Applying the Technology Acceptance Model to Explore Intention to Use Telecare System in Taiwan

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Abstract—This purpose of the study is to develop the usage intention model of Telecare systems. Based on the Technology Acceptance Model, the proposed framework is validated with 365 respondents from Nantou County located in Taiwan, which shows that both perceived ease of use, and perceived usefulness are key factors affecting the intention to use telecare system. According to the statistical results, the proposed model fits very well for the samples. In other words, perceived ease of use, and perceived usefulness will affect simultaneously behavioral intention in telecare system. This study emphasizes that the managers of hospitals and designers of telecare system companies should pay more attention to understanding the perceptions of elderly (or patients) and improving the system and information quality of the system. Therefore, successful telecare systems not only provide robust system quality of information systems, but also delivery reliable information quality of health cares.

Keywords—telecare; perceived ease of use; perceived usefulness

I. INTRODUCTION

In recent years, owing to the influence of relevantly socio-economic background factors, the birth rate of infants in each family has also declined year by year. On account of the decline in the birth rate as well as the extension of people’s average life, these double influences have made the phenomenon of ageing demographic structure continue to be more and more obvious. With the phenomenon of the ageing of population, what has generated includes both the changes of middle-aged adults and the elderly in lifestyle patterns and their problems of seeking medical advice, including emergency medical care, life care when physical and mental functions are lost, chronic diseases and so on. These changes and problems have become crucial medical care issues nowadays. And these care issues also reveal the importance of professional fields such as long-term care and senior health management.

Recently, technical suitability, clinical feasibility and the economic load of medical care services have been improved due to the rapid development of information-related technology and biomedical technology. Currently, many counties have attempted to apply the information technology to telecare and to develop the functions, including the emergency notification of unusual events, medication reminder, physiological recording and monitoring, remote video and medical consultation by combining medical care and information technology. It is expected to reduce huge medical costs, lower labor costs and become one of important potential industries in the future.

However, there are still shortcomings in current studies concerning telecare. Currently in the pilot studies regarding telecare, most of the emphasis is put on the technological aspect to stress the construction of information platform and system. Telecare service is a medical process including social and technological interaction. It not only requires to evaluate the quality of technology, but it also requires to deeply explore the issues such as related technology in the process of services, social psychology, and management, in order to obtain a comprehensive overview of whether telecare is successful or not. Also, current progress of telecare is not just home monitoring, but it also emphasizes active health management and self care to advance the abilities of the elderly or patients in health and self management. Therefore, the perceptions and experiences of the elderly or patients about telecare will influence their degree of acceptance. Hence, to evaluate the technological acceptance of telecare from the perspective of the elderly or patients will advance the successful implementation of telecare. Besides, many of previous relevant studies are limited in scopes (medical specific fields) or sizes (number of samples), and the discussions or contributions to clinical practices of telecare are very limited.

TAM (Technology Acceptance Model) is a well-accepted intention model for predicting and explaining IT usage. TAM identifies that an individual’s system usage depends on
two beliefs: perceived ease of use and perceived usefulness. TAM has been found more favorable in many studies [1]. Because TAM is a well-defined model, the proposed model of the study is based on this model to explore intention to use telecare system in Taiwan.

II. LITERATURE REVIEW

A. Telecare

Telecare is one of the applied fields for telemedicine technology. Literature argued that telecare is to utilize video conference or telecommunication technology to advance the communication between patients and health care providers who are geographically separated [2]. Telecare can help senior citizens who are in remote and underserved districts to have access to health care and supportive services.

The contents of remote home health care services can roughly include the following aspects: (1) capture of physiological information: the capture of basic physiological signals (such as body temperature, heartbeat, number of respirations, systolic blood pressure, diastolic blood pressure, mean blood pressure, electrocardiogram, blood to oxygen ratio, and basic lung function), (2) contact and coordination of care services: including the emergency call for help from home, sending the unusual warning signals, notice of return visit and so on, and (3) assistance in health self-management: assist care receivers to grasp the daily changes of physiological information, do the self-management and tracking well, and take early precautions. In addition to the above functions, some home telecare systems also include: (4) communication and video equipment (such as the video telephone) which can contact case managers to assist patients in their own health management or assist caregivers in the enhancement of care skills, and (5) health education websites set up by medical institutions to provide patients or their family members with online consultations or the access to knowledge of health education.

According to [3], telecare system can be divided into three generations. The first-generation system roughly emerged between 1980 and 1990, including a home mainframe, an emergency button, and a call center which receives messages. If an emergency happens, press the emergency button. Then the call center can be reached through the home mainframe for the rescue or assistance. The second-generation system was roughly in the late 1990. It utilizes infrared sensors to continuously monitor the daily activities and physiological indicators of senior citizens, or it is called “smart home”. When the physiological indicators are out of normal range, the system will automatically activate the alarm. The goal of the third-generation system is to improve the health and living quality of senior citizens. In addition to continuously using infrared sensors, the delivery of images is added. Senior citizens can participate in wider community groups through the usage of information and communication technology to make families become the focus of community health care.

In view of people’s increasing need for long-term care in our country, the Department of Health, Executive Yuan, R.O.C. (Taiwan) has started to promote “Telecare Pilot Project” since 2007. Through telecare along with the combination and application of information and communication technology, three telecare service models, including community-based telecare, home-based telecare, and institution-based telecare, are developed. Moreover, an integration platform of telecare information is established. It is learned from the summary of literature review and the observation of industrial trends that current telecare is no longer just restricted to home monitoring, but it has the functions of advancing the active participation in self-health management, self-care, health education videos, and pharmaceutical consultations. It is of tremendous benefits for the security and independence of living quality of senior citizens and chronic patients.

B. Theory of Reasoned Action (TRA) and Technology Acceptance Model (TAM)

The theory of reasoned action (TRA) is developed to predict and explain human beings’ consciously intended behavior in social psychological field [4]. According to TRA, an individual’s specified behavior is determined by behavioral intention to perform the behavior, whereas the intention is jointly determined by the person’s attitude and subjective norm concerning the behavior. The attitude toward behavior is an individual’s evaluative affect about performing the behavior, and the subjective norm is an individual’s perception that important referents of him think he should or should not perform the target behavior.

The Technology Acceptance Model (TAM) adapts the original TRA to predict and explain a person’s adoption of information technology [5]. 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 usage of information technology is influenced by behavioral intention to use the information technology, while behavioral intention is determined jointly by perceived usefulness and attitude toward information technology usage. Besides, the attitude toward information technology usage is jointly determined by perceived ease of use and perceived usefulness. Also, perceived usefulness is 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.

III. RESEARCH METHOD

We adopted the 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. Responses to the various variables related to the perceptions of the individual subjects were measured using Likert-type scale.
The questionnaire items included demographic characteristics, perceived ease of use, perceived usefulness, and usage intention of using telecare systems. The survey subjects of questionnaire are the residents who are the end users of a telecare system from Nantou County, Taiwan. These end users all had the experience of using the telecare system over one month. The telecare system was developed and installed by a community hospital in Jhushang township, namely Chu Shang Show Chwan Hospital. Of the recruited 370 subjects, there were 365 subjects who agreed to participate in the study.

IV. RESULT

The data analysis proceeds according to the two-step approach recommended by [6]. First, we assess the measurement model which consists of the seven latent factors, 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 seven constructs.

A. Sample Characteristics

Of these respondents, 217 respondents are women (59.5 %), 148 respondents are men (40.5 %). Most respondents are at the age group of 71-80 years (41.9%). Most respondents hold elementary school degrees (46.8%). A majority of the caregivers are spouses (48.8%). Mostly respondents suffered from at least one chronic disease (71.2%).

B. 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 [7]. The Cronbach’s \( \alpha \) of every subscales range from 0.958 to 0.994, which are above the acceptability value 0.7 [8]. Besides, the composite reliability values range from 0.958 to 0.994, and the average variances extracted by our measures range from 0.920 to 0.988, are all within the commonly accepted range greater than 0.5 [7]. In addition, all measures are significant on their path loadings at the level of 0.001. Therefore, the convergent validities of all seven constructs are confirmed.

Besides, according to [9], 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 constructs in the study is satisfactory.

C. Structural Model Results

To validate the measurement model, we used AMOS 8.0 to assess the analysis. As shown in the Table 1, the goodness-of-fit indices are within accepted thresholds. Generally, these fit indexes are all greater than or equal to 0.9 for GFI, AGFI, NFI, CFI. Besides, \( \chi^2/d.f. \) value is less than 5 and RMSEA value is less than 0.05. Accordingly, the summary of the overall goodness-of-fit indices indicate a excellent fit of the model and data.

<table>
<thead>
<tr>
<th>TABLE I. Fit indices for the Structural Model</th>
<th>Structure Model Statistic</th>
<th>Fit Indexes</th>
<th>Recommended Threshold</th>
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<tbody>
<tr>
<td>( \chi^2 )</td>
<td>6.453</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>( \chi^2/d.f. )</td>
<td>0.587</td>
<td>&lt; 5</td>
<td></td>
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<tr>
<td>GFI</td>
<td>0.995</td>
<td>&gt; 0.9</td>
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<tr>
<td>RMSEA</td>
<td>0.000</td>
<td>&lt; 0.05</td>
<td></td>
</tr>
<tr>
<td>AGFI</td>
<td>0.987</td>
<td>&gt; 0.9</td>
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<tr>
<td>NFI</td>
<td>0.999</td>
<td>&gt; 0.9</td>
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<tr>
<td>RFI</td>
<td>0.998</td>
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<td>IFI</td>
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<td>TLI</td>
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<td>CFI</td>
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As predicted, all TAM proposed hypotheses are supported. The results of the structural model show that both perceived ease of use and perceived usefulness are key aspects affecting usage intention of telecare system.

V. DISCUSSION AND CONCLUSION

Based on TAM model, this study proposed a research model to better understand the older residents’ usage intention of telecare system. The model considered the relationships among perceived ease of use, perceived usefulness and intention to use. Using Structural Equation Modeling (SEM), the hypotheses are proposed to validate the fit of empirical data and model. The results show that the relationships proposed in the model are all supported. Our findings suggest that both perceived ease of use and perceived usefulness are two important antecedents which directly influence behavioral intention to use telecare system. Therefore, the greater the perceived ease of use and the greater perceived usefulness, the greater the intent to adopt it.

With an ageing population, the care of older people and the role of telecare system will become increasingly important [10]. Both perceived ease of use and perceived usefulness are crucial to predict intention to use telecare system. Accordingly, the perceptions and experiences of the elderly (or patients) about telecare will influence their degree of acceptance. This implies that the managers of hospitals and designers of telecare system companies should pay more attention to understanding the perceptions of elderly (or patients) and improving the system and information quality of the system. Not only the operating functions of telecare system need to be as easy as possible to use, but also the output information of telecare system needs to be developed to be beneficial for individuals’ levels of health status.
Therefore, successful telecare systems not only provide robust system quality of information systems, but also delivery reliable information quality of health cares. We believe this study is a useful starting point to explore implement of telecare systems in Taiwan. While the TAM is found to be an effective model, there are clearly other meaningful factors [11]. Future research could continue to explore the other factors that influence adoption decision in the telecare system.

REFERENCES