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Factors Affecting Users' Continuance Intention toward Mobile Health: Integration of Theory of Consumption Value and Expectation Confirmation

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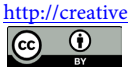


Abstract

Introduction: Due to the rapid development of information and communication technology in the past decades, mobile health had a significant impact on the development of healthcare systems as an innovative medical service model. Despite the popularity of mobile health worldwide, its continuance use has not been very high. Therefore, the factors that influence consumers' continuance intention of mobile health deserve further study. **Methods:** From July to August 2022, data were collected via a cross-sectional survey conducted with a self-designed questionnaire. The characteristics that affect the intention to continue utilizing mobile health were studied using the partial least squares approach. **Results:** Functional value, social value, emotional value, and conditional value had a positive effect on perceived value while epistemic value had no correlation with perceived value. Additionally, satisfaction, perceived value and habit were positively related to continuance intention. Furthermore, the mediating effect of satisfaction was significant between confirmation and continuance intention, and between perceived value and continuance intention. **Conclusion:** Satisfaction, habit and perceived value have a significant effect on mobile health apps continuance intention. At the same time, emotional value, functional value, conditional value and confirmation have an indirect positive effect on continuance intention. Therefore, we suggest that mobile health product developers should improve the functionality of the application in detail to enhance the user experience, so that the apps can be used continuously, and prevent the potential loss caused by the user uninstalling the application.

Subject Areas

Social Sciences and Medicine

Keywords

Mobile Health, Continuance Intention, Theory of Consumption Value, Expectation Confirmation Theory, Structural Equation Modeling

1. Introduction

With the continuous development of information technology, cloud computing, 5G technology, and big data have penetrated every aspect of our life. In recent years, the booming development of e-health in the medical field has changed the traditional medical model. The increasing use of smartphones and wearable devices has greatly increased medical resource allocation efficiency and changed the way of obtaining information in our daily life. By December 2021, there were 1.029 billion mobile Internet users in China, with 99.7% of Internet users using mobile phones [1]. Mobile health has become an inevitable trend, and it played an increasingly important role in promoting health and well-being and improving healthcare quality.

Professor Robert Istepanian first proposed the concept of mobile health in 2005 [2]. In 2011, the World Health Organization defined mobile health (mHealth) as "mobile technology-enabled medical and public health practice" [3]. Kim *et al.* also defined mHealth as the dissemination of any type of health services and information through mobile devices [4]. Future developments in medical care will focus on mobile health as an important tool for treating patients with its portability, cost-effectiveness, and efficiency.

Over the past decade, it is increasingly common for mobile health (mHealth) services to assist patients in self-managing chronic diseases and overcoming barriers such as distance, cost, and time by providing health information, assessment, and assistance to patients anywhere, anytime [5]. With the wide spread of COVID-19, mobile health has played a very important role in remote monitoring, remote consultation, personalized medical services, patient health status tracking, rapid medical treatment, and effective interaction between medical professionals. Mobile health is often underutilized, despite its benefits. Approximately 45.7% (427/934) of those who downloaded mHealth apps no longer used them, according to a national survey conducted in the United States [6]. A review of the previous literature on the use of mobile health by patients revealed that most studies focused on patients' acceptance and initial use of these applications [7] [8], while only a few studies focused on the continuance use of mHealth services [9]. From the perspective of mobile health providers, the continued use of a portal by users is a key factor in determining the ultimate success and sustainability of an information technology (IT) portal, which is more valuable to study than just the first use [10]. In other words, IT or IS's long-term success depends more on its continuous use than on its initial deployment.

Information system usage behavior can be divided into pre-adoption behavior

and post-adoption behavior, in which continued IS usage or IS continuance belongs to post-adoption behavior [11]. The intention of continuous use of information systems refers to an individual's intention to continue or reuse it after initial use or acceptance. According to Bhattacherjee [10], the behavior of users to continue using an information system is similar to repeated purchase behavior. Both types of decisions take place after the initial decision and are influenced by the initial user experience. Expectation confirmation theory (ECT) was originally used to study customer satisfaction and post-purchase behavior in the field of consumer behavior in marketing research. Bhattacherjee applied ECT to IS continuity studies in the field of IS research and proposed the expectation confirmation model (ECM) to study the drivers that influence consumers' behavioral intentions to continue using information technology after initial adoption. In this model, users first generate the initial expectations before buying products or services, gradually form attitudes or feelings after using the service or product, and then compare with the initial expectations to determine the extent of the expected, and ultimately affect the consumers' intention to continue to use through satisfaction. Nowadays, ECM is being widely used and extended to investigate the factors influencing users' intentions and behavior toward IS in various research settings, including shared nurses [12], digital textbooks [13], and mobile health apps [14].

Theory of Consumption Value (TCV) is a method used to determine preferences among consumers [15]. It is based on five dimensions: epistemic value, social value, emotional value, functional value, and conditional value. Functional value referred a product's functional, utility, or physical performance abilities, measured against product attributes. In consumer behavior, functional value has been extensively studied and demonstrated in numerous contexts and is associated with convenience or ease of use [16]. Emotional value is the psychological reaction brought on by using a product that might arouse powerful emotions [15]. Hedonic value and usefulness are combined to form the two-dimensional concept of emotional value. Mobile health services are useful in improving the quality of medical care for users with the purpose of meeting their medical needs. At the same time, users have a pleasant experience in using mobile health services, so the emotional value can be used to study mobile health. Social value reflects how useful a product is to a consumer based on its relationship with one or more particular social groupings. In a variety of products/services, social influence has been found to influence consumers' purchase or repurchase decisions [17]. In addition, social value is enhanced and favorably influenced by friends, family, and other close ties among customers. Epistemic value refers to the ability of a product to evoke curiosity, provide novelty, or satisfy a desire for knowledge. It has also been found to be an important component in deciding whether to purchase a new product/service. Conditional values emphasize the importance of context or context in consumer product choices. When it comes to purchasing intentions for goods related to health, conditional value has been shown to have a substantial

impact. Mobile health apps are vulnerable to similar views; Thus, contextual value can influence purchase intentions for mobile health services [18].

Based on the above description and introduction of the theory and model, this paper will select relevant factors and propose the hypotheses as shown in Table 1. Based on the theory of ECT and TCV, this paper also introduces two factors of perceived value and habit, combined with previous studies and the characteristics of mobile health, and proposes a research model according to the above assumptions as shown in Figure 1.

2. Materials and Methods

2.1. Questionnaire Design and Measurement Instruments

In order to collect data to validate the proposed research model and hypothesis,

Table 1. Hypotheses items.

Hypothesis	Items
H1	Social value has a positive impact on perceived value.
H2	Emotional value has a positive impact on perceived value.
H3	Functional value has a positive impact on perceived value.
H4	Conditional value has a positive impact on perceived value.
H5	Epistemic value has a positive impact on perceived value.
H6	Perceived value has a positive impact on satisfaction.
H7	Confirmation has a positive impact on satisfaction.
H8	Satisfaction has a positive impact on continuance intention.
H9	Perceived value has a positive impact on continuance intention.
H10	Habit has a positive impact on continuance intention.

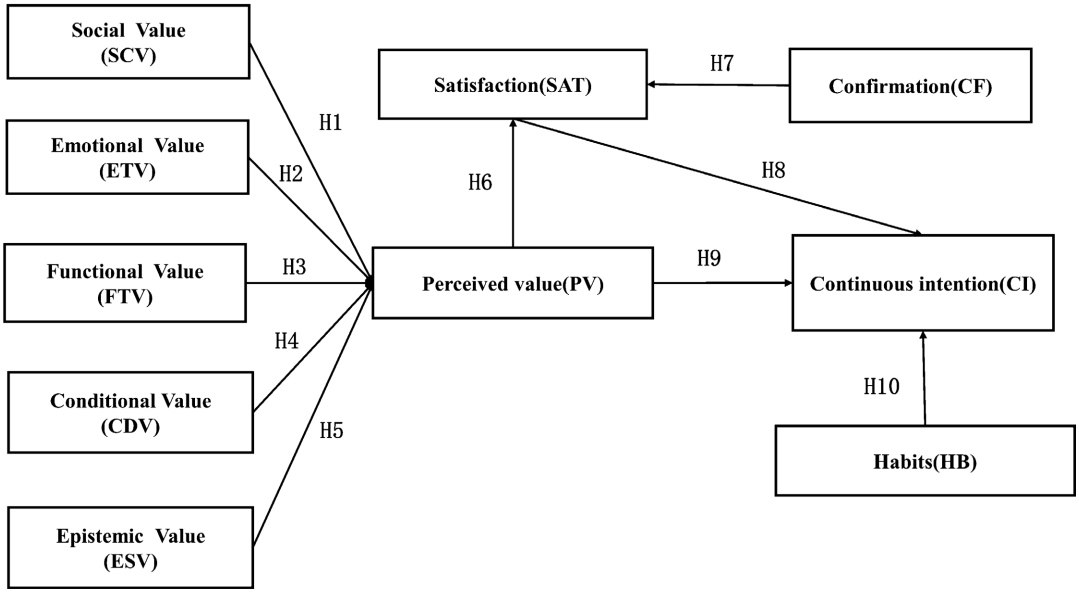


Figure 1. Proposed conceptual model.

a questionnaire was conducted.

This study adopts the research strategy of questionnaire survey, which has the advantage of measuring the variables required for the sample efficiently, cost-effectively, and accurately. Among many questionnaire survey methods, online questionnaires were selected for this study. Online surveys can span time and distance as well as collecting large sample sizes. China has a large population and has many mobile health users. Therefore, online questionnaires were chosen and distributed on the major social platforms and major online medical platforms.

According to the research hypothesis and research model, this study designed relevant questionnaire questions. The design of the questionnaire was divided into three parts: the first part mainly investigated the participants' use of mobile health, so as to screen the sample. The second part focuses on the demographic characteristics of the subjects, including gender, age, education level, and location. The third part is the measurement items of the study variables in the model, including functional value, emotional value, conditional value, epistemic value, social value, perceived value, confirmation, satisfaction, habit, and continuance intention. This scale includes 10 latent variables and 32 measurement items. The measurement items of the questionnaire were all from existing studies at home and abroad, and the scenarios of some items were revised in combination with the characteristics of telemedicine, so as to ensure both the content validity of the scale and its adaptability to mobile health. The items were measured on a 7-point Likert type scale used to express the degree of agreement of respondents to the survey content (1 - 7 indicates the range from "strongly disagree" to "strongly agree") and respondents were asked to give a score that best matched their actual feelings based on their actual use of mobile health services. The overall length of the questionnaire is appropriate, the layout is reasonable, and the questions are easy to understand, so as to facilitate the respondents to read and fill in. **Table 2** presents a list of questions for each study model variable.

2.2. Data Collection and Analysis

The study data were obtained from an online questionnaire survey on major online social and medical platforms. Surveys were conducted from July 2022 to August 2022. Of the 349 answer sheets that we collected, 317 were validly recorded, yielding an effective rate of 90.83%. SPSS 25.0 and Smart PLS 3.0 were used to analyze the data. The descriptive statistics of the data were assessed using SPSS 25.0. To test the research model and hypotheses, the partial least squares (PLS) method was used to verify the structural equation model (SEM) [22].

3. Results

3.1. Survey Participant Demographic Characteristics

The demographic information of the respondents is shown in **Table 3**. The proportion of female participants was higher than that of male participants. The highest frequency of respondents was observed in the 19 - 25-year age group (n

Table 2. Summary of construct with measurement items.

Construct	Measurement items	References
Social Value	SCV1: People who are important for me use mobile health apps. SCV2: I think using mobile health will help feel more acceptable. SCV3: I think mobile health apps are used by professionals.	Sheth *et al.*, 1991 [15]
Emotional Value	ETV1: I feel relaxed while using mobile health apps. ETV2: I enjoy using mobile health apps. ETV3: Using mobile health apps gives me pleasure.	Sheth *et al.*, 1991 [15]
Functional Value	FTV1: I think mobile health apps require less effort in comparison to offline medical. FTV2: I think mobile health apps are reliable. FTV3: I think mobile health apps helps to get quicker solution. FTV4: I think mobile health apps are beneficial to me.	Sheth *et al.*, 1991 [15]
Epistemic Value	ESV1: I am curious about people who use mobile health apps. ESV2: I am interested in seeking novel information in mobile health apps. ESV3: I feel using mobile health helps me acquire knowledge.	Sheth *et al.*, 1991 [15]
Conditional Value	CDV1: I believe I will use mobile health apps when I don't want to stand in a queue for health checkup. CDV2: I believe I will use mobile health apps when I have to make instant payments. CDV3: I believe I will use mobile health apps whenever there is a need for cashless transactions.	Sheth *et al.*, 1991 [15]
Perceived value	PV1: Compared to the information and services I get from mobile health services, it is worth the effort. PV2: Compared to the information and services I get from mobile health services; my time is well worth it. PV3: All in all, my involvement in mobile health is worth it.	Zeithaml VA., 1988 [19]
Confirmation	CF1: My experience with using mobile health better than what I expected. CF2: The benefit provided by mobile health was better than what I expected. CF3: Mobile health can meet demands in excess of what I required for the service. CF4: Overall, most of my expectations from using mobile health were confirmed.	Bhattacherjee, 2001 [10]
Satisfaction	SF1: The overall experience of mobile health services is poor. SF2: The overall medical experience of mobile health services is satisfying. SF3: Mobile health services can meet my medical needs.	Bhattacherjee, 2001 [10]
Habits	HB1: Using mobile health apps has become automatic to me. HB2: Using mobile health apps is natural to me. HB3: When faced with a particular task, using mobile health apps is an obvious choice for me.	Limayem *et al.*,2003 [20]
Continuous intention	CI1: I would like to continue using mobile health apps. CI2: I would like to recommend mobile health to my friends. CI3: I plan to use mobile health more in the future.	Davis FD *et al.* 1989 [21]

Table 3. Demographics of respondents.

Measure	Items	Frequency	Percentage
gender	Male	147	46.4%
	Female	170	53.6%
age	<18	20	6.3%
	19 - 25	94	29.7%
	26 - 30	76	24%
	31 - 40	65	20.5%
	41 - 60	41	12.9%
	>60	21	6.6%
education	High school education or lower	40	12.6%
	High school graduate	44	13.9%
	Bachelor's degree	182	57.4%
	The Master's degree or other	51	16.1%
Location	Rural	96	30.3%
	Town	132	41.6%
	City	89	28.1%
Mobile health service (participants were allowed to select multiple answers)	Appointment register	109	34.4%
	Online consultation	125	39.4%
	Medical report query	88	27.8%
	Medical information inquiry	87	27.4%
	Online drug purchase	90	28.4%
	Health monitoring	66	20.8%
	Evaluation doctors	78	24.6%
	Others	5	1.6%

= 94, 29.7%). Most respondents had a bachelor's degree (n = 182, 57.4%). Most of the respondents were in town (n = 132, 41.6%). Among the mobile health services used, the top three with the highest percentage were following: online consultation (n = 125, 39.4%), appointment register (n = 109, 34.4%) and online drug purchase (n = 90, 28.4%).

3.2. Measurement Model

Cronbach's alpha and composite reliability measures are commonly used to assess the internal consistency of a given structure [23] [24]. Values greater than 0.70 are acceptable. As shown in Table 4, Cronbach's alpha coefficient ranged from 0.837 to 0.912, which was greater than its threshold of 0.700, and the composite reliability ranged from 0.902 to 0.941, which was greater than its threshold of 0.700 and thus have good internal consistency reliability. The average variance

Table 4. The measurement model.

Constructs	items	loadings	Cronbach's Alpha	CR	AVE
Social Value (SCV)	SCV 1	0.905	0.902	0.939	0.836
	SCV 2	0.940			
	SCV 3	0.898			
Emotional Value (ETV)	ETV 1	0.848	0.846	0.907	0.765
	ETV 2	0.928			
	ETV 3	0.847			
Functional Value (FTV)	FTV 1	0.893	0.908	0.936	0.785
	FTV 2	0.892			
	FTV 3	0.902			
	FTV 4	0.856			
Conditional Value (CDV)	CDV 1	0.892	0.881	0.926	0.807
	CDV 2	0.911			
	CDV 3	0.892			
Epistemic Value (ESV)	ESV 1	0.876	0.875	0.923	0.800
	ESV 2	0.906			
	ESV 3	0.901			
Perceived value (PV)	PV 1	0.841	0.837	0.902	0.755
	PV 2	0.908			
	PV 3	0.856			
Confirmation (CF)	CF 1	0.899	0.912	0.939	0.793
	CF 2	0.924			
	CF 3	0.902			
	CF 4	0.834			
Satisfaction (SAT)	SAT 1	0.897	0.906	0.941	0.842
	SAT 2	0.941			
	SAT 3	0.915			
Habits (HB)	HB 1	0.900	0.879	0.925	0.806
	HB 2	0.930			
	HB 3	0.861			
Continuous intention (CI)	CI 1	0.882	0.875	0.923	0.800
	CI 2	0.916			
	CI 3	0.886			

extraction value ranged from 0.755 to 0.842, which was higher than the recommended value of 0.5 [25]. All factor loadings were greater than 0.7. In addition, the cross-loading of each measurement item and the arithmetic square root of the extracted mean-variance were examined, which showed good discriminant validity. The cross-loads of all constructs were higher than the cross-loads of the other constructs, and the correlation coefficients of any two constructs were smaller than the arithmetic square root of the extracted mean-variance as shown in Table 5. All the test results showed that the measurement model had good reliability and validity, which met the requirements of the study.

3.3. Hypothesis Testing

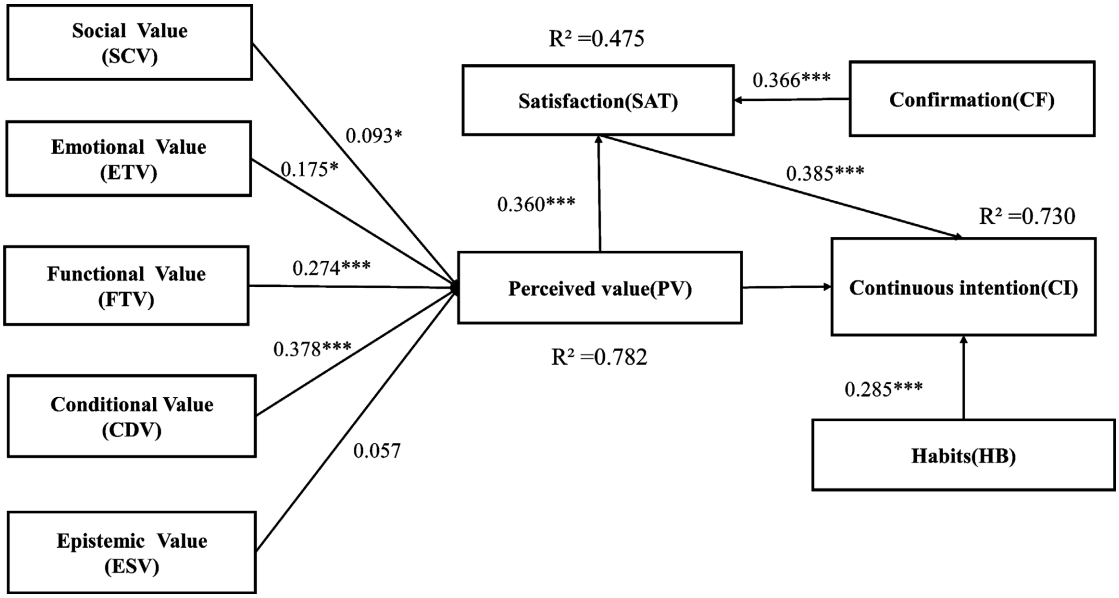
To evaluate the hypothesis, the structural model was analyzed. In this study, we used the Bootstrapping procedure to test the significance of all paths of the model. The T-value was used as the significance coefficient, and the significance level of 0.05 was used to test the hypothesis, that is, when the T-value exceeded 1.96, the hypothesis was valid. According to the data in Table 6, social value (H1: P = 0.023), emotional value (H2: P = 0.003), functional value (H3: P = 0.000) and conditional value (H4: P = 0.000) had significant effects on perceived value, while epistemic value (H5: P = 0.272) had no correlation with perceived value, and the variance of the explanation of perceived value reached 78.2%. Regarding satisfaction, perceived value (H6: P = 0.000), expected confirmation (H7: p = 0.000) had a great effect on and explained 47.5% of the variation in satisfaction. Similarly, satisfaction (H8: p = 0.000), the perceived value (H9: p = 0.000), and habits (H10: p = 0.000) were positively related to continuance intention, and the three factors explained 73.0% of the variation in continuance intention. Therefore, except for hypothesis H5, all hypotheses proposed in the model are supported, among which H3, H4, H6, H7, H8, H9, and H10 have high significance at 0.001 level. The hypothesis support of the study model is summarized in Table 6 and Figure 2.

Table 5. Correlation matrix and discriminant validity.

	SCV	ETV	FTV	CDV	ESV	PV	CF	SAT	HB	CI
SCV	**0.914**									
ETV	0.658	**0.875**								
FTV	0.644	0.810	**0.886**							
CDV	0.633	0.775	0.786	**0.898**						
ESV	0.611	0.820	0.767	0.745	**0.894**					
PV	0.659	0.798	0.817	0.830	0.749	**0.869**				
CF	0.660	0.866	0.846	0.799	0.819	0.803	**0.890**			
SAT	0.823	0.656	0.637	0.657	0.605	0.653	0.655	**0.918**		
HB	0.718	0.729	0.703	0.699	0.653	0.684	0.709	0.782	**0.898**	
CI	0.764	0.684	0.675	0.671	0.628	0.693	0.679	0.795	0.782	**0.895**

Table 6. SEM results.

Hypothesis	Path	T-statistics	P-values	Supported
H1	SCV -> PV	2.273	0.023	Yes
H2	ETV -> PV	2.990	0.003	Yes
H3	FTV -> PV	3.982	0.000	Yes
H4	CDV -> PV	6.876	0.000	Yes
H5	ESV -> PV	1.098	0.272	No
H6	PV -> SAT	5.783	0.000	Yes
H7	CF-> SAT	5.851	0.000	Yes
H8	SAT -> CI	6.304	0.000	Yes
H9	PV-> CI	3.565	0.000	Yes
H10	HB -> CI	4.712	0.000	Yes



Note: ***: $p < 0.001$; *: $p < 0.05$.

Figure 2. Structural analysis of the research model.

4. Discussion

By combining expectation confirmation theory and consumer value theory, our study proposed a research model of continuance intention toward mobile health. According to the regression results of the model path coefficient and the confidence level T value, it could be found that all hypotheses except hypothesis H5 have been verified. The positive effect between epistemic value and perceived value has not been verified. The possible reason is that users' use of mobile medical products or services does not aim at the novelty of the products or meet the needs of acquiring knowledge and information. According to the survey results of mobile medical services used by users in this paper, users use mobile medical

apps more for online consultation, appointment register and online drug purchase, which were for their medical purposes, rather than for obtaining information. On the other hand, unlike other products, mobile medical products are mainly developed for the convenience and practicability of users' medical treatment and to protect their health, rather than to stimulate users' curiosity. In addition, users' curiosity and interest in the new mobile medical technology tend to be more obvious before the adoption, but the research object of this paper is the intention to continue using the new mobile medical technology after the adoption, so epistemic value have no significant impact on the continuance use of mobile health services.

The main findings of this paper include the following points. First, functional value, emotional value, social value, and conditional value have a significant positive effect on perceived value. At the same time, emotional value, functional value, and conditional value have a positive effect on continuance intention through perceived value. Through the functional, emotional and conditional value of mobile medical products or services, users can obtain subjective feelings, perceive the value or benefits of mobile medical products or services to their behavioral decisions, and thus have the intention or tendency to continue using them. However, social value does not affect the continuance intention through the perceived value, which may be because users have the tendency of using mobile health due to the use of friends and relatives around them. However, this influence is not enough to affect their continuous use, and a person produces sustained will or behavior more motivated by its own internal demand. Activities are no longer seen to be exclusive to the privileged, and social values have little role in the decision to use internet services like healthcare apps. The practical advantages of apps have increased the importance of the functional value of healthcare apps. Meanwhile, value-added services are increasingly being included into healthcare apps to increase their utility.

Second, the mediating effect of satisfaction was significant between expected confirmation and continuance intention, and between perceived value and continuance intention. Before using a mobile medical product or service, people will create initial expectations for it according to the product description and other users' evaluations. Users will evaluate their real experience after using the product or receiving the service and generate opinions or expectations about them. This expectation will affect the user's perception of the mobile health service. Therefore, if the actual utility of mobile health services perceived by users does not live up to their expectations, it will trigger negative emotions and make them lose confidence in continuing to it. Finally, it will affect whether they will continue to use it. In this regard, perceived value also plays an important role. After users adopt or experience the product or services, they will make a subjective evaluation of whether they are satisfied or not through the perception of the overall value of the product or service, to have a positive impact on the continuance intention toward it. According to the results of this study, the direct positive effect of perceived value on continuance intention is greater than the indi-

rect effect.

Third, habit had a direct positive impact on the continuance intention. It also had a moderating effect on the relationship between satisfaction and continuous use intention. Venkatesh *et al.* [26] introduced the habit factor in UTAUT2, explaining that habit reflects the extent to which consumers naturally, repeatedly, and automatically perform relevant behaviors. This concept is consistent with Limayem *et al.* [27]. When users use mobile health as a spontaneous habit behavior, then they will continue to use it because of regularity and routine. At present, 99.7% of Chinese people use mobile phones to access the Internet. Online medical treatment through mobile phones has become a part of people's daily life.

5. Recommendation

Therefore, based on the above discussion, we make the following suggestions for mobile health product developers: First, improve the functions of mobile health products and platforms, simplify the use process, and provide personalized services. For example, medical records can be added online in the platform or application, and users can fill in the basic personal information, current medical history, past history, marriage and childbearing history, family history and other health and disease status, medical insurance holding status, etc., which can be classified according to eight human body systems, and users can fill in the corresponding system disease status. The platform or application can screen targeted information according to the user's medical record, push relevant popular science knowledge and medication items to the user, recommend doctors and institutions with high matching degree, and evaluate the patient's disease status and the coverage of various medical insurance, so that the patient can have an understanding of the expenses to be borne. Second, improve the suitability of mobile medical product content and enhance the content correlation. In the design of the platform or application page, users can be allowed to adjust the order of the plates according to the degree of interest, adjust the functions with the highest demand to the top, and put the unnecessary functions at the bottom or remove them directly, so as to increase the convenience of users, present the personalized design to the maximum extent, strengthen user stickiness, and improve users' willingness to continue to use the Internet medical. At the same time, in the payment link, the payment type can be enriched, the payment process can be optimized, so that users can focus their time and energy on the most important medical needs and reduce the time of the less important links, so as to improve the overall perceived benefits and satisfaction of users and strengthen the strong intention of continuous use. Third, mobile medical service providers should strengthen the compatibility and operability of mobile health apps and increase publicity efforts. Integrating mobile medical apps into daily work is essential for continuous use. Furthermore, strengthen the positioning of mobile health, take it as a common tool for daily life health consultation and preliminary consultation, and enhance patients' use habits of mobile health.

6. Conclusions

This study investigated the factors that influence users' intention to continue using mobile health and constructed a combined model based on ECT and TCV theory to predict continuance intention. The research model provided strong explanatory power. According to the statistical results, the factors that positively affect continuance intention include satisfaction, habit, and perceived value. At the same time, emotional value, functional value, and conditional value had indirect positive effects on continuance intention through perceived value. Confirmation also has an indirect positive effect on continuance intention through satisfaction. The results of this study can help mobile health product managers provide effective strategies to focus on these factors to promote continuous behavioral activities of mobile health users in China. The results are expected to provide value for the continued development of mobile health in China and similar settings.

This study also involved some limitations. This paper explores the intention to use mobile health from the perspective of perceived benefits. However, the factors affecting the occurrence of an event are various, and there are also some other factors that have effects on the intention to continue using mobile health, such as perceived risk. As a new medical mode based on information technology, the existence of perceived risk cannot be ignored. Cocosila, M. and Turel, O. [28] believed that consumers' risk perception itself is a significant factor in the adoption of mobile medical services and concluded that technology risk perception has an obstructive effect on mobile medical services, while activity risk perception has a driving effect, both of which show a very significant impact. Therefore, future studies can incorporate perceived risk into the research model to explore the impact mechanism of risk factors on mobile health.

Conflicts of Interest

The authors declare no conflicts of interest.

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