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Mobile Health Adoption Readiness in Developing Countries: A Systematic Literature Review

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Abstract

Mobile Health (m-Health) has emerged as a pivotal solution to the healthcare delivery challenges faced by developing countries, offering a promising avenue to bridge significant healthcare gaps. This systematic literature review synthesizes research findings from developing nations to assess the readiness for m-Health adoption, focusing on a complex interplay of technological access, *security concerns, socio-economic disparities, and cultural influences.* Utilizing a systematic review methodology following Kitchenham and Charters' guidelines, the research analysed primary studies and existing literature to provide a comprehensive overview of m-Health adoption readiness. Findings revealed that while m-Health holds substantial promise for improving healthcare access and outcomes, its adoption is hindered by digital literacy deficits, lack of infrastructure, and resistance to technological change. The research emphasizes the critical role of government support and global partnerships in facilitating m-Health implementation. Limitations of this research include its reliance on published studies up to 2022, potentially omitting recent advancements and broader geographical representations. Future research should focus on longitudinal studies to track m-Health adoption readiness trends over time and explore the impact of emerging technologies on healthcare delivery in these regions.

Keywords: Mobile Health, M-Health, Readiness, Adoption Developing Countries, Technological Access, Digital Literacy

Introduction

In recent times, mobile technologies have continued to penetrate enormously worldwide. This has made health service providers invest hugely in targeted mobile interventions popularly known as mobile health (m-Health). The World Health Organization (WHO) defines mobile health as the use of mobile devices, including mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices, to support medical and public health practices (Mechael, 2009). This transformation is particularly pivotal in

developing nations, where traditional healthcare infrastructure often struggles to meet the population's needs. Despite its potential, adopting m-Health in these regions faces significant hurdles. These include a range of technological, socio-economic, and cultural barriers that inhibit the widespread utilization of mobile technologies for health services. The importance of m-Health in bridging the digital divide cannot be overstated, as it has shown considerable success in enhancing access to essential healthcare services like real-time treatment and disease surveillance. This study conducts a systematic literature review to explore m-Health adoption readiness in developing countries. It aims to provide a comprehensive overview of the existing research landscape, identifying the key factors influencing m-Health readiness and pinpointing the gaps in current knowledge. By integrating findings from a wide array of studies, the review outlines the complex dynamics of technological access, security concerns, and the socio-economic and cultural factors at play.

Furthermore, the study underscores the critical role of government support and international cooperation in facilitating the successful implementation of m-Health initiatives. The challenges of resistance to change, the need for community engagement, and the establishment of continuous monitoring and evaluation frameworks are also highlighted as essential components for sustained success. This introduction outlines the structure of the paper, which includes a comprehensive exploration of related studies, a description of the methodology employed, and a discussion of the findings aimed at enhancing our understanding and implementation of m-Health solutions globally.

Problem Statement

The adoption of Mobile Health (m-Health) technologies in developing countries holds significant promise for bridging healthcare delivery gaps and improving health outcomes. However, despite the potential benefits, the readiness and ability to adopt these technologies in developing countries face numerous challenges. These challenges include technological access, digital literacy deficits, socio-economic disparities, cultural influences, and security concerns. There is a lack of comprehensive understanding of these factors and how they affect m-Health adoption readiness. This research was conducted to systematically review and synthesise existing studies on m-Health adoption in developing countries. The goal is to identify the key factors influencing readiness for m-Health adoption, understand the barriers to effective implementation, and propose strategies to overcome these challenges. By doing so, the research aims to provide valuable insights that can guide policymakers, healthcare providers, and stakeholders in developing effective m-Health strategies tailored to the unique needs of developing nations.

Related Work

Numerous studies have delved into assessing the impact of mobile health (m-Health) in developing countries. One research in China, conducted by Wu et al. (2022), revealed that users' performance expectations, social influence, perceived reliability, and online reviews positively influence their intention to continue using m-Health apps. This intention, in turn, affects their actual app usage. The habitual use of m-Health apps amplifies the positive effect of user satisfaction (Wu et al., 2022). In Bangladesh, research found that the community exhibits moderate readiness regarding technological access and service availability. Most respondents expressed willingness to embrace m-Health in the future, anticipating essential healthcare services through mobile devices. A significant gap exists, however, between

technical competence and human resource readiness (Khatun et al., 2015). Another investigation in Egypt discovered that innovation and optimism significantly influence m-Health users, while discomfort and insecurity have a comparatively minor impact. Additionally, the research highlighted that value perception positively affected the subjective well-being of m-Health consumers, albeit among educated university students. It calls for further exploration of the perspectives of the less-educated population (Aboelmaged et al., 2021). In Indonesia, research emphasised the importance of understanding readiness factors from users' perspectives to inform m-Health design and implementation. A notable challenge is the absence of specific guidelines for m-Health or telemedicine implementation, emphasising the need for clear guidelines in the digital health domain (Handayani et al., 2021). Intervention research aimed at preventing hypertension in Peru, Guatemala, and Argentina identified challenges related to the acceptability of m-Health innovations. This underscores the necessity of customising interventions to address low literacy levels and limited cultural background understanding (Diez-Canseco et al., 2015). Low technology readiness adoption rates, digital literacy deficits, and limited exposure to technology were identified in India. These challenges were linked to respondents' social status and age barriers (Rasekaba et al., 2022). A bi-directional m-Health research in Brazil improved the coverage of HIV testing, syphilis, and antenatal care. However, it stressed the importance of maximising the reach of similar m-Health programs through well-designed studies (Oliveira-Ciabati et al., 2017).

Family recommendations and government support influenced users' readiness to adopt m-Health. This research also provided valuable insights into Vietnamese customers' behaviour during the COVID-19 pandemic, comparing it with pre-COVID literature (Nguyen et al., 2022). Chowdhury and Jahan's research in Bangladesh confirmed that lack of education and access to technology infrastructure were significant barriers to m-Health readiness and awareness. They proposed a set of procedures for implementing m-Health and assessed the opportunities, issues, and threats of developing m-Health systems in developing countries. Their work suggested a potential m-Health model and guidelines for a successful m-Health system in such contexts (Chowdhury & Jahan, 2014). In Nigeria, research provided a comprehensive thematic overview of rural healthcare systems, emphasising their socio-material structures and health-related practices. It shed light on the challenges posed by a structured yet limited professional healthcare system, decentralised peer-driven practices, and historical factors that hinder the effective implementation of m-Health tools. These factors include the scarcity of trained healthcare professionals, distributed informal communities of practice, and the perception of mobile phones primarily as tools for peer communication (Eze et al., 2021).

Research in Nigeria assessed the practical effects of a m-Health application on the quality of healthcare facility operations, and no supplementary interventions or support were provided to health workers or clients. The research revealed significant enhancements in client education and counselling, which have the potential to yield positive maternal health outcomes. Moreover, there was a noteworthy increase in client satisfaction, underscoring the success of the intervention in enhancing both service quality and the overall client experience in maternal healthcare. It is worth noting that the authors pointed out the absence of similar research in developing countries, highlighting a gap in the existing literature (McNabb et al., 2015). The research conducted in Jordan investigated the factors influencing patients' intention to use m-Health applications. The research's results revealed that several factors,

including performance expectancy, effort expectancy, social influence, perceived health threat, m-Health app quality, and life quality expectancy, directly impacted patients' willingness to use m-Health. Conversely, security and privacy risks negatively affected patients' intention to use M-Health. Additionally, the research found that resistance to change indirectly affected patients' intention to use m-Health, mediated through performance expectancy (Alaiad et al., 2019).

The findings of these studies revealed low confidence in adopting m-Health readiness because of inadequate digital literacy, social status, age barriers, low-level access to (ICT) infrastructure, lack of government support, and limited exposure to technology. However, keywords used to search for relevant studies and the limited number of selected articles may not cover all the available m-Health readiness in developing countries. Therefore, there is a need for in-depth research into the factors hindering m-Health readiness in developing countries.

Table 1
Primary Studies Selected for the Review

Authors and Year	Title	Method	Findings
(Wu et al., 2022)	Factors influencing continued usage behavior on mobile health applications.	Quantitative	User expectations, social influence, perceived reliability, and online reviews positively influence m-Health app usage.
(Nguyen et al., 2022)	Demand for Mobile Health in Developing Countries During COVID-19: Vietnamese's Perspectives from Different Age Groups and Health Conditions	Quantitative	Family recommendations and government support are critical factors influencing m-Health readiness.
(Rasekaba et al., 2022)	Exploring Telehealth Readiness in a Resource Limited Setting: Digital and Health Literacy among Older People in Rural India (DAHLIA)	Quantitative	Low technology adoption, digital literacy deficits, and age-related barriers.
(Eze et al., 2022)	Worlds apart: a socio-material exploration of mHealth in rural areas of developing countries	Mix methods	Challenges due to limited healthcare resources and historical factors hindering m-Health implementation.
(Aboelmaged et al., 2021)	Predicting subjective well-being among mHealth users: a readiness – value model	Quantitative	Innovation and optimism significantly influence m-Health users; value perception positively affects subjective well-being
(Handayani et al., 2021)	Mobile health readiness factors: From the perspectives of mobile health users in Indonesia	Quantitative	Need for user-oriented readiness factors and clear implementation guidelines.
(Alaiad et al., 2019)	The determinants of m-health adoption in developing countries: an empirical investigation.	Quantitative	Performance expectancy, effort expectancy, social influence, and perceived health threat positively impact m-Health adoption; security and privacy concerns negatively affect adoption.
(Lee et al., 2018)	m-Health policy readiness and enabling actors: Comparisons of Sub-Saharan Africa and organization for economic cooperation and development countries	Quantitative	m-Health policy readiness varies significantly; enabling factors include infrastructure and policy support
(Diez-Canseco et al., 2015)	Design and Multi-Country Validation of Text Messages for an mHealth Intervention for Primary Prevention of Progression to Hypertension in Latin America	Quantitative	Customization of interventions needed to address low literacy levels and cultural background understanding
(Oliveira-Ciabati et al., 2017)	A mHealth messaging system to complement antenatal care: A cluster-randomized trial	Quantitative	Importance of well-designed studies to maximize the reach of m-Health programs.
(Khatun et al., 2015)	Determinants of readiness to adopt mHealth in a rural community of Banglades	Quantitative	Moderate technological readiness, significant gap in human resources readiness.
(Chowdhury & Jahan, 2014)	Applicability of mHealth for healthcare management in developing countries: a study in Bangladesh	Quantitative	Significant barriers due to lack of education and access to technology infrastructure.

Research Methodology

The review methodology follows the protocol established by Kitchenham and Charters (2007), as depicted in Figure 1. This structured approach includes three main phases: planning the review, conducting the review, and reporting the review (Kitchenham, 2007).

Figure 1. Kitchenam and Charters review protocol (Kitchenham, 2007).

The research questions and criteria for selecting relevant studies were defined in the planning phase. The conducting phase involved a comprehensive literature search, selection of studies, data extraction, and quality assessment. Finally, the reporting phase synthesised the findings to answer the research questions and provide recommendations. This systematic approach ensures a thorough, transparent, reproducible review process (Kitchenham, 2007).

Research Questions

This study is more interested in investigating empirical studies on adopting m-Health technologies within the healthcare sector in developing countries. The review was based on specific aspects such as the readiness for m-Health adoption, the technological, socio-economic, and cultural factors influencing this readiness, and the challenges encountered. This approach addresses the current gap in the existing literature on m-Health adoption in developing countries. To achieve this objective, the following research questions were defined:

RQ1: What are the key challenges developing countries face in achieving readiness for m-Health adoption?

RQ2: How widespread is the utilisation of m-Health in developing countries, and what factors influence its adoption?

RQ3: What are the best strategies for implementing m-Health in developing countries?

By exploring these questions, we aim to provide a comprehensive understanding of the factors influencing m-Health adoption readiness and propose practical strategies for overcoming the identified challenges.

Searching Strategy

The search strategy was identified by describing the scope, method, and search string. The year of publishing and publication location are included in the search scope. The investigation focused on papers published between 2014 to 2022. In addition, the scope was applied only during the study selection criteria, and the Scopus database is the venue for the search of the desired research papers. However, both manual and automatic methods were used to search the literature. The former employed the snowball method, while the latter employed a pre-defined search string to search the relevant databases. The search string was created by

combining keywords from the research questions with synonyms. A pilot search was then used to improve the search string. The following is the resultant search string: *(mobile AND health OR mHealth OR m-health) AND (readiness OR preparedness) AND (low OR middle-in-come OR countries OR "Developing Countries").*

Criteria for Selection of Study

A set of criteria (exclusion criteria) was applied to identify the relevant research papers and eliminate studies that did not fit the study's goal, as depicted in Table 2. The table lists the exclusion criteria employed in this research.

Table 2
Selection Criteria

No.	Criteria
SC1	Papers published between 2014 and 2022
SC2	The paper did not relate to developing countries */ LMICs*
SC3	Full papers not available or accessible
SC4	The Abstract did not capture the m-Health domain
SC5	Papers that are not related to m-Health

The initial search identified 104 papers subjected to rigorous exclusion criteria outlined in Table 2. Of these, 25 papers were excluded for being published before 2014, 30 for not focusing on developing countries or LMICs, 10 for lack of full accessibility, 18 for not adequately addressing the m-Health domain in their abstracts, and 8 for not being related to m-Health. This process led to the exclusion of 91 papers. The remaining 13 papers underwent further quality assessment and were deemed suitable for inclusion in the final analysis, ensuring that only the most relevant and high-quality studies were reviewed.

Quality Assessment Criteria

After applying the exclusion criteria, the 13 remaining papers were further reviewed according to a well-defined quality checklist in Table 3. This was done to provide a more detailed exclusion criterion. The quality assessment criteria used in the research are based on *Kitchenam and charters review protocol* (Kitchenham, 2007).

Table 3
Quality Assessment Criteria

No.	Criteria
QA1	The aim and objectives of the research are clearly stated.
QA2	The research methodology is well-presented
QA3	The paper answered all the research questions.
QA4	The paper used explicit theories and models.
QA5	Papers with a comprehensive description of m-Health readiness
QA6	The paper's conclusions relate to the aim of the study.
QA7	The paper's conclusions relate to the aim of the study.

Data Extraction

A data extraction form was developed for accurate data collection from the selected empirical studies, followed by pilot data extraction. The reviewed studies are listed in Table 3. below.

Data Synthesis

This study employed a descriptive synthesis of the data extracted from the selected primary studies. Research papers with similar or identical meanings were identified and grouped under a concept. Moreover, the finding was presented and summarised in a manner that answered the research question.

Results

The study chooses journal articles published in reputable and diverse periodicals. While some articles covered many countries, others focused on a specific region. Additionally, the research period covered was from 2014 to 2022. Below is the table depicting the year-wise distribution of selected articles.

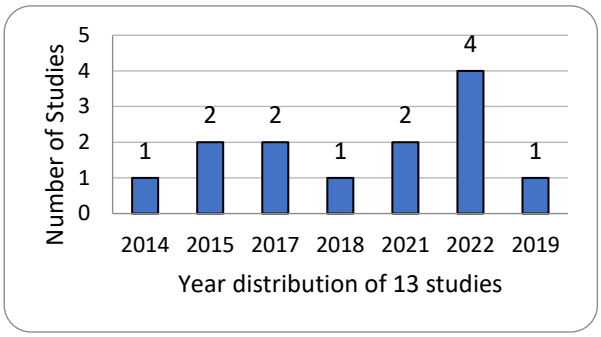

Figure 2. Year Distribution of Studies

The study has implications for future research and practice. Figure 2. illustrates the year-wise distribution of the selected articles, highlighting the progression and focus of research on m-Health adoption readiness in developing countries over time. The study has implications for future research and practice. The findings provided an up-to-date picture of current M-Health perspectives and readiness levels in developing countries, allowing them to take additional public health initiatives, such as promoting, using, and adopting M-Health services by government health institutes and health personnel.

Methodological Quality

Figure 3 summarises the quality assessment of the thirteen primary studies using a predefined checklist based on the Kitchenham and Charters (2007) protocol. Each study was evaluated against seven criteria (QA1 to QA7), such as clearly stated aims, well-presented methodology, and supported conclusions. Each criterion was scored on a binary scale: '1' if met, '0' if not, resulting in a total score ranging from 0 to 7. Studies scoring eight and above were classified as high quality, while those scoring below eight were classified as medium quality. This assessment revealed that 60% of the studies were of high quality, and 40% were of medium quality, ensuring only rigorous and relevant studies were included in the final review.

Figure 3. Overall Quality of the Selected Studies

RQ1: What are the key challenges developing countries face in achieving readiness for m-Health adoption?

Developing countries face key challenges in achieving readiness for m-Health adoption, including technological access deficits, digital literacy gaps, socio-economic disparities, and cultural barriers (Khatun et al., 2015; Rasekaba et al., 2022). Additional obstacles include inadequate infrastructure, resistance to technological change, and security and privacy concerns (Handayani et al., 2021; Alaiad et al., 2019). Addressing these challenges requires comprehensive strategies involving government support, community engagement, and tailored interventions (Eze et al., 2021; Nguyen et al., 2022).

Table 4
Source of Article Publication and their Frequencies

Publication Source	Freq
Patient preference and adherence	1
International Journal of Medical Informatics	1
International Journal of Information Management	1
Informatics in Medicine Unlocked	1
JMIR mHealth and uHealth	1
Geriatrics	1
Reproductive health	1
International Journal of Bio-Science and Bio-Technology	1
Telemedicine and e-Health	1
PLOS one	1
Health	1
Applied Clinical Informatics	1
Digital Policy, Regulation and Governance	1

RQ2: How widespread is the utilisation of m-Health in developing countries, and what factors influence its adoption?

Widespread utilisation of m-Health in Developing Nations: The study revealed that mobile technology has experienced significant penetration in developing countries, with mobile device subscriptions expected to increase further. This indicates a growing user base and potential for m-Health utilisation (Nguyen et al., 2022). Table 5 depicts the developing countries using m-Health, which answers the second research question.

Table 5
Study Countries

Country	Study
Egypt	Wu, Pei, et al.
Jordan	Nguyen, et al
Bangladesh	Khatun et al and Chowdhury & Jahan
India	Rasekaba,et al
Peru, Guatemala, and Argentina	Diez-Canseco et al.
Nigeria	Eze et al. and McNabb et al
Indonesia	Handayani et al
Vietnam	Nguyen et al
Brazil	Oliveira-Ciabati et al
China	Wu et al

Factors Influencing m-Health Adoption in Developing Countries
Technological Access: One of the critical factors influencing m-Health adoption is the level of technological access. Countries with better mobile network coverage and smartphone penetration tend to have higher m-Health utilisation rates (Khatun et al., 2015).

Digital Literacy: The study suggests that digital literacy among healthcare workers and the general population is pivotal in m-Health adoption readiness. Countries with higher digital literacy may readily embrace m-Health (Rasekaba et al., 2022).

Government Support: Government policies and support have a significant impact. Countries with proactive government support and clear policy frameworks for m-Health tend to adopt more successfully (Chowdhury & Jahan, 2014).

Cultural and Contextual Factors: Cultural factors and contextual differences influence adoption patterns. m-Health applications that are culturally sensitive and adaptable to local practices are more likely to be adopted in Countries with diverse populations (Handayani et al., 2021).

Data Privacy and Security: Data privacy and security concerns may affect adoption. Countries with robust data protection measures tend to trust m-Health applications more (Alaiad et al., 2019).

RQ3: What are the best strategies for implementing m-Health in developing countries?
The best strategies for implementing m-Health in developing countries include investing in robust ICT infrastructure, promoting digital literacy among healthcare workers and the general population, and ensuring governmental support and clear policy frameworks (Handayani et al., 2021; Rasekaba et al., 2022). Additionally, m-Health interventions should be customized to align with local cultural and societal contexts, address security and privacy concerns, and include continuous monitoring and evaluation frameworks to ensure effectiveness and adaptability (Diez-Canseco et al., 2015; McNabb et al., 2015; Alaiad et al., 2019).

Summary of Key Findings

The systematic literature review on Mobile Health (m-Health) adoption readiness in developing countries synthesises research findings to assess the readiness for m-Health adoption. The key findings are:

Technological Access and Digital Literacy*:* Technological access and digital literacy influence m-Health adoption. Developing countries with better mobile network coverage and higher digital literacy rates tend to have higher m-Health utilisation (Khatun et al., 2015; Rasekaba et al., 2022).

Government Support and Policy Frameworks*:* Proactive government support and clear policy frameworks significantly impact m-Health adoption success (Chowdhury & Jahan, 2014; Nguyen et al., 2022).

Cultural Sensitivity*:* m-Health applications that are culturally sensitive and adaptable to local practices are more likely to be adopted (Handayani et al., 2021; Diez-Canseco et al., 2015).

Data Privacy and Security*:* Robust data privacy and security measures are essential for gaining user trust and facilitating m-Health adoption (Alaiad et al., 2019).

Customization of Interventions*:* Customizing m-Health interventions to address local literacy levels and cultural backgrounds is crucial for their acceptability and effectiveness (Diez-Canseco et al., 2015; Aboelmaged et al., 2021).

By addressing these factors, developing countries can enhance m-Health adoption, ultimately improving healthcare access and outcomes. This review highlights the importance of targeted strategies and continuous improvement in the m-Health domain.

Discussions and Recommendations

The literature review elucidates several pivotal challenges and promising opportunities for adopting m-Health in developing countries. User performance expectations and satisfaction emerge as critical determinants in m-Health app adoption, as demonstrated in China, where these factors significantly influence continued usage behaviour (Wu et al., 2022). A discernible gap exists between technological readiness and human resource preparedness in many developing nations. For instance, Bangladesh exhibits moderate technological readiness but faces significant human resource challenges (Khatun et al., 2015). However, the necessity for clear and comprehensive implementation guidelines is underscored by findings from Indonesia, where the absence of specific m-Health directives impedes effective adoption (Handayani et al., 2021). Cultural and socioeconomic factors wield substantial influence over m-Health adoption, with Egypt emphasising the importance of innovation and optimism among users, while India's research highlights the critical challenges posed by social status and age barriers (Aboelmaged et al., 2021; Rasekaba et al., 2022).

Furthermore, customising m-Health interventions to address low literacy levels and limited cultural understanding is imperative, as illustrated by studies from Peru, Guatemala, and Argentina (Diez-Canseco et al., 2015). Family recommendations and government support are crucial factors influencing m-Health adoption, as evidenced by research in Brazil and Vietnam (Nguyen et al., 2022; Oliveira-Ciabati et al., 2017). Addressing security and privacy concerns is vital for successfully implementing m-Health, as these issues can significantly hinder adoption (Alaiad et al., 2019). Successful m-Health applications, such as the one studied in Nigeria, demonstrate the potential to substantially improve healthcare quality and client satisfaction (McNabb et al., 2015).

Drawing from these insights, several strategic recommendations are proposed for implementing m-Health effectively. Developing countries should prioritise investment in robust ICT infrastructure to underpin m-Health applications. Promoting digital literacy among healthcare workers and the general populace is essential to bolster m-Health adoption. Governmental solid support and international partnerships are paramount in creating a conducive environment for m-Health. Tailoring m-Health interventions to align with local cultural and societal contexts will enhance their acceptability and efficacy. Implementing rigorous security measures and educating users about data protection is necessary to alleviate concerns and build trust in m-Health applications. Establishing continuous monitoring and evaluation frameworks is crucial to ensure the efficacy and adaptability of m-Health initiatives. By adhering to these guidelines, developing countries can leverage m-Health to improve healthcare access, outcomes, and satisfaction, thereby rendering healthcare more equitable and accessible.

Conclusions

The systematic literature review on Mobile Health (m-Health) adoption readiness in developing countries reveals significant potential for m-Health to bridge healthcare delivery gaps and improve health outcomes. The findings highlight key factors influencing m-Health adoption, including technological access, digital literacy, governmental support, cultural sensitivity, data privacy, and the need for customized interventions. Countries with robust mobile networks, higher digital literacy, proactive governmental policies, and culturally sensitive m-Health applications are more likely to succeed in m-Health adoption. However, the research is limited by its reliance on articles from 2014 to 2022 and its focus on a few developing countries, possibly missing broader global insights. Future research should expand to cover more recent and diverse data, and address challenges specific to less-educated populations to ensure m-Health interventions are culturally and educationally appropriate.

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