Influencing Factors of Chinese Users' Intention to Use Mobile Health Service

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Abstract

The objectives of this paper are 1) to analyze the influencing factors on the intention to use and the satisfaction in using the mobile health services, and 2) to analyze the mediating effect of user satisfaction on product quality and perceived risk on the user intention to use mobile health services. This paper explores the factors that influence the use of mobile health services. A combination of theoretical models on willingness to use such as UTAUT, health belief model (HBM), D&M model, and risk theory, hypothesis, and research model are proposed. The target population is 11,600 residents over the age of 18 living in Yingze Community, Taiyuan City, Shanxi Province, China. A total of 429 samples were selected by simple random sampling method. This study adopts the method of a questionnaire survey for quantitative research, and uses SPSS 24.0 to perform statistical analysis. AMOS 24.0 is verified by the structural equation model. The empirical results show that performance expectancy, health concerns, and product quality positively affect user intention, and that product quality and perceived risk have an impact on user intention to use through the mediating variable of user satisfaction. User satisfaction mediates the correlation between product quality, perceived risk, and intention to use. Finally, based on the empirical results, relevant suggestions are put forward

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and research prospects are made, hoping to promote the development of the mobile health service industry in China.

Keywords: Influencing Factors, Chinese Users, Intention to Use Mobile Health Service

1. Introduction

The WHO has acknowledged mobile health as a positive approach to health administration(Albabtain, AlMulhim, Yunus, & Househ, 2014). Mobile health service (MHS) efficiently incorporates mobile electronics science into the clinical occupation to useful resources in the discount of medical expenses, the enchantment of medical standards, and the facilitation of patients' get admission to medical services. The successful integration of digital technology with medical care to improve individualized care is the most promising future for mobile health services, but at the same time, it also faces many problems. Some online consulting and health service platforms (such as Chunyu Doctor, Haidao Doctor, Dingxiang Garden, etc.) have many users, but only a small number of them are active users. Despite the somewhat widely recognized nature of mHealth services, the size of users using mHealth services has not met the expectancy. Discussion of the influences that influence the intention to use mHealth services not only contributes to the advancement of e-science to a certain extent but more importantly, has far-reaching implications for the health and medical field.

User adoption studies focus on the adoption of smart mobile health services such as wearable devices, online medical services, and intelligent health management. J. Li, Ma, Chan, and Man (2019) investigated the factors influencing the acceptance of smart wearable systems among older adults and showed that cognitive usefulness, compatibility, convenience, and self-reported health status had a significant positive effect on the willingness of older adults to use such mHealth services. Xue et al. (2012) examined the perceived attitudes of women over the age of 50 toward the adoption of health intervention software and found that perceived usefulness, perceived ease of use, compatibility, and subjective norms had significant effects in

predicting older women's willingness to adopt. Zhang, Luo, Nie, and Zhang (2017) studied users' intention to adopt wearable medical technologies from three perspectives: technical attributes (i.e., perceived convenience, perceived irreplaceability, perceived trustworthiness, and perceived usefulness), health attributes (i.e., health beliefs), and consumer attributes. C.-R. Li, Zhang, and Han (2021) found in their study that physician service quality, interpersonal relationship quality, and electronic word of mouth had a positive effect on patients' intention to adopt online follow-up services. In addition, disease privacy and the availability of private physician services significantly moderated the relationship between physician service quality and e-word-of-mouth and patient intention to adopt online follow-up services.

This article takes mobile health services as an example, studies the willingness of Chinese users to use mHealth services, establishes an innovative research model, and empirically studies and validates the assumptions in the model. This provides security and support for the promotion of mHealth services and the development of related devices.

2. Literature Review and Hypothesis

2.1 Performance expectancy and intention to use MHS.

Performance expectancy (PE) refer to the fact that by using mobile health services, users can effectively improve their physical fitness, enjoy disease monitoring, early warning, alerts, and consultation services, and stay informed about their health status and have access to valuable medical information resources. Numerous studies have proven that performance expectancy has a favorable impact on users' behavioral intentions. In general, users tend to use mHealth services when they believe that they can assist them in obtaining more quality and efficient services (Alam, Hoque, Hu, & Barua, 2020). Therefore, hypothesis 1 is proposed.

H1: Performance expectancy has a significant relationship with use intention to use mobile health services.

2.2 Health concern and use intention to use MHS.

The demand for health information is not only limited to people with diseases, but healthy people also need to use health knowledge for disease prevention and disease risk assessment. Health concern (HC) is defined as the degree of attention users pay to their own health status and health problems. When people pay attention to health, there is a need for health information. The likelihood of using mHealth is positively impacted by the level of health concern (Cho, Quinlan, Park, & Noh, 2014). As a result, hypothesis 2 is formulated:

H2: Health concerns have a significant relationship with use intention to use mobile health service.

2.3 Product quality and use intention to use MHS.

Product quality(PQ) refers to the overall performance of a medical-related mobile application in terms of systems, information, and services((Huang, Zhang, & Peng, 2020). Due to the particularity of mobile applications, product quality not only includes the smoothness of system operation, user experience, and whether the information provided is true and reliable, but also whether the medical services provided are timely to ensure the real-time interaction between doctors and patients. Therefore, the system quality, information quality and service quality of products together constitute the product quality of mobile medical services. Its positive effect on user behavior, intention and user satisfaction has been confirmed by many researchers. The better the product quality, the higher the user satisfaction and the stronger the intention to use (Haryaka, Agus, & Kridalaksana, 2017). As a result, hypotheses 3 and 5 are formulated:

H3: Product quality has a significant relationship with use intention to use mobile health services.

H5: Product quality has a significant relationship with users' satisfaction with mobile health services.

2.4 Perceived risk and use intention to use MHS.

Perceived risk is a concept first derived from research in the field of psychology. There is an unpredictable consequence of any purchase decision made by a user, and this unpredictable consequence is risk. If the result of an individual's actions is unpleasant or unfavorable to oneself, then the magnitude of the potential loss of such an outcome is the perceived risk. Mobile medical care involves personal health and life safety issues. Compared with other technological services, users will pay greater interest to the protection and reliability of mobile health services (Reychav et al., 2019). When using mobile services in the online environment to carry out entertainment, social, medical, and shopping activities, it is bound to reveal sensitive information such as your account, health, needs, preferences, etc., especially when it is related to your own vital interests, you will pay greater interest to the reliability and protection of mobile services. The hazards that consumers anticipate will come with utilizing mobile services are referred to in this study as the perceived risk (PR), including information privacy security, functions, physical and mental health, etc. The more risk users feel in the process of using, the more reluctant they are to use, that is, the user's decision to use mobile services is adversely affected by these risk factors (Junnonyang, 2021). As a result, hypotheses 4 and 6 are formulated:

H4: Perceived risk has significant relationship with use intention to use mobile health services.

H6: Perceived risk has a significant relationship with users' satisfaction with mobile health services.

2.5 User satisfaction and user intention to use MHS.

The long-term development and effectiveness of emerging technologies and systems is closely related to users' adoption willingness and behavior, which is already one of the most significant and important topics in the field of user reception research. The TAM is a research model on behavioral intention, mainly based on individual psychological behaviors. It is currently widely used in various fields, including e-commerce, mobile payment, software applications, website platforms, and online

learning systems. The following summarizes the main theoretical models of its development process. Expectation Confirmation Theory (ECT) considers satisfaction as a user's assessment of a service experience, which may or may not be satisfactory. The major factor influencing the continuation of a good or service is user happiness. If users are satisfied when using the product, they will continue to use it; Conversely, if they are dissatisfied, they will stop using it and switch to other products. In the area of information systems, user satisfaction(US) is the final emotional attitude of users who directly interact with the application program towards the system, which affects users' attitudes and acceptance of technology, the success of information systems, and their willingness to continue using the system (Vaezi, Mills, Chin, & Zafar, 2016). The more all their needs are met in using mHealth services for health consultation, health information inquiry, and treatment experience exchange, the greater the consumer satisfaction, and the more intent there is to use online health and medical applications (Keikhosrokiani, Mustaffa, Zakaria, & Abdullah, 2020). As a result, hypothesis 7 is formulated:

H7: User satisfaction has a significant relationship with user intention to use mobile health services.

2.6 Mediating Effect of User satisfaction

In the model of UTAUT, the direct influencing factors of use behavior include behavioral intention and facilitating conditions; The mediator factors of gender, age, and experience interfere with the impact of effort expectation on behavioral intention; the moderator variables of gender, age, experience, and voluntariness of use interfere with the effect of social influence on behavioral intention. Performance expectation, effort expectation and social influence effect use behavior through their influence on behavioral intention; The effect of performance expectations on behavioral intention is interfered by gender and age; The moderator variable's experience disrupts the effects of facilitating conditions on use behavior. The influencing components of behavioral intention include performance expectation, effort expectation, and social influence (Venkatesh et al., 2003). Different from traditional commodities, mobile phone applications are new products in the Internet era.

The quality of the product may also have an effect on the user's satisfaction, thereby affecting the willingness to use the product (Oppong, Hinson, Adeola, Muritala, & Kosiba, 2021). The product quality of mobile services has a positive impact on purchase intention and user satisfaction. Product quality influences intention to use by strengthening mediating factors such as user satisfaction. As a result, hypothesis 8 is formulated:

H8: User satisfaction plays a mediating role in the relationship between product quality and use intention.

Mobile health service, as an innovative service that adapts to the times, can bring convenience to the people, improve the work efficiency of medical institutions, ease doctor-patient relationship and promote social development, is bound to gain more and more popularity and attention in the future (Alam, Alam, Uddin, & Mohd Noor, 2022). However, considering the sensitivity of health information privacy and the complexity of the network environment, users' concerns about health, functions, and finances are likely to affect their satisfaction with mobile health services, and thus affect users' attitudes toward using them. When users believe that the service puts them at risk, satisfaction may decrease, resulting in lower intention to use. As a result, hypothesis 9 is formulated:

H9: User satisfaction plays a mediating role in the relationship between perceived risk and use intention.

3. Conceptual Framework

Based on the characteristics of mobile service and the health service, the health belief model and perceived risk theory are introduced based on UTAUT and D&M IS Success Model. Taking performance expectancy in UTAUT (Venkatesh, Morris, Davis, & Davis, 2003), product quality in D&M model (DeLone & McLean, 2003), health concern in health belief model (Glanz, Rimer, & Viswanath, 2015) and perceived risk (Van der Heijden, Verhagen, & Creemers, 2003) as independent variables, and user satisfaction as mediating variables, the influencing factor model of usage intention of mobile health was constructed, as shown in Figure 1.
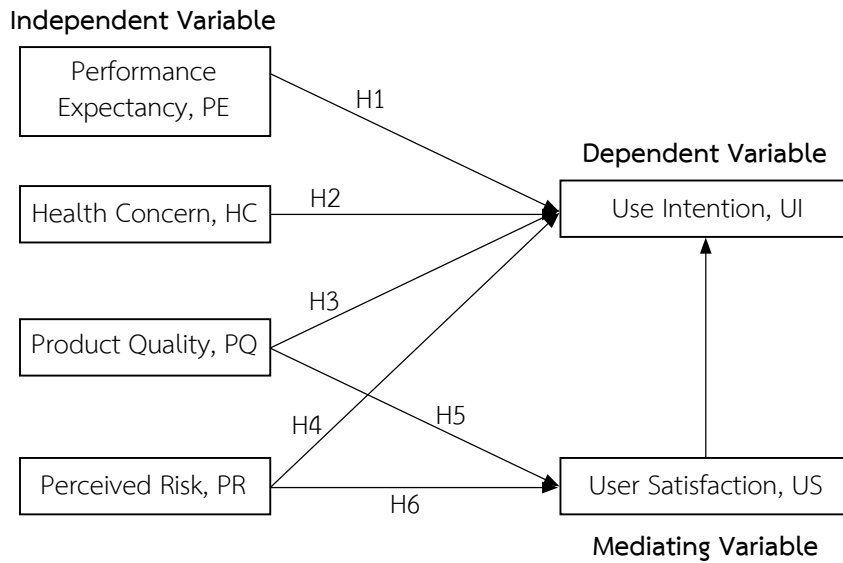
Figure 1 Research Conceptual Framework

4. Method

4.1 Research Design

The research method of this paper is quantitative research methodology. Quantitative research was carried out by questionnaire survey. A questionnaire was designed according to the variables, and data were collected through the questionnaire survey. A simple random sample of 429 was obtained using simple random sampling. Finally, the collected data are analyzed empirically. SPSS and AMOS software were used to conduct descriptive statistical analysis, reliability and validity test, confirmatory factor analysis and correlation analysis on the collected data. Then the structural equation model for path analysis was constructed to calculate the effect of each variable, analyze the influence of each factor on mobile medical services, and test the mediating role of mediating variables, to verify the validity of each hypothesis proposed.

4.2 Respondents

The participants are residents of Yingze District in Taiyuan, Shanxi Province, China. Among the valid samples of the respondents, male accounted for 60.6% and female accounted for 39.4%, and the proportion of male was slightly higher than that of female. In terms of age, 12.4% are under 25 years old, 27% are 26-35 years old, 28% are 36-45 years old, 24.2% are 46-60 years old, 8.4% are over 60, and the most people are 26-45 years old. From the perspective of educational background, the population with bachelor's degree is the largest, with a total of 172 people, accounting for 40.1%, followed by the population with college degree, a total of 112 people, accounting for 26.1%, and the number of people with master's degree or above and high school or below is less. They accounted for 24% and 9.8% respectively. In terms of occupations, students, organs and institutions, enterprise employees account for the majority, accounting for 19.8%, 24.5%, 22.4%, which represents 66.7% of the total number of people, while freelance, manual workers, retirees and others are less, which represents 33.3% of the total number of people.

4.3 Measures/Instruments

In this study, performance expectancy is a kind of health expectation, which means that mobile medical services can provide effective medical and health services. It was measured by 3 items that are adapted from (Davis, 1989). Health concern refers to the degree of concern an individual has about his own physical health and health-related problems, including his knowledge of his own health status and the health problems he faces, as well as his ability to maintain a good level of health or improve it. It was measured by 3 items that are adapted from (Cho, Quinlan, et al., 2014). Product quality refers to the system quality, service quality and information quality of mobile health products. It was measured by 3 items that are adapted from (Aljaberi et al., 2018). Perceive risk refers to the psychological expectation of negative or adverse outcomes that may occur during the propensity for conduct of mobile health services by users. It was measured by 3 items that are adapted from (Stone & Grønhaug, 1993). User satisfaction refers to the user's satisfaction with the product or service in the process of using mobile medical services. It was measured by 3 items

that are adapted from(Kim, Chang, Park, & Lee, 2015). Use intention refers to the possibility or subjective willingness of users to feel that they will use mobile medical services at a certain time in the future. It was measured by 3 items that are adapted from (Yu et al., 2021).

5. Results

Table 1 provides the reliability results of all the study constructs, the average variance extracted (AVE) and the values of construct reliability (CR).

Table 1 Constructs validity and reliability

Variable	Item	Loading	AVE	CR
Performance expectancy	PE_1	0.720	0.490	0.742
	PE_2	0.697		
	PE_3	0.682		
Health Concern	HC_1	0.719	0.650	0.847
	HC_2	0.881		
	HC_3	0.810		
Product Quality	PQ_1	0.747	0.688	0.868
	PQ_2	0.875		
	PQ_3	0.861		
Perceived Risk	PR_1	0.905	0.814	0.929
	PR_2	0.930		
	PR_3	0.870		
User Satisfaction	UI_1	0.893	0.753	0.902
	UI_2	0.838		
	UI_3	0.872		
Use Intention	US_1	0.933	0.824	0.933
	US_2	0.923		
	US_3	0.865		

Table 1 shows that the CR calculated from the standardized factor loadings of the questionnaire items were all greater than 0.7 and the AVE was greater than 0.5 except for performance expectancy. The AVE values for the variables of this study exceeded 0.5 and the CR values exceeded 0.7, so the sample data had good convergent validity and were suitable for future path analysis(Hair Jr, Black, Babin, & Anderson, 2010). PE is also acceptable because it achieves what is suggested by (Fornell & Larcker, 1981): AVE > 0.4 is acceptable and CR needs to be higher than 0.6.

According to the theoretical assumption model proposed above, AMOS 24.0 is used to build a mobile medical service usage intention model, in which performance expectation (PE), health concern (HC), product quality (PQ), and perceived risk (PR) are external factors and potential variables. Satisfaction (US) and use intention (UI) are internal latent variables, Figure 2 show the SEM of mobile health use intention and regression weights of the model.
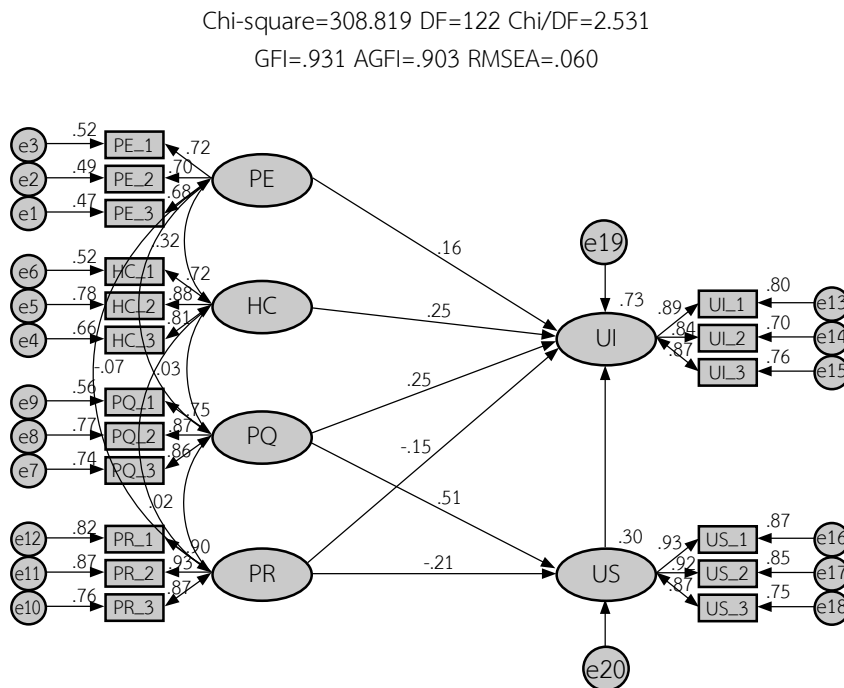
Chi-square=308.819 DF=122 Chi/DF=2.531
GFI=.931 AGFI=.903 RMSEA=.060

Figure 2 Regression Weights of Mobile health Use Intention

According to the model and AMOS24.0, how well the model graph matches the data is measured by the model fit index. This is done to determine how well the covariance matrix generated by the hypothesis model fits the covariance matrix generated by the sample data. This study uses AMOS 24.0 to estimate the model parameters by the maximum likelihood method. The obtained model fit results are shown in Table 2.

Table 2 Fit Satisfaction

Fit Measures	Recommended Value	Sample Value
Chi-square/df	<5.0	2.531
GFI	>0.9	0.931
AGFI	>0.9	0.903
NFI	>0.9	0.942
CFI	>0.9	0.964
RMSEA	<0.08	0.06

From table 2, the model is fit for the research.

The eight research hypotheses' contents are examined considering the findings of the route coefficient analysis, and the findings are shown in Table 3.

Table 3 Path Coefficient and Hypothesis Result

Hypothesis	Path	Estimate	S.E.	C.R.	P	Decision
H1	UI<---PE	0.163	0.06	3.645	***	Supported
H2	UI<---HC	0.250	0.056	6.433	***	Supported
H3	UI<---PQ	0.246	0.05	5.48	***	Supported
H4	UI<---PR	-0.152	0.034	-4.359	***	Supported
H5	US<---PQ	0.514	0.07	10.503	***	Supported
H6	US<---PR	-0.208	0.056	-4.592	***	Supported
H7	UI<---US	0.523	0.033	12.275	***	Supported

It showed that hypothesis H1 to H7 are all supported.

The user satisfaction mediation effect is examined in this article using the Bootstrap approach. Use AMOS 24.0, set Bootstrap = 1000, confidence = 95%.

As shown in table 4, direct effect is 0.275, indirect effect is 0.300, total effect is 0.575(total effect = direct effect + indirect effect). In addition, the mediating effect of product quality on use intention through user satisfaction is significant. H8 is supported.

Table 4 Mediating Effect Test of PQ-US-UI

Path	Effects	Coefficient	95% Confidence Interval		P	Mediation Judgment
			Lower	Upper		
PQ-US-UI	Total	0.575	0.235	0.382	***	
	Direct	0.275			***	Mediation
	Indirect	0.300			***	

As shown in table 5, direct effect is -0.146, indirect effect is -0.105, total effect is -0.251(total effect = direct effect + indirect effect). In addition, the mediating effect of perceived risk on use intention and through user satisfaction is significant. H9 is supported.

Table 5 Mediating Effect Test of PR-US-UI

Path	Effects	Coefficient	95% Confidence Interval		P	Mediation Judgment
			Lower	Upper		
PR-US-UI	Total	-0.251	-0.156	-0.064	***	
	Direct	-0.146			***	Mediation
	Indirect	-0.105			***	

6. Conclusion

The main objective of this paper is to investigate the factors influencing the intention to use mobile health services. It is found that performance expectancy had a positive effect on intention to use, health concern had a positive effect on intention to use, product quality had a positive effect on intention to use, and perceived risk had a negative effect on intention to use. The study also shows that user satisfaction mediates the paths of product quality, perceived risk, and use intention, respectively. The results of this study can provide a reference for promoting mHealth applications. Mobile health services have become one of the most significant channels for online information and health services because of the rapid growth of mobile Internet technology. Therefore, research on the use of influencing factors to carry out the intention of mobile medical service users is very important. By combing the existing research results, combining the characteristics of mobile medical services and communicating with experts and scholars in the industry, on the basis of UTAUT model and D&M model, adding health belief model and perceived risk theory, constructing the theoretical model of mobile medical service users' intention to use from the influencing factors of performance expectation, health concern, product quality, perceived risk and user satisfaction, and designing The questionnaire data were collected and distributed through online and offline methods, and using SPSS software, the validity and reliability of the recovered questionnaire data were assessed, and the theoretical model and research hypotheses were verified using AMOS software.

7. Discussion

To investigate the factors influencing the intention to use mHealth services, this paper validates that performance expectancy, health concern, product quality, perceived risk, and user satisfaction have an impact on users' use of Health services through a quantitative research approach. This is consistent with earlier studies. Examples of the antecedents explored include technological artifacts from UTAUT, consumer environments from UTAUT2, and psychological behavior theories such citizens' channel preferences and product selection criteria (Dwivedi et. al., 2016).

It also explores the impact of cultural domination on citizens' perception. The research target is residents from the U.S., Canada, and Bangladesh. The findings of the research are congruent with those of this work in that performance expectancy has a substantial influence on the motivation of mobile healthcare. In order to determine the key factors influencing older customers' motivation to accept and utilize mHealth services, (Hoque & Sorwar, 2017) made a substantial contribution by creating a theoretical model based on UTAUT and experimentally testing it. The results of the study show that performance expectancy affects the intention of mobile medical services. The conclusion is consistent with the results of this paper. By quantitative study, (Cho, Park, & Lee, 2014) discovered that people's health knowledge directly affects how they utilize health applications. (Cho, Quinlan, et al., 2014) discovered that usage intention was significantly impacted by health awareness. Intention to use mobile health services is influenced by health concerns, according to the findings of these research, which are congruent with those of this study. (Chung & Park, 2019) suggest a cloud-based healthcare network with a mobile health service with assured QoS. (Nisha, Iqbal, & Rifat, 2019) looks at how knowledge and service quality, along with other underlying factors, affect future intentions to use m-Health services in the context of Bangladesh. These research findings corroborate those in this study, and product quality has an impact on consumers' intentions to utilize mobile health services. In order to increase users' intention to use mHealth services, (Liu, Lu, Zhao, Li, & Shi, 2022) set out to look at the direct and indirect effects that users' self-efficacy and privacy concerns have on their desire to utilize mHealth services. They also offered advice for mHealth service providers. It proves that user privacy concerns affect the behaviors of mobile terminal users (Rowan & Dehlinger, 2014). These research findings support the findings of this paper: use intention is influenced by perceived risk.

However, due to the restrictions on research capabilities and costs, this study cannot analyze all factors affecting mobile health services. For instance, (Deng, Mo, & Liu, 2014) used a study paradigm based on the TPB, the value disposition behavior model, and four aging-related components to examine how older and middle-aged

adults adopted mobile health services. Age thus has the potential to be a new influencing element. Additionally, to understand why older customers want to keep using the service, consider the traits of older consumers, such as health status and technological anxiety can be factors (Meng, Guo, Zhang, Peng, & Lai, 2020). (Cocosila & Turel, 2019) found that non-adoption risk is a moderately strong antecedent of motivational factors in contrast to adoption risk that hinders the acceptance of a mobile service supporting health promotion. In other words, risks can also arise when mobile services are not applicable. These are very innovative perspectives, and they can be considered continuing to discuss in the future.

8. Recommendation

From the result of the research, we found several recommendations as follows:

Management Recommendations. Evaluation of a new product into the market after the success or not, the user perspective is not to be ignored the most important, good product quality, wide user coverage, high willingness to use, then these products will be accepted by the market. The findings of the empirical study demonstrate that consumers' happiness with mHealth services and, consequently, their desire to utilize them, are highly influenced by product quality and perceived risk. This study evaluates the critical elements that influence how consumers utilize mHealth services based on the findings of the empirical investigation. It then gives the following suggestions to mHealth service providers.

This study had several limitations that could be addressed in future studies. First, the scope of the sample can be expanded. China is a vast and populous country, and there are differences between regions. To obtain a more comprehensive picture of users' perceptions of mHealth, the data collection area was expanded to make the study results more representative. Second, the study participants were categorized according to different health conditions. Users with different health states have different needs and different intentions to use mHealth services. Whether studies on the use of mHealth services by different groups can lead to different conclusions also deserves further research.

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