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Mohammad Zahedul Alam

*School of Management, Wuhan University of Technology, Wuhan, P.R. China-430070; Department of Marketing, Bangladesh University of Professionals, Bangladesh, zaheddu2000@yahoo.com*

Wang Hu

*School of Management, Wuhan University of Technology, Wuhan, P.R. China-430070, wanghu61@126.com*

Md Osman Gani

*Department of Marketing, Bangladesh University of Professionals, Bangladesh*

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# An Empirical Analysis of the Influencing Factors of Adoption of Mobile Health Services in Bangladesh Based on Extended UTAUT Model

Mohammad Zahedul Alam<sup>1,2</sup>, Wang Hu<sup>1</sup>, Md Osman Gani<sup>2</sup>

<sup>1</sup>School of Management, Wuhan University of Technology, Wuhan, P.R. China-430070

<sup>2</sup>Department of Marketing, Bangladesh University of Professionals, Bangladesh

**Abstract:** The aim of this study was to examine the critical factors affecting the adoption of mobile technologies in healthcare system of Bangladesh. Using the Unified Theory of Acceptance and Use of Technology (UTAUT) model as a theoretical framework, this study incorporates perceived reliability, price value as new factors that reflects the user's reliability, beliefs and monetary concerns in the acceptance of mHealth services in the context of Bangladesh. A cross sectional survey questionnaire was used to collect data from 296 participants from general mHealth users in Bangladesh. The results demonstrate that performance expectancy, effort expectancy, social influence, facilitating condition & perceived reliability had significant influence on the intention to use mHealth services in Bangladesh. Surprisingly, price value ( $p > 0.05$ ) had no significant influence on adoption of mHealth services. The insights from this study could benefit mHealth services providers, agencies and policy maker in implementing more effective marketing strategies to increase the acceptability of this service. With the proposed model, it is possible to develop better mHealth services to meet the requirements of the common people based on widely available Smartphone.

Keywords: mHealth; UTAUT model; perceived reliability; general users; Bangladesh.

## 1. INTRODUCTION

The digitalization of healthcare can increase efficiency and allows for the provision of better quality healthcare services, with many benefits to stakeholders <sup>[1]</sup>. As an emerging field in the healthcare industry, mobile health service has been paid more and more attention in recent years <sup>[2]</sup>. mHealth is defined as the use of portable electronic devices, i.e. mobile phones, patient monitoring devices, personal digital assistants (PDAs), sensors, wireless networks and other wireless devices for mobile voice and data communication over a cellular or other wireless network of base stations to provide health information. Recent evidences demonstrate that mHealth can be a blessing brought about by Information and Communication Technology (ICT) which is an alternative solution to resolve healthcare problem. It delivers healthcare services by overcoming geographical, temporal, and even organizational barriers. It has facilitated ease of access to health care for all and especially for female, the elderly and the poor who can now easily access medical advices through smart mobile phone. With unique features of mobile technologies, numerous mHealth projects are being implemented globally for healthcare delivery <sup>[3]</sup>. Mobile devices are used to acquire information where personal computers were not available; in that case, Smartphone are the sole device for the internet connection due to economical and public Wi-Fi access. In Bangladesh, although many health indicators show much improvement, until today, the healthcare sector of the country is left with significant accessibility and affordability challenges. Bangladesh as a whole has a severe shortage of hospitals, clinics, doctors, and nurses. Surprisingly, Bangladesh has been recognized as one of 57 countries in the world with an imbalanced health system and facing a severe healthcare disaster due to insufficient skilled health workers including physicians, nurses and dentists and other healthcare resources <sup>[4]</sup>.

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<sup>1</sup> Corresponding author. email: zaheddu2000@yahoo.com, wanghu61@126.com.

Under these circumstances, alternative and cost-effective solution is essential for providing healthcare services in the context of Bangladesh. This ICT-enabled services can be an effective solution for the countries including Bangladesh where healthcare system faces various challenges. In Bangladesh, there is an increasing interest in engaging mobile systems in all aspects of citizens' and customers' daily life due to high penetration rate of mobile phone usages. The government has shown highest interest to attain the Digital Bangladesh Vision 2021 by incorporating ICTs into its health delivery services. In the current study, the authors emphasized only on the delivery of health services via Smart phone only.

As for mobile technology, there are over six nationwide independently owned cell phone operators with 157 million subscribers. Nearly, 80% have mobile phone subscriptions in this country and a calculated 13.8% annual growth rate and 90.5 million internet users in Bangladesh and about 8.2 million are Smartphone users <sup>[5]</sup>. In comparison to other developing countries, mHealth is at the infant stage in healthcare industry of Bangladesh where mHealth services have been evolved in the mid-1999. A total of 26 initiatives with direct or indirect associations with eHealth and/or mHealth have been undertaken in Bangladesh <sup>[6]</sup>. On the other hand, Different public and private hospitals, nongovernment organizations (NGOs), and private organizations have introduced a number of eHealth programs and services over the time.

In order to achieve the sustainable health development goals, the government invested huge amounts of budget for eHealth system and has extended their resources to the training of doctors, administrative staffs and nurses to ensure the effective utilization of eHealth services. In the context of healthcare challenges, mHealth is being promoted as a route to cost effective, equitable and quality healthcare in Bangladesh <sup>[7]</sup>.

Although, the growth of mHealth and its potential benefits is incredible, but the adoption of mHealth remains still low in the context of Bangladesh. Khatun, Heywood <sup>[8]</sup> conducted a study on mHealth over 4915 randomly selected respondents from a remote rural district in Bangladesh. They found that only 5% of respondents used the services on their mobile phone. A study by Sorwar, Rahamn <sup>[6]</sup> reported that few citizens were aware of mHealth services and perceived them as potentially useful. But the adoption rate of mHealth among the general people in Bangladesh is very insignificant. They are not much aware about the mHealth services. A large number of mHealth projects have not been successfully implemented in the existing health system and adopted by users. Many telemedicine/mHealth projects have been discontinued over the years and are dysfunctional whereas mHealth service is not well accepted by its citizen <sup>[9]</sup>. But, not all of its users employ mobile phones to adopt health services and only a small minority of them continues using the services. mHealth services are being introduced in Bangladesh with the intention of improving the access of healthcare to all citizens, quite a few number of researchers have addressed the related issues of such technology. These raise the questions why and what factors affect mHealth adoption. So, the question arises, "What are the key factors affecting the adoption of mHealth services among general people in Bangladesh?" Furthermore, a considerable number of studies in different contexts of various countries have focused on the factors that impact the adoption of mHealth services.

From a practical point of views, pinpointing the variables that influence the usage of mHealth in Bangladesh would increase the capacity of decision makers in applying proper efficient strategies for increasing the usage of mHealth through controlling and manipulating the independent variables. But Little is known about the adoption behavior of mHealth in the context of Bangladesh and it is not clear what factors affecting the adoption of mHealth in Bangladesh. Furthermore, the gap in the mHealth literature in Bangladesh would be bridged by proposing a comprehensive conceptual model, which scrupulously clarifies the use of mHealth services from the perspective of Bangladeshi users.

## 2. REVIEW OF LITERATURE

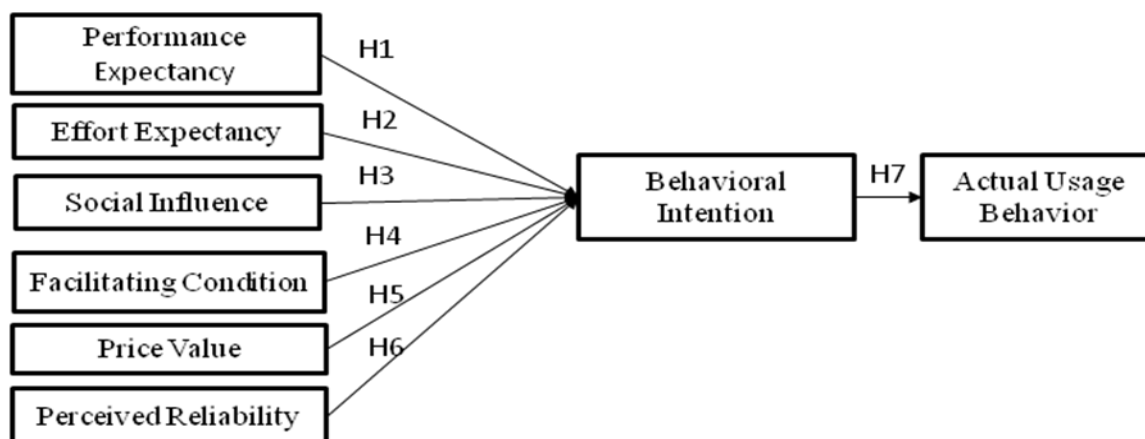
Williams, Rana <sup>[10]</sup> revealed that there are many journals and conferences publishing UTAUT research, with contributors from many regions although the majority is unsurprisingly from the developed countries. Few previous studies have been examined from patients' perspective. Lim, Xue <sup>[11]</sup> revealed that Perceived Usefulness and Self-efficacy positively predicted the intention to use mobile phones to seek health information. Phichitchaisopa and Naenna <sup>[12]</sup> found that the factors with a significant effect on mHealth adoption are performance expectancy, effort expectancy, facilitating conditions and behavioral intention on technology adoption. Rana, Dwivedi <sup>[13]</sup> explored that performance expectancy and facilitating conditions have significant influence on IT usage while effort expectancy and subjective norms do not influence on IT adoption. Shareef, Dwivedi <sup>[14]</sup> shown that customer attitude (CA), perceived usefulness (PU) and perceived ease of use (PEoU) are vital factors affecting the acceptance of the technology. Lee and Han <sup>[15]</sup> demonstrated that performance expectancy, effort expectancy, social influence, technology anxiety, and resistance to change had a significant impact on the users' behavioral intention to adopt mHealth services. A meta-analysis conducted by Sun, Wang <sup>[2]</sup> indicated that perceived usefulness, perceived ease of use, perceived vulnerability and perceived severity all have significant impacts on individual attitude, while perceived usefulness, perceived ease of use, subjective norms, trust, perceived risk and attitude significantly influence behavioral intention.

Surprisingly, there has been a constant demand for high reliability and maintainability of the systems due to lifetime threats after improper treatment. So, perceived reliability is critical to user satisfaction and usage intentions on the interactive IT because it reflects a capability of the IT to perform the promised service dependably, safely, and accurately. Technical reliability plays a pivotal role to induce customer to adopt technology-based self-service. Furthermore, many researchers identified that reliability is an important factor of technology-based service quality <sup>[16]</sup>. According to Venkatesh, Thong <sup>[17]</sup>, in the customer context, price issues were found to be critical and received particular interest from customers when they were in the process of accepting or rejecting innovative services. In addition, customers seem to be weighing up the utilities received and the financial cost of using a new technology. So, Perceived reliability and price value play vital role in accepting or rejecting the services in Bangladesh context. Thus these two variables were included into the UTAUT model developed by Venkatesh, Morris <sup>[18]</sup>. In contrast, the studies on health technology adoption behavior from the perspective of general patients are relatively rare. This lack is a divergence for the increasing prevalence of health technology. Whereas most academic concentration has gone to understanding user acceptance of technology in organizations, some recent studies have extended the scope of the research to consumer context <sup>[19]</sup>. Surprisingly, few or no research have been conducted on investigating the factors affecting adoption of mHealth services on general people in the urban areas of Bangladesh <sup>[20]</sup>. In the mobile context to the best of our knowledge, no research has yet studied mHealth adoption behavior of general people by extending the perceived reliability and price value through UTAUT variables in Bangladesh.

## 3. THEORETICAL FRAMEWORK AND HYPOTHESES DEVELOPMENT

Technology acceptance research is being dominated by the Technology Acceptance Model (TAM) and UTAUT, which are widely accepted for examining IS adoption behavior. Some of the theories and models that have been widely accepted and applied to explain the technology acceptance. The Unified Theory of Acceptance and Use of Technology (UTAUT) is the latest derivative of TAM. The UTAUT model has been empirically tested and proven superior to other prevailing competing models <sup>[21]</sup>. The UTAUT model aims to analyze any technological innovation acceptance and usage intention in consumers' point of view. Many previous studies confirmed the acceptability of UTAUT model in mobile technology in healthcare context. However, this study differs from the aforementioned studies as it expands the range of factors that might impact

the use of mHealth within the context of Bangladesh. Given the complex environmental, cultural, and social paradigm in Bangladesh, researchers adopted perceived reliability and price value as two additional construct that affect consumer's behavioral intention to adopt mHealth services in Bangladesh. The extended proposed model is shown in figure 1.



**Figure 1 Research Model (Extension of UTAUT Model) Adapted from [Koenig-Lewis, Palmer [22], 23]**

Performance expectancy is defined as “the degree to which an individual believes that using the Information System (IS) will help him/her to attain gains in job performance” [24]. Performance expectancy in the context of mHealth usages is about how a user expects a technology will help to solve a health problem. Hoque, Bao [25] have found that PE is one of the significant determinants of users’ behavior intention to use mHealth. EE is defined as “the degree of ease associated with the use of the system” [26]. Users feel connected to technologies that are convenient and simple to use [27]. The easy accessibility of a technology tends to motivate users, making them highly inclined to adopt the technology. EE has been identified as an important factor directly influencing users’ intention to use mobile health [2]. SI is “the extent to which an individual perceives that important others believe he or she should apply the new system” [26]. Social influential factors, such as affiliation and perceived popularity of a new technology, also have an impact [28]. [2] reported that SI affects the behavioral intention to use mobile health services. Facilitating condition is defined as “the degree to which an individual believes that an organization and technical infrastructure exists to support the use of the system” [26]. A study by Boontarig, Chutimaskul [29] suggested that FC positively influences the behavioral intention and use of Smartphone for health services. Lee, Lee [30] defined reliability as the degree to which a consumer believes a new technology will perform a job consistently and accurately. In addition, perceived reliability has significant influence on behavioral intention of adopting mHealth services [29]. Price value is defined as “consumers’ cognitive tradeoff between the perceived benefits of the applications and the monetary cost for using them” [22]. Among so many reasons, the shedding of light on transaction cost analysis, the authors can infer that price-value could be a strong determinant in capturing consumers’ behavior for mHealth adoption [31]. On the other hand, Behavioral intention was operationalized as the degree to which a person perceives his/her willingness to use mHealth services [32]. Behavioral intention and actual usage behavior are highly correlated and behavioral intention is a predictor of actual use behavior of health technology adoption. On the basis of the extant literature review, the following hypotheses were postulated;

*H1: Performance Expectancy positively influences the behavioral intention to adopt mHealth services.*

*H2: Effort Expectancy positively influences the behavioral intention to adopt mHealth services.*

*H3: Social Influence positively influences the behavioral intention to adopt mHealth services.*

*H4: Facilitating condition positively influences the behavioral intention to adopt mHealth services.*

*H5: Perceived Reliability positively influences the behavioral intention to adopt mHealth services.*

*H6: Price Value positively influences the behavioral intention to adopt mHealth services.*

*H7: Behavioral Intention positively influences the behavioral intention to adopt mHealth services.*

#### **4. RESEARCH METHODOLOGY**

The target population for this study was the general inhabitants of Dhaka City, the Mega and Capital City of Bangladesh where most of the citizens use smart phone with the highest internet penetration. This study recruited general participants from Dhaka City due to 100% network coverage allowing access to mHealth services from anywhere and anytime. Due to lack of list of mHealth users, Simple convenience sampling method was used as survey instrument with judgment sampling method in some aspect. Items selected for the constructs were mainly adapted from literature and modified to fit the specific technology studied in the context of developing countries including Bangladesh. Furthermore, the literature review, discussions with academicians, researchers, medical experts and personal experiences helped in the generation of scale items.

A structured questionnaire was originally developed in English, and then translated into the local language (Known as Bangla) by a professional translator, a native Bangla speaker with an excellent command of the English language and good knowledge of mHealth, ensuring that both versions were considered to be similar by a group of experts. Respondents were screened for whether they had ever used mHealth services. The interviews were conducted over a period of three weeks by a team of three interviewers who were well-trained and professional in conducting the personal interviews. To contact with the respondents, trained interviewers from a professional research firm randomly approached people in public places or mall-intercept and asked them to participate in face to face interview. A 5-point Likert scale ranging from (1) “strongly disagree” to (5) “strongly agree” is used for measuring the desired constructs. The researchers distributed 323 questionnaires initially, and 304 were returned, resulting in a 94% response rate. Eight incomplete questionnaires were excluded from the analysis. After removing the incomplete cases and outliers, 296 valid responses were obtained for the analysis. In this study, the participation of the respondents was completely voluntary and no incentive or gift was given in order to avoid the biasness. Data management and analysis was performed using smart PLS 2.0.

#### **5. RESULT AND DISCUSSION**

The demographic profiles of the respondents indicated that the majority of the respondents were female (56%). Participants were in the range of different age level. Majority of the respondents were graduate (71%), post graduate (28%) and PhD holders (1%). Experiences in using mHealth were 1 to 3 years (61%), whereas experiences in using mobile phone were more than 5 years (86%).

##### **5.1 Measurement Model**

The following table 1 shows that all the constructs used in the research model have Cronbach's alpha and composite reliability values of more than 0.80, which is higher than the threshold value recommended by literature. The measurement model shows that AVE are ranged from 0.681 to 0.805, whereas items loading ranging from 0.773 to 0.921 are higher than the threshold level recommended by literature. Therefore, conditions for convergent validity requirement were satisfied. The calculated square root of AVE was greater than the corresponding correlation, Confirming the discriminant validity of the data.

**Table 1 Reliability and Convergent Validity**

Constructs	No. of Items	Items Loading	CR	AVE	Cronbach'@
Performance Expectancy	4	0.85-0.87	0.89	0.75	0.89
Effort Expectancy	4	0.83-0.87	0.91	0.72	0.87
Social Influence	4	0.87-0.89	0.93	0.76	0.90
Facilitating Condition	5	0.80-0.88	0.93	0.73	0.91
Perceived Reliability	4	0.78-0.89	0.91	0.72	0.87
Price Value	3	0.87-0.92	0.93	0.80	0.88
Behavioral Intention	3	0.86-0.89	0.91	0.76	0.84
Actual Usage	4	0.77-0.88	0.89	0.68	0.84

## 5.2 Structural Model

The bootstrapping method was used to test the hypothesized relationship at a level of significance of 0.05 ( $p < 0.05$ ). In this stage, the study tests the relationship between dependent and independent variables by path coefficient ( $\beta$ ) and t-statistics at a level of significance of 0.05 ( $p < 0.05$ ) shown in table 2. The results show that PE ( $t=2.210$ ,  $\beta=0.181$ ), EE ( $t=2.045$ , ( $\beta$ )=0.201), SI ( $t=1.997$ ,  $\beta=0.136$ ), FC ( $t=2.423$ ,  $\beta=0.250$ ), PR ( $t=1.990$ ,  $\beta=0.173$ ), BI ( $t=4.832$ ,  $\beta=0.372$ ), and had a significant effect on general people's intention to adopt mHealth services. Thus, H1, H2, H3, H4, H6 & H7 were supported. However, surprisingly, price value ( $t=0.579$ ,  $\beta=0.034$ ) had no significant effect on general people's intention and actual use of mHealth services. So, H5 were not supported.

**Table 2 Testing The Hypotheses in The Structural Model**

Hypothesis	Relationship	$\beta$	Std error	P-values	Decision
H1	PE -> BI	0.181	0.082	0.027	supported
H2	EE -> BI	0.201	0.097	0.041	supported
H3	SI -> BI	0.136	0.069	0.046	supported
H4	FC -> BI	0.250	0.104	0.015	supported
H5	PV -> BI	0.034	0.054	0.562	Not supported
H6	PR -> BI	0.173	0.086	0.047	supported
H7	BI -> AU	0.372	0.076	0.000	supported

## 6. DISCUSSION

This study added on trust based construct (Perceived Reliability) and resource based construct (Price value) to the core determinants of the UTAUT model. Regarding the phenomenon that the adoption rate and usage of mHealth are still marginal, the findings of the study are in agreement with the result of previous studies on the application of UTAUT model in mHealth adoption. Results indicate that the extended UTAUT is a good predictive model of general people's intention to use mHealth services. Out of the seven constructs, Effort expectancy and Facilitating condition have the highest positive impact on the intention to use mHealth services in comparison to other constructs.

In this study, Performance expectancy is found to have significant impact on behavioral intention to adopt mHealth services. This is somewhat inconsistent with<sup>[33]</sup>. This is not surprising, since study found that PE and EE have a significant influence on physician adoption of electronic medical records (EMR)<sup>[34]</sup>. As presented in the results section, PE was observed to be among the strongest factors predicting actual use behavior. Other results of this study showed that there is a significant relationship between Effort Expectancy and Behavioral Intention. The result of this study is consistent with the results of<sup>[35]</sup> and<sup>[36]</sup>. Veer AJ<sup>[37]</sup> demonstrated that PE, EE, and SI are highly related to behavioral intention to use eHealth/mHealth. In our study, Facilitating

Condition (FC) is found to have significant impact on behavioral intention to adopt mHealth services. Surprisingly, this is inconsistent with the findings of <sup>[38]</sup> that their study did not find any significant relationship between FC and elderly's behavioral intention and actual use of mHealth services.

On the other hand, Perceived reliability has a significant impact on the adoption of mHealth. This is not surprising, perceived reliability plays a vital role in technology adoption behavior. This finding is supported by previous studies. Reliable technological function assists customer to get favorable outcome. Accurate and error free performance of self-service technology (SST) i.e. reliability of SST leads customer to favorably evaluate SST <sup>[39]</sup> and favorable evaluation of services leads customer to exhibit positive behavioral intention. On the other hand, Moon Taesoo <sup>[40]</sup> demonstrated that perceived reliability plays significant influence on behavioral intention to adopt the information technology. This result is consistent with the findings reported in the IS literature by multiple researchers <sup>[41]</sup>. It is somewhat surprising that price value has no significant effect on behavioral intention to use which is supported by Koenig-Lewis <sup>[42]</sup>. This is supported by Xie, Wu <sup>[43]</sup>. So, it is confirmed that price value was less salient to the general people who are health conscious. Whereas, this finding is inconsistent with the research conducted by <sup>[44]</sup>. Accordingly, customers usually engaged in a trade-off process between the cost of using mobile technologies and the benefits recognized <sup>[45]</sup>. But this finding is supported by <sup>[46]</sup>.

## 7. CONCLUSION

The successful adoption of mHealth depends on the engagement of end users, i.e. Hospitals, physicians, nurses and patients etc. This study is the milestone for developing countries to examine factors affecting the adoption of mHealth services especially in Bangladesh. This is in addition to see how using such system could contribute to the Healthcare providers in term of behavioral intention and actual usage behavior. So, the UTAUT model with extension of perceived reliability and price value was proposed to test the hypotheses. This study confirmed that in addition to agreement with the original construct of the UTAUT model, perceived reliability is vital for the adoption of mHealth in Bangladesh. Surprisingly, price value was not positively related to behavioral intention to adopt mHealth services. For achieving greater adoption and use of mHealth services, an effective roadmap needs to be set and followed by both public, private and NGOs level healthcare providers. On the other hand, the findings have theoretical and practical contributions to the extant literature. Firstly, this study produces new quantitative knowledge about the factors that influence the usage of mHealth in Bangladesh. Secondly, this study tested the extended UTAUT model in a new context (i.e. Bangladesh) and new technological services (i.e. mHealth services). Thirdly, the integration of two additional variables with the UTAUT model is unique in the literature as, to date, no such combination has been done in developing countries including Bangladesh. This integration of the two additional variables has contributed to increasing the predictive power of consumer usage of mHealth services in Bangladesh.

Practical Implications can be embraced by Bangladeshi decision makers in order to increase the level of mHealth usage among Bangladeshi users. This is done by manipulating the effective variables from each model which were proved to have significant influence over adoption intention and actual usage behavior among Bangladeshi mHealth users. Thus, mHealth services providers should consider the role of PE, EE, FC, SI and PR in increasing the level of intention and usage, when using mHealth services. Furthermore, mHealth services providers should increase the level of service reliability through continuous attention on maximizing their overall support for mHealth end-users at any time and under any circumstances. With regard to monitoring and controlling PE, EE, FC, SI, PR, it is essential to focus particularly on the role of FC, which has the highest level of influence over mHealth usages among Bangladeshi users. Hence, healthcare organizations and decision makers should consider that Bangladeshi mHealth users, particularly the youth, on middle-sized income, and



educated, start being more individualistic when using highly individualistic IT services (i.e. mHealth). FC should also be implemented in order to raise the level of personal customization in mHealth services. The findings of this study will be helpful for the policy makers, services providers and agencies to develop the effective mHealth campaign. The finding has important implications for developing marketing strategies in order to convince the general people to adopt mHealth as preventive tool.

In order to get a more representative sample to the whole population, future studies should extend to the whole geography of Bangladesh by including participants from urban and non-urban areas. Moreover, future research can include new variables such as perceived security and perceived privacy due to the importance of these two factors in health information dealings.

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