Investigating Users' Intention to Use Personal Health Management Services: An Empirical Study in Taiwan

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Abstract. With the increasingly aged population and advances in health information technology (IT), personal health management services (PHMS) have become an important topic, since they enable people to input health-related data and to check preventive health records. Although several prior studies have focused on the factors that impact the adoption of personal health information management and electronic medical records, the literature directly related to people's self-management behaviors toward PHMS is scant. According to the technology acceptance and status quo bias perspectives, this study develops an integrated model to explain Taiwanese people's intention to use to a PHMS. A field survey was conducted in Taiwan to collect data from citizens over the age of 20. The results indicate that perceived ease of use (PEOU) and perceived usefulness (PU) have positive effects on usage intention, and PEOU has a positive effect on PU. The results also indicate a significant negative effect in the relationship between citizens' inertia and intention to use a PHMS. Furthermore, inertia was jointly predicted by behavioral-based inertia, cognitive-based inertia, and affective-based inertia. The study has implications for the development of strategies to improve personal health IT acceptance.

Keywords: Personal health management services · Self-management · Technology acceptance · Status quo bias

1 Introduction

The rapid evolution of mobile technologies and the increasing diffusion of smartphones have provided significant opportunities for health care organizations to create new healthcare solutions and to offer value-added services to their customers. With Taiwan now considered an aging society, Taiwan's Health Promotion Administration (HPA) must meet the growing demand for geriatric care and chronic illnesses care. By using information and communications services based on cloud technology, the Taiwan HPA established personal health management services (PHMS) in 2015. It provides the public with convenient, all-in one smart and multi-functional health

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management tools for the management of a healthy lifestyle, health examination records, health risk assessments, health alerts, and health education. It has become possible for people to use mobile channels to obtain accurate health information and preventive health services, leading to better health. Thus, the PHMS improves the transmission of personalized preventive health information to those most in need. Although some practitioners emphasize the opportunities that the PHMS offers to citizens, the overall adoption rate remains low; therefore, citizens' acceptance of, and support for, the PHMS is particularly critical in Taiwan.

It is a fact that some user resistance is unavoidable and may cause performance of the PHMS system to be lower than expected. Although prior studies have focused on the factors that impact the adoption or use of medical informatics [1–3], the literature directly related to citizens' self-management behaviors toward mobile health management services are scant. Empirically, self-management is not a simple activity, yet it is a lifesaving mechanism via the PHMS. Thus, the existing variables related to technology acceptance theories do not fully reflect the motives of health it uses. Previous research has suggested the need to incorporate additional inhibitors to improve the predictive capacity and explanatory power of these dimensions. A variety of behavior theories can be used to explain health IT adoption or use phenomena. Among them, two theoretical models that have been used extensively to predict user involvement in technology-related behaviors are the technology acceptance model (TAM; [4]) and status quo bias (SQB; [5]). In particular, the SQB theory aims to explain users' preferences for maintaining their current status. Thus, SQB theory provides a set of useful theoretical explanations for understanding the impact of inertia as an inhibitor of new health IT acceptance. Rooted in the TAM and SQB perspectives, this study proposes a theoretical model to explain citizens' intention to use mobile health management services.

2 Literature Review

2.1 The Technology Acceptance Model

The theory of reasoned action (TRA; [6]) has been tested across a variety of behaviors and contexts. It suggests that an individual's behavior is determined by his or her intention to perform the behavior, and that this intention is consequently a function of his or her attitude and subjective norms toward that behavior. Based on the TRA, Davis [4] introduced the TAM model to explain new technology use behaviors. The TAM assumes that there are two specified beliefs that determine system use: perceived usefulness (PU) and perceived ease of use (PEOU). PU refers to the extent to which users believe that system use will enhance their job performance, while PEOU is the extent to which users believe that their use will be relatively free of effort [4]. The TAM suggests that PU and PEOU are two salient, cognitive determinants of technology acceptance because users want to use new technology that benefits their tasks without costing them a lot of effort. Since its introduction, the TAM has become the most frequently cited and influential model for understanding the acceptance of new technology and has received extensive empirical support. Certain prior studies found that the TAM has good explanatory power for predicting health IT acceptance among individual professionals [7–12]. According to the technology perspective, TAM has focused on users' enabling perceptions related to IT use (e.g., its PU and PEOU) [13]. Thus, we propose that citizens' intent to use a new technology such as the PHMS is based on two enablers of system use: PU and PEOU.

2.2 The Status Quo Bias Theory

The SQB theory explains why individuals prefer to maintain their current status or situation, rather than to switch to a new action [5]. According to the SQB perspective, one may express the intent to continue using the incumbent course of action, since this is what they have always done, or in spite of being aware that better alternatives exist (i.e., due to inertia). Thus, inertia reflects a bias toward the status quo [5]. Polites and Karahanna [14] define inertia in a technology acceptance context as user attachment to, and persistence in using, an incumbent system even if there are better alternatives or incentives to change. Further, they conceptualize inertia as having behavioral, cognitive, and affective components. Behavior-based inertia implies that the use of an incumbent system continues simply because it is what a user has always done, and therefore it persists without them giving it much, if any, thought. Cognitive-based inertia implies that the user consciously continues to use an incumbent system, even though he or she is aware that it might not necessarily be the best, most efficient, or most effective way of doing things. Affective-based inertia occurs when a user continues using an incumbent system because it would be stressful to change, because they enjoy or feel comfortable using it, or because they have otherwise developed a strong emotional attachment to the current way of doing things. In the technology acceptance context, inertia occurs when expected learning tasks related to a new system are difficult. It could be reasonably argued that individual inertia inhibits users from accepting new technologies [15]. Inertia reduces the motivation to be and is a key predictor of the use of health technology services; this is well supported, from a theoretical perspective, in the literature [16]. Thus, the SQB view provides a set of useful theoretical explanations for understanding the impact of maintaining users current status as inhibitors (e.g., inertia).

3 Research Model

In keeping with the TAM and SQB perspectives, we propose that Taiwanese citizens' intention to use the PHMS is based on two opposing forces: enabling and inhibiting perceptions. In the case of enabling perceptions, we propose that users' intention to use the PHMS is based on two enablers of IS use: PU and PEOU. In the case of inhibiting perceptions, inertia is seen as a manifestation of the SQB. Further, this study conceptualizes inertia as a multidimensional construct comprising three components: behavioral-based inertia, cognitive-based inertia, and affective-based inertia. Figure 1 shows the proposed research model.

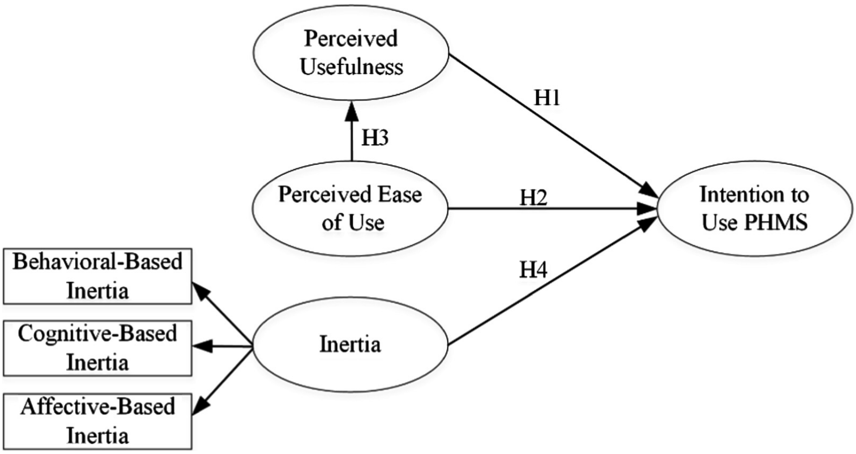

Fig. 1. Research framework.

According to the TAM perspective, PU and PEOU are two direct antecedents for determining behavioral intention to use, because users want to use new technologies that benefit their job tasks and that do not cost them a lot of effort [4]. Further, a new IT tool that requires less effort and is easier to use will be perceived as more useful than an older one. Since the PHMS is one specific instance of health IT, the salience and effects of PU and PEOU on system use should also apply to the healthcare context as enablers of system use. Tung et al. [17] and Yu et al. [18] provide empirical support for both associations within the healthcare context, leading us to hypothesize the following:

H1. The PU of PHMS use is positively related to the intention to use the PHMS.
H2. The PEOU of PHMS use is positively related to the intention to use the PHMS.
H3. The PEOU of PHMS is positively related to the PU of the PHMS.

According to the SQB perspective, users persist in using an incumbent system or work method either because this is what they have always done or because it may be too stressful or emotionally taxing to change [14]. For example, when an individual is confronted with a new technology and requested to develop a learning task for the new system, the new task's stress and (at least temporary) loss of control makes users produce negative emotions [15]. Thus, inertia will result in lowered use intentions. Hsieh and Lin [16] and Jaw [15] provided empirical support for both associations within the healthcare context. With this in mind, we suggest the following hypothesis:

H4. Inertia is negatively related to the intention to use the PHMS.

4 Research Method

4.1 Questionnaire Development

The construct measures shown in Fig. 1 were all adopted from previous studies and were rated using a 5-point Likert scale; the anchors ranged from "strongly agree" to "strongly disagree." Although previous studies have validated the questionnaire items, we conducted pretests by asking two health care professionals and an information management professor to evaluate each item. To ensure the questionnaire's validity and reliability, we conducted a pilot test with a sample that was representative of the actual respondents. We conducted structural equation modeling using partial least squares (PLS) estimations for the data analysis because the PLS method requires a minimal sample size and has few residual distribution requirements for model validation [19].

4.2 Sample and Data Collection

The target participants were Taiwanese citizens over the age of 20. This study employed an online survey for data collection, because online surveys provide researchers with various benefits, such as saving time and reducing expenses by overcoming geographic distance [20]. A total of 250 questionnaires were distributed through an online survey company, and 200 questionnaires were returned. We assessed nonresponse bias by comparing early and late respondents (i.e., those who replied during the first three days and the last three days). We found no significant difference between the two respondent groups based on the sample attributes (i.e., gender and age).

5 Research Results

The resulting 200 valid questionnaires constituted a response rate of 80%. Respondents' demographics are presented in Table 1. Most were female (51%) and between the ages of 20 and 49 (67.5%).

Table 1. Respondents' demographics.

Respondent characteristics		Frequency	Percent (%)
Gender	Male	98	49
	Female	102	51
Age	20–29	45	22.5
	30–39	45	22.5
	40–49	45	22.5
	50–59	41	20.5
	>60	24	12
Education	Secondary School or Less	37	18.5
	College	22	11
	University	99	49.5
	Master/PhD	42	21
Occupation	Industry	39	19.5
	Public service	28	14
	Service	44	22
	Students	8	4
	Farming	46	23
	Homemaker	16	8
	Others	19	9.5

We tested the reliability and validity of the proposed model. Reliability was assessed based on a construct reliability greater than 0.7 [21]. Convergent validity was assessed based on the following three criteria: (a) item loading greater than 0.7 and statistically significant, (b) composite construct reliability greater than 0.7, and (c) average variance extracted (AVE) greater than 0.5 [22]. The discriminant validity between the constructs was assessed based on the criterion that the square root of the AVE for each construct should be greater than the corresponding correlations with all other constructs [21]. In this study, the construct reliabilities are all greater than 0.9. For the convergent validity, the item loadings are all greater than 0.9, and the AVEs range from 0.86 to 0.97. For the discriminant validity, the square root of the AVE for a construct is greater than its corresponding correlations with other constructs. Table 2 shows the descriptive statistics of the principal constructs and the correlation matrix, respectively. These results indicate acceptable reliability, convergent validity, and discriminant validity.

Table 2. Reliability and validity of the scale

Construct	Item loading	CR	AVE	Correlation					
				PU	PEOU	BBI	CBI	ABI	IU
PU	.94–.96	.97	.91	**.95**					
PEOU	.90–.95	.97	.86	.28	**.93**				
BBI	.90–.96	.96	.88	−.04	−.32	**.94**			
CBI	.97–.98	.98	.97	−.03	−.27	.54	**.99**		
ABI	.92–.96	.97	.90	−.07	−.33	.57	.59	**.95**	
IU	.95–.96	.97	.92	.47	.57	−.53	−.52	−.51	**.96**

Note: Leading diagonal shows the square root of AVE of each construct Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Behavioral-Based Inertia (BBI), Cognitive-Based Inertia (CBI), Affective-Based Inertia (ABI), and Intention to Use (IU)

The testing results in the structural model are indicated in Fig. 2. In general, the statistical testing conclusions all support this research model. In this study, intention to use was jointly predicted by PU ($\beta = 0.36$, standardized path coefficient, $p < 0.001$), PEOU ($\beta = 0.44$, $p < 0.001$), and inertia ($\beta = -0.40$, $p < 0.001$), and these variables together explained 68% of the variance of intention to use. As a result, hypotheses 1, 2, and 4 were all supported. In this study, PEOU ($\beta = 0.28$, $p < 0.001$) significantly influenced PU, explaining 10% of the total variance in PU. Accordingly, hypothesis 3 was supported.

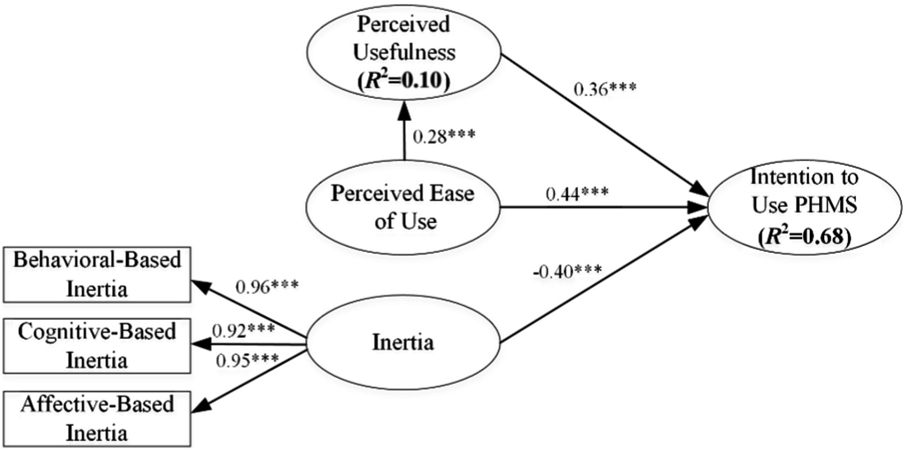

Fig. 2. Results of the structural model (Value on path: path coefficient; R^2, coefficient of determinant; ***p < 0.001)

6 Discussion

In this empirical study, we explored how variables affected citizens' intention to use the PHMS. Therefore, we extended the TAM by adding one belief construct (inertia) and its three major components (behavioral, cognitive, and affective) to understand whether our proposed extended model is a better model. The study results indicated that the TAM integrated with inertia provides a superior explanation of citizen intentions toward using PHMS, because the r-square of usage intention is 0.68. This implies that the TAM integrated with inertia might be a robust research model for predicting citizens' use intention toward health IT.

The results indicated that PU and PEOU are key determinants in citizens' use intentions. The PEOU also has a positive direct effect on PU. These findings are consistent with the results obtained by Tung et al. [17] and Yu et al. [18]. The effects of these usage intention variables were significant in explaining citizens' PHMS use behaviors by conforming to Davis [4], who maintained that the relative importance of PU and PEOU in predicting use intention varies across behaviors and situations. Inversely, inertia has a direct negative effect on citizens' use intentions, meaning that higher levels of inertia result in lower intention to use the PHMS. Inertia contains three major components: behavioral-based, cognitive-based, and affective-based elements. People persist in using the incumbent method either because it is what they have always done in the past (behavior-based inertia), because it may be too stressful or emotionally taxing to change (affective-based inertia), or despite their awareness that it might not necessarily be the best, most efficient, or most effective way of doing things (cognitive-based inertia). This result coincided with the findings of previous studies on IS adoption [14, 16]. In the absence of inertia, it is possible that a habitual user of an incumbent process or tool may readily recognize the advantages of switching to the

PHMS and may form genuine intentions to do so. These findings could interest and encourage researchers who are developing a health IT acceptance and resistance model.

This study has several implications for, and makes numerous contributions to, future research. A primary contribution is that technology acceptance and user resistance theories are combined to examine how individuals assess overall change related to a new health technology. By making use of the TAM to integrate and add to relevant concepts from SQB theory, the study contributes by operationalizing and testing the developed model through a survey methodology, which has little precedence in the user resistance literature. Hence, we provide theoretical insights that researchers may employ to encourage users to adopt a new health technology. Second, our study confirms that PU and PEOU are critical factors for facilitating the intention to use new health IT. While the role of inertia is important, the driving forces would have a negative effect on citizens' intent to use the PHMS. This finding could interest and encourage researchers who are developing a new health IT acceptance model. Future research should aim to identify additional incumbent action constructs and theorize on the interplay between incumbent action and new technology cognition and behaviors. As an extension of previous research, this study has demonstrated how inertia can be applied in health IT research to explain citizens' intention to make new health IT-related changes. Thus, this reliable and valid instrument provides an effective tool for researchers to measure users' behaviors and to explain, justify, and compare the differences in study results.

Our study findings provide useful recommendations for systems managers aiming to enhance citizens' usage intent regarding the PHMS. Because higher perceived levels of usefulness and ease of use encourage citizens to have more intentional behaviors, the PHMS should be designed in a more user-friendly manner that is consistent with current health needs. Those who can use the PHMS easily and who find that it enables them to access their health information efficiently will develop a better attitude toward it and increase their usage intentions. Systems managers should focus on creating an environment in which citizens have a positive attitude that encourages their use of the PHMS. Second, managers should be aware of the critical effect of inhibitors on users' intention behaviors. Managers can attempt to reduce inertia by enhancing citizens' favorable opinions toward new health IT-related changes. Furthermore, most health IT designs tend to focus on system considerations, such as new functionalities and connectivity, rather than on users' considerations, such as the system's impact on health behaviors. A better understanding of users' resistance to health IT may help facilitate the design of better systems that are both functionally good and acceptable to their targeted user populations.

The limitations of our findings should be acknowledged. The first limitation is our choice of constructs, which was based on prior literature and our own observation of the behaviors of users at our study site. There may be other inhibitors or enablers of health IT use that were not included in this study and which could be the subject of future research. There may be additional predictors of behavioral intention, beyond PU, PEOU, and inertia, that should be examined in future research. The identification and validation of such constructs will also help advance our preliminary model of health IT acceptance behavior. Second, the relevance of this study is confined to the health IT acceptance behaviors of the general public. The findings and implications drawn from this study cannot be readily generalized to other special groups, such as patients. A study targeting patients, who might have varying information needs and different levels of computing support and abilities, could yield different results. Future research should focus on accumulating further empirical evidence and data to overcome the limitations of this study.

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