

*Full Length Research Paper*

# Rural residents' acceptance towards a telehealth system: The integrative perspective of technology acceptance model and social cognitive theory

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The purpose of the study is to integrate technology acceptance model (TAM) and social cognitive theory (SCT) to explore the usage intention model of telehealth systems. A survey of valid 480 users of telehealth was conducted to validate the proposed model. The findings show that computer anxiety has negatively significant effects on computer self-efficacy. Computer self-efficacy has positively significant effects on perceived ease of use. Both computer self-efficacy and perceived ease of use have jointly significant effects on perceived usefulness. In addition, both perceived ease of use and perceived usefulness have positively significant effects on usage intention. This study also confirms that both perceived ease of use and perceived usefulness are important mediators between computer self-efficacy and usage intention. According to the statistical results, the proposed model fits very well for the samples. The integrative viewpoint of this research can provide telehealth designers and managers of the hospital with the implication that hospitals should promote both technological aspect (perceived ease of use and perceived usefulness), and psychosocial aspect (self-efficacy and computer anxiety) simultaneously to increase rural residents' intention of using telehealth.

**Key words:** Technology acceptance model, social cognitive theory, telehealth system.

## INTRODUCTION

Recently, technical suitability, clinical feasibility, and the costs of medical care services have been improved due to the rapid development of information-related technology and biomedical technology. Currently, many countries have attempted to apply information technology to telehealth and to develop other functions, such as the emergency notification of unusual events, medication reminders, physiological recording and monitoring, remote video, and medical consultation by combining medical care and information technology. It is expected

that these will reduce medical costs, lower labor costs, and become one of the important potential industries.

Technology acceptance model (TAM) is a well-accepted intention model for predicting and explaining IT (Information Technology) usage. TAM has been found more favorable in many studies (Venkatesh, 2000). Because TAM is a well-defined model, the proposed model of the study is based on this model to explore the intention to use a telehealth system in Taiwan. In addition, computer self-efficacy and computer anxiety of social

cognitive theory (SCT) (Bandura, 1977) can also provide good ability in predicting people's behaviors in using new technology. This study is therefore aimed, on the bases of TAM and SCT, to discuss the behaviors of the residents in a rural community in using telehealth and to understand the factors which affect their use of telehealth, thus popularizing the use of telehealth in a community.

## LITERATURE REVIEW

### Telehealth

Telehealth refers to the remote exchange of data between a patient (usually at home) and healthcare professionals (at a monitoring center) to assist in the management of an existing long-term condition (Hendy and Barlow, 2012). Telehealth has been considered a partial solution to the problems of delivering health care to remote areas as well as to areas underserved by health care professionals (Miller et al., 2003). The devices monitor vital signs of patients (or rural residents) including blood pressure, blood glucose, blood oxygen, and weight.

### Technology acceptance model (TAM)

The Technology Acceptance Model (TAM) is the most widely applied model of user acceptance and usage. TAM identifies two relevant beliefs, that is, perceived ease of use and perceived usefulness. Perceived ease of use is defined as the extent to which an individual believes that using the system will be free of effort, while perceived usefulness is defined as the extent to which an individual believes that using the system will enhance the job performance. According to TAM, the behavioral intention is determined jointly by perceived ease of use and perceived usefulness. Furthermore, perceived usefulness is also influenced by perceived ease of use and external variables. TAM has been widely applied in practice, extended in academics, and empirically tested in the field of information management in the last decade (Venkatesh, 2000).

### Social cognitive theory (SCT), computer self-efficacy, computer anxiety

Social Cognitive Theory (SCT) emphasizes the role of self-referent thinking in guiding human motivation and behavior. SCT is a theoretical framework for analyzing human motivation, thought, and action that embraces an interact model of causation in which behavior, cognition and other personal factors, and environment influences all operate as interacting determinants that influence each other bidirectionally (Bandura, 1977).

Computer self-efficacy is a special application of the more general construct of self-efficacy, which is a key

element of SCT. Compeau and Higgins (1995) defined computer self-efficacy as "people's judgments about their abilities to use a computer system successfully". According to Venkatesh (2000), computer self-efficacy is the important determinants of perceived ease of use. Some studies have also found a positive relationship between computer self-efficacy and perceived usefulness (Mathieson, 1991).

According to SCT, anxiety is an emotional arousal that is caused partly by fear of aversive physiological reactions (Bandura, 1977). Computer anxiety refers to a feeling of apprehension or anxiety toward using computers. Computer anxiety is associated with negative perceptions about computers, problems in playing with them, and avoidance of the technology (Igbaria and Iivari, 1995). Igbaria et al. (1996) proved that computer anxiety is negatively related to computer usage, perceived usefulness, perceived enjoyment, and social pressure. Also, van Raaij and Schepers (2008) have shown that computer anxiety has negatively direct effects on perceived ease of use. In addition, previous empirical studies have repeatedly observed the relationship between computer anxiety and computer self-efficacy as negative and strong (He and Freeman, 2010). The previous arguments support the proposed research model depicted in Figure 1.

## METHODOLOGY

We adopted the Likert-type questionnaire survey for data collection, and examined our hypotheses by applying the structural equation modeling (SEM) method to validate the model. The measurement instruments for variables in the questionnaire were developed from previous studies to enhance the variability and reliability.

The survey subjects of the questionnaire were those rural residents who are the end users of a telehealth system from Nantou County, Taiwan. The first generation of telehealth system was developed and installed by a community hospital in Jhushang township, namely Chu Shang Show Chwan Hospital in 2009. Recently, the new generation of telehealth system is running and these respondents all have used the system for at least one month since 2012.

## RESULTS

The data analysis proceeds according to the two-step approach recommended by Anderson and Gerbing (1988). First, we assess the measurement model, which consists of the five latent factors, and includes the assessment of reliability, discriminant validity, and convergent validity of the scales. Second, we validate the structural model, which represents the series of path relationships linking the five constructs.

### Sample characteristics

Of the recruited 500 subjects, there were 480 subjects

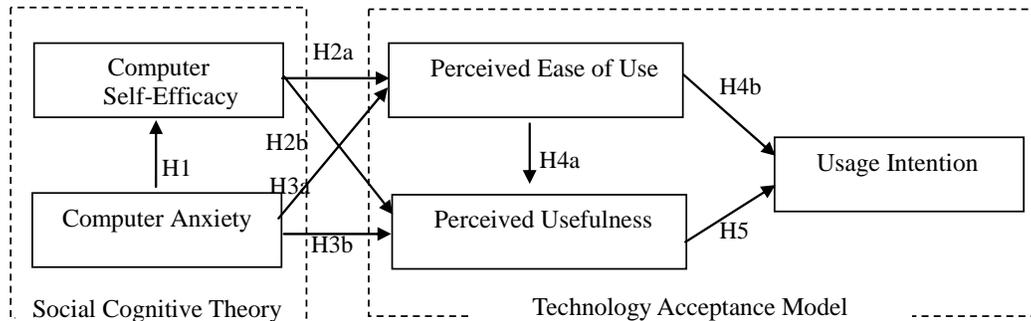


Figure 1. The proposed research model.

Table 1. Construct reliability and convergent validity.

Construct	Cronbach's $\alpha$	Composite reliability	Average variance extracted
Computer Self-Efficacy	0.976	0.976	0.933
Computer Anxiety	0.975	0.975	0.929
Perceived Ease of Use	0.992	0.991	0.983
Perceived Usefulness	0.957	0.957	0.882
Usage Intention	0.970	0.970	0.942

who agreed to participate in the study. Of these respondents, 262 respondents are women (54.6%) and 218 respondents are men (45.4%). Most of the respondents were 71 to 80 years of age (48.2%). Most respondents hold elementary school degrees (54.4%). A majority of the caregivers are spouses (40.2%). The respondents mostly suffered from at least one chronic disease (69.4%).

### Measurement model results

To validate the measurement model, three types of validity were assessed: content validity, convergent validity, and discriminant validity. Content validity was done by interviewing senior system users and pilot-testing the instrument. And the convergent validity was validated by examining Cronbach's  $\alpha$ , composite reliability and average variance extracted from the measures (Hair et al., 1998). As shown in Table 1, the Cronbach's  $\alpha$  of every subscale range from 0.957 to 0.992 was above the acceptability value 0.7. Moreover, the composite reliability values, which ranged from 0.957 to 0.991, and the average variances extracted by our measures, which ranged from 0.882 to 0.983, are all within the commonly accepted range greater than 0.5. In addition, all measures are significant on their path loadings at the level of 0.001. Therefore, the convergent validities of all five constructs are confirmed.

In addition, discriminant validity can be tested among all constructs by comparing the average variance

extracted (AVE) of each construct with the squared correlation of that construct and all the other constructs. All squared correlations between two constructs are less than the average variance extracted of both constructs. Therefore, the results confirm that the discriminant validity of the constructs in the study is satisfactory.

### Structural model results

To validate the measurement model, we used AMOS 8.0 to assess the analysis. As shown in the Table 2, the goodness-of-fit indices are within the accepted thresholds. Generally, these fit indexes are all greater than or equal to 0.9 for Goodness Of Fit Index (GFI), Adjusted Goodness Of Fit Index (AGFI), Normed Fit Index (NFI), Comparative Fit Index (CFI). Furthermore,  $\chi^2/d.f.$  value is less than 3 and RMSEA value is less than 0.08. Accordingly, the summary of the overall goodness-of-fit indices indicate an excellent fit of the model and data.

Table 3 illustrates the results of the structural model with the estimated standardized path coefficients and path significance among constructs (non-significant paths as dotted lines). As predicted, almost all proposed hypotheses except for  $H_{3a}$  and  $H_{3b}$  are supported. However, computer anxiety has insignificant effect on perceived ease of use and perceived usefulness ( $H_{3a}$  and  $H_{3b}$ ). The unexpected finding can be explained that the residents have enough resources about telehealth system from the community hospital (Chu Shang Show Chwan Hospital), such as explanation sessions, training

**Table 2.** Fit Indices for the structural model.

Structural model statistic	Fit indexes	Recommended threshold
$\chi^2 / \text{d.f}$	2.988	< 3
GFI	0.949	> 0.9
RMSEA	0.064	< 0.08
AGFI	0.919	> 0.9
NFI	0.982	> 0.9
CFI	0.988	> 0.9

**Table 3.** Hypotheses validated results.

Path	Results	Standardized path estimate
H1 Computer Anxiety → Computer Self-Efficacy	Supported	-0.500***
H2a Computer Self-Efficacy → Perceived Ease of Use	Supported	0.634***
H2b Computer Self-Efficacy → Perceived Usefulness	Supported	0.142*
H3a Computer Anxiety → Perceived Ease of Use	Not Supported	-0.062
H3b Computer Anxiety → Perceived Usefulness	Not Supported	-0.050
H4a Perceived Ease of Use → Perceived Usefulness	Supported	0.331***
H4b Perceived Ease of Use → Usage Intention	Supported	0.205***
H5 Perceived Usefulness → Usage Intention	Supported	0.477***

\*\*\* path is significant at the 0.001 level, \*\* path is significant at the 0.01 level, \* path is significant at the 0.05 level.

courses and community volunteers. If the residents feel themselves unable to use the system, they may request the community nurses or volunteers to show the usage processes directly. Therefore, computer anxiety of the residents may not impact significantly on perceived ease of use and perceived usefulness of telehealth system.

## Conclusion

The findings of this study suggest that both perceived ease of use and perceived usefulness are two important antecedents that directly influence behavioral intention to use the telehealth system. In addition, computer self-efficacy has significantly positive effects on perceived ease of use, and perceived usefulness separately. Furthermore, both computer anxiety and computer self-efficacy have significant impacts on usage intention mediated by perceived ease of use, and perceived usefulness. The integrative viewpoint implies that hospitals should promote both technological aspect (perceived ease of use and perceived useful), and psychosocial aspect (self-efficacy and computer anxiety) simultaneously, to increase rural residents' intention of using telehealth. We believe that the integrative perspective of TAM and SCT applied in future studies should provide more valuable and informative contributions toward development of successful telehealth.

## REFERENCES

- Anderson JC, Gerbing DW (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychol. Bull.* 103(3):411-423. <http://dx.doi.org/10.1037/0033-2909.103.3.411>
- Bandura A (1977). Self-Efficacy: Toward a unifying theory of behavioral change. *Psychol. Rev.* 84(2): 191-215. <http://dx.doi.org/10.1037/0033-295X.84.2.191>
- Compeau DR, Higgins CA (1995). Computer self-efficacy: Development of A Measure and Initial Test. *MIS Quart.* 19:189-211. <http://dx.doi.org/10.2307/249688>
- Hair JF, Anderson RE, Tatham RL, Black WC (1998). *Multivariate Data Analysis*. NJ: Prentice Hall.
- He J, Freeman LA (2010). Understanding the formation of general computer self-efficacy. *Commun. Assoc. Inf. Syst.* 26:225-244.
- Hendy J, Barlow J (2012). The adoption of telecare in the community. *Community Practitioner* 85(3):41-43. PMID:22479805
- Igbaria M, livari J (1995). The effects of self-efficacy on computer usage. *Omega* 23:587-605. [http://dx.doi.org/10.1016/0305-0483\(95\)00035-6](http://dx.doi.org/10.1016/0305-0483(95)00035-6)
- Igbaria M, Parasuraman S, Baroudi JJ (1996). A motivation model of microcomputer usage. *J. Manage. Inf. Sys.* 13(1):127-143.
- Mathieson K (1991). Predicting user intentions: Comparing the technology acceptance model with the theory of planned behavior. *Inf. Sys. Res.* 2(3):173-191. <http://dx.doi.org/10.1287/isre.2.3.173>
- Miller TW, Miller JM, Kraus RF, Kaak O, Sprang R, Veltkamp LJ (2003). Telehealth: A clinical application model for rural consultation. *Consult. Psychol. J. Pract. Res.* 55:119-127. <http://dx.doi.org/10.1037/1061-4087.55.2.119>
- van Raaij EM, Schepers JJJ (2008). The Acceptance and use of a virtual learning environment in China. *Comput. Edu.* 50(3):838-852. <http://dx.doi.org/10.1016/j.compedu.2006.09.001>
- Venkatesh V (2000). Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Inf. Sys. Res.* 11(4):342-365. <http://dx.doi.org/10.1287/isre.11.4.342.11872>