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ORIGINAL ARTICLE

Modeling the adoption of personal health record (PHR) among individual: the effect of health-care technology self-efficacy and gender concern

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ABSTRACT

Background: With the development of information technology (IT) and medical technology, medical information has been developed from traditional paper-based records into up-to-date medical information exchange system called personal health record (PHR). Empowering PHR provides health awareness and intention for health promotion.

Objective: The purpose of this study was to present a research framework to examine individuals' intention to PHR use.

Methods: This cross-sectional study used the questionnaire to collect data from the individual in Taiwan. Individual's intention to use PHR has been examined by a framework based on extended technology acceptance model (TAM), with gender and health-care technology self-efficacy (HTSE) as external variables. Additionally, gender differences were explored in perceptions and relationships among factors influencing an individual's intention to PHR use. The research framework was evaluated by structural equation modeling (SEM) and represented by Analysis of a Moment Structures (AMOS).

Results: A total of 234 valid responses were used for analysis. The results suggest that the extended TAM model explains 40.6% of the variance of intention to PHR use (R^2 = 0.406). The findings also supported that perceived usefulness, perceived ease of use, and attitude toward using PHR significantly influenced individual's intention to PHR use. Additionally, results also indicated that women were more strongly influenced by perceptions of HTSE.

Conclusions: The extended TAM model contributes reasonable explanation for interprets and anticipates of individuals' intention to use and adopt PHR. Moreover, the results have provided support for HTSE and gender as significant variables in TAM. However, the study identified three relevant factors directly and one factor indirectly influencing on individuals' intention to PHR use. Thus, health care providers and hospital authorities must take these factors and gender difference into consideration in the development and validation of the theories regarding the acceptance of PHR. Based on the findings, the theoretical and practical implications are discussed.

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Personal health record (PHR); technology acceptance model (TAM); genders; health-care technology self-efficacy; intention to use

1. Introduction

Health-care system is increasingly becoming the burden for countries like Taiwan, Japan due to its aging populations [1]. The previous study reported that the solitary way to achieve the future requirement could be to empower individuals, so they might come across their own health requirements more self-sufficiently from existing structures [2]. World Health Organization (WHO) pointed out that better access of information communication technologies (ICTs) might contribute to improving consideration and management of specific medical conditions, which could allow individuals to involve more in self-care [3].

Keeping track of own health information might have a significant effect on health management, especially for those who have been suffering from chronic disease [4]. For example, individuals who have been suffering from diabetes would understand the association between food consumption, medication, and workout in a better way by tracking their health condition on a regular basis. According to Zurita & Nohr [5], patients are willing to gain more control over their personal health information. The American Academy of Pediatrics (AAP) promotes scholastic programs for families and physicians to encourage the effective and systematic use of the personal version of electronic health records (EHR), known as personal health record (PHR) to improve the quality of health care for children [6]. Thus, it is understandable that issues regarding PHR increasingly receiving attention over the last few years.

PHR, current study perspective, is defined as the information related to individuals' past, present, and future medical condition, which is required to provide health care provider to receive better treatment. PHR is considered to involve individuals into their own care management by empowering them with tools and knowledge that would advance their access and

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interaction in a more efficient and effective manner. However, several studies have debated over patients' cognition and acceptance of PHR [7–9], but while exploring the personal perception of PHR from individuals' or health consumers' perspective [10] such study is limited.

Despite the several benefits of PHR including enhanced patient-provider relationships, improved patient empowerment, increased care security, efficiency, coordination and quality, prior studies indicated that PHR adoption continues to be slow, due to various reasons [11]. So, identifying the reasons that have influenced on individuals' intentions to use PHR is important to health care providers to optimize development policies. Thus, we propose a model based on the classical theory of TAM, with gender and health-care technology self-efficacy (HTSE) as external variables, to explore gender differences in perceptions and relationships among factors influencing individuals' intention to PHR use. We are positive that the results of this study can improve our current understanding regarding individuals' intention to use and accept PHR and it will support both policymakers and health-care providers to determine the factors that may contribute to individuals' acceptance of PHR more clearly.

2. Literature review

2.1. Technology acceptance model (TAM)

Understanding individual's acceptance or rejection of information technology (IT) is considered as one of the most challenging issues in information system (IS) **research** [12]. One of the biggest human concerns is resistance to change. So, successful implementation of an IS depends heavily on the degree of attention given to human concerns which have the certain influence on the process [13]. Thus, understanding factors influencing PHR acceptance is one of the key elements in confirming its optimal integration and, ultimately, considerable benefits within the health-care system and population.

Liu et al. [8] examined patients' acceptance toward web-based PHR system based on TAM model and their results found the significant influence of all the relationships except perceived ease of use (PEOU) to adopt PHR. Gartrell et al. [14] studied health-care professional's acceptance of electronic PHRs (ePHRs) based on TAM and their findings also have the significant impact on nurse's intention to accept ePHRs. The previous study by Noblin et al. [9] found that perceived usefulness (PU) is the most significant factors influencing patients' intention to use PHRs. Whetstone and Goldsmith [15] examined factors that concern consumers' intention to create and use a PHR and their findings showed that PU of PHR was positively associated with intent to create a PHR.

Overall, previous studies have shown certain support to use TAM as the theoretical model to examine the individuals' acceptance of PHR. However, TAM is still limited in their predictive power and, prior research suggested that TAM should be extended by incorporating additional variables to improve its specificity and explanatory power [16].

2.2. Health-care technology self-efficacy (HTSE)

According to Bandura [17], Compeau & Higgins [18], and Johnson & Marakas [19], an individual's computer self-efficacy (CSE) and general self-efficacy (GSE) are usually categorized as a distal self-efficacy evaluation, where perception about his or her capability to perform a specific task is gradually formed over a persistent period of time through several experiences. In contrast, HTSE is more of a direct measure than distal measure where an individual's perception is influenced by his or her immediate health emotion based on the person's on-going health condition [20]. Anderson and Agarwal [21] explored that the health-care context is considered unique into two ways; a) individuals consider health information is more sensitive in nature other than non-health related information and b) feeling plays a major role when dealing with health information. Bansal et al. [22] stated that the individuals' level of emotion depends on their health conditions, which in turn impacts their decision-making choices, for example, their intentions to use health-care-related technologies. Holden and Karsh [23] also emphasized the significance of differentiating between health-care technology adoption behaviors and non-health-care technology adoption behaviors. Hsu and Chiu [24] defined a trait-oriented efficacy as a stable cognizance that is developed over time based on an individual's life-long experience, while a state-based efficacy perception is developed based on his or her decision immediately before the task execution. Therefore, we concluded that HTSE is characteristically more state-oriented than trait-oriented efficacy because an individual's HTSE perception is not the steady perception that is formed and developed over a persistent period of the lifetime of the individual; instead, it could vary depending on his or her immediate cognitive situation related to his or her current health condition.

2.3. PHR in Taiwan

Drawing upon the models relating to IT development in health care, Taiwan's Department of Health (DOH) had initiated a five-year project known as national health-care information project (NHIP) to promote the acceptance of PHR system and to improve health information exchange [25]. DOH has introduced Taiwan electronic medical record template (TMT) principally to achieve functional and semantic interoperability of

health information within the country. TMT is a local electronic record template that has been developed by adopting international standards, for instance, Health Level Seven (HL7) clinical document architecture (CDA), which is expected to provide interoperability within health-care systems [26].

The Taiwan government has initiated compulsory enrollment for all citizens and legal residents under Taiwan's health insurance system put into operation in 1995. In other words, individuals have the freedom to go to any kind of health-care provider, implicating referral from health centers and general practitioners clinics are not essential to visit medical centers. However, in this context, the PHR system could be effective in delivering patient's medical history timely, to get rid of needless test requests and drug prescriptions while patients visit totally different health-care providers. Thus, Taiwan offers a positive atmosphere to take highest benefits from the PHR system [10].

2.4. Gender

Examining individuals' intention to use technology is yet another topic in which gender difference has been neglected [27]. Having that, current study further recognizes the moderating effect of gender on the relationship between the factors and behavioral intention to use. Although, several studies have examined the gender difference in computer-related attitudes and its use, limited studies have integrated gender as moderator in evaluating the correlations between HTSE, PEOU, and PU toward the intention to PHR use. Chu [28] stated that gender differences in the use of the technology must be carefully investigated, rather than merely indicating differences. Thus, understanding the role of gender in the strength of the path coefficients might bring further insight into conventional beliefs regarding gender issues.

3. Research hypothesis

3.1. Technology acceptance model (TAM)

With the on-going development of health-care technologies, several theoretical models have emerged to investigate and justify factors that influence individuals' acceptance, rejection, or continuous use of new technology [10,29–32]. Davis [31] introduced the TAM and proposed a theoretical framework that explained the relationship between individuals' attitude and behavioral intention. Based on the TAM model, PU and PEOU are hypothesized to be the principal factors of individuals' acceptance.

Kowitlawalul et al. [33] indicated the influence of PU and PEOU on attitude toward using and behavioral intention in their study. Ortega et al. [34] denoted that the relationship between PU and individual's attitude toward using IT and the intention to use of IT must be taken into consideration for accepting IS by individuals in health-care information services. Furthermore, Lee & Chang [35] revealed that PEOU is significantly correlated with attitude or intention through PU. Wong et al. [36] also indicated that PEOU is positively correlated with behavioral intention to use the Internet for health-related Information. Yun and Park [37] explored that attitude towards using the Internet for pursuing disease information had a positive influence on the intention to use this technology for pursuing disease information. Thus, the following hypotheses were generated:

H_{1a} PU positively influences on individuals' attitude toward PHR use.

H_{1b} PU positively influences on individuals' intention to PHR use.

H_{2a} PEOU positively influences on individuals' PU.

H_{2b} PEOU positively influences on individuals' attitude toward PHR use.

H_{2c} PEOU positively influences on individuals' intention to PHR use.

H_3 Attitude toward using PHR positively influences on individuals' intention to PHR use.

3.2. Health-care technology self-efficacy (HTSE)

Prior studies relating to health-care technology, using self-efficacy as an antecedent variable, has the significantly positive influence on PEOU, which in turn impacts on PU [33,38,39]. It suggests that if an individual considered him or herself is capable of using IT, then operating the specific IS such as PHR system could be perceived easier if further supports were provided, additionally this could improve individual's usefulness regarding the system. Kowitlawalul et al. [33] explored that degrees of self-efficacy of nursing students relating to EHRs may have a considerable positive influence on their PU and PEOU, that is, the more self-efficacy is attained throughout training; the system is perceived to be easier to operate. This furthermore intensifies enthusiasm of learning (PU). Rahman et al. [20] found that HTSE has a positive influence on attitude toward the use of health technologies. Moreover, Sun et al. [40] examined self-efficacy as an antecedent factor affecting individuals' health technology acceptance behavior in their study and their findings validate a significant positive relationship between an individual's self-efficacy and their attitudinal intentions to adopt mobile health services. Thus, based on the above observations, the following hypotheses were put forth:

H_{4a} Health-care technology self-efficacy positively influences individuals' PU.

H_{4b} Health-care technology self-efficacy positively influences individuals' PEOU.

H_{4c} Health-care technology self-efficacy positively influences individuals' attitude toward using PHR.

3.3. Gender

The role of gender has received much attention, and many researchers have studied the issue in different perspectives lately. The gender difference in terms of the individual's belief, individual's self-efficacy, and attitude toward using health-care technology is a significant research area [41]. Vekiri and Chronaki [42] investigated gender differences in self-efficacy and revealed that female students' lacking positive perceptions and less attentiveness in technology lead to a less propensity for them to develop technical competence than male students. Kekkonen-Moneta and Moneta [43] also subjected that the practice of technology in learning is a commanding achievement for male students who thus have more positive attitudes toward learning with technology than female students.

Gefen and Straub [27] examined the gender difference in technology acceptance and verified that gender difference considerably moderated the effects of PU and PEOU toward behavioral intention. Moon and Kim [16] revealed that females show less ease of use in IT. Venkatesh et al. [12] also found that men were more task-oriented and influenced by PU; whereas, women were more influenced by PEOU, which was related to their self-efficacy. Thus, the following hypotheses were generated, giving the research model in Figure 1:

H_{5a} Health-care technology self-efficacy influences perceived usefulness more strongly for men than for women.

H_{5b} Health-care technology self-efficacy influences perceived ease of use more strongly for men than for women.

H_{5c} Health-care technology self-efficacy influences attitude toward using PHR more strongly for men than for women.

H_{6a} Perceived usefulness influences attitude toward using PHR more strongly for men than for women.

H_{6b} Perceived usefulness influences intention to use PHR more strongly for men than for women.

H_{7a} Perceived ease of use influences attitude toward using PHR more strongly for women than for men.

H_{7b} Perceived ease of use influences intention to use PHR more strongly for women than for men.

H_8 Attitude toward using PHR influences intention to use PHR more strongly for men than for women.

4. Materials and methods

4.1. Questionnaires design and data collection

A preliminary list of measurement items was initially developed after reviewing the literature regarding PHR, TAM, gender differences, and self-efficacy and summarizes into the Appendix A (Table A1). The instrument used for this study included three sections. In the first section, cover page, the purpose of the study and a definition of PHR were provided. The second section regarded respondents' basic information, including their age, gender, and educational level. The third section contained indicators regarding TAM and HTSE (19 items). The respondents were instructed to use a seven-point Likert scale to evaluate each item, ranging from 1 for strongly disagree to 7 for strongly agree. To enhance the reliability and validity of the indicators, this study modified the content of the items regarding TAM and HTSE. A total of 246 respondents, representing a response rate of 74.55%, completed the survey questionnaire.

Both a pre-test and a pilot test were conducted to validate the instrument. The pre-test involved seven experts, that is, three professors from information management (IM) department, three doctoral scholars in the medical information field, and one doctoral scholar in the IM field. Respondents were asked to mention the appropriateness of items, the format, the length of the instrument, and the wording of the scales.

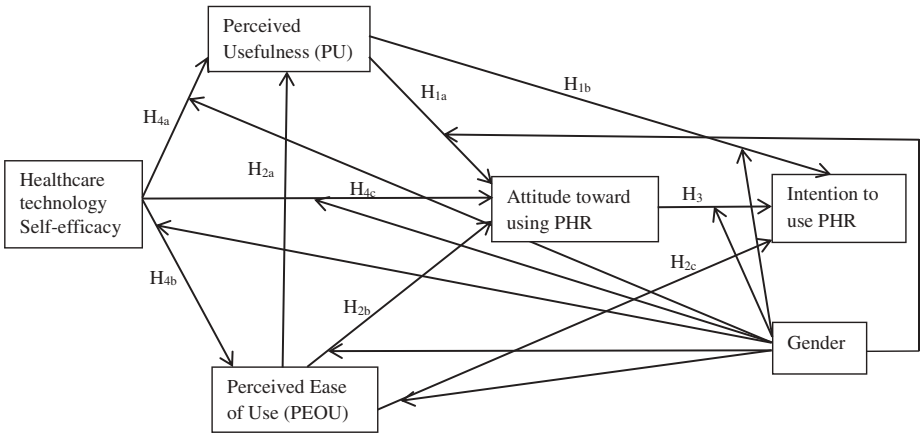

Figure 1. Research Framework.

The pilot study involved 40 respondents self-selected from the study population. Based on the respondents' response at the pre-test and pilot test, some items were modified to represent the survey's purpose more clearly. The reliability of all items was acceptable (Cronbach's alpha is above 0.78), and items loaded in the confirmatory factor analysis are 0.70 or more. Thus, the instrument has validated reliability and content validity. The pilot study result is presented in the Appendix B (Table B1).

4.2. Research setting

The target population for the current study was Taiwanese. We used convenience sampling method as the survey instrument, as it is cost-effective and has been extensively used in IS research [44]. All participants were given consent forms and information sheets which clearly explained the purpose of the current study. Respondents were also conscious of their rights to be withdrawn participation at any time during the study.

Additionally, we presented our participants a short description of how PHR works in general. This approach was chosen because of two reasons. First, to overcome any lack of familiarity about PHR that could have kept on among our participants by reasons of its continuous technological innovation and second, to form a reasonable opinion about the potential usages of PHR.

4.3. Data analysis

Data analysis was conducted by the two-step approach suggested by Anderson and Gerbing [45]. First, testing convergent validity and discriminant validity of the measurement model, and subsequently testing research hypotheses and structural model. Structural equation modeling (SEM) was used for statistical analysis due to three reasons. First, SEM is a multivariate technique that allows the simultaneous estimation of multiple equations [46]. Second, SEM executes factor analysis and regression analysis in a single step, as SEM is used to test a structural theory. Third, SEM has become a very popular analysis technique in social science researches. The AMOS statistical software was employed in the current study.

5. Results

5.1. Profile of sample

This study collected 246 responses. Of which 12 were considered unusable, because of incomplete responses. Thus, we included 234 valid responses for final analysis. The demographic information of the survey respondents is shown in Table 1. The demographic results pointed out that the respondents are differed correspondingly in gender, age, and educational level.

Table 1. Sample demographics.

Item	Option	Count	Percentage %
Gender	Male	120	51.28
	Female	114	48.72
Age	20–29	98	41.88
	30–39	69	29.49
	40–49	32	13.68
	50–59	20	8.54
	≥ 60	15	6.41
Education Level	High School or under	30	12.82
	College	137	58.55
	Master or above	67	28.63
Experienced of using health-care information system (HIS)	Yes	199	85.04
	No	35	14.96

5.2. Tests of the measurement model

Reliability analysis was verified using Cronbach's alpha and composite reliability (CR), to measure the model's internal consistency. Table 2 shows the results. The Cronbach's alpha of each construct ranged from 0.82 to 0.92 is above the recommended value of 0.70 by Hair et al. [46]. CR values of the latent factors are above 0.70 also suggested by Hair et al. [46], implying good reliability and consistency for the measurement items of each construct.

Convergent validity of the scales is examined using three standards suggested by Bagozzi and Yi [47]: (1) Loadings of each indicator should be higher than 0.70 [48]; (2) CR should be above 0.70; and (3) Average variance extracted (AVE) of each construct should be surpassed the variance because of the measurement error of that construct (i.e. AVE should be exceeded 0.50). As Table 2 confirms, the factor loading of each item in the measurement model of current study exceeded are well above 0.70. CR values have ranged from 0.84 to 0.95 (Table 2). AVE values of constructs are ranged from 0.72 to 0.83, thus meeting each condition for convergent validity (Table 3).

To test discriminant validity, Fornell and Larcker [48] recommended the square root of the AVE of the construct should be greater than the estimated correlation shared between the construct and other constructs in the model. Table 3 shows the square root of AVE for each construct was greater than the correlation values of the construct, thus meeting the condition for discriminant validity.

Hair et al. [46] recommended that most model-fit indices ought to reach accepted standards before judging model fitness. As shown in Table 4, each model-fit index is above the recommended values [47,49], exhibiting an adequate fit to the collected data.

5.3. Tests of the structural model

The results of the standardized structural path analysis are presented in the Appendix C (Figure C1). The results provide support for the proposed

Table 2. Descriptive statistics of the study dimensions.

Constructs	Item	Loadings	No. of items	Composite Reliability	Standardized Cronbach's α	AVE
PU	PU1	0.806	4	0.84	0.82	0.78
	PU2	0.834				
	PU3	0.817				
	PU4	0.883				
PEOU	PEOU1	0.856	4	0.87	0.84	0.76
	PEOU2	0.827				
	PEOU3	0.784				
	PEOU4	0.841				
ATT	ATT1	0.892	4	0.95	0.92	0.83
	ATT2	0.865				
	ATT3	0.821				
	ATT4	0.874				
INT	INT1	0.862	3	0.91	0.89	0.81
	INT2	0.872				
	INT3	0.892				
HTSE	HTSE1	0.912	4	0.92	0.87	0.72
	HTSE2	0.894				
	HTSE3	0.861				
	HTSE4	0.868				

Note. PU = perceived usefulness; PEOU = perceived ease of use; ATT = attitude toward using PHR; INT = intention to use PHR; HTSE = health-care technology self-efficacy.

Table 3. Average variance extracted and discriminant validity.

	PU	PEOU	ATT	INT	HTSE	AVE
PU	**0.88**					0.78
PEOU	0.42**	**0.87**				0.76
ATT	0.51**	0.54**	**0.91**			0.83
INT	0.47*	0.52*	0.53**	**0.90**		0.81
HTSE	0.54**	0.57**	0.43*	0.65**	**0.85**	0.72

Note. PU = perceived usefulness; PEOU = perceived ease of use; ATT = attitude toward using PHR; INT = intention to use PHR; HTSE = health-care technology self-efficacy.

Diagonal in Bold: square root of the average variance extracted (AVE) from observed items; Off-diagonal: correlations between constructs. *$p < 0.05$; **$p < 0.01$

Table 4. Goodness-of-fit measures of the research model.

Goodness-of-fit measure	Recommended value (a)	Model Value
χ^2/degree of freedom	≤3.00	2.17
Goodness-of-fit index (GFI)	≥0.90	0.94
Adjusted goodness-of-fit index (AGFI)	≥0.80	0.86
Normed fit index (NFI)	≥0.90	0.91
Non-normed fit index (NNFI)	≥0.90	0.92
Comparative fit index (CFI)	≥0.90	0.95
Root mean square residual (RMSR)	≤0.10	0.07

Note. a: Bagozzi and Yi [47]; Hair et al. [49].

significant relationships between the eight relationships (i.e. H1a, H1b, H2a, H2c, H3, H4a, H4b, and H4c) while the remaining one relationship (i.e. H2b) is not significant at the 0.05 level of significance. HTSE, PU, and PEOU have reported 52.7% (R^2 = 0.527) of the variance in attitude toward using PHR. Perceived usefulness was significantly reported by HTSE and PEOU resulting in variance explained was 57.8% (R^2 = 0.578). PEOU was significantly reported by HTSE, resulting in variance explained was 32.1% (R^2 = 0.321). Overall, the model explained 40.6% (R^2 = 0.406) of the variance in intention to PHR use.

5.4. Measurement of total, direct and indirect effects

To evaluate confidence intervals for the indirect effect, a bootstrapping test was performed. Table D1 (in the Appendix D) indicates the standardized total, direct, and indirect effects related to each of the endogenous and exogenous variables toward intention to PHR use. In-line with MacKinnon [50], standardized path coefficients with values close to 1 are measured to be greater than the values that influence. The most dominant factor of intention to use is PEOU, with a total impact of 0.744 and is followed by PU, HTSE, and ATT with an outcome of 0.655, 0.653, and 0.297, respectively. Jointly, these four factors explain 40.6% of the variance in intention to PHR use. Moreover, HTSE functioned as a significant factor for all endogenous variables in the model.

A two-group test was executed to investigate the gender differences in strength of the path coefficient. On this evaluation, one path coefficient turned into confined to be same across the two gender groups, and the resulting model suit was compared with a base model, wherein all path coefficients were freely expected the use of a χ^2 difference test. The results of the gender difference analysis are shown in Table 5 and Figure 2. The paths from HTSE → PU, HTSE → PEOU, and HTSE → ATT, were found to be significantly different. Therefore, Hypotheses 5_a, 5_b, and 5_c were supported. But, the path coefficient from PU → ATT, PU → INT, PEOU → ATT, PEOU → INT, and ATT → INT did not find the difference between two groups. Thus, hypotheses 6_a, 6_b, 7_a, 7_b and 8 were not supported. Table 6 shows the results of hypothesis testing.

6. Discussion

The current study empirically validated the TAM in a health-care perspective by going a step further to

Table 5. Two group comparisons of paths for men and women users.

		χ^2	*Df*	$\Delta\chi^2$ from base model
Unconstrained base model [a]		256.158	127	
Constrained paths [b]	HTSE → PU	264.212		7.626*
	HTSE → PEOU	264.048		7.502**
	HTSE → ATT	268.181		10.232**
	PU → ATT	268.166		0.121^{ns}
	PU → INT	256.321		0.164^{ns}
	PEOU → ATT	259.264		0.051^{ns}
	PEOU → INT	256.219		0.072^{ns}
	ATT → INT	256.297		0.172^{ns}

Note. PU = perceived usefulness; PEOU = perceived ease of use; ATT = attitude toward using PHR; INT = intention to use PHR; HTSE = health-care technology self-efficacy.
[a]Paths for the two groups were allowed to be freely estimated.
[b]The path specified was constrained to be equal across the two groups.
*$p < 0.05$; **$p < 0.01$; ns = not significant.

investigate the gender difference and HTSE as external variables. The findings of this study offer several significant implications from the academic and practical point of view regarding the acceptance of PHR. According to the findings of goodness-of-fit measurement, this study concluded that the research model positively represents the collected data and the factors, toward individuals' intention to PHR use.

As expected, PU, PEOU, and attitude toward using PHR were found to have a significant positive influence on intention to PHR use. The findings support the current study that recommends the positive and significant relationship among perceived usefulness, perceived ease of use, and attitude toward PHR use toward behavioral intention [40,51]. From the effect sizes, PEOU is the most dominant factor of behavioral intention, followed by PU, HTSE and attitude toward PHR use. Attitude toward PHR use accounted for the least variance among four factors, possibly because of the fact that individuals have not perceived the importance of PHR system engagement in their health-care behavioral activities.

PEOU is not significantly correlated with attitudes toward using PHR, consistent with the prior study conducted in health-care perspective [51]. This might be due to the fact that the PHR system may be easy to operate from one option to another. However, easy to operate may be significantly influenced on users' intention to use a system in some specific context, for example, online banking services [39], but in the health-care context, a medical support system such as PHR is used by individuals with specific purposes. Individuals use PHR as necessary by their health requirements either impulsively or resulting from the advice of medical professionals. Thus, individuals are mainly concerned about whether the services and contents offered by the PHR system are really helpful to improve their health-care behavioral performance. If individuals perceive that despite the system is easy to use, but did not improve their health-care behavioral activities, then their attitude toward using PHR is not going to be improved anyhow. Therefore, the difficulties with the system's interface or easiness to

Table 6. Hypothesis results.

	Path	Hypothesis	Results
Relationship			
H_{1a}	PU → ATT	Positive	Supported
H_{1b}	PU → INT	Positive	Supported
H_{2a}	PEOU → PU	Positive	Supported
H_{2b}	PEOU → ATT	Positive	Not supported
H_{2c}	PEOU → INT	Positive	Supported
H_3	ATT → INT	Positive	Supported
H_{4a}	HTSE → PU	Positive	Supported
H_{4b}	HTSE → PEOU	Positive	Supported
H_{4c}	HTSE → ATT	Positive	Supported
Gender difference			
H_{5a}	HTSE → PU	Men > Women	Not supported (women > men)
H_{5b}	HTSE → PEOU	Men > Women	Not supported (women > men)
H_{5c}	HTSE → ATT	Men > Women	Not supported (women > men)
H_{6a}	PU → ATT	Men > Women	Not supported (no difference)
H_{6b}	PU → INT	Men > Women	Not supported (no difference)
H_{7a}	PEOU → ATT	Women > Men	Not supported (no difference)
H_{7b}	PEOU → INT	Women > Men	Not supported (no difference)
H_8	ATT → INT	Men > Women	Not supported (no difference)

Note. PU = perceived usefulness; PEOU = perceived ease of use; ATT = attitude toward using PHR; INT = intention to use PHR; HTSE = health-care technology self-efficacy.

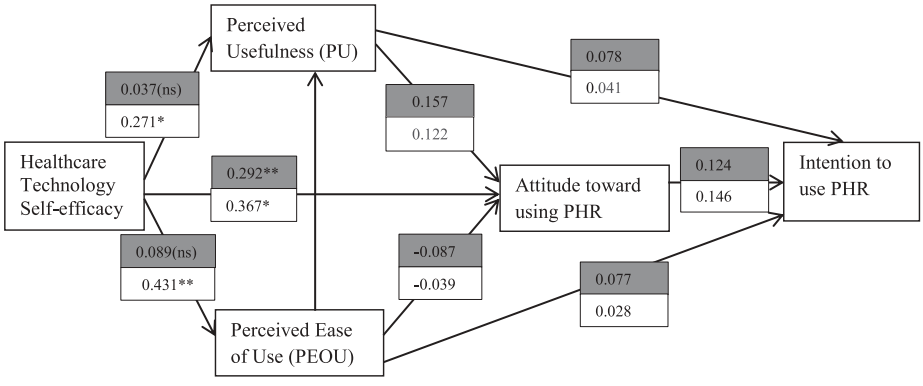

Figure 2. Standardized path coefficients for the male and female users.
Note. Coefficients for male users are in the shaded boxes.*p < 0.05;**p < 0.01; ns = not significant.

operate may possibly not be the important consideration in health-care perspective. Thus, the findings of current study recommend that health-care system developers should emphasize on the factors, individuals reasonably expecting from the PHR system, such as accurate, reliable, and complete information, control over how users' health information is accessed, used, and disclosed, etc., which could improve individuals' attitude to accept PHR. Another possible justification is that current finding could have resulted from the restrictions of the TAM model's appropriateness to different user populations. The analysis showed that the majority (71.37%) of the participants was between 20 and 39 years old and most of them have previously experienced to use health-care IS (85.04%). So, individuals have a considerable level of confidence based on their previous experience in using the health-care application. Although, further studies are needed to validate the finding. This result suggests that individuals' informative program should be reviewed and more sophisticated and effective applications might be introduced for users, will help individuals facing challenges of using the PHR system for their health-care activities in the near future.

This study examines whether there is any gender difference present in the effect of the factors on intention to PHR use. The results reported that gender did not moderate the effects of PU→ATT, PU→INT, PEOU →ATT, PEOU→INT, and ATT→INT. This result is inconsistent with the prior studies which indicated that gender significantly moderates the effects of PU and PEOU toward the intention to use technology [12,27]. This, may, due to the fact that PHR has not infiltrated the everyday lives of individuals and differences in the usage between men and women have not been widened therefore it is still not significant. Thus, this finding highlights that regardless of gender, those with greater PU, PEOU, and attitude toward using PHR had greater levels of intention to PHR use than those with lower PU, PEOU, and attitude toward using PHR.

Therefore, an exciting finding from this study is that the effect of HTSE on PU and PEOU was noteworthy for women, but insignificant for men. Additionally, HTSE influenced attitude toward using PHR more intensely for women instead of for men. It suggests that compared with men, women more positively influenced by their own potential aptitude to educate with PHR system, and also by their confidence about using the PHR system as efficient lessoning methods to improve their performance in health-care behaviors. This could be due to the recognition that men tend to have better technological self-efficacy, and therefore HTSE does not affect their perceptions of PHR use. Although several studies have observed that women revealed lower self-efficacy regarding technological usage than men [52,53]. The lower self-confidence of women toward the usage of technologies may have consequences for their own aptitude beliefs in the use of PHR for health-care activities. However, specific informative technology training programs regarding health-care behavior should be introduced for women to allow them acquiring self-confidence, and a self-belief that using the PHR system might improve their health-care behavioral performance, which in turn improve their overall health status. Therefore, this explanation requires further investigation and assessment as a large number of study participants is young.

With concerns about certain efficacy factors, it was also verified conclusively that HTSE has a positive influence on PU, PEOU, and attitude toward using PHR. From the effect sizes, HTSE has the most influential effect on attitude toward PHR use, followed by perceived ease of use and perceived usefulness. The key objective is that HTSE has indirect impacts on attitude toward using PHR and intention to PHR use. This finding has presented an additional understanding of the implication of HTSE and verifies a new contribution in the health-care context. Due to the importance of HTSE in motivating higher intentions toward the PHR use among individuals, policymakers, and health-care providers must pay additional attention to increasing individuals' conviction and confidence in using the PHR system in their health-care activities, especially in designing the training session of informative programs for individuals. Updating the health-care technology standards in individuals' informative programs periodically is essential, as technologies continue to improve and advance rapidly. This could also serve as a psychological preparedness for individuals to be prepared toward appropriate information acquisition and effective use of technological system regarding health care in the near future.

This study contributes to theory and practice in multiple ways. First, integrated model analyzed in this study, combined elements of the TAM, external variable HTSE and gender difference have overcome the limited applicability of the TAM to study users' acceptance of health-care IT and the results of the study improve the current understanding in the field of technology acceptance and health-care IT implementation. Second, the study instrument provides not only an overall assessment but also has the ability to analyze what aspects of the PHR (technology, behavioral or user's demographic differences) adoption are challenging from the users' perspective. Third, our extension of the TAM model explains how variations in usage intention are influenced by PHR perception in users. The acceptance theory evolved from current study could be improved for application in large-scale services and for organizations considering the adoption of PHR. Fourth, an understanding of the effects of gender difference on intention to PHR use is important in

overcoming barriers to the diffusion of technology across institutions. An understanding of the mechanisms through which gender difference influence technology usage behavior is important for reducing resistance to technology use. Fifth, as this study focuses on PHR use and unlike studies examine behavioral intention, any development regarding the better understanding of phenomena can translate into higher acceptance and usage of the health information system (HIS) after implementation. Finally, the results of this study lead to better technology usage and could also have a better consideration for health-care providers and policymakers before taking the decision about further spending on new HIS implementation.

7. Conclusions

This study proposes a new hybrid technology acceptance model based on classical theory TAM with external variables HTSE and gender to confirm and expand the PHR acceptance model as well as to make a significant contribution in both academic and practice. Results of SEM analysis demonstrated that the model provided meaningful insight for perception, interpretation, anticipation and exhibit good explanatory power to predict individual's intention to use and accept PHR, providing a new direction for researchers to contemplate in subsequent research. The current study evidently identified three relevant factors, i.e. perceived usefulness, perceived ease of use, and attitude toward using PHR directly influencing on individuals' intention to use and accept PHR, in addition, HTSE had the stronger effect for women on PU, PEOU, and attitude toward using PHR.

Despite its significant findings and implications, this study comprises some limitations. First, the implications are from a single study with samples in Taiwan. Thus, researchers should be careful while generalizing the results to other health-care circumstances. Future studies should conduct research in cross-cultural perspectives to explore and compare the differences in the antecedents to usage intention. Second, the relatively moderate variance is reported for intention to PHR use, only 40.6%, leaving 59.4% unexplained. Thus, future study should include additional contextual variables that could improve our ability to explain the unexplained variance for intention to PHR use more clearly among individuals.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Appendix A

Table A1. Measurement Items.

Dimension		Items	Sources
Perceived Usefulness (PU)	PU1	Using PHR, I can improve my health quality.	Davis [31]
	PU2	Using PHR, I can make my life more convenient.	
	PU3	Using PHR, I can understand my physical condition.	
	PU4	Overall, I find PHR to be useful for my health.	
Perceived ease of use (PEOU)	PEOU1	Learning to operate PHR will be easy for me.	Davis [31]
	PEOU2	I can easily become skillful at using PHR.	
	PEOU3	I can get PHR to do what I want to do.	
	PEOU4	Overall, I think using PHR is very easy to use.	
Attitude toward using PHR (ATT)	ATT1	Using PHR is a good idea.	Davis [31]; Sun et al. [40]
	ATT2	Using PHR is pleasant.	
	ATT3	Using PHR is beneficial.	
	ATT4	Overall, I like the idea of using PHR.	
Intention to use PHR (INT)	INT1	I intend to use PHR in the near future to manage my health.	Venkatesh et al. [12]; Sun et al [40].
	INT2	I plan to use PHR in the near future to manage my health.	
	INT3	My willingness to use PHR is high.	
Health-care technology Self-efficacy (HTSE)	HTSE1	It is easy for me to use health technology.	Rahman et al. [20]
	HTSE2	I have the capability to use health technology.	
	HTSE3	I do not feel comfortable using health technology.	
	HTSE4	While using health technology, I am worry that I might press the wrong button and risk my health.	

Appendix B

Table B1. Results of confirmatory factor analysis and reliability analysis.

Constructs	Item	Loadings	Standardized Cronbach's α
Perceived usefulness (PU)	PU1	0.792	0.79
	PU2	0.813	
	PU3	0.806	
	PU4	0.862	
Perceived ease of use (PEOU)	PEOU1	0.834	0.82
	PEOU2	0.812	
	PEOU3	0.762	
	PEOU4	0.814	
Attitude toward using EMR (ATT)	ATT1	0.871	0.87
	ATT2	0.854	
	ATT3	0.812	
	ATT4	0.845	
Health-care technology self-efficacy (HTSE)	HTSE1	0.851	0.84
	HTSE2	0.842	
	HTSE3	0.865	
	HTSE4	0.874	
Intention to use PHR (INT)	INT1	0.894	0.86
	INT2	0.867	
	INT3	0.858	

NOTE. PU = perceived usefulness; PEOU = perceived ease of use; ATT = attitude toward using PHR; INT = intention to use PHR; HTSE = health-care technology self-efficacy

Appendix C

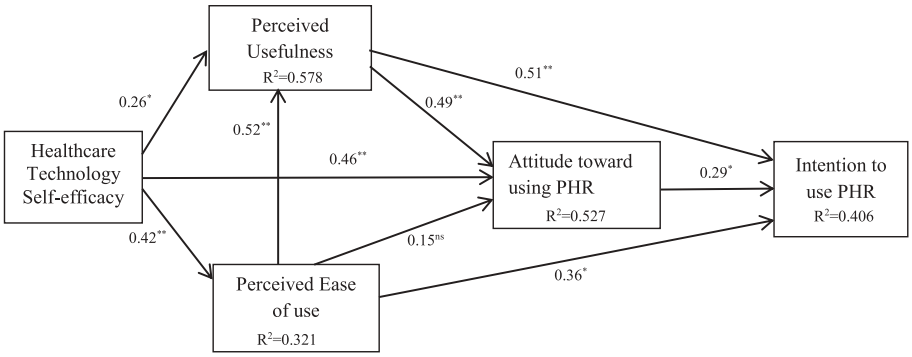

Figure C1. standardized structural path analysis.

NOTE. * Significant at p < 0.05 level, ** Significant at p < 0.01 level, ns not significant at p < 0.05 level.

Appendix D

Table D1. Direct, indirect and total effects of research model.

			Standardized estimates		
Predictor Variables	Outcome Variables	R^2	Direct	Indirect	Total
HTSE	PU	0.578	0.261	0.218	0.479aa
PEOU	PU		0.523	-	0.523aa
HTSE	PEOU	0.321	0.426	-	0.426[aa]
HTSE	ATT	0.527	0. 461	0.297	0.758a
PU	ATT		0.492	-	0.492[aa]
PEOU	ATT		0.151	0.254	0.405aa
HTSE	INT	0.406	-	0.653	0.653a
PU	INT		0.513	0.142	0.655aa
PEOU	INT		0.362	0.382	0.744a
ATT	INT		0.297	-	0.297[aa]

NOTE. PU = perceived usefulness; PEOU = perceived ease of use; ATT = attitude toward using PHR; INT = intention to use PHR; HTSE = health-care technology self-efficacy.

a$p < 0.05$; **$p < 0.01$