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Application of TRA in u-health system focusing on moderating effect of health privacy information

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Abstract

The purpose of this study is to analyze the moderating effect of health privacy information on the relationship between the factors that affect the behavioral intention of the usage of u-health system have. Therefore, as a research hypothesis in TRA (Theory of Reasoned Action), self-efficacy and perceived usefulness will have a positive effect on the behavioral intention of the u-health system, and in the path, that personal information factors have an effect on each path. This study used the PLS-SEM methodology to verify the proposed research model. As a result of the analysis, this study showed that the moderating effect of health personal information in the presented model affects to some extent by the increase of R2 explanatory power. However, it was found that it was more consistent with the role of the independent variable rather than the moderating influence on the perceived usefulness.

Key words: u-health system, health privacy information, theory of reasoned action, moderating effect

유헬스 시스템에 대한 TRA의 적용에 관한 연구 : 건강개인정보의 조절 효과를 중심으로

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요 약

본 연구의 목적은 유헬스 시스템의 사용(usage)이라는 행위 의도(behavioral intention)에 미치는 영향 요인들 간의 관계에서 건강개인정보(health privacy information)의 조절적 효과(moderating effect)를 분석하는데 있다. 합리적 행동이론에 근거한 모형 내 연구가설로서 자기효능(self-effiacy) 및 인지된 유용성(perceived usefulness)은 유헬스 시스템의 행위 의도(behavioral intention)에 긍정적인 (positive) 영향을 미칠 것이며, 그 경로(path)에서 사용자의 건강개인정보 요인이 각 경로에서 어떤 영향을 미칠 것으로 제시하였다. 본 연구는 그 제시된 연구모형을 검증하기 위해서 PLS-SEM 방법론을 활용하였다. 분석 결과, 제시된 모형 내에서 건강개인정보의 조절적 효과가 R2 설명력의 증가치에 의해 어느 정도의 영향을 미친다고 볼 수 있지만, 조절변수로의 역할보다는 인지적 유용성(perceived usefulness)에 영향을 미치는 독립변수의 역할에 부합됨을 알 수 있었다.

키워드: 유헬스 시스템, 건강개인정보, 합리적인 행동이론, 조절효과 이론

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1. Introduction

The increase in the elderly population has led to a sudden increase in the number of patients with chronic diseases. This increases the cost of health care for the elderly, and this creates a hierarchy that receives low health care services[1]. As a solution to this problem, we recognize the importance of management for disease prevention through ubiquitous health (u-health) based on smartphone application (app)[2]. However, relevant regulations, safety and security issues must be considered provocatively before the introduction of such systems[3].

Based on this research background, the purpose of this study is to analyze the moderating effect of personal information on the relationship between factors influencing adoption intention of u-health system. In particular, the approach of this study is to derive implications using Ajzen & Fishbein[4] of 'Theory of Reasoned Action (TRA)'.

2. Theoretical Background

2.1 u-health and health privacy

Ubiquitous computing refers to an intelligent environment composed of a myriad of computers that can provide the information necessary for anytime anywhere[5]. This is a complex field where various fields such as embedded and artificial intelligent are merged. As a result, the development of ubiquitous information technology and the increase in infrastructure of wired and wireless networks such as 4G, wibro, and wi-fi are expected that the health environment will be improved and the development will be greatly influenced in the future. This is the paradigm that developed the e-health centered on the healthcare consumers as the information technology development in the industrial field progressed[6]. In other words, if such electronic medical care is an exchange-oriented concept centered on healthcare providers, u-health means that it is expanded into a paradigm of connection and application and is embedded in the lives and care of healthcare subjects.

However, it is emphasized that the convenience of this kind of health and the health information of the individual is leaked and the privacy is infringed, and research on legislation is under way[7]. In this study, we investigate the effect of individual health information factors on consumer behavior theory.

2.2 Theory of Reasoned Action (TRA)

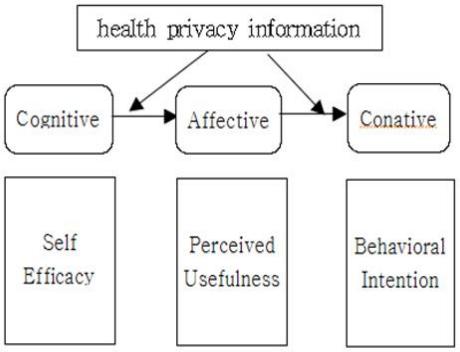
TRA (Theory of reasoned action) used in this study was established by Ajzen & Fishbein[4]. The behavioral intention of the consumer (in this study, the system can be seen as the user) can be explained through the relationship between three factors (cognitive, affective, conative). In other words, humans collect relevant information through rational and systematic behavioral processes and finally act. It is possible to predict the user's intention to act.

Through the analysis of the theories applied in this study, it is possible to understand the causal relationship between the factors and present the theoretically meaningful results, and furthermore, to give the relevant implications to the relevant stakeholders.

3. Research Model and Hypotheses

The research model based on the rational behavior theory used in this study consisted of three factors: self-efficacy as a cognitive factor[8], perceived as an affective factor Perceived usefulness[9], and behavioral

intention as an cognitive factor [10]. In this study, it examines a moderating effect of health privacy information. Therefore, a research model was constructed as shown in



(Figure 1) Research model

This is the statistical analysis of the moderating effect of the user's health personal information in the research model. Therefore, we set the following hypothesis.

Hypothesis: In the u-health system, self-efficacy and perceived usefulness will have a positive impact on usage intention, Health privacy information will have a moderating effect.

In this study, to verify the hypothesis of the research model, we focused on the verification of the path and applied partial least squares-structural equation modeling (PLS-SEM), which is less affected by the size of the sample[11].

4. Empirical Analysis and Results

4.1 General Characteristics of the Sample

The questionnaires used in the statistical analysis were general adults over 30 years old, and those who responded inappropriately were excluded from the statistical analysis, and the final 216 data were analyzed.

Variable	Category	Frequency	Ratio (%)
Gender	Male	103	47.7
	Female	113	52.3
Age	30-39	100	46.3
	40-49	73	33.8
	50 and over	43	19.9
Education	High School and below	67	31.1
	Undergraduate	138	63.8
	Postgraduate	11	5.1
Total	216		100%

<Table 1> Demographic characteristics of respondents

According to the analysis of the characteristics of the respondents, it was 47.7% of males and 52.39% of females, respectively. The distribution by age group was the highest among the respondents in their 30s. The percentage of students who graduated from college or university was 63.8% (See Table 1).

4.2 Confirmatory Factor Analysis

In order to apply the PLS-SEM analysis, Confirmatory Factor Analysis (CFA) was applied to latent variables in the research model. This process validates the validity and reliability of each factor. One of the reasons for using this method is that it takes into account the small number of samples[11]. In general, the smallest possible sample size is 20 times of the latent variable[12]. This study, as shown in the study model, yielded a total of six (total exogenous 4, mediation 1, subordinate 1) factors, and it is statistically insignificant because it is the number of samples applied in this study. One of the processes for assessing the reliability of each latent variable included in the study model is to evaluate it as a CR (Composite Reliability)

measure, which is an internal consistency measure[13, 14]. In general, the criterion is preferably 0.7 or more, but it can be adjusted by taking into consideration the situation of research[15]. Thus, confirmatory factor analysis showed factor loadings that showed higher measures than other key factors [16].

The measure of the mean variance extracted (AVE) square root of each factor is to check the convergent validity of the latent variables in the model. The results of these analyzes should show that the AVE is larger than the cross-correlations of other constructs. Therefore, each attribute shows a discriminant validity because it shows more characteristics than other attributes in the measurement model[13, 14] (See Table 2).

Factor	Cronbach *a*	Communality	CR	1	2	3
1. eff	0.85	0.62	0.89	**0.79**		
2. use	0.86	0.65	0.90	0.39	**0.80**	
5. int	0.88	0.90	0.95	0.14	0.23	**0.95**

Note 1: Items on the diagonal (in bold) represent the square root of AVE scores
Note 2: eff refers to self-efficacy; use refers to perceived usefulness; int refers to behavioral intention

<Table 2> Analysis results on latent variable correlation

4.3 Hypothesis Testing by PLS-SEM Analysis

In this study, the Partial Least Squares (PLS) and Structural Equation Model (SEM) are used to measure the suitability of the proposed model for the path of each proposed model and the collected data. The combined method PLS-SEM was applied. This methodology is largely determined by the PLS in the path, and by the SEM whether the data is compatible with the research model[10].

We performed the analysis with Smartpls version 2.0 software[17] and estimated through the bootstrap re-sampling method to measure the t-value of each path. <Table 3> shows the path value and the value of R2. Each factor in the model shows a positive statistical level with a positive value in the relationship between the paths. R2 also has a high explanatory power (see Table 3).

Paths	t-value	R^2
eff -> use (H1)	4.10**	0.14
use -> int (H2)	1.89*	0.05

Note 1: † $p<0.1$, *$p<0.05$, **$p<0.01$
Note 2: eff refers to self-efficacy; use refers to perceived usefulness; int refers to behavioral intention

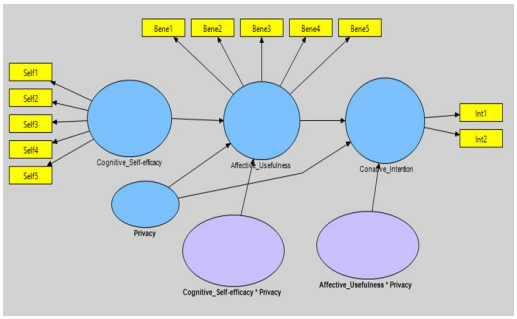
<Table 3> Results of PLS-SEM

The purpose of this study was to analyze the effect of health information factor as a control variable. The questionnaire items about health personal information used in this study are as follows.

'In ubiquitous healthcare, it is necessary to establish a system to prevent leakage of health personal information or a system to verify inaccurate information.'

This is a questionnaire item that focuses on the necessity of verifying health information for individuals in u-health.

As a result, by inserting health privacy factors as control variables, the PLS-SEM study model is as follows.



(Figure 2) PLS-SEM with health privacy information

In Smartpls[17], the analysis of the adjustment effect is analyzed through the value of f2, which indicates the increment of R2 explanatory power. In general, a value of 0.02 or more has a slight modulating effect, a moderate effect of 0.15 or more, and a significant modulating effect of 0.35 or more[11, 14]. In the analysis of this study, the f2 value of Hypothesis 1 (H1) in <Table 3> is 0.16 and the f2 value of Hypothesis 2 (H2) is 0.03, showing some explanatory power. However, as measured by the interaction effect proposed by Baron and Kenny[18], health personal information has a significant (+) effect on the independent variable (perceived usefulness is the dependent variable.) rather than the moderating effect.

5. Conclusions

This study used PLS-SEM (Partial Least Squares-Structural Equation Modeling) methodology to verify the proposed research model. The expected outcome of this study is to statistically grasp how health personal information affects the path of self-efficacy and ultimately affect user's intention to numerically show the effect of intention.

In this case, the questionnaire on health personal information was focused on the necessity of verification of health information.

Consequently, this study showed that the moderating effect of health personal information in the presented model affects to some extent by the increase of R2 explanatory power. However, it was found that it was more consistent with the role of the independent variable rather than the moderating influence on the perceived usefulness.

However, in this study, it is necessary to supplement the concept of U-health system and the concept of health personal information to be applied, and further analysis can be made to generalize the results of this study. In addition, each factor selected in rational action theory should be tested proactively and the possibility of other variables should be searched[19]. In addition, a more segmented analysis should be done considering the non-linear effects in the path analysis in the study model.

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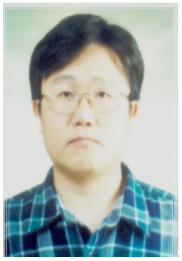

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