Understanding the insight of factors affecting mHealth adoption: A systematic review

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ABSTRACT

Numerous studies have addressed the different context of mHealth services among diverse user groups. But due to a lack of understanding the insight of factors affecting the mHealth adoption, it's crucial need to conduct a systematic review on this issue. The objective of this study was to synthesize the present understanding of the influential factors of mHealth adoption. We performed a systematic literature search on eight electronically reputed scientific databases from 2010 to March 2019, such as Science Direct, Springer, IEEE Xplore, JMIR, Taylor & Francis, Emerald, Mary Ann Liebert and Google Scholar. This was accomplished by gathering data including authors, countries, years, target population, sample size, models/theories, and key influential factors. Primarily, a total of 2969 potentially relatable papers were found, of which 50 met the inclusion criteria. It was found that cross-sectional approach, survey methods and structural equation modeling (SEM) were the most explored research methodologies whereas PLS-SEM was found to be the largest used analysis tools. From the analysis, a total of ninety-four influential factors were clearly recognized and the findings represent that the following 15 factors appeared most recurrently and significantly: perceived usefulness, perceived ease of use, social-influence, subjective norm, self-efficacy, trust, facilitating conditions, technology anxiety, performance expectancy, effort expectancy, cost, attitude, resistance to change, perceived privacy and security, and perceived behavioral control. The research results have significant theoretical and practical implications for mHealth services providers, researchers and policy makers with regards to the Sustainable Development Goals (SDGs) allied to healthcare. This is the first initiative that has widely reviewed the literature on factors influencing the adoption of mHealth and given accumulative understanding of these factors to the researchers.

Introduction

The digitalization of healthcare can increase efficiency and allows for the provision of better-quality healthcare services, offering with many benefits to stakeholders (Laurenza, Quintano, Schiavone, & Vrontis, 2018). Recently, many innovative technological solutions have been appeared to solve people's health-related needs (Ashraf, Hasan, Lewis, Hasan, & Ray, 2017; Esposito et al., 2018). As an evolving healthcare sector, mobile health (mHealth) services have been receiving increasing attention in latest years as an alternative solution (Zhao, Ni, & Zhou, 2018). Over the past two decades, mHealth has developed into a significant channel for healthcare services delivery and promotion (Steinhubl, Muse, & Topol, 2015). A number of mHealth services and applications around the world have already been introduced by main stakeholders – mobile operators, healthcare providers, device suppliers,
content players, foundations, non-government organizations (NGOs) and governments (PWC, 2012). Consequently, users progressively use mHealth facilities to satisfy their requirements, manage their health and communicate with their suppliers (Brown III, Yen, Rojas, & Schnall, 2013). In recent years, mHealth has gained more popularity in developing countries where many governments are recognizing the possible benefits of mHealth and have integrated it into their plans to meet their health system target such as Sustainable Development Goal (SDG) targets 3 (Ensure Healthy Lives and Promote Well Being for All at All Ages).

Although, various mHealth initiatives have been undertaken across the world, but the adoption rate is significantly low. Many mHealth projects have been postponed due to a lack of awareness about mHealth services. Most of the health service-related initiatives have not been able to sustain or obtain optimal results (Chandwani, De, & Dwivedi, 2018). However, there are some widely accepted models identifying the influential factors for technology adoption in mHealth research, still there are some limitations of these models used. It has been observed that there are diversified conflicting factors affecting the adoption intention of mHealth services among the end users. There is theoretically no conflict among the factors affecting the adoption of mHealth services but empirically there are conflicts among the constructs. So, it raises questions regarding the factors affecting the adoption of mHealth services. Hence, it is required to administer a systematic literature review on the factors affecting the adoption of mHealth services.

Therefore, the current research aims to conduct a systematic literature review on understanding the factors behind mHealth adoption, i.e. firstly, to carry out a systematic review of the factors affecting the adoption of mHealth services. Secondly, to clarify the most key factors and thirdly, to reconfirm the outcomes of past research with regard to the factors for mHealth adoption. Finally, the research provides a fresh, easy and simplest way of understanding, but an extensive conceptual framework for adopting mHealth. This study unveils the key factors behind the adoption of mHealth services in developed and developing countries and to provide a comprehensive model covering the influential factors of this service. However, researchers and academicians find this paper more useful for understanding the concept and further exploration in mHealth adoption research from insights and future research direction.

The rest of this paper is organized as follows; the next section describes the literature review, the methodologies used in this study followed by a review of the 50 selected studies. The results are detailed in subsequent sections and finally, it includes discussions, conclusion, limitations, and future research directions.

**Literature Review**

Research on healthcare applications design for mobile devices (mHealth) has gained growing attention over the past decade (Miah, Gammack, & Hasan, 2017). The applications of mHealth have been widely, and there has been a development of many new services that have not only changed health delivery systems but have also improved the effectiveness of health care services (Sadeh, Saadat, Sepehri, & Assadi, 2018). mHealth has been described as mobile-supported medical and public health procedures such as mobile phones, personal digital assistants (PDAs), patient surveillance systems and other wireless devices (Greenspun & Coughlin, 2012). However, mHealth has been proposed as one of the alternative solutions to improve access to high-quality emergency care. It is seen as a simple and inexpensive solution for improving worldwide access to healthcare facilities, particularly in resource shortages (Källander et al., 2013). It can, however, encourage the goals of persuading individuals to embrace the technology because of the cost, accessibility and coverage benefits of technology (Srisawangwong & Kasemvilas, 2014), the integration with internet (Yusof & Lahad, 2012), the capacity to monitor illnesses and provide essential data to physicians who can then assist users more efficiently in recovery and well-being (Kalem & Turhan, 2015). Moreover, mHealth can improve the efficiency of healthcare workers for providers and distributors, i.e. physicians, healthcare workers and hospitals, decrease expenses for patients looking for medical care and enhance the overall quality of services (Bjornland, Goh, Haanæs, Kainu, & Kennedy, 2012).

The mHealth literature focusing on developed and developing countries has certainly flourished in recent years. Recent proof suggests that mHealth may be an ICT derived blessings and one of the most prominent services with significant impacts on the healthcare industry’s growth (Chiarini, Ray, Akter, Masella, & Ganz, 2013; Md Rakibul Hoque, Mazmum, & Bao, 2014; Mechael et al., 2010; Sharifi et al., 2013). But the unending task of confirming user acceptance of innovative technology is an endless leadership challenge (Schwarz & Chin, 2007), and research into technology adoption and diffusion is now regarded among the more mature fields of exploration in the present context (Venkatesh, Morris, Davis, & Davis, 2003). This significant amount of activity has seen the use of a broad spectrum of exploratory methods that examine many distinct systems and technologies in diverse contexts, to the extent that even the most cursory examination of the current literature reveals a variety of stakeholder's perspectives, contexts, technologies, units of analysis and models/theories of research (Williams, Dwivedi, Lal, & Schwarz, 2009).

From the extant literature described later part of the study, it has been observed that many different researchers with different research intentions and subjects of focus have conducted mHealth researches by applying a variety of research methodologies in different environmental context. This diverse body of work has seen numerous new constructs being incorporated into the original
and widely accepted theories, i.e. TAM, UTAUT, UTAUT2 and on occasion, a re-specification of the underlying relationships between variables. These research papers were published in journals and conferences in diverse streams of study.

Researchers have regularly called for theoretically based interventions, suggesting the increased likelihood of meeting success criteria (Krishna, Boren, & Balas, 2009), yet few studies examine the systematic review on the underlying factors for mHealth adoption. Recent reviews of mHealth provide a range of analyses focusing on particular technological features, process, improvements in healthcare service delivery, and behavior change and healthcare outcomes. A majority of the reviews chose to use methodological standards as an inclusion and exclusion criterion, limiting the reviews to cross-sectional, survey methods, specific context and meta-analysis found within the peer-reviewed literature.

However, a considerable amount of research has been conducted across the world i.e. (different context, users and diseases). But, as per our knowledge, no systematic research was being conducted on understanding the insight of factors affecting mHealth adoption. To overcome these limitations, a systematic literature review is required to explore the most dominant factors behind the adoption of mHealth services. Therefore, the main focus of studies has been on inputs, while research in influencing factors and underlying theory is missing.

**Materials and Method**

This research followed a systematic review process of retrieving data from credible databases. Saunders (2011) described that a systematic review of literature starts with the definition of suitable keywords used in the search and retrieval of literature from databases and the presentation of the analysis. Tranfield, Denyer, and Smart (2003) argued that the purpose of a literature review is to define literature gaps and limitations of the knowledge. In addition, literature review summarizes and sorts current researches on the basis of key themes and recommendations for future works (Seuring, Müller, Westhaus, & Morana, 2005). Despite the fact that this strict proof-based strategy has been used particularly in medical scientific studies, the transition from medicine to other fields to practice dependent on the best accessible evidence (Tranfield et al., 2003). The processes used to carry out the systematic review in the present research are based on the initial rules suggested by Kitchenham (2004) & Kitchenham et al. (2009).

An original scoping research was performed in order to investigate the most suitable search approach, and the results were talked about with different researchers and bagged in a review protocol with specific depictions of the techniques used. A predefined protocol is often needed to decrease the researchers’ potential for bias (Kitchenham et al., 2009). The key information concerning the search strategy covered in the protocols are presented in the followings;

**Database Searched**

A comprehensive systematic search of the pertinent academic literature was performed from 2010 to March, 2019 as extensive searches using the following electronic databases: Science Direct, Emerald, IEEE Xplore, Taylor & Francis, Springer, Mary Ann Liebert Inc., and Google Scholar and a specific journal database JMIR. The papers were searched through an extensive list of topics due to the multidisciplinary nature of the field researched (mHealth), but the primary focus stayed on the view of mHealth adoption, in line with the review issue. Moreover, reference lists of relevant researches and personal collections were also searched. However, documents published before 2010 were excluded from this study.

Additionally, a gray literature search was also undertaken examining articles and websites from relevant organizations including WHO, International Telecommunications Union (ITU), the mHealth Alliances (mhealthalliance.org), Health Unbound (healthunbound.org), mHealth Knowledge (mhealthknowledge.org), Global mHealth Initiatives (jhumhealth.org), and Google searches, etc. Furthermore, duplicate citations and referencing across databases were recognized and excluded using Endnote, and for verification, a manual revision was performed. If a research was stated in more than one publication and the same information were submitted, the latest publication was included only. However, in multiple publications describing the same research, if innovative information were submitted, all were also included.

**Searched Terms**

we adapted the experimental results suggested by Dieste, Grimán, and Juristo (2009) regarding the development of an optimum search strategy to identify the most suitable search terms. By considering the objectives of this review to survey as many empirical studies as possible related to the adoption of mHealth, the term’s ‘Health’ and ‘mHealth’ adoption was searched. Similarly, researchers also regarded all possible abbreviations, alternative spellings, and combinations of terms generally linked to the significance of ‘mHealth acceptance’ and extracted from the scoping research, literature review, and discussions with other researchers in their attempts to be thorough. Search terms such as {‘mHealth’ and/or ‘adoption’}, {‘mobile health’, and/or ‘adoption’}, {‘factors influencing mHealth adoption’, and/or ‘mobile health adoption’}, {‘mHealthcare’, and/or ‘mobile healthcare’ adoption}, {‘self-care’}, and/or {mHealth and/or ‘mobile health’} were used here. Finally, the following themes related to mHealth
adoption: ‘acceptance’, ‘acceptability’, ‘utilization’, or ‘attitude’ toward using mHealth services were also searched. The different combinations produced from these keywords were also used to define related studies that were conducted to identify factors influencing the adoption of mHealth. It has been observed that maximum common words used in the title are health, mobile, use followed by ‘Acceptance and use,’ ‘mobile health services’, and so on shown in the following figure 1.

![Figure 1: Most 10 Frequently used word in the sample articles (Source: Authors’ Study)](image)

Furthermore, Figure 2 presented the word cloud which has been derived from the software, highlighting the most common words in bigger and bold fonts, in contrast, others relatively less common words appear in smaller fonts. This word cloud is an simple way to define the common words in a complex setting (Birko, Dove, & V, 2015), and can therefore be used to identify the most common themes and keywords used in publications.

![Figure 2: Word cloud for most common words in mHealth publications (Source: Authors’ Study)](image)

**Inclusion/Exclusion Criteria**

Inclusion and exclusion criteria were also developed in advance and agreement was sought among the reviewers shown in Figure 03. The experiments were based on an empirical design, descriptive survey design, literature review and conference proceedings as well as all relevant data. We included studies reporting findings from worldwide that focused only on factors affecting mHealth adoption as part of the overall intervention strategy for primary health monitoring among various groups such as all populations (young, middle-aged and older), patients, Medical Staffs, Physicians, Caregivers, healthcare professionals, general health users, technology providers, Mid-level providers and healthcare workers published between 2010 to March, 2019. The inclusion criteria used to navigate the search were: (1) health behavioral studies that included conceptual model and hypotheses, (2) mHealth affairs
The exclusion criteria were: (1) articles not related to mobile (2) related to mobile apps (3) not related to healthcare services (4) all technical studies (5) for which the full text was not available online (6) mobile communication technologies, protocols and standards, and (7) in the form of book chapters, tutorials, guest editorials, poster sessions, correspondence, roundtable discussions, comments, position papers, article summaries, prefaces, interviews and unstructured observations. They were also excluded if these health interventions were provided via a conventional fixed telephone line or using a desktop computer via the internet.

A total of 2969 studies were selected; 573 from Science Direct, 32 from Emerald, 43 from IEEE Xplore, 17 from JMIR, 294 from Taylor & Francis, 90 from Springer, 31 from Mary Ann Liebert Inc., and 1889 from Google Scholar. Of these, 1758 studies were found duplicate and not to be related to mobile health adoption. After that 714 articles were not meet the inclusion criteria and exclude more 61 papers which are related to mHealth artifact design. However, more 348 papers were excluded which did not meet research questions, wrong intervention, unavailability of full text and no longitudinal study. Finally, 38 articles were not included due to unmatched with scope in this study and 50 articles were selected for review (see Figure 3).

![Sample Selection Flow Chart](source)

**Figure 3:** Sample Selection Flow Chart (Source: Authors’ Study)

**Data Extraction**

Authors combined search outcomes from various sources and assessed their eligibility at distinct rates. In order to extract a number of eligible research, abstract screening, title screening and full-text screening were performed in sequence by implementing predefined exclusion and inclusion criteria. An Excel template was developed which outlined mHealth domains and characteristics of the study. Moreover, authors carried out a critical appraisal and verified the results of this quality assessment. Then authors performed test data extractions using this model to verify for any inconsistencies of interpretation of the definitions, and the extraction model was further refined. However, by team agreement, discrepancies in article inclusion, data extraction, and bias evaluation have been resolved. For the purposes of data extraction, an excel spreadsheet was created containing a row for each included review and column to describe the studies and classify the extracted data related to eHealth services implementation.

**Reporting the Reviews**

One strength of this review is to extend the search of references from which the studies were selected. Furthermore, the 50 articles...
chosen that fulfill the inclusion criteria have been evaluated and the findings are described in detail in Appendix A. The authors’ names and the years in which the articles were published, countries, independent variables (IV), dependent variables (DV), target population, sample size, and models / theories used by researchers are also presented in the same table, including important findings from the respective research.

**Results**

In this review, the current status of mHealth adoption by different user groups were also investigated for their healthcare management and have been reported in the literature. Based on the searching in publications/databases, 50 articles were observed to be pertinent in identifying the factors affecting the adoption of mHealth services. Therefore, the systematically selected evidence is synthesized and presented below:

**Key Factors**

The latent variables having five or more than five frequency of occurrences were incorporated in the following figure 4. Altogether, a total of 72 latent variables were identified as the most positive influential factors, whereas a total of 22 factors were identified as the most negative influential factors for mHealth adoption.

![Figure 4: Most significant and highly frequent usages factors (Source: Analysis form Appendix A)](image)

The findings explored that both perceived ease of use and perceived usefulness manifested themselves 26 & 23 times whilst behavioral intention to use emerged 21 times. These two variables were also seen as the most commonly used factors among the previous studies reviewed. Perceived usefulness, perceived ease of use, and self-efficacy had a frequency of 26, 23 and 7 respectively which had an impact directly or indirectly on behavioral intention or via attitude in a different context. While, perceived vulnerability, perceived severity, personal innovativeness in IT, and response efficacy had a frequency of 4 for each construct which stimulate the behavioral intention through the mediation of attitude only which were excluded from the analysis. Moreover, all other factors shown in the figure 4 had a direct significant impact on behavioral intention.

**Publication by Countries**

All published articles were sorted out on a country by country basis. It was remarkably noticeable in figure 5 that China published the highest number of papers (40%) in mHealth literature followed by Bangladesh (14%). Following that, Taiwan published 8% of the total papers. On the other hand, Jordan, Burundi, and Korea both share 4% of the total published papers. It's become apparent that China dominates the mHealth literature. This could be due to increased awareness of sustainable healthcare services during the last few decades. It is also observed that mHealth adoption researches were conducted mostly in developing countries.
Publications by Years

Figure 6 demonstrates that the advent of publications on mHealth services started before 2010, followed by balanced growth till the current year. From 2010 onwards, the following figure shows exponential growth and linear forecasting that indicates its potentiality. Likewise, the pattern line additionally shows an expanding design, which means that the mHealth literature continues to grow.

In 2015, 10 papers were published, which in comparison with prior years is considerably the largest amount of articles. However, it can be concluded that there is constantly expanding trends and interests on mHealth issues, along with rising issues of environmental sustainability, industrial and national pollution, and concerns about social responsibility on the part of both state and corporate bodies.

Models/Theories

Over the last several decades, a plethora of theoretical models/theories have been proposed to examine IS/IT acceptance and usage intention (Yogesh K. Dwivedi, Kapoor, Williams, & Williams, 2013; Yogesh K Dwivedi et al., 2017). Moreover, researchers have used one or more theories or sometimes blended an array of accepted theories in an attempt to elaborate on the notion of technology
acceptance. A thorough examination of the theories/models taken by these research investigates the significance of considering a theoretical basis/base best suited to the view of the customer. The following figure7 shows that most of the studies used an integrated model to identify the factors influencing the adoption of mHealth services. The TAM has, however, been used in quantitative and qualitative studies of healthcare services to determine the factors affecting the acceptance of mobile technology by physicians and medical students respectively, and in health studies on subjects such as the adoption of mHealth services (Cho, 2014).

![Figure 7: Most frequently used Theory/Model (Source: Analysis from Appendix A)](image)

**Studies by Target Population**

The figure8 illustrated that studies were divided into several categories according to the user’s types. Our study reveals that most of the studies emphasized the general users of mHealth services followed by an elderly person. Furthermore, target respondents were categorized on the basis of age. It was also seen that there were some studies on organizational and professional perspective.

![Figure 8: Percentage of Study by Target Population (Source: Analysis from Appendix A)](image)

**Publishers/Databases**

The following figure9 represents the number of articles found in different publishers and databases. Most of the research articles were found in Google Scholar followed by Science Direct. This clearly indicates that researchers and academicians are presently quite varied and widespread for the publication landscape of mHealth adoption.
Proposed Comprehensive Model

The following figure 10 represents the comprehensive model derived from systematic review. It includes the most influential factors affecting the adoption intention of mHealth services.

Figure 10: Comprehensive Proposed Model (Source: Authors’ Study)

On the basis of the systematic review, 15 most influential factors were identified that affect the adoption of mHealth services shown in the above figure. However, performance expectancy and perceived usefulness were labeled as functional benefits; perceived ease of use and effort expectancy were labeled as operational benefits; social influence and subjective norms were labeled as social

Figure 9: Percentage of Publications by Database (Source: Analysis form Appendix A)
benefits; trust, perceived privacy and security were labeled as confidential benefits; technological anxiety, resistance to change and attitudes were labeled as psychological aspects, cost was labeled as financial aspect, facilitating conditions was labeled as infrastructural benefits, and finally perceived behavioral control and self-efficacy were labeled as skills.

Discussions

The growing evidence for the use of mobile information and communication technologies and the mobility of information in healthcare known as mHealth has attracted the attention of physicians, practitioners, researchers and policymakers worldwide (Free et al., 2010; Leslie, Sherrington, Dicks, Gray, & Chang, 2011; Waegemann, 2010). Our intention in this study was to perform a systematic literature review of the factors affecting the adoption of mHealth services from 2010 to March, 2019 in distinct contexts among distinct user groups. Given the significant attention that mHealth gets worldwide, identifying the factors that facilitate end-user acceptance seemed crucial. The principal results of this research identified that at the organizational, individual and contextual levels, several factors are associated with mHealth adoption. This type of research may offer benefits within the field as it offers an indication for future research growth. New or early career researchers can find a landscape for building a foundation of their own study within the health informatics field.

Among the search engine, Web of Sciences and Google scholar were mostly used for searching the mHealth adoption related research. Our analysis indicates that 50 selected studies were conducted in 19 countries that could identify the predictors affecting the adoption of mHealth service. It has been observed that China was the leading country followed by Bangladesh both in terms of research areas and the number of research affiliations with mHealth services. It was also apparent that many authors have been affiliated with Chinese universities in a number of instances. Furthermore, there were no dominating institutions publishing mHealth related articles. It was also noticeable that majority articles were published in the year of 2015. Our assessment of publication statistics shows that the number of integrated model related publication rather than a single model has generally increased year upon year since 2010. Results of our keyword analysis suggested that the extended TAM model has been primarily used for mHealth adoption research. TAM was discussed most frequently in terms of the 8 contributing theories / models alongside the UTAUT model.

In terms of methodological aspects, maximum studies were conducted by cross-sectional in nature or survey dominance. For statistical analysis aspects, our results found that Smart PLS 2.0 & 3.0, AMOS, Regression analysis, SEM, CFA, FA have been employed to test the validity of the model. Among these analytical tools, PLS-SEM appears to be the most favored for conducting the analysis while AMOS and LISREL have been used on a number of occasions. From our study, it was revealed that perceived usefulness and perceived ease of use of the technology were seen as two of the most significant factors regarding the adoption of mHealth in the included publication which is consistent with (Gagnon, Ngangue, Payne-Gagnon, & Desmartis, 2016). But they led this systematic review of mHealth adoption on professional perspectives. All of the included reviews demonstrated that numerous factors were crucial for the intention to adopt mHealth, and no single factor was recognized as a significant factor. In our study, it was observed that there were some factors that were negatively associated with mHealth adoption intention.

The most influential factors found in this study are in agreement with the result of previous studies on the application of UTAUT, TAM, Extended and UTAUT2 model in mHealth adoption. It was noticeable in our study that the name of the dependent variables is diverse such as behavioral intention, adoption intention, intention to use, attitude, actual use, use behavior and actual usage behavior. Amongst this dependent variable, behavioral intention was found as the most usable variable followed by adoption intention. It was also noticeable that the majority study emphasized on the general people as the target population followed by elderly people. Furthermore, subjective norm was another key factor influencing the adoption of mHealth services. In comparing the findings of our study with Chiari et al. (2013) and Ross, Stevenson, Lau, and Murray (2016), Our findings focused on the factors affecting the adoption of mHealth which is a subset of eHealth. Research in the health information domain is not a completely new field, but in this study we reinforce a need for substantial exploration and improvement in various emerging sub-fields of the health informatics field, that may provide an insight which motivates researchers and practitioners in the field, by suggesting new research areas on innovative health systems, and their users and the context of their use. We consider that there is a need for more theoretical and applied research to contribute to the maturity of the health informatics field, which is a significant subset of information systems research.

Conclusions

There has been insufficient exploration with respects to the mHealth adoption. The present research is therefore aimed at enriching the existing literature of such research. In this research, top categories journals and conference papers were reviewed to find out the research on the critical variables influencing mHealth adoption. It is revealed that in a distinct context and user groups, there are many journals and conferences publishing mHealth / eHealth adoption research, with contributors from many areas, although
the majority are unsurprising from the view of developing nations. Now, the key factors affecting the efficient implementation of mHealth services have been identified, we are focused on empirical assessment of the suggested model with health customers to achieve a credible model that reflects variables that substantially influence the intentions of customers to leverage the use of mHealth. The results of this systematic review provide a common ground, enabling the most important factors behind mHealth services to be better understood. Of the ninety-four variables identified, fifteen were recognized as important factors affecting the intention to adopt mHealth. The results of this research could be helpful for mHealth developers, professionals and policy makers to further assist them build more efficient health care delivery system. It will enable them to better comprehend the factors affecting health consumers’ intentions to use mHealth effectively for their self-care. Moreover, the systematic review enables professionals and managers to develop credible proof based on collective ideas through theoretical synthesis.

Although this research presented an exhaustive synthesis of present information on mHealth adoption factors, there are some constraints to this review. First, the conceptual framework for the classification of factors recognized as facilitators for mHealth adoption from the research included in this review, was a generic grid of adoption factors. We recognized that using other theoretical frameworks/models might have revealed other dimensions of mHealth adoption. Furthermore, it does not include commercial mHealth alternatives created in latest years but not reported or quoted in any publication. Second, this review only looked at the data submitted in published research and there were no further contacts with the authors to obtain extra information or confirm our classification. Therefore, other reasons for acceptance of mHealth might have been missed. In addition, the systematic review method itself has the constraints that it depended strongly on the keywords selected. Third, although the study found the need for efficient assessment studies, the criticism of the methodologies of the studies included in this review was not delimited. Finally, only literature searches were performed in Eight bibliographic databases, but to recognize other possibly appropriate publications, we thoroughly verified references of included research and articles mentioning those studies. Future researchers may concentrate on overcoming the study’s limitations.

References


mHealth in a rural community of Bangladesh. Int J Med Inform, 84(10), 847-856. doi: 10.1016/j.ijmedinf.2015.06.008


Appendix A: Review of factors affecting the adoption of mHealth

<table>
<thead>
<tr>
<th>Author</th>
<th>Country</th>
<th>IV</th>
<th>DV</th>
<th>Target population</th>
<th>Sample Size</th>
<th>Model/Theories</th>
<th>Key Significant and Insignificant Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Quoasar, Hoque, &amp; Bao, 2018)</td>
<td>Bangladesh</td>
<td>- Performance Expectancy - Effort Expectancy - Facilitating condition</td>
<td>- Behavioral Intention -Use Behavior</td>
<td>Elderly Persons</td>
<td>245</td>
<td>Extended UTAUT</td>
<td>Significant: Performance expectancy, effort expectancy, social influence, and perceived credibility. Insignificant:</td>
</tr>
<tr>
<td>(M. R. Hoque, 2016)</td>
<td>Bangladesh</td>
<td>- Perceived Usefulness - Perceived Ease of Use - Subjective Norm</td>
<td>- Intention to Use -Actual Use</td>
<td>Young Citizens</td>
<td>227</td>
<td>Extended TAM</td>
<td>Significant: Perceived ease of use, perceived usefulness, and subjective norm. Insignificant: Personal</td>
</tr>
<tr>
<td>(Md Rakibul Hoque, Karim, &amp; Amin, 2015)</td>
<td>Bangladesh</td>
<td>- Perceived Usefulness - Perceived Ease of Use</td>
<td>-Intention to Use -Actual Use</td>
<td>Young Citizens</td>
<td>137</td>
<td>TAM</td>
<td>Significant: Perceived Usefulness Insignificant: Perceived ease of use</td>
</tr>
<tr>
<td>(Shareef, Kumar, &amp; Kumar, 2014)</td>
<td>Bangladesh</td>
<td>- Perceived usefulness, - Perceived ease of use, - Perceived reliability, - Perceived ease of m-health</td>
<td>- Adoption of m-health</td>
<td>General Population</td>
<td>326</td>
<td>Extended TAM</td>
<td>Significant: Perceived usefulness, perceived ease of use, perceived reliability, and perceived security and privacy. Insignificant: Perceived compatibility</td>
</tr>
<tr>
<td>(Khatun et al., 2015)</td>
<td>Bangladesh</td>
<td>- Technological readiness - Motivational readiness</td>
<td>- mHealth Readiness</td>
<td>Rural People</td>
<td>4915</td>
<td>Integrated</td>
<td>Significant: Technological readiness, Human resource readiness, and</td>
</tr>
<tr>
<td>(Zhaohua Deng, Mo, &amp; Liu, 2014)</td>
<td>China</td>
<td>- Perceived value - Attitude - Perceived behavior control - Subject norm - Perceived physical condition - Resistance to change - Technology anxiety</td>
<td>- Behavioral Intention</td>
<td>Middle-aged persons &amp; Older Adults</td>
<td>424</td>
<td>Integrated</td>
<td>Significant: Perceived value, attitude, perceived behavior control, and resistance to change for middle-aged and perceived value, attitude, perceived behavior control, technology anxiety, and self-actualization for older adults.</td>
</tr>
<tr>
<td>Study</td>
<td>Country</td>
<td>Variables</td>
<td>Intention</td>
<td>Sample Size</td>
<td>Theory</td>
<td>Significant Factors</td>
<td></td>
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</tr>
<tr>
<td>Kaium et al., 2019</td>
<td>China</td>
<td>-Attitude toward the behavior -Facilitating conditions -Subjective norm</td>
<td>-Adoption intention</td>
<td>General Population</td>
<td>481</td>
<td>Extended TRA</td>
<td>Facilitating conditions, attitude, and subjective norms.</td>
</tr>
<tr>
<td>Zhao et al., 2018</td>
<td>China</td>
<td>-Perceived usefulness -Perceived ease of use -Perceived vulnerability -Perceived severity -Perceived behavioral control</td>
<td>-Attitude -Behavioral Intention</td>
<td>General Population</td>
<td>Meta-Analysis</td>
<td>Meta-Analysis</td>
<td>Perceived usefulness, perceived ease of use, perceived vulnerability and perceived severity for individual attitude whereas perceived usefulness, perceived ease of use, subjective norm, trust, perceived risk and attitude for behavioral intention.</td>
</tr>
<tr>
<td>Z. Deng, Hong, Ren, Zhang, &amp; Xiang, 2018</td>
<td>China</td>
<td>-Perceived usefulness -Perceived ease of use -Perceived Risk -Privacy Risk -Performance Risk</td>
<td>-Trust -Adoption Intention</td>
<td>All Patients and caregivers</td>
<td>388</td>
<td>Extended TAM</td>
<td>Significant: Trust, perceived usefulness, and perceived ease of use, Privacy and performance risks.</td>
</tr>
<tr>
<td>Miao et al., 2017</td>
<td>China</td>
<td>-Perceived ease of use -Perceived usefulness -Technology fear -Subjective norm -Network Effect -Existing degree of satisfaction</td>
<td>-Adoption Intention</td>
<td>All Patients</td>
<td>519</td>
<td>Extended TAM</td>
<td>Perceived usefulness, perceived ease of use, subjective norm, satisfaction, network effect, and cost factor.</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Country</td>
<td>Variables</td>
<td>Sample Size</td>
<td>Theory</td>
<td>Significant Factors</td>
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<tr>
<td>(X.-t. Guo, Yuan, Cao, &amp; Chen, 2012)</td>
<td>China</td>
<td>- Perceived ease of use&lt;br&gt;- Perceived usefulness&lt;br&gt;- Social norms</td>
<td>Adoption Intention&lt;br&gt;General Population&lt;br&gt;492</td>
<td>TAM</td>
<td>- Perceived ease of use, perceived usefulness, Outcome quality, Social norms.</td>
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<tr>
<td>(Y. Sun, Wang, Guo, &amp; Peng, 2013)</td>
<td>China</td>
<td>- Perceived Usefulness&lt;br&gt;- Perceived Ease of Use&lt;br&gt;- Attitude&lt;br&gt;- Subjective Norm&lt;br&gt;- Perceived Behavioral Control&lt;br&gt;- Perceived Vulnerability&lt;br&gt;- Perceived Severity&lt;br&gt;- Response Efficacy&lt;br&gt;- Response Cost</td>
<td>Adoption Intention&lt;br&gt;Elderly Persons&lt;br&gt;212</td>
<td>Integrated</td>
<td>- Perceived Usefulness, Perceived Ease of Use, attitude, subjective norms, perceived behavioral control, perceived vulnerability, response efficacy, response cost, self-efficacy. Insignificant: Perceived severity.</td>
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<tr>
<td>(Wang et al., 2018)</td>
<td>China</td>
<td>- mHealth service matching&lt;br&gt;- mHealth service competence&lt;br&gt;- Affective attitude&lt;br&gt;- Cognitive attitude</td>
<td>Use Intention&lt;br&gt;General Population&lt;br&gt;217</td>
<td>Integrated</td>
<td>- mHealth service matching, mHealth service competence, cognitive and affective attitudes.</td>
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<tr>
<td>(N. Sun &amp; Rau, 2015)</td>
<td>China</td>
<td>- Attitude toward technology&lt;br&gt;- Perceived usefulness&lt;br&gt;- Ease of learning and availability</td>
<td>Adoption Intention&lt;br&gt;General Population&lt;br&gt;346</td>
<td>Integrated</td>
<td>- Attitude toward technology, ease of learning and social norm. Insignificant: Perceived Pressure, Perceived享乐.</td>
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<tr>
<td>(Xitong Guo, Sun, Yan, &amp; Wang, 2012)</td>
<td>China</td>
<td>- Privacy concern&lt;br&gt;- Personalization concern&lt;br&gt;- Trust</td>
<td>Adoption Intention&lt;br&gt;All Professionals&lt;br&gt;492</td>
<td>Integrated</td>
<td>- Privacy concern and Personalization concern. Insignificant: Privacy concern.</td>
<td></td>
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<tr>
<td>(Liu, Ngai, &amp; Ju, 2019)</td>
<td>China</td>
<td>- Perceived usefulness&lt;br&gt;- Perceived enjoyment&lt;br&gt;- Emergency use intention&lt;br&gt;- Routine use</td>
<td>Adoption Intention&lt;br&gt;Community people&lt;br&gt;241</td>
<td>Extended Motivation Theory</td>
<td>- Perceived usefulness and perceived enjoyment.</td>
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<tr>
<td>(X. Guo, Han, Zhang, Dang, &amp; Chen, 2015)</td>
<td>China</td>
<td>- Perceived vulnerability&lt;br&gt;- Perceived severity&lt;br&gt;- Response efficacy&lt;br&gt;- Self-efficacy</td>
<td>Adoption Intention to use&lt;br&gt;General Population&lt;br&gt;428</td>
<td>PMT</td>
<td>- Perceived vulnerability, perceived severity, response efficacy, self-efficacy</td>
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<tr>
<td>(Meng, Guo, Peng, Lai, &amp; Zhao, 2019)</td>
<td>China</td>
<td>- Trust in offline health services&lt;br&gt;- Trust in mHealth services&lt;br&gt;- Support from hospitals</td>
<td>Adoption Intention&lt;br&gt;Elderly Persons&lt;br&gt;395</td>
<td>Trust Transfer Model</td>
<td>- Trust in mHealth, trust in offline, declining psychological conditions. Insignificant: Support from hospitals</td>
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<tr>
<td>(X. Zhang et al., 2017)</td>
<td>China</td>
<td>- Perceived usefulness&lt;br&gt;- Perceived ease of use&lt;br&gt;- Self-efficacy</td>
<td>Adoption Intention&lt;br&gt;General Population&lt;br&gt;600</td>
<td>Integrated</td>
<td>- Perceived usefulness, self-efficacy, response efficacy and perceived ease of use.</td>
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<td>Study</td>
<td>Country</td>
<td>Sample Description</td>
<td>Significant Factors</td>
<td>Insignificant Factors</td>
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<tr>
<td>(Zhu, Liu, Che, &amp; Chen, 2018)</td>
<td>China</td>
<td>General Population</td>
<td>Perceived usefulness, perceived ease of use, perceived disease threat, perceived risk, initial trust</td>
<td>Perceived security</td>
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<tr>
<td>(Hung &amp; Jen, 2012)</td>
<td>Taiwan</td>
<td>General Population</td>
<td>Perceived usefulness, perceived ease of use, perceived disease threat, perceived risk, initial trust</td>
<td>Technology anxiety</td>
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<td>(Wu, Li, &amp; Fu, 2011)</td>
<td>Taiwan</td>
<td>Healthcare Professionals</td>
<td>Perceived usefulness, perceived ease of use, perceived disease threat, perceived risk, initial trust</td>
<td>Technology anxiety</td>
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<tr>
<td>(Hsiao, Chen, &amp; Tang, 2013)</td>
<td>Taiwan</td>
<td>Elderly Persons</td>
<td>Perceived usefulness, perceived ease of use, perceived disease threat, perceived risk, initial trust</td>
<td>Technology anxiety</td>
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<tr>
<td>(Jen &amp; Hung, 2010)</td>
<td>Taiwan</td>
<td>Middle-aged persons</td>
<td>Perceived usefulness, perceived ease of use, perceived disease threat, perceived risk, initial trust</td>
<td>Technology anxiety</td>
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<tr>
<td>(Faqih &amp; Jaradat, 2015)</td>
<td>Jordan</td>
<td>All Patients</td>
<td>Perceived usefulness, social influence, trust, security/privacy</td>
<td>Technology anxiety</td>
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<tr>
<td>(Alalwan et al., 2018)</td>
<td>Jordan</td>
<td>General Population</td>
<td>Perceived usefulness, perceived ease of use, perceived disease threat, perceived risk, initial trust</td>
<td>Technology anxiety</td>
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<tr>
<td>(E. Lee &amp; Han, 2015)</td>
<td>South Korea</td>
<td>General Population</td>
<td>Perceived usefulness, perceived ease of use, perceived disease threat, perceived risk, initial trust</td>
<td>Technology anxiety</td>
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<tr>
<td>(S.-J. Lee, Choi, Kim, &amp; Choi, 2019)</td>
<td>South Korea</td>
<td>General Population</td>
<td>Perceived usefulness, perceived ease of use, perceived disease threat, perceived risk, initial trust</td>
<td>Technology anxiety</td>
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<tr>
<td>Study</td>
<td>Country</td>
<td>Variables</td>
<td>Groups</td>
<td>Model</td>
<td>Significance</td>
<td>Notes</td>
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<td>(Ndayizigamiye &amp; Maharaj, 2016)</td>
<td>Burundi</td>
<td>- Performance Expectancy</td>
<td>Healthcare Professionals</td>
<td>212</td>
<td>UTAUT</td>
<td>Significant: Performance expectancy, effort expectancy and facilitating conditions are significantly correlated with mHealth adoption.</td>
<td></td>
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<tr>
<td>(Ndayizigamiye &amp; Maharaj, 2017)</td>
<td>Burundi</td>
<td>- Relative advantage</td>
<td>Healthcare Professionals</td>
<td>212</td>
<td>Integrated</td>
<td>Significant: Relative advantage, compatibility, trialability and observability are significantly correlated with adoption.</td>
<td></td>
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<tr>
<td>(Munyua, Rotich, &amp; Kimwele, 2015)</td>
<td>India</td>
<td>- Knowledge and awareness</td>
<td>All Patients &amp; Medical Staff</td>
<td>121</td>
<td>Integrated</td>
<td>Significant: Knowledge and awareness, government policies, access to mobile technology, ICT infrastructure, and cost are significantly correlated with adoption intent.</td>
<td></td>
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<tr>
<td>(Shintaro Okazaki, Blas, &amp; Castañeda, 2015)</td>
<td>Spain</td>
<td>- Subjective norm</td>
<td>All Physicians</td>
<td>495</td>
<td>Extended D &amp; M</td>
<td>Significant: Perceived norm, overall quality, and perceived value are significantly correlated with usage intention.</td>
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<tr>
<td>(Rai, Chen, Pye, &amp; Baird, 2013)</td>
<td>USA</td>
<td>- Personal innovativeness</td>
<td>General Population</td>
<td>1132</td>
<td>Integrated</td>
<td>Significant: Consumers’ PIMS and perceived health conditions are significantly correlated with behavioral intention.</td>
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<tr>
<td>(Alloghani, Hussain, Al-Jumeily, &amp; Abuelma’atti, 2015)</td>
<td>UAE</td>
<td>- Perceived usefulness, - Perceived ease of use, - Trust, - Security</td>
<td>All Patients</td>
<td>144</td>
<td>Extended TAM</td>
<td>Significant: Perceived usefulness, perceived ease of use, trust, and security are significantly correlated with behavioral intention.</td>
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<tr>
<td>(El-Wajeh, Galal-Edeen, &amp; Mokhtar, 2014)</td>
<td>Egypt, Yemen</td>
<td>- Perceived Usefulness, - Perceived Ease to Use, - Trust, - Social Influence, - Data Privacy, - Perceived Value, - Facilitating Conditions, - Technology Anxiety, - Resistance to Change</td>
<td>All Patients, health professionals, and general health users</td>
<td>302</td>
<td>Extended TAM</td>
<td>Significant: Perceived usefulness, perceived ease of use, perceived value, portability, self-efficacy, and technology anxiety, trust, social influence, facilitating conditions are significantly correlated with behavioral intention.</td>
<td></td>
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<tr>
<td>(Maiga &amp; Namagembe, 2014)</td>
<td>Uganda</td>
<td>- Performance Expectancy</td>
<td>Healthcare Professionals</td>
<td>169</td>
<td>Extended UTAUT</td>
<td>Significant: Performance expectancy, effort expectancy, and disturbance concerns are significantly correlated with adoption.</td>
<td></td>
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<tr>
<td>Study</td>
<td>Country(s)</td>
<td>Sample Characteristics</td>
<td>Key Predictors</td>
<td>Significant Findings</td>
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<td>(Lim et al., 2011)</td>
<td>Singapore</td>
<td>-Perceived Usefulness -Perceived Ease of Use -Self-efficacy -Technological -Behavioral Intention -Actual Use</td>
<td>All females 175 Extended TAM</td>
<td>Significant: Perceived usefulness, perceived ease of use and self-efficacy. Insignificant: Self-efficacy, Hedonic motivation.</td>
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<tr>
<td>(Yogesh et al., 2015)</td>
<td>USA, Canada, and Bangladesh</td>
<td>-Performance Expectancy -Effort Expectancy -Facilitating conditions -Social influence -Self-concept -Price Value -Waiting time -Hedonic motivation -Behavioral Intention -Actual usage Behavior</td>
<td>Elderly persons 1121 Integrated</td>
<td>Significant: Performance expectancy, effort expectancy, facilitating conditions, social influence, price value, waiting time was significant for these three countries. Insignificant: Self-efficacy, Hedonic motivation.</td>
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<tr>
<td>(Basak, Gumussoy, &amp; Calisir, 2015)</td>
<td>Turkey</td>
<td>-Perceived usefulness -Perceived enjoyment -Perceived ease of use -Subjective norms -Personal -Behavioral Intention</td>
<td>All Physicians 339 Extended TAM</td>
<td>Significant: Perceived usefulness, perceived ease of use, Subjective norms, Personal innovativeness, and computer self-efficacy. Insignificant: Perceived enjoyment</td>
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<tr>
<td>(Gagnon et al., 2016)</td>
<td>All Countries</td>
<td>-Perceived usefulness -Perceived ease of use -Design and technical concerns, Cost, Time, Privacy and security issues, Familiarity with the technology, -Adoption Intention</td>
<td>Healthcare Professionals Meta-Analysis Meta-Analysis</td>
<td>Significant: Perceived usefulness, Perceived ease of use, Design and technical concerns, Cost, time, privacy and security issues, Familiarity with the technology, Risk-benefit assessment, Interaction with others.</td>
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