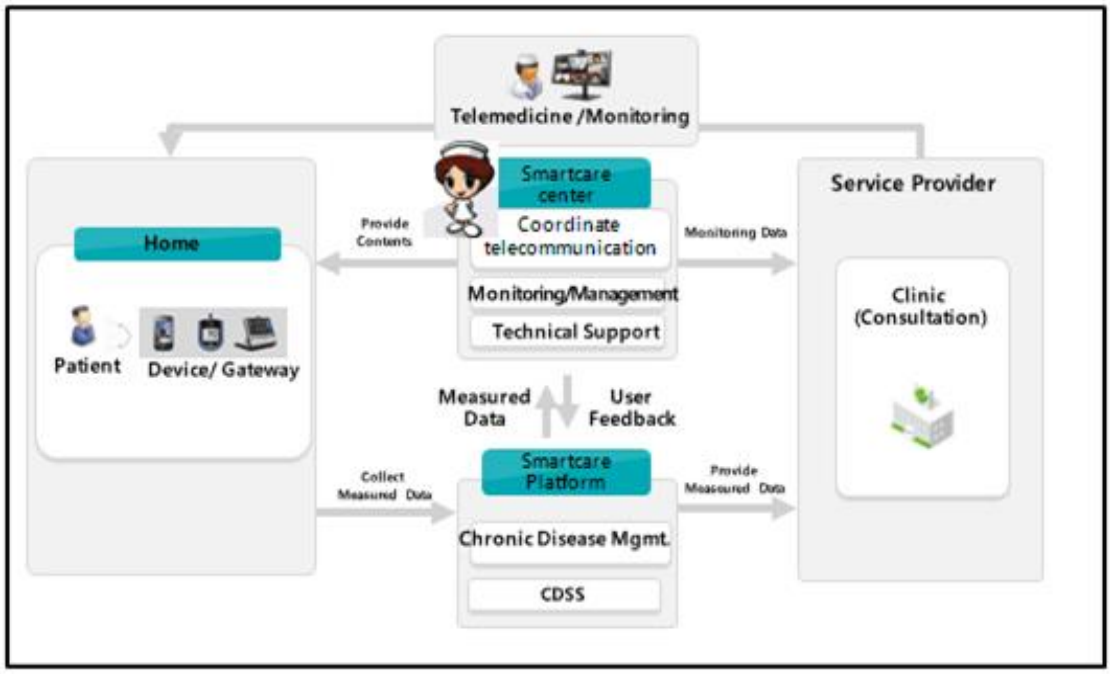

Figure 2. "Smartcare" Service Provides Diabetic Management tools to Patient at Home

Poorly managed chronic disease patients can improve outcomes in terms of exacerbations, admissions to hospitals, and days lost from school or work.

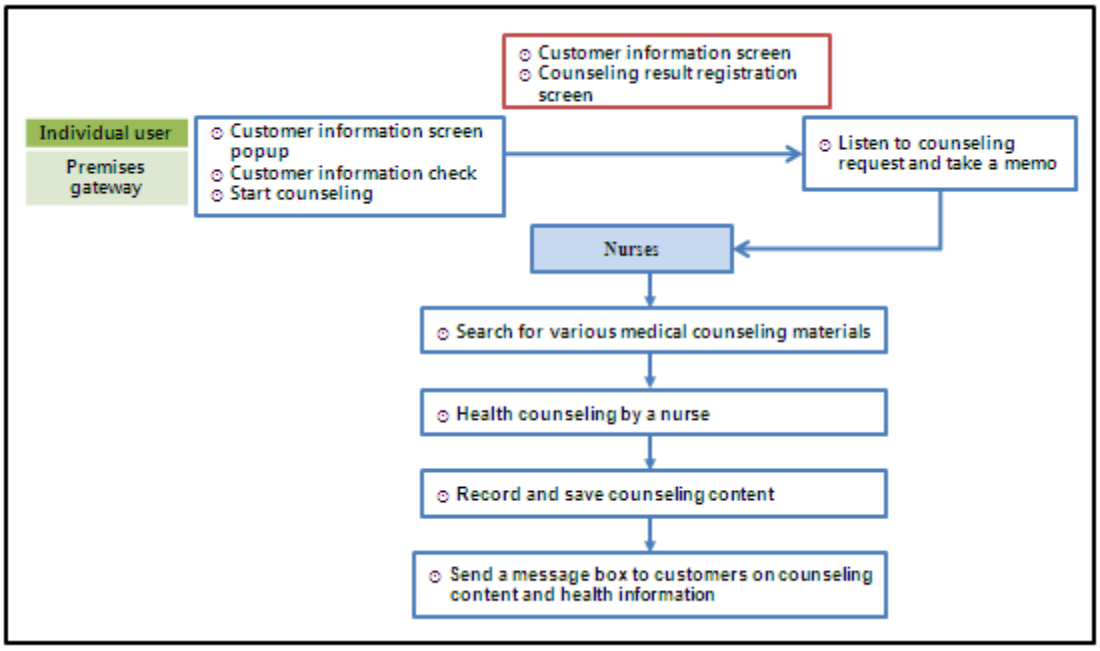

Figure 3. Process of "Smartcare" by Nurse's Telecommunication

2.4. Instruments

The survey form used for this research was composed of survey questions selected from general attributes and references related to telecommunication that asks about the awareness and satisfaction level. Survey possesses information about the participant's age, sex, location and etc. and is composed of 3 parts (2 parts about awareness, 1 part about requirements, 2 parts about satisfaction level and willingness to pay).

2.5. Data Analysis

The collected data was processed electronically by means of SPSS Win 20.0.

3. Results

3.1. General Characteristics of the Overall Participants

As a result, male participants were 124(67%) and female participants were 61(33%). As for age distribution, 50s was the largest part constituting 35.1%, followed by 60s of 47 with a rate of 25.4%, and 40s of 37 with 20%, showing the range from 40s to 60s of 80.5%. Looking into the regional composition, participants in K-region was 123(66.5%) and C-region was 62(33.5%). Also, more participants used a fixed terminal rather than a mobile device. The main reason for such choice was that most participants were advised to use the fixed terminal by their medical staff and 50% of the respondents answered for the reason (Table 1).

Table 1. General characteristics of Participants

(N=185)

Variables	Type	Number (%)
Gender	Male	124(67.0)
	Female	61(33.0)
Age	20~29 years	1(0.5)
	30~39 years	7(3.8)
	40~49 years	37(20.0)
	50~59 years	65(35,1)
	60~69 year	47(25.4)
	70~79 year	27(14.6)
	Over 80 year	1(0.5)
Region of living	K-region	123(66.5)
	C-region	62(33.5)
Gateway	Mobile type	66(35.7)
	Fixed type	119(64.3)

3.2. Awareness, Requirements and Satisfaction lLvel

As the reason for participating in the pilot project, the largest part of 153(82.7%) respondents answered that they were recommended by their medical staff. As for the reason of participation in the pilot project, 181(98%) respondents answered "yes" to the need for chronic disease management. As to the terminal preference, it was found that medical staff's advice in recruiting participants in the project had the biggest impact in which 89 participants (74.8%) chose fixed device and 26 participants (39.4%) chose portable device. Regarding satisfaction level on the nursing counseling service, largest part of 98 respondents (53%) answered that the priority as a useful service was 1. self-management 2. counseling management 3. management by medical staff, and the second largest part of 53 (28.6%) answered that it was 1. counseling management 2. self-management 3. management by medical staff. This result shows that self-management and counseling management was ranked as the first and the second respectively. Also, as an inconvenience of the telephone counseling compared to face-to-face treatment by a doctor, 121(65.4%) respondents presented difficulty in use of the equipment (censor/gateway), and 54 (29.2%) respondents with lack of understanding on the service.

Table 2. "Smartcare" Service Awareness, Needs and Satisfaction

(N=185)

Categories	Questions	Answers	Number(%)
awareness		Suggestion from medical staff	88 (73.9)
		Large screen	13 (10.9)
	Reason for choosing fixed device (n= 119)	Can trust the device	9 (7.6)
		Easy to use	7 (5.9)
		Easy to store	1(0.8)
	Reason for choosing portable device (n= 66)	Suggestion from medical staff	26(39.4)
		Easy to carry	13(19.7)
		Can use different functions at once	10(15.2)
		Can call	7(10.6)
		Easy to use	10(15.2)
needs		Suggestion from medical staff	153 (82.7)
	Reason for participating	Suggestion from others (friends, family)	22 (11.9)
		Others	7 (3.8)
		Personal choice after reading the information	3 (1.6)
		Yes	181 (97.9)
	Need for management of chronic disease (diabetes, hypertension).	Not sure	3 (1.6)
		No	1 (0.5)
satisfaction		1 - 2 - 3	98 (53.0)
	Order of the most helpful service from nursing counseling service through telecommunication: 1. Self-management 2. Counseling Center Management 3. Medical staff f management	2 - 1 - 3	53 (28.6)
		2 - 3- 1	12 (6.5)
		1 - 3 - 2	15 (8.1)
		3 - 1 - 2	5 (2.7)
		3 - 2 - 1	2 (1.1)
	Incommodity about the device	Hard to use(sensor/gateway)	125 (67.6)
		Hard to understand about the service	54 (29.2)
		Lack of information	6(3.2)

The 105(57.3%) respondents answered with "yes" to willingness to pay for the nursing counseling through telecommunication while 79 (42.7%) respondents answered as "no willingness to pay".

Specifically, 102 of the respondents (55.1%) showed their willingness to pay monthly charge of KW 5,000~KW 25,000 for the service (Table 3).

Table 3. Willingness to Pay for Nursing Intervention Service by Telephone

(N=185)

Questions	Answers	Number (%)
Willingness To Pay	Yes	106(57.3)
	No	79(42.7)
If the monthly service fee is 50,000 won, would you pay?	5,000 won	33(17.8)
	15,000 won	45(24.3)
	25,000 won	24(13.0)
	35,000 won	2(1.1)
	50.000 won	2(1.1)
	No	79(42.7)

3.3. The 691 General Participants' Results

The choice of gateway device preference by age groups is as shown below (Figure 4).

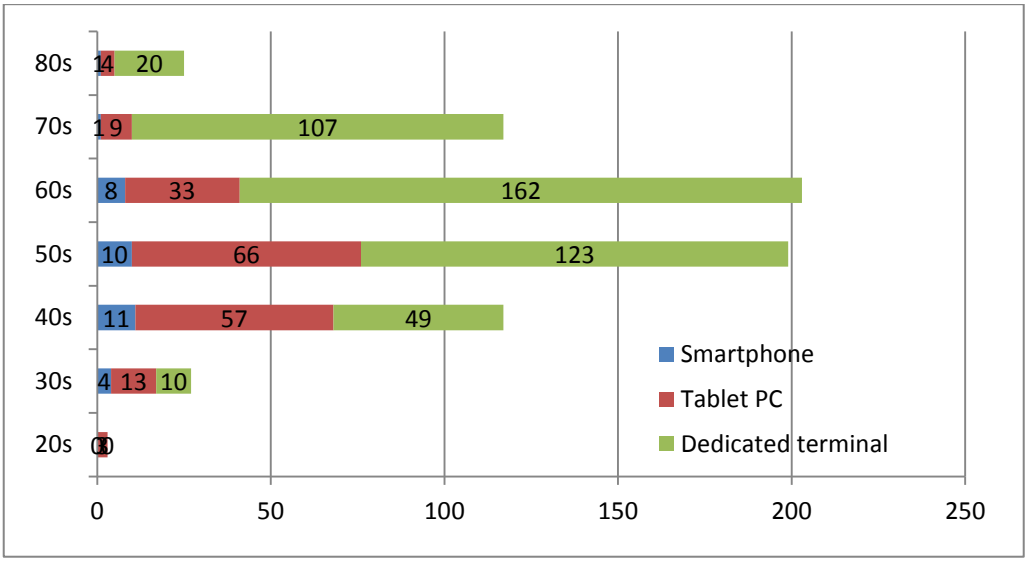

Figure 4. The Choice of Gateway Device

According to our results, the average age of the 691 that participants exhibited a preference for a mobile device (mobile gateway) was 52.9 years (Tablet PC's n= 35 or smartphone's n= 185, stdev = 11.16) and the average age of the participants that exhibited a preference for a fixed gateway device was 62.3 years (n= 471, stdev= 10.5).

Table 4. Frequency Analysis of Using Mobile and Fixed Gateway in Blood Glucose Measurement

	Mobile gateway	Fixed gateway
Mean (# of usage/day)	0.44	0.32
Variance	0.12	0.20
Observation numbers	111	51
F-test : P(F<=f) one tail	<0.001	
T-test: P(T<=t) one tail	<0.003	

Mean (# of usage/day) of mobile gateway was 0.44 and fixed gateway was 0.32. Variance of mobile gateway was 0.12 and fixed gateway was 0.20. F-test: P (F<=f) one tail of mobile gateway was under 0.001and T-test: P (T<=t) one tail of mobile gateway was under 0.003.

An independent two-sample t-test was performed on the Tablet PC user group (n=147) and the fixed gateway use group (n=243). The results of the F-test indicate that the two samples had unequal variances. The T-test results indicate that there is a statistically meaningful difference in the frequency with which mobile gateway users take blood glucose measurements when compared to dedicated fixed gateway users [12].

Therefore, an unpaired unequal T-test was applied to analyze difference of a frequency of using devices that figures for smartphone usage were excluded from the analysis due to an insufficient number of users [12].

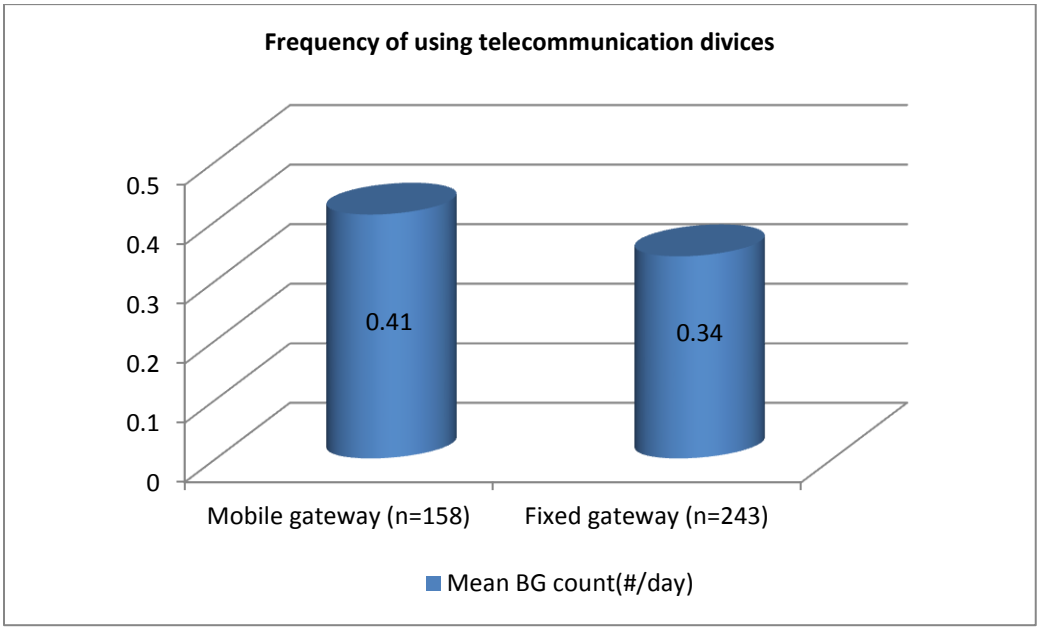

Figure 5. Mean of Blood Glucose Counts

Results for the telephone survey are as follows: mobile gateway users reported relatively higher rates of satisfaction and an increased willingness to pay when compared to fixed gateway users. This result is consistent with users who found value in the portability and multi-functionality of tablet PCs and Smart phones. Fixed gateway users reported more

complaints about the difficulty of usage and frequent breakdown of devices, which lowered satisfaction rates and diminished the users' willingness to pay for service.

In the case of fixed gateway devices, a patient had to purchase the device for the singular purpose of receiving telecommunication services. Tablet PC and smartphone users could pay only 10~20% of the cost of a fixed gateway device to modify their existing mobile device [14]. For manufacturers and service providers, a fixed gateway requires dedicated manufacturing, logistics and A/S functionalities, whereas tablet PCs and smartphone have the advantage of using an existing cross-functional platform to provide and maintain the devices.

In the question about general levels of service, more than 80% of both mobile and fixed gateway users answered that their overall understanding of self management by nursing intervention call had improved. This can have particularly far-ranging implications in the case of patients with diabetes, where self-awareness is a key factor to successful self control management by nursing intervention call [12].

4. Discussion

As a result of this research, as for willingness to pay for counseling by a nurse, the rate of respondents who showed willingness to pay was 37.3% out of 57.3%, if the service charge is assumed as KW 50,000. As the amount that they are willing to pay, KW15,000~25,000 was the largest part and the average price was KW15,188 among respondents who showed a willingness to pay. This result is somewhat different from that of the past research at Korea Health Industry Development Institute to estimate healthcare service and u-Healthcare market size under which the average rate of use from respondents from 20s to 60s in the age was 12.93% and the average price was KW 20,879[10]. Also, compared to the information that effect of the application of telecommunication to cancer patients after they leave was huge, the hospital the satisfaction level, number of outpatient visit, medical service fee and etc. were the same as the ones from nursing counseling center.

Therefore, it is necessary to divide people into healthy people and patients, and dualistic approach is required in cost estimation of the tele-health. As for the healthy people, the service is applied as a prevention and health improvement, thus self-payment is recommended for them. For the patient group, the cost should be shared with self-payment and the government by developing a scheme as a part of the national health insurance fee.

Looking into the status of diabetic patients in South Korea by age, the older groups have higher prevalence rate [11], as showed that 30s constituted 2.5%, 40s with 6.6%, 50s with 13.9%, 60s with 19.7%, and more than 70s was 21%. Out of the participants in the pilot project, 50s constituted the largest proportion with 35.1%, followed by 60s with 25.4%, and more than 70s with 15.1%, showing high proportion (95.7%) of the age groups more than 40s. Given that 64.3% of them responded that they chose the fixed terminal by medical staff's recommendation to the reason for terminal choice for tele-health and 35.7% chose the mobile device, it is necessary to consider customers' awareness, requirements and satisfaction level on terminals and satisfaction level in the follow-up research. 55.1% of the users of the service were willing to use the service and pay 5,000 won to 25,000 won monthly for the service, and they were willing to pay if the average amount for the fee was 15,000 which show that the rate of the willingness to pay is high. Continuing research is required as the reason why the rate for fixed device (64.4%) was higher than portable device (35.7%) was because the researched regions were limited to countryside of K- region and C-region.

There were also subjective views of nurses on telecommunication service. Strengths of telecommunication service among those subjective views are as following. "Regular telephone call stimulates patient's measurement", "Patients can retrieve sufficient health

information about nutrition, exercise, disease through gateway", "and Patients get to know the importance of self disease management through telephone counseling and sufficient information", " Family doctor can retrieve patient's measurement result to make a decision of medication", "The service is very helpful for patient's blood glucose control", "The service is very helpful for patient to correct their wrong way of measurement, exercise and diet".

Weaknesses of telecommunication service among those subjective views are as following. "Counseling is helpful but not easy to use because of many errors of device", "Inconvenience to be counseled through telephone call because it is not easy to focus on and make enough time for telephone call", "Patients receive message too often and stressed when they skip measurement", "The result of blood glucose measurement is not accurate and it is not easy to buy strip", "It is inconvenient for patient to receive telephone call when they are busy", "Contents and information provided are not new".

5. Conclusion

The subjects of this research were diabetes patients who participated in the demo business of "Smartcare" at the first medical center that ran "Smartcare". The service fee of the telecommunication service cannot be separately computed within the national health insurance and the fee cannot be received from the users as there is no standard made by the law or the system. Therefore, the service is run by some health managing service companies after getting consignments from insurance companies. So, even if telecommunication service cost-effective, it is continually being an issue as it can violate medical law as there are no standards [9]. It is urgent for the government to create a law that allows telemedicine between doctors to make an alternation for chronic disease patients. Telephone nursing counseling using u-Health devices in the telecommunication field is expected to be a new alternative to self-management for chronic patients [15].

A concept of "Smartcare" has been evolving from telemedicine, tele-health e-healthcare, u-healthcare, and Smartcare or Smart-healthcare. U-healthcare or Ubiquitous healthcare is an emerging area of technology that uses a large number of environmental and patient sensors and actuators to monitor and improve patients' physical condition. U-healthcare includes three types of services: u-Health for health care for patients especially living in the remote areas, u-wellness for health promotion of healthy population, and u-silver for the elderly population including u-home visiting nursing services.

However, the use of smartphone in telecommunication presents some unique challenges with the older segment of the population. A group has expressed resistance in adopting the technology and was less willing to pay the costs associated with telecommunication service. Though we were unable to recruit enough applicants to validate the smartphone in depth, the widespread use of smartphone among the general population leads us to believe that it certainly could be a viable option for telecommunication service by nurses in the near future.

Our results show that mobile-based gateway devices could be an effective alternative to existing fixed gateway devices in telecommunication services with nursing intervention call. Moreover, user responses for mobile gateway devices indicate of acceptance and willingness to pay, suggesting favorable prospects for future investment and growth in telecommunication service businesses. Telecommunication service can expand its application field by applying smartphone technology and intelligent IT to holistic healthcare.

Acknowledgements

This study was funded by the Korea Ministry of Knowledge Economy (Policy Studies, 2010-2013) Running heads: "Smartcare" Services Pilot Project.

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