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# IT USAGE BEHAVIOR OF MEDICAL PERSONNEL: AN EMPIRICAL STUDY BASED ON THE THEORY OF PLANNED BEHAVIOR

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## Abstract

*Digitalization of regional public health information is an irreversible trend in the course of China's social development. This is also one of the key tasks to reform China's medicine and public health system. To learn more about the influence of using information technology for medical personnel and hospital performance, this study reviews in the personal perspective to know more about the sustainable action of using IT in hospitals based on the Theory of Planned Behavior. We proposed a research model which expanded TPB and tested it based on 278 valid data collected from employees in a large-scale hospital in Anhui Province, East China. The results of study reveal: 1. We verified TPB in the Chinese context and found that attitude and subjective norm not only have a directly influence on behavioral intention, but also can influence the use behavior. 2. The habit of using IT of medical personnel has a directly influence on the attitude of using IT, and it also has significant influence on the behavioral intention. Our research model discovered the relationship between subjective factors of IT users' and their behaviour. The founding of this study not only can provide references regarding the direction of public hospitals reform in China for decision makers of hospitals, but also is very helpful for management teams in hospitals to adopt more rational management measures for better IT use among medical personnel, and better hospital performance.*

*Keywords: IT Continued Use Behavior, Theory of Planned Behavior, Habit, Attitude, Health Care Management.*

# 1 INTRODUCTION

Due to the speeding up of hospital informationization the application of information technology (IT) in hospital has showed broad development prospect. IT in hospital mainly manifest in improving the quality of patients' care, staff's working efficiency and benefit and an obvious reduction of operating costs etc. There has already been wide application of IT in hospital, but it still requires further study to find out whether staffs in hospital have truly accepted the use of information technology because of the management and medical system. In order to make information technology of hospital better accepted by the staff and play a greater value, we need to pay attention to the relationship between IT and personal factors.

At present, there have already been various theories and models discovered and applied into the research of (Wang, et al, 2003; Bhattacharjee, 2006) information system. However, most of the prior researches only focus on the adoption of information system. Nearly no research combines the determinants and results of technology acceptance behavior. Besides, there are few researches have applied the TPB (theory of planned behavior) into medical environments and studied the continued use behavior of information technologies after their adoption.

This paper attempts to develop a model from the perspective of users of hospital information system on the basis of TPB by adding a new external variable- habit. We conducted an empirical analysis based on 278 valid data collected from employees in a large-scale hospital in Anhui Province, East China. The results showed that the individual subjective factors of medical staff have played a relatively large role in the behaviours of medical staff. This finding has important enlightenments of management for improving the performance of medical personnel, as well as organizational performance of the whole hospitals by continuous and better use of IT in hospitals.

## 2 THEORETICAL REVIEW

The theory of reasoned action (TRA) proposed by Fishbein and Ajzen (1975) makes predictions and explanations of personal behaviors. The theory states that individuals are rational, who are able to comprehensively consider the significance and result of various information before making decision. The main application field of TRA is to analyze how attitude consciously influences behavior. As one of the most influential theories studying human behaviors, it has already had wide application in social psychology and been successfully proved to predict and explain human behavior in many fields (Gergely & Csibra 2003; Hansen et al. 2004; Fitzmaurice 2005). In the field of IT, this theory is often used to analyze IT acceptance behavior of individuals for IT.

However, there is an important assumption of "a behavior is based on the control of individual willpower" implied in TRA theory. But under the actual circumstances, individuals' control of willpower is usually influenced by many types of factors, such as time and information. Therefore, TRA usually cannot give reasonable explanations that personal willpower is unable to control behaviors completely. Based on TRA, Davis (1989) has extended new technology acceptance model (TAM). Davis believes that behaviors are determined by willpower and adoption attitude can determine behavioral intention. At the forefront of the model, behavioral intention is determined jointly by two constructs, perceived usefulness and perceived ease of use.

TAM model, however, abandons the subjective norm in the TRA model and only make explanations by using perceived usefulness and perceived ease of use. This sets a limit to the application in the situation of individual involuntary behaviours because it seems not to match a basic fact that people who live in the social environment and small organized structures, will inevitably be influenced by the others. Later on, on the basis of TRA, Ajzen (1991) puts forward the theory of planned behavior (TPB) and carried on the extension of TRA theory. He focused on studying the relationship between attitude, willpower and behavior when individuals cannot completely control their behaviors in order to improve the predicting ability of models. Similar to TRA model, TPB has been proved to make predictions and explanations human behaviors in various fields successfully (Hrubes et al. 2001; Conner et al. 2002; Armitage 2005; Truong 2009; Yousafzai et al. 2010). As one of the most influential theories in human behavior, it is often used to make analysis of individual acceptance behavior (Ajzen, 2002) to IT in the corresponding field.

### **3 RESEARCH MODEL AND HYPOTHESIS**

#### **3.1 PBC, SN, Attitude And Intention**

According to the Expected Value Theory (EVT) proposed by Fishbein and Ajzen (2000), every individual has a large number of beliefs about some actions may lead to probable results, which called behavioral belief. Attitude toward behavior reflects the personal behavior like or dislike, happiness or unhappiness. Lots of literatures in marketing studies showed positive correlation between customer satisfaction and repurchase intention. Homburg (2001) proposed that the higher the customer satisfaction, customer is more inclined to buy again and advised others to buy the same product or service. In the information systems, there are also some studies have shown that customer satisfaction is one of the influence factors of user intention. Bhattacharjee's (2001) Expectation Confirmation Theory aim to study the user's unsustainable behavior, he points out that the user's satisfaction has significant positive relationship between continuous uses of behavioral intention. So from the perspective of the attitude of users who use the system, we think:

H1a: The attitude of the medical personnel has significantly positive impacts on behavioral intention of their continued use of IT in hospitals.

According to TPB, attitude and subjective norm impact the behavior directly. The subjective norm comes from the pressures of society, and it is related to the subjective culture and human communication in the organizations. As a social man, everyone's decisions are always affected by the environment. Researches show that it is the views about whether they should do something or not from someone significant to them that has remarkable positive impacts on their own attitudes of the behaviors. In the medical field, with the popularity of IT in hospitals and because it is gradually accepted by most healthcare workers, IT in hospitals will encourage more medical workers to accept the hospital information technology. So we suppose that:

H1b: The subjective norm of medical personnel has a significantly positive influence on their continuous IT use intention in hospitals.

The difference from the theory of reasoned action is that the theory of planned behavior added a new concept of "Perceived behavioral control". In the theory of planned behavior, Ajzen (1991) think that individual behavior intention is influenced by the perceived behavior control. Various researches find

that perceived behavioral control can predict the behavioral intention, such as the intention of using the new software by the predictors (Miyazaki et.al, 1992). Perceived behavioral control can harmony the relationship between the behavioral intention and the using behaviour, and it has remarkable positive impacts on the behavioral intention. The ability of using the information system will be influenced by the confidence of IT users in hospitals about the difficulty of using health care information technology, and also it will cause some impacts on the using intention by them. So we suppose that :

H1c: The perceived behavioral control of medical personnel has a significantly positive influence on their continuous IT use intention in hospitals. .

In the previous study, following the suggestions of Thompson ( 1991 ) and Davis ( 1993 ) etc., one of the development direction in explaining usage behavior is to consider the habit factor. Taylor and Todd (1995) found that comparing experienced and inexperienced users, significant differences appear on their causal connection strength of behavioural intention and behavior, which means experienced users have a stronger relationship between their intention and behavior than users without experience. In summary, we propose the following hypotheses:

H2a: IT use of medical personnel has a significantly positive influence on their attitude to IT use.

H2b: IT use of medical personnel has a significantly positive influence on their IT use behavior.

### **3.2 Intention, PBC and Behavior**

Through the TPB model, we can find that the behavior intention is the most influential predictors of behavior (Limayem, 2003). Behavior socialization defines muscle movement patterns. It directly influences a person's behavioral intention and habits. Behavior intention shows that people are consciously to carry out some behavior. Habit reflects the personal experience in the past in the form of the aware behavior, caused by specific stimuli, even if no instructions will enforce the behavior. Therefore, under the influence of habit, behavior will become routine. But before getting reutilization, IT use behavior of medical personnel still will be influenced by their behavioral intention. Hence, we suppose:

H3: Behavior intention of medical personnel has a significantly positive influence on their IT use behavior.

The perceived behavior control accurately reflect the actual control situation, so it can be used as a surrogate measures of the actual control condition indexes behavior prediction (Limayem, 2003). Perceived behavior control may promote or hinder the behavior factors of individual capability assessment collection of convenience as well as the perception of these factors. So we assume that:

H4: Perceived behavior control of medical personnel in hospitals has a significantly positive influence on their IT use behavior.

Based on those hypotheses, our research model is presented in Figure 1.

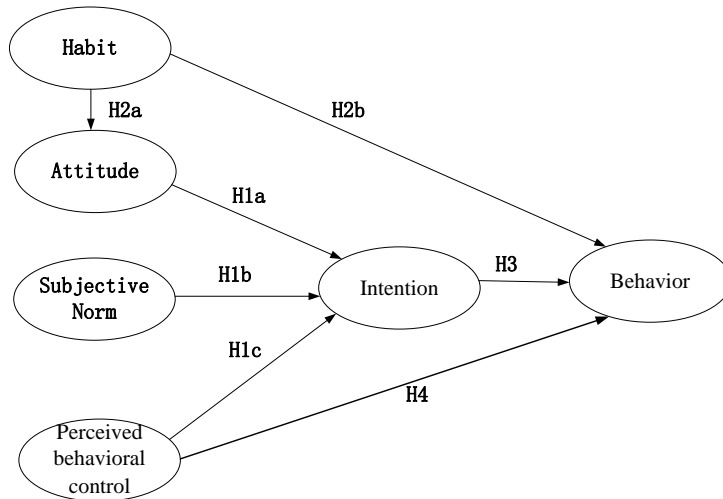


Figure 1. Research model

## 4 METHOD

### 4.1 Sample and Data collection

The data for our empirical analysis was collected from AU Hospital, one of 3-A hospitals, as well as one of the biggest hospitals in East China. 3-A represents the one of the best hospitals in China. The hospital information systems (HIS) implement rate in the hospital is high. We collected the data using a multistage iterative process and did a random questionnaire in hospitals. Once respondents completed the questionnaire, we provided them a gifts incentive for completing and returning the questionnaire. We spent three months to collect data in hospitals. Of returned 294 questionnaires, 278 valid questionnaires are used for further data analysis. Besides the information with respect to our model of study, we also collect the basic information of respondents, such as gender, age and Educational background.

### 4.2 Measures

Measures for all the variables were taken from previous studies and adapted to the context of hospital. Content validity for all instrument scales was established through both literature review and a content validity expert panel comprised of eight faculty and doctoral students skilled in quantitative analysis and quantitative research methods. Six variables were measured in this study: Habit, Attitude, Subjective Norm, Perceived Behavioral Control, Intention, and Behavior. All the items were measured with seven-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree).

## 5 RESULTS

### 5.1 Measurement Model

Table 1 presents the means, loadings of each item and descriptive statistics of each item. The loadings of all the items were above the threshold 0.75, indicating that the observed variables have high

convergent validity. Also the loadings show a high correlation between observed variables and structural variables (Hair, Anderson, Tatham, & Black, 1998).

Construct	Measurement Item	Mean	SD	loading
Subjective Norm	SN1	5.99	1.073	0.8637
	SN2	6.09	1.017	0.822
	SN3	5.59	1.236	0.7369
	SN4	5.63	1.173	0.7669
	SN5	5.98	1.108	0.7196
Attitude	Att1	5.09	1.199	0.8096
	Att2	4.90	1.196	0.8615
	Att3	5.18	1.284	0.8076
	Att4	4.62	1.353	0.8522
	Att5	4.53	1.385	0.8327
Habit	Habit1	5.57	1.200	0.8284
	Habit2	5.38	1.187	0.8548
	Habit3	5.58	1.139	0.9072
	Habit4	5.14	1.054	0.7531
Perceived Behavioral Control	PBC1	4.91	1.791	0.6398
	PBC2	5.73	1.526	0.709
	PBC3	6.00	1.122	0.8188
	PBC4	5.26	1.122	0.7215
Intention	Int1	5.38	1.091	0.8091
	Int2	5.49	1.077	0.8319
	Int3	5.78	1.062	0.8531
	Int4	5.74	1.033	0.856
	Int5	5.68	1.024	0.8463
Behavior	Beh1	5.27	1.138	0.8354
	Beh2	5.00	1.257	0.8273
	Beh3	5.07	1.247	0.8934
	Beh4	5.33	1.145	0.8936

*Table 1. Descriptive statistics of the measure*

The acceptability of the measurement model was assessed by the reliability of individual items, internal consistency between items, and the model's convergent and discriminant validity. SmartPLS 2.0 was employed to assess the measurement model. Table 2 shows the composite reliability, average variance extracted (AVE), and square root of the AVE, as well as the correlations between the constructs. Scale reliability is an important measure of scale adequacy. When scale reliability is high, variables measuring a single factor share a high degree of common variance (Sanders & Premus, 2005). The Cronbach's alphas of the six constructs are all above the recommending criterion of 0.70 (Nunnally, 1978), ranging from 0.7242 (PBC) to 0.8952 (Intention), which show that the measures are internally consistent. The composite reliability values of all the constructs were above 0.8, exceeding the cut-off of 0.70 (Bagozzi, 1980) which indicates adequate internal consistency

(Nunnally & Bernstein, 1994). The AVE for each construct was higher than 0.50, suggesting that observed items explain more variance than the error terms (Fornell & Larcker, 1981). In addition, the square root of the AVE for each construct was higher than the correlations between the construct and all other constructs (Fornell & Larcker, 1981), suggesting satisfactory discriminant validity. All of the results show that all scales of the measurement model demonstrate adequate internal consistency for further analysis of the construct model.

	C.A	C.R.	AVE	SN	Hab	Beh	Att	PBC	Int
SN	0.8429	0.8879	0.6141	<b>0.7836</b>	0	0	0	0	0
Hab	0.8563	0.9036	0.7018	0.4646	<b>0.8377</b>	0	0	0	0
Beh	0.8861	0.921	0.7448	0.3546	0.645	<b>0.8630</b>	0	0	0
Att	0.8897	0.9189	0.6939	0.3567	0.4905	0.6287	<b>0.8330</b>	0	0
PBC	0.7242	0.8148	0.5258	0.4757	0.5205	0.4872	0.3932	<b>0.7251</b>	0
Int	0.8952	0.9227	0.7047	0.5152	0.6296	0.6319	0.4763	0.5437	<b>0.8395</b>

Table 2. Measurement model results

Note. C.A= Cronbach's alphas. C.R. =Composite Reliability. AVE =average variance extracted. The bold numbers on the diagonal are the square root of the variance shared between the constructs and their measures. Off-diagonal elements are correlations among constructs. For discriminate validity, diagonal elements should be larger than off-diagonal elements.

## 5.2 Structural Modeling Analysis

Structural equation modelling was applied for data analysis using partial least squares with SmartPLS 2.0. The parameter estimates in a structural model exhibited the direct effects of one construct on the other and thereby a significant coefficient at a certain level of  $\alpha$  reveals a significant casual relationship between latent constructs. (Figure.2, Table 3).

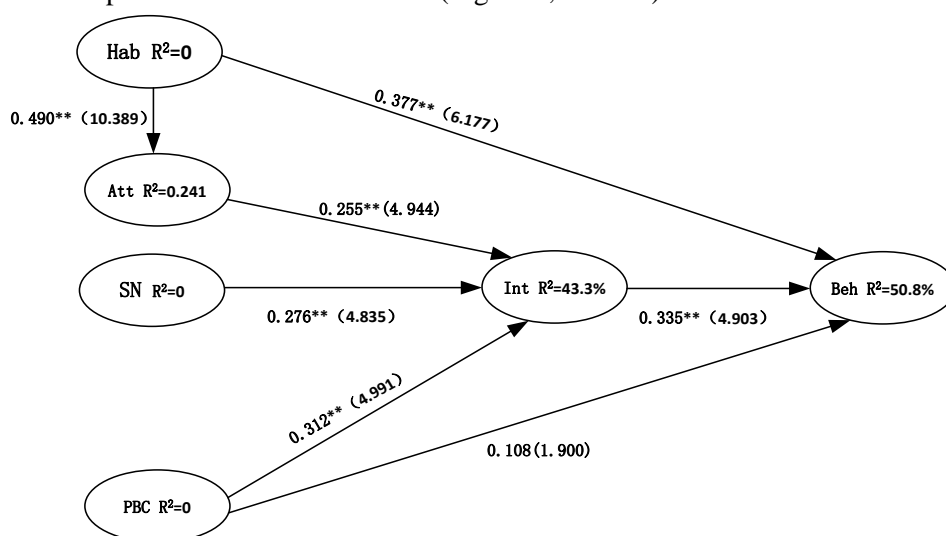


Figure. 2. Model results. Note. Path coefficients with t value in parentheses. \*  $p < .05$ . \*\*  $p < .01$ .

H1a and H1b, and H1c were all supported. Attitude and SN as well as PBC explain 43.3% of



the variance in user intention. H2a, which hypothesized a positive relationship between user habit and user attitude, was supported (path coefficients=0.490,  $p<0.01$ ). Habit also has a positive and significant effect on user Intention (H2b), with path coefficients of 0.377 ( $p<0.01$ ). As predicted by H3, user intention significantly influenced his (or her) behavior, with path coefficients of 0.335 ( $p<0.01$ ) respectively. However, the path from PBC to Behavior is not supported. The results of this hypothesis may be caused by the Chinese medical system.

Hypothesized path	Standardized path coefficients	t-value	Results
H1a: Attitude → Intention	0.255	4.944**	Supported
H1b: SN → Intention	0.276	4.835**	Supported
H1c: PBC → Intention	0.312	4.991**	Supported
H2a: Habit → Attitude	0.490	10.389**	Supported
H2b: Habit → Behavior	0.377	6.177**	Supported
H3: Intention → Behavior	0.335	4.903**	Supported
H4: PBC → Behavior	0.108	1.900	Unsupported

Table 3. Structural parameter estimates

## 6 CONCLUSION

The research is to explore the relationship between the individual subjective factors of hospital medical staff and the behavior that they continued to use the medical information technology in hospitals. According to the results of empirical research, all hypotheses except for one have been supported. The empirical results show that the user habits of using HIS will affect their attitude toward using it. Their habits will affect their IT use behavior through their attitude. Meanwhile, their habits have a direct impact on users' behavior. Hence the habits of the medical staff using IT significantly affect the behavior of its use, which are consistent to the findings of Limayem (2003).

According to the characteristics of TPB, and applies it to the field of medical information, expand the scope of application of the Theory of Planned Behavior. This paper is not only the traditional TPB, this paper adds new variables on the structure of the original theory frame, further enrich the theory of TPB which is a further development of the Theory of Planned Behavior. Meanwhile, our study also enlightenment related personnel in medical field, high quality and good habits of medical personnel can promote the hospital IT acceptance and further use, and to improve the work performance.

While this article has obtained certain research results, we still have some limitations. First of all, the data we used in this study just came from one hospital in one city and has inevitably regional limitation. The future research can expand the scope of respondents, and more hospitals in various cities with different provinces could be covered for study. In this way, our proposed model can have more generally applicability. In addition, because of the different developing level of informatization and regional economy, the applicable levels of IT in hospitals are unbalanced in different medical systems or regions in China. The gap between the economic developed regions and underdeveloped ones is big, so the study of this

study also has some limitations in the comparison of study on different hospitals from various regions in China. The study on the relationship between medical personnel's individual subjective factors and their performance is also worthy of an intensive study.

In addition, although this paper extends the TPB model, but by reviewing other scholar's related studies, we find that the TPB model is generally applied by combing TAM model and decomposing the structure variables of TPB. So from the view of an individual user, it is a hard process to construct a model which can be widely used and well explained for IT adoption and use in hospitals. All the above issues can be constantly improved in the future.

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