

# Use of Mobile Applications in Healthcare: A Review

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**Abstract**— In today's world smart phones have become ubiquitous. Due to their attributes such as mobility, instant connectivity, convenience, personalization, location awareness, smart phones have gained huge acceptance from all walks of life. Smart phones of this era are equipped with multi-core processors providing massive onboard processing power and are equipped with large storage capacity, and open operating systems. Mobile apps have become so popular because of their simplicity, user friendliness, speed, and portability. They make the required information available at fingertips to the user, wherever and whenever required. Mobile Apps have encompassed many areas including m-commerce, entertainment, advertisement, education, as well as healthcare. The far and wide reach of mobile devices and ease of use of mobile applications has made them a perfect choice for medical professionals. Mobile healthcare apps are increasingly being adapted to mainstream. Most commonly used apps in clinical practice can be listed as drug guides, medical calculators, coding and billing apps, pregnancy wheels, etc. These apps are revolutionizing the delivery of healthcare services across the globe and increasingly proving beneficial for chronic disease management, lifestyle interventions, and behavioral therapy.

**Keywords**— mobile apps, healthcare, mHealth, self-management, mobile health, chronic disease management, lifestyle interventions

## INTRODUCTION

In today's world smart phones have become ubiquitous. They have revolutionized every walk of life and have become an integral part of our lives. They have been adapted so readily by everybody because of their ability to perform a variety of tasks that normally a desktop computer will do. Smart phones of this era are equipped with multi-core processors providing massive onboard processing power and are equipped with large storage capacity, and open operating systems. Due to their attributes such as mobility, instant connectivity, convenience, personalization, location awareness, smart phones have gained huge acceptance from all over the world. In the earlier days, phones were just a medium of voice communication but today's phones are viewed more as handheld computing devices rather than just communication devices. Nowadays, cell phones are being used more for surfing the web, checking email, snapping photos, and updating our social media status than actually placing calls.

Mobile applications or Apps have quickly become popular in mobile users. An app is a specialized software program that can be downloaded and accessed using one's own mobile device such as a smart phone or a tablet computer. Today, we have an app for practically everything, right from booking movie tickets, airline tickets, ordering food, online shopping for clothes, electronic items, to booking doctor's appointment. Apps have become so popular because of their simplicity, user friendliness, speed, and portability. They make the required information available at fingertips to the user, wherever and whenever required. Mobile Apps have encompassed many areas including m-commerce, entertainment, advertisement, education, as well as healthcare.

The far and wide reach of mobile devices and ease of use of mobile applications has made them a perfect choice for medical professionals. More and more apps are being developed in the healthcare sector. These apps are revolutionizing the delivery of healthcare services across the globe. The ever increasing popularity of such healthcare apps has resulted into creating of a

dedicated category for healthcare apps in Apple App Store (Dolan, 2011). These healthcare apps are benefitting many facets of healthcare industry such as remote monitoring of chronic diseases, helping elderly and expectant mothers, extending the reach of healthcare services to remote areas (West). Most commonly used apps in clinical practice can be listed as drug guides, medical calculators, coding and billing apps, pregnancy wheels, etc (Franko, 2012) According to a report published by IMS Institute for Healthcare Informatics, as of 2015 there are around 165000 mobile health applications available for consumers (Constantino, 2015). The report also notes that mobile healthcare apps are increasingly being adapted to mainstream as more and more healthcare providers as well as patients are expressing greater interest in such apps. Many of the apps specialize in sending biofeedback in the form of physiological function data from the patients with their ability to connect to a sensor. This has resulted into greatly enhancing the accuracy of data collection and convenience of the patients. As a result, the adaption rate of such apps is increasing faster. Following is an overview of various medical apps that are benefitting patients and healthcare providers alike.

## **MOBILE MEDICAL APPLICATIONS**

mHealth or mobile health apps targeting the areas such as patient monitoring, data collection, documentation, and advertising are proving increasingly useful to clinicians. Healthcare apps can radically improve the ease and speed with which healthcare professionals can access, analyze, and respond to clinical data and reference information. Smart phones or touch screen devices also aide the clinicians by providing the capability of visual representation and manipulation of reference material (Cohen, 2013). General architecture of health monitoring application consists of three separate tiers. The first tier consists of sensors and wearable devices that monitor vital signs of human body. The second tier includes the devices at the end user such as PDAs or smart phones. These devices act as mediators that communicate the data between first and the third tier. At the third tier, there are servers that perform actual functionality and provide database operation facilities to the applications (Oguz Karan, 2012).

### **Mobile Applications for Diabetes Management**

Diabetes is a chronic health condition that requires constant monitoring. Patients have to regularly visit the physicians just to monitor the vital signs essential for disease management. Various mobile apps are available that aide the patients in monitoring their glucose levels, food intake, physical activity and will enable individuals to have better control of their diabetes condition. These apps also help to reduce number of times the patients have to visit their healthcare providers thus proving to be a cost effective solution for diabetes management and also saving a lot of time of both patients and the physicians (Holtz, 2012). Interventions provided in this manner help in a holistic way to educate patient for successful self-management of the disease and to provide support to reduce risk of long-term disability caused by negligence of the condition. The primary functionalities provided by such apps include blood glucose monitoring, medication alerts, diet management, physical exercise monitoring, etc while the secondary functions fall in the range of education, decision support, weight/BMI monitoring, communication, social networking, etc (El-Gayar, 2013).

Authors Aarsand, Tarata, et. al had conducted a study on a focus group through questionnaire and interviews and they have observed that mobile applications for diabetes management have a positive impact on patients where the apps motivate the users to follow a healthy diet, follow a regular exercise regimen, and regular blood glucose level testing leading to overall improvement in health habits (Aarsand, 2010). In their study, the authors have also noted some shortcomings of the current state of the mobile applications. They have observed that many of the commercial diabetes self-management applications do not include educational information even though clinical guidelines emphasize importance of self-management education in diabetes care. Automated data entry is a huge factor in usability and customer satisfaction of such apps yet the commercial apps that provide this kind of support is as less as 1%. Another important element that that authors found missing was linkage of such apps with personal health record.

### **Mobile Applications for Weight Management**

Excess weight and obesity has become a prevalent problem worldwide. Obesity is a serious health hazard that can lead to many serious conditions such as type 2 diabetes, heart disease, bone and joint diseases, sleep apnea, metabolic syndrome, etc. Treatment for obesity can be complex as there are many interrelated factors such as genetic condition, lifestyle, metabolic rate, etc. and the response may differ from patient to patient. General methods used for weight reduction and management include lifestyle intervention, reducing caloric intake, increasing physical activity, intensive counseling, etc.

Mobile technology can be helpful in providing necessary intervention to do lifestyle and behavioral changes required for weight management. Authors Azar, Lesser, et.al. have reviewed weight management apps present in Health and Fitness category of iTunes App Store. They have observed that the functionality provided by these apps range from diet tracking, healthy cooking, weight tracking, to grocery decision making and even restaurant decision making. There are many strategies based on behavioral theory such as self-monitoring, realistic goal setting, stimulus control, self-reward, etc. that can be employed to increase the efficacy of weight reduction and management efforts. The authors have noted that even though majority of the reviewed apps help users in some way but they have failed to include these strategies (Azar, 2013).

### **Mobile Applications for Smoking Cessation**

Smoking is a major public health hazard particularly in adolescents and young adults. There are at least 60 diseases that can be caused as a direct result of smoking, most prevalent cause of ill health and death. For every death as a direct result of smoking, there can be as many as 20 additional individuals that will suffer from smoking related illnesses (Lim, 2013).

Traditional smoking cessation methods include regular physician counseling, using nicotine patches, gums, sprays, etc. Self determination and motivation of an individual plays a major role in smoking cessation efforts. Mobile technology can prove as an effective intervention technique to improve self-determination and motivation. Adolescents and young adults are amongst the heaviest users of mobile phones and spend a lot of time of the day with mobile phones. This fact can be used to advantage to educate and motivate the youth against smoking. The authors Haug, Castro et.al have conducted a study to analyze the efficacy of SMS-based intervention for smoking cessation among students who smoke tobacco daily or occasionally. In the study the students received personalized text messages to support smoking cessation. The authors have noted this type of intervention has shown improved results reducing number of cigarettes smoked per day, number of smoking days per month, etc (Haug, 2014). This method is also proving more cost effective as compared to face-to-face intervention by avoiding high personal and infrastructural costs making such programs more scalable. This method also has a potential to have far and wide reach due to ubiquitous nature of the mobile phones and as the SMSs are received automatically, it makes this type of intervention more convenient and accessible (Ybarra, 2014).

### **Mobile Applications in Cardiology**

Cardiovascular diseases or heart-related diseases are among the leading causes of deaths worldwide. Apart from medical treatment other important factors for disease maintenance and prevention are following a healthy lifestyle, regular physical activity, taking medication on time, reducing smoking and weight, etc. Mobile applications are looking promising in helping patients in self-management of the diseases. Authors Martinez-Perez, Torre-Diez, et.al have reviewed literature on currently available mobile applications as well as the mobiles applications available in leading app stores for cardiovascular diseases. Amongst the most popular apps for heart-related diseases are heart monitors and medical calculators. Other application categories include blood pressure tracking, ECG education and interpretation, CPR instructions, etc (Borja Martínez-Pérez, 2013).

### **Future Directions**

For developing effective health management practices, apart from monitoring just health activities and states directly tied individual's health goals, understanding the context that influences health activities is also crucial for chronic disease management. This allows healthcare providers to better understand the circumstances influencing individual's health and create better management strategies. Developers of mobile apps should also explore the potential of leveraging social network for healthcare applications. A whole new class of apps can be envisioned with the social networking tools such as Twitter and Face book, powered by automatically added location data and lightweight tagging. These applications can make it possible for people to form a support group of individuals with similar health concerns where they can share their experiences, medical advice, and resources (Klasanja, 2012).

In addition to providing chronic disease management by means of monitoring symptoms and critical events, there is a vast landscape in healthcare that is yet to be explored. Such areas include providing individuals the tools to access their health-related information from anywhere, ease of collecting and grouping care-related information.

Even though majority of applications have succeeded in achieving user satisfaction, there are some cases where the applications fail to achieve their goals. For mental illnesses such as bipolar disease, strict adherence to medication as well as patient education about the disease is essential for effective management of the disease. Majority of the currently available apps for management of bipolar disease fail to reference clinical practice guidelines, standard psycho-education information, or established self-management tools. Many apps fail to provide combined tools for disorder information, symptom monitoring, screening and assessment, and community support. Though apps are available that provide individual functionality mentioned in above list, they are not as effective. Failure of these apps is caused by low levels of adherence to quality assessment criteria, failure to comprehensively address main psycho-education domains, and nonendorsement of evidence-based practice guidelines (Nicholas, 2015). The desired benefits may not be realized by the apps that provide low quality generic information and do not adhere accepted medical practices. Unfortunately, such apps are predominant in the landscape of asthma care (Huckvale, 2015).

To improve the quality of apps, medical apps accreditation program should be undertaken that will assess the quality of available apps and certify or rank them for clinical use. Apart from establishing such a program, it is also essential to regularly revise the accreditation program and reassess and recertify the apps to accommodate for rapid turnover and feature evolution of apps (Huckvale, 2015).

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#### CONCLUSION

The popularity of healthcare apps is increasing by the day. They are proving beneficial for both clinicians and patients alike. Healthcare apps can radically improve the ease and speed with which healthcare professionals can access, analyze, and respond to clinical data and reference information. These apps are still in their primary stage of development. For developing effective health management practices, apart from monitoring just health activities and states directly tied individual's health goals, understanding the context that influences health activities is also crucial for chronic disease management. Although development in this space is vibrant and full of opportunities, the desired benefits may not be realized by the apps that provide low quality generic information and do not adhere accepted medical practices.

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