



# Barriers, Problems and Challenges in the Implementation of Mobile Healthcare Applications: A Systematic Literature Review

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**Abstract:** Nowadays, advancements in mobile technology have boosted the utilization of mobile-based health technologies referred as mobile health. The Goal of these systems is to providing quick response regarding person's health condition. The Rising acceptance of mobile phones constructs the recent opportunities of "pervasive health". Recent numerous mobile-based monitoring systems those are designed, with the ability to compute a broad range of physiological signals. Mobile devices have enhanced the access of health information for patients and healthcare provider. It delivers timely healthcare reminder to patients. These devices are giving healthcare facilities at low cost. Although, with all these are several problems and challenges in the deployment of mobile healthcare applications. In this paper, issues, challenges and problems are described regarding mobile healthcare applications.

**Keywords:** mhealthcare (mobile healthcare), Challenges, Barriers, Health Information System.

## I. INTRODUCTION

There are many capabilities provided by mobile healthcare applications are voice, text, videos and images by one way, two way and multiway communications. These applications include text messages, phone calls, health record tracking for data transfer and patient monitoring system for diagnose [1]. Additionally, mobile health technologies have potential to provide more conventional health communication methods and SMS have demonstrated to be effective, messages can be sent to many mobile phone users at a time and at very low cost. [2] [3].

Recently, to monitor the health condition of patient, body sensors and mobile phones are broadly used. However, inadequate computational power, storage space and battery problems of mobile make it ineffectual [4]. Wireless communication networks are such as: (2<sup>nd</sup> Generation (2G), 3<sup>rd</sup> Generation (3G) and 4<sup>th</sup> Generation (4G)), Wireless Local Area Network (WLAN), Wireless Personal Area Network (WPAN), including Bluetooth, Wireless Body Area Network (WBAN), Wireless Sensor Network (WSN), Radio frequency identification (RFID) has greatly boosted mobile healthcare applications [5].

New devices are also being developed including Personal Digital Assistant (PDAs), iPhone, smart phones and tablets come into sight in market. Although, PDAs were famous in 1990s to 2000s after that they replaced by smart phone. Smart phones now mostly used in developed countries. 80% of world population uses smart phones worldwide. In United States, 88% of adults are owner of cell

phones and the number of smart phone users crossed 200 million by 2016. Mobile phone users in Pakistan crossed 133.02 million by 2016, 77% of smart phone users are just 21 to 30 years old. Additionally, 60% smart phone users carry more than one mobile device due to security issue [6].

Thus, there is a great opportunity for mobile health application implementation in healthcare organization for the betterment of health facilities. Developed countries are spending a lot of resources over the integration of mobile healthcare applications in health organizations [7].

## II. AIM OF THIS SYSTEMATIC REVIEW

Aim of this review is to discuss the challenges and issues in mobile healthcare applications. Studies have presented that mobile healthcare applications have great potential to improve the health quality. Systematic review shows the availability of resources, risks and evidence regarding problems and issues in mobile healthcare applications. The fundamental aim of this review is to analyze and examine the several issues. Objective of this paper is to highlight the valuable research approaches for collaborative research by investigating number of studies.

## III. METHODOLOGY

In this paper review searched by four electronic databases: PubMed/MEDLINE, IEEE xplore, science direct and telemedicine and informatics. Review search based on peer-reviewed papers published in between 2011-2018 in English. The search strategy based on four keywords: barriers,

challenges, benefits and mobile healthcare applications along with AND/OR search terms. Barriers, challenges and issues were obtained by reading abstract and entire articles. The inclusion criteria for this review were: studies having focus on problems and issues in the deployment of mobile healthcare applications in hospitals. Furthermore, articles in which authors have discussed the network infrastructure issues, budget issues and policy issues of low and middle income countries were also included. Authors eliminated the duplicate citations opposite to the inclusion criteria for this review by manual revision. .

**IV. RESULTS**

Review included 138 total articles from search database. 48 articles were selected for full-text review. From 48 articles 15 papers were excluded because they did not match with criteria. 6 papers were discussed the critical factors have influence on adoption. 2 papers have not clearly defined the proper methodology. 3 papers were not discussed the network and device issues. 2 papers just presented the success factors towards the adoption. 2 papers were students papers not ware review papers. Therefore, 33 articles were included in final review. Figure 1 the flow diagram shows the flow of review search.

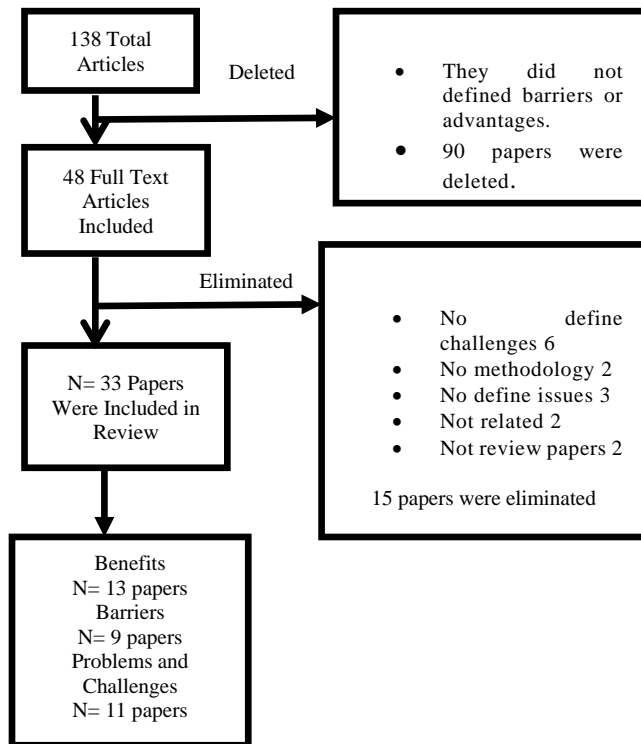


Figure 1 Flow Diagram of Systematic Review

**V. BENEFITS OF MOBILE HEALTHCARE APPLICATIONS**

Individuals, government, hospitals, employees and suppliers can get benefit from the advances in mobile health services; literature addressed these categories of benefits. These categories are discussed one by one:

*A) Education and Awareness*

Authors of [8] have evaluated the use of mobile healthcare applications in health to support education and awareness, it increases the accessibility of health for all, text messaging used to provide reminders and alerts to patients it can used to monitor the chronic condition of patients. Mobile health applications can use in the prevention of communicable and non-communicable diseases.

*B) Self-Monitoring and Assessment*

Research scholars of [9] have reported that mobile devices allow for inexpensive and expeditious communication between patient and doctor, these devices stay easiest way to access quality healthcare. Mobile healthcare applications can also be beneficial for other sides of self-monitoring through increasing the social support. Mobile healthcare applications are good to encourage the patients so they become more active in health.

*C) Easy Access of Information*

A study proposed by [10] has evaluated the benefits of mobile healthcare applications can be defined as an information system, for instance healthcare providers can obtain the information of patients by wirelessly to the institute of information systems. Doctors can access patient’s data, lab results and pharmaceutical information. So, the implementation of mobile healthcare applications, medical resources would be enhanced. Mobile health applications are also helpful in home healthcare by self-monitoring system, to improve the quality of care patients [11].

*D) Helping in Emergencies*

In the study [12], has examined mobile health applications provide quick feedback to censorious medical care without regard to, geographic blockades. These applications are used to track patients in any emergencies; hence several injured patients can manage easily. These applications provide flexible access to expert opinion and good advice for any health issue without delay and with better management as well as in emergencies.

*E) Helping in Decision Making*

Research [13] evaluated that mobile health applications provide quick response to detect the unusual pattern of diseases and its outbreak, mobile healthcare applications provide accurate data which can help healthcare providers make decisions. These services save time and as well as money and health information would become easy to access.

*F) Capacity Enhancer*

Authors of [14] have explored, Due to mobile phones, people in rural areas can get rapid and easy access of healthcare facilities. Mobile healthcare services are used to save time for work, where healthcare providers have provided up-to-date information regarding health updates in a huge amount of patients.

*G) Knowledge Generator*

In [15] has evaluated that social networking and written material regarding health assumed as a more common source of getting information. Health issues can be resolved by delivering of SMS and written material on social sites.

*H) Reduce Human Efforts*

According [16] the implementation of mobile health application in organizations, Pen and Paper method will reduce in medical laboratories as well as in a hospital environment. Furthermore, data store in a file format that would reduce the space. Most importantly, the less wired system means less danger, so in that manner wireless systems are easy to implement.

*I) Reduce Error Rates*

[17] Has proposed that mobile health applications have influence, especially in those areas where experts are rare, distances are large and health facilities are limited; lots of medical flaws happen in decision making because of lack of proper information. In result of incorrect diagnosis and drug reciprocal action errors occur. So, mobile technology, through tracking of patients, suppliers, and medication can decrease the medical errors.

In [18] authors have reported mobile healthcare applications have great potential to solve healthcare issues and provide better health facilities. Approximately 100% of the population operates text messaging service globally because text messages can be sent by a simple mobile as well as a smartphone. The popularity of mobile healthcare services based on smart phones, can facilitate broadly deliver effective prevention and treatment to the patients. Smart phones provide six basic fundamental functions; it is used to inform about health risks and available resources, mobile devices used for training purpose and provide an automatic monitoring facility. Mainly mobile healthcare services support to develop and maintain the healthcare organizations and their management [19].

## **VI. BARRIERS IN THE IMPLEMENTATION OF MOBILE HEALTHCARE**

There are so many problems and barriers regarding the implementation of mobile healthcare applications in the organization. Barriers are numerous in number, but some are highlighted in the literature. Some are discussed below:

*A) Cost*

In [20] cost is a main factor in the implementation of mobile healthcare applications. The World Health Organization (WHO) has recommended the all states member of WHO must spend at least 5% of budget on health department. To achieve the goals set by the nations. More importantly, many success stories of the health system in many countries relay on the strong commitment of the government. It should be the basic governmental priority that nation should not suffer from any lack of healthcare facility. Cuban government reduced military budget and increased health budget around 7%. As a result, their health improved. Additionally, another example is United Kingdom (UK), they spent tax money on health services with improved check and balance. They spend 4% on medical technology. Egypt is one of lower middle income country, but giving much priority to the health. Additionally, Sri Lanka has also spent 4.3% of the budget on their health department.

Traditionally in Pakistan, we spent low rate of budget on health services. The health budget devised by the federal government and provincial government do planning for implementation of the proposed budget. The one-third of the population of Pakistan is suffering from poverty and the quality health services are staying inaccessible to the public. Public health sectors are not highly equipped with health facilities and over 75% people visit private sectors for better health treatment. Moreover, the donor agencies have been contributing all times. The reliance of the country is on foreign funding.

So to improve the health condition, we have to increase health budget and the proper utilization of money is required. At the level of policy making we do not ignore corrupt management. We have to be transparent and efficient in the delivery of health care services. When insufficient and late funds released by the federal government to the provincial government, provincial government released late funds to district level government. Due to late released funds, eventually district level government also released late and insufficient funds to the hospitals management; therefore the hospitals management does not provide healthcare facilities in a proper way. The Majority of our population is not utilizing public sector hospitals, which is mostly free, but unfortunately due to poor quality and reliability people do not utilize it. And this is the main factor of failure in the implementation of health in public sectors of healthcare organizations. There should be a strong commitment by political leadership to develop the confidence in the people. In order to refine health of nation, to create well organized and effective implementation of funds are required.

Health quality of private hospitals is better than public hospitals and they are in urban areas. Private hospital services are out-of-pocket for poor peoples and poor people spend a good portion of their income on health. Rural areas of the country are very poor at health facilities. Ratios of public hospitals are high in Punjab, Khyber Pakhtunkhwa (KPK) is on second number and rests of two provinces are

rough at in this ratio. Price of medicine is lowest in Punjab and KPK. While in Sindh and Baluchistan the medicine rates are higher. So the coverage of health facilities in rural areas of Punjab and KPK has the highest rate. Rural and urban use of health facilities remains rough in Sindh and Baluchistan. In 2010/11 coverage of health in rural Punjab and KPK is 79% and 77%, but only 67% and 45% in Sindh and Baluchistan [21].

Gap between public and private sector has addressed a question that why the private healthcare option is more demanding than public healthcare services. Significantly, the cost has been a major barrier in the provision of effective healthcare services [22].

#### B) *Policy Making*

According to [23] the main barrier is lack of effective policy making. In Pakistan ministry of health is responsible for planning and policy making. The provincial government has established health department to protect the health of its citizens. The province government regulates public and private health services. For the delivery of effective and low cost health to everybody; the policy designers would require to comprehend the demands of people and their capacity to pay for it. Healthcare system requires sincere involvement of policy makers. In policy making, the government doesn't pay attention of technology involved in healthcare services.

#### C) *Poor Data Reporting and Monitoring*

In [24] there is lack of poor data reporting and monitoring systems. Monitoring and reporting, the evaluation is necessary not only for improvement in performance of the health sector, but in the enhancement of relief programs for the public. In this manner, to achieve this object, of health monitoring system had developed by the Pakistan government in 1992 with the help of United States Agency for International Development (USAID), but the surveillance system for public health is always neglected by the government and still unable to generate the data regarding health issues. For surveillance mobile healthcare applications is really effective tool and government must have to pay attention on mobile healthcare technologies. They can use smart phone technology to monitor the health services, especially in rural areas. By the implementation of these technologies they can evaluate their system and their plans and policies for the betterment of health.

#### D) *Education*

According to [25], there is a lack of education in Pakistan and literacy ratio, resulting people does not know how to operate a smart phone. The Very little percentage of people can know about it. Female literacy, particularly in rural women is the lowest in the world; many women have no access to the modern health facilities during pregnancy and childbirth. In this regard the government should have organized health awareness programs regarding mobile

phone technology for public awareness. There should be training programs for educated women, where they can learn how to operate any mobile device and their instructors should be women or lady health workers because of cultural issues. In that manner, lack of education counts as a big barrier in the implementation of mobile health applications. When people would know about the mobile health application, then they can get benefit from these applications.

#### E) *Economic Factor*

In [26], poverty is also one of main issues in our society. Poverty, not only prohibit people from advantages of healthcare facilities but also restrict them from participating in a decision that would affect their health. For health disbursement in Pakistan, 76% reach out-of-pocket. This factor also establishes the capacity of people in a family as a whole to fulfill their health needs. No doubt cost is a big blockade in the implementation of mobile healthcare facilities.

### VII. PROBLEMS AND CHALLENGES IN THE IMPLEMENTATION OF MOBILE HEALTHCARE TECHNOLOGIES

There are many problems and challenges faced in the deployment of mobile healthcare applications especially in healthcare organizations; some are highlighted in the review:

#### A) *Internet Connectivity*

In [27] Internet connectivity is a major problem because every person has not internet access and for web-based application internet connectivity and smart phone are required. In Pakistan, the poverty rate is high so, every person cannot afford a smart phone and internet connectivity. These applications require the users to have an internet credit on his/her smart phone.

#### B) *Technological Literacy*

According to [28], there is lack of technological literacy. Everybody doesn't know about smart phone even people don't know to operate a smart phone even they don't know to install mobile application because literacy ratio is low. Illiteracy itself is a major issue that could prevent the effective use of smart phones in this situation. People cannot access SMS and they face difficulties with reading SMS because they don't know English. So there must be Information Technology (IT) professionals in hospitals. Who train the people and guide them how to operate mobile health application. Patients who are young adults are more technology-aware users. They are playing important role in access of health care implementation to their friends and family by using mobile technology.

#### C) *Security and Privacy Issue*

In [29], Security and privacy issues in mobile healthcare are also challenging. Privacy concerns for access, utilization and sharing of personal data is crucial. Personal

accountability occupies firewall, encryption and password on smart phones. In Pakistan, especially in rural areas women mobility is restricted. When a patient is not the owner of his phone so here is a big issue especially with women. Mostly, males are the owner of the cell phone in homes. Women have no access of mobility in rural areas. For the mobility, women must ask permission from their husbands and fathers for the use of mobile phones. Women use mobile phone with the permission of their males. Additionally, women don't want to share their mobile contacts and images for even health purpose.

#### D) *Device Storage*

[30] Indicates that Device storage is a big issue in simple mobile phones, there is a limit for text messages. But for smart phones, cloud computing has resolved this issue, it enables hospitals to store, manage patient record through internet connection. New batteries offer longer battery timing and new memory cards having larger capacity could easily expend memory storage.

#### E) *Decision Making Complexity*

[31] reported the state when the number of variables, parameters and outcome possibilities are multiple in decision making become complex over here and healthcare providers need to make these complex decision making error free and at that point tasks can increase the multitasking and is a chance for increased number of cognitive load for healthcare professionals. If interface of a mobile phone is not applicable for fast reading and writing, at that point situation will become more complex like poor visibility of text, animation and graphics. It can lead wrong understanding and wrong entry of data.

These problems solved by many ways, firstly, reduce the irrelevant information. Filter the information. Secondly, improve the presentation of information which leads to correct understanding and increase the usability and reduce the cognitive load. Finally, reduce the process of complexity. Set the priority and time for tasks. Thus the cognitive load can be reduced.

#### F) *Problems in Network Infrastructure*

In [32] Problems in Network Infrastructure provide wide coverage of the network. From a room to wide-area mobility as a country or world, the infrastructure should lead both synchronous and asynchronous version of mobile health; In case of demands and resources of mobile networking. Network infrastructure contributes an essential part in providing health anytime and anywhere which leads to quality in mobile healthcare. It is an also lead network resource which meets with various requirements for regular and emergency condition in mobile health services. The observation of patients and healthcare professionals would effectively by the abilities and limitation of without wired infrastructure. Infrastructure should allow fast access of desired data to the patients and healthcare providers.

To achieve these objectives needs physical connectivity, adequate bandwidth and real time delivery. There are numerous health applications where high bandwidth is needed. The current 3G and 4G cellular wireless network provides physical connectivity based on network coverage for patients and healthcare providers. Bandwidth problems can affect real-time ability in healthcare applications.

#### G) *Proper Network Management*

According to [33] in mobile healthcare infrastructure many and different networks work together named as cellular networks, WLANs and Satellites networks. To collect patient's information from sensors, proper integration of these networks is needed. Transmission of patient's information from Bluetooth network to smart phone that can carry out by 3G or 4G wireless network, in this manner, research is needed in the integration of different networks in healthcare context.

### VIII. DISCUSSION

The purpose of this review is to summarize the problem and issues behind the successful adoption of mobile healthcare applications in hospital manner. Mobile healthcare applications are large project especially in hospital level. These projects contain many challenges and risks. Depend upon context were they are implemented. However, we cannot ignore the benefits and advantages of these applications in health sector they reduce human efforts, errors and generate knowledge among people. These applications are helpful to handle emergencies situation they provide information access, self-monitoring and spread awareness regarding health issues [8 9 12 16]. Findings of this review shows many issues associated with implementation of mobile healthcare applications at organizational level. These projects need large scale mobility, huge network infrastructure and financial resources. Policy making, poor data reporting and monitoring issues are seem as blockades [20 24]. Internet connectivity, technology literacy, device storage, security issues and proper management are highlighted as most important challenges towards the acceptance of mobile healthcare applications [27 29 30 32]. Findings of this review suggested some recommendations: establish efficient network infrastructure with proper network management, make effective health policies. Do awareness seminars to educate the people regarding health issues. Encourage collaboration of hospital management and govt. regulatory bodies to grant financial aids for the implementation of these huge projects, for the betterment of healthcare conditions in hospitals. Adoption of mobile healthcare applications can improve and refine the public health delivery in low and middle income countries.

## IX. CONCLUSION

Mobile healthcare domain contains so many challenges in the process of implementation. It includes network issue, security issue and device issue. The study of these challenges shows that there is wider research in the field of mobile healthcare applications.

In that manner, there is big need of secured and trustable deployment of mobile healthcare applications. Applications should be designed easy so, they can engage a user but healthcare providers are very conservative to adopt new technologies because their practice is personally with patients safety. Now there is a question mark that how the field of mobile healthcare applications can go forward for the betterment of healthcare in the cost and as well as patient care. Medical staff and hospital management should use and support mobile healthcare applications in their work practices for effective use of mobile healthcare applications. Mobile healthcare applications can be efficient and trustable only when these problems and issues would sort out by powerful technological solutions.

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