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A study on Mobile apps in the Healthcare Industry

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Abstract:

Ever since Mobile app came to the forefront has become core part of our life.

What is a mobile app?

A mobile application, also referred as a mobile app or simply an app, is a software program designed & developed to run on a mobile device such smartphones, tablet or even a smart watch. A mobile app can range from small software application like looking up to the weather to more complex application including financial software.

There isn't a single industry which does not deploy mobile app in one form or other, Which includes health care industry as well.

This document research and outlines the usage of mobile app with focus on healthcare industry and its benefits when deployed aptly towards improving patient experience,

Keywords - *Mobile application, Healthcare, Health tech, Clinical Health Tech, non-clinical health tech, Predictive Analytics, cloud computing, patient experience, patient app*

I. INTRODUCTION

Ever since iPhone was launched in 2007, the technology landscape has transformed tremendously. Even though there were smartphones before iPhone, Apple came up with the concept of app store using which users can download & install apps for varied usage.

Healthcare is in the midst of a mobile revolution, and it will only be a matter of time before mobile healthcare applications (“apps”) change how we deliver, consume, measure, and pay for healthcare.

The rapid pace of innovation and broad applicability of mobile healthcare applications have fueled this revolution. The healthcare mobile app market, currently estimated to be worth \$4 billion, is expected to increase to \$26 billion by 2017. [1]

Mobile applications (apps) to improve health are proliferating, but before healthcare providers or organizations can recommend an app to the patients they serve, they need to be confident the app will be user-friendly and helpful for the target disease or behavior.[2]

Mobile applications have also been used in critical areas such as tele-stroke consultation which proves to be fatal if not diagnosed properly and timely. And usage of mobile app has played a very significant role.

The cloud based mobile application for stroke patients outlines the measures to be implemented for the rehabilitation of patients on post-stroke. Furthermore, the existing cloud-based services and the techniques to be modified for the improvement in the patients’ health status and reduce fatality.[3]

Mobile applications have become ubiquitous and many healthcare apps are now available for download to mobile devices and to be used by health care professionals, consumers, and patients. Mobile apps can help people manage their own health, promote healthy living, and gain access to medical information. Mobile health apps are considered to have the potential to disruptive shift in patient engagement and healthcare delivery (Tyer, 2013). Half of healthcare IT professionals who responded to HIMSS (Healthcare Information Management Systems Society) second annual Mobile Technology Survey believed “mobile technology would substantially impact patient care delivery” while with another 16 percent reporting that “mobile technology will dramatically change the future of healthcare delivery” (mHIMSS, 2012). [4]

Smartphones have been one of the success stories of the last decade. In a relatively short period of time, smart mobile technology has penetrated significantly into society, capturing an entire age spectrum of subscribers in western industrialised nations, from school children to senior citizens. Such progress has built upon a long history of the use of communication devices, and a rapid adoption of mobile communication devices that began in the latter part of the last century.

According to Traxler [5] such rapid uptake in mobile phone ownership has transformed many aspects of our lives, both in the Western world and just about everywhere else around the globe.

Although encounters via mobile telephony are generally briefer than face to face interactions, there is evidence that for young people in particular, the number of daily contacts through text messaging can be very high [6].

Many older people also use mobile phones on a regular basis, to sustain contact with distant relatives and friends, and to converse on a daily basis, helped by call costs being generally distance independent. However, the mobile phone can undoubtedly be viewed as much more than a simple communication device[7]



It exerts a far reaching influence in society, because in effect, the mobile phone has enabled us to become 'distributed beings', due to the fact that mobile communication has unfettered us from our geographical boundedness[8]

Whilst the demographic statistics may vary from country to country, the smartphone is a phenomenon that is here to stay, and one which will rapidly progress in its evolution in the years to come. There is therefore great scope to harness the potential of mobile telephony to improve many aspects of society, including healthcare.[9]

II. MOBILE APP IMPACT ON HEALTHCARE INDUSTRY

Healthcare apps are nothing short of a boon for the entire healthcare industry. Every stakeholders from doctors to patients to pharmacists, everybody is drawing huge advantage from this technological marvel.

Global Mobile Medical Apps Market to Reach US\$20.7 Billion by the Year 2027

Amid the COVID-19 crisis, the global market for Mobile Medical Apps estimated at US\$4.2 Billion in the year 2020, is projected to reach a revised size of US\$20.7 Billion by 2027, growing at a CAGR of 25.5% over the analysis period 2020-2027.

Medical Monitoring, one of the segments analyzed in the report, is projected to grow at a 25.3% CAGR to reach US\$5 Billion by the end of the analysis period. After an early analysis of the business implications of the pandemic and its induced economic crisis, growth in the Nutrition & Fitness segment is readjusted to a revised 28.6% CAGR for the next 7-year period. This segment currently accounts for a 35.4% share of the global Mobile Medical Apps market.[10]

III. IMPACT OF MOBILE APP DURING COVID 19

Covid 19, has become a pandemic beyond anyone's imagination. What started has a small virus pocket in china, has engulfed every nation on earth and has caused significant dent to the overall ecosystem.

Overall, health app downloads have increased by 25% during the pandemic. Covid-19 has emphasised and increased the use of digital health tools, and that while some have found it challenging, others have embraced it.

As countries enter subsequent wave there is eminent national lockdowns, although health services remain open, there are still efforts to treat people remotely. Now, and when life slowly comes back to a new normal, must continue to harness digital health to address the health and service issues left by Covid-19 and not lose the gains that digital health has provided over this period," the report said. [11]

The first COVID-19 apps that were developed and widely publicized were contact tracing apps, which were created to notify its users if they had crossed paths with another person infected with the coronavirus [12]. The first

national app was developed in Singapore, which used Bluetooth technology for contact tracing [13]. If someone was in close proximity with an infected individual, the app would send a push notification to alert them of possible COVID-19 infection and further suggest that they undergo testing [14]. The technology was made open source and shared internationally for other countries to build similar apps for their own populations [15-16]. Since then, there have been various other types of contact tracing apps available, each using different methods of data collection to track the movements of its users.

Symptom monitoring apps have also emerged in response to COVID-19. These apps commonly collect information about the user's health by posing a list of questions related to symptom identification, from which a differential diagnosis is made [17]. However, other innovative methods have also been used, such as automatic collection and recording of the user's health-related data (eg, temperature and pulse rates) from wearables like wristbands [18,19]. In the case of a suspected COVID-19 infection, the user is alerted and advised to go for a checkup at a nearby clinic.

Amid the rapidly evolving COVID-19 environment, mHealth apps have been playing a pivotal role in mitigating the COVID-19 response. Without mobile app being available the response to the outbreak would not have been effective as today.

IV. MULTIPLE MOBILE APP USE CASE

There is plethora of apps available in the healthcare industry. However, it can be categorized into major categories below-

Clinical and diagnostic apps

The mobile apps developed that allows doctors to gather, evaluate data about their patients. They may include ability to fetch data from electronic health records (EHR) in real-time, view lab results such as blood work or any other lab tests including digital imaging. Many apps allow providers & patients to self diagnose illness & injuries quickly which enables doctors to understand the kind of situation the patient is in-

Many evidence-based software apps serve as useful bedside clinical decision-making tools. Printed medical references often used in disease diagnosis are now available as mobile device apps that provide information on diagnosis, treatment, differential diagnosis, infectious diseases, pathogens, and other topics [20]. Such apps include: Johns Hopkins Antibiotic Guide (JHABx), Dynamed, UpToDate, 5-Minute Clinical Consult (5MCC), 5-Minute Infectious Diseases Consult (5MIDC), Sanford Guide to Antimicrobial Therapy (SG), ePocrates ID, Infectious Disease Notes (ID Notes), Pocket Medicine Infectious Diseases (PMID), and Iddx [21].

Diagnosaurus, a popular, low-cost mobile differential diagnosis app for the iPhone, iPad, and iTouch, can help ensure that alternative diagnoses are not overlooked [22]. Flowcharts to help physicians identify diagnostic

possibilities are included in the apps 5MCC and Pocket Guide to Diagnostic Tests. Other diagnostic mobile apps apply clinical algorithms to aid physicians in determining a disease diagnosis [20] Mobile devices can also be used to access CDSSs installed on desktop computers in clinical settings to aid in diagnosis and treatment decisions[21] Mobile apps can also help clinicians identify the appropriate scans or tests to order, decreasing unnecessary procedures and reducing cost of care. Lab test apps provide information such as: reference values and interpretation, causes for abnormal values, and laboratory unit conversions [20] They include: Pocket Lab Values, Lab Pro Values, Palm LabDX, Normal Lab Values, Lab Unit Converter, Labs 360, Davis's Laboratory and Diagnostic Tests, and Pocket Guide to Diagnostic Tests[23].

Mobile apps can also be used directly to conduct simple examinations for visual acuity or color blindness, as well as blood pressure or glucose level[23]. The iPhone iSeismometer app, which is used to measure tremor frequency, has been reported to match more sophisticated and expensive devices used for electromyogram analysis. The iMurmur app provides recordings of 20 types of heart murmurs, allowing a physician to match and identify what she or he hears. Many apps are available to determine pregnancy due dates by using a patient's sonogram and date of last period, such as "Perfect OB Wheel." These apps have been said to predict pregnancy due dates more accurately than the paper wheels that had previously been the standard [24]

Remote monitoring apps

With advent of highly improved technologies smartphones are using now, not every health condition needs to be managed in clinical setting. Remote monitoring mobile apps are being developed & launched rapidly

Remote monitoring apps allow patient to stay at home while still under the virtual care of the providers. Now with internet enabled medical devices patients can update their vitals like heart rate, oxygen level, blood glucose readings, blood pressure and other important healthcare information without need for visits to providers. This offers providers to manage and take care of patients virtually

Remote patient monitoring systems are designed to obtain a number of physiological data from patients. Most common data are Electrocardiogram (ECG), Electroencephalogram (EEG), heart beats and respiration rate, oxygen volume in blood or pulse oximetry, signals from the nervous system, blood pressure, body/skin temperature and blood glucose level. In addition to these, sometimes, weight of the patient, level of activity of the patient and sleep data are collected. A number of researches have been done for wound management and sleep monitoring applications.[25]

Heart related monitoring systems are the most common type of monitoring systems. The reason for this could be that the vital signs associated with heart could relate to many illnesses at the same time revealing many hidden

illnesses. Cardiac arrhythmia, chronic heart failure, strokes, blood clots and high blood pressure are some of the most common illnesses in this subcategory. The possibility to measure ECG, heart rate, respiration rate, blood pressure, oxygen volume in blood and detection of arrhythmias have been discussed in literature. Various technologies such as actual ECG monitors or textile-based wearable systems are used to get these data. Although these essential data can be gathered, there is much room for improving the accuracy of these systems.[26]

Healthy living apps

App developers have been churning out mobile apps for deeper engagement and towards focus on healthy living tracking health metrics such as diet, exercise, heart rate, sleep etc. Patients with chronic conditions such as diabetes may benefit from apps that offer diet plan, daily routine, lifestyle changes etc.

Designed with patient engagement in mind, healthy living apps track health metrics such as diet, exercise, heart rate, and sleep. Pregnant women can even use apps about fetal development. Patients with diabetes or heart disease may benefit apps that offer a diet plan tailored to their specific circumstances.

There is need for innovative ways to promote physical activity and a healthy lifestyle. One promising development is the use of smartphones during exercise. Use of mobile applications (apps) may be a powerful tool to encourage physical activity and health [27,28]. Apps are accessible, have a large reach, and have multiple functionalities, such as interactive possibilities and feedback opportunities [29,30]. Although more than 17,000 health and fitness apps have been developed and are available for the public [29], the literature considering the relationship of app use and health and physical activity is scarce.

Clinical reference apps

There are mobile apps available today for clinical knowledgeable users and offers digital access to ICD-9 and ICD-10, E&M Coding & other specialized materials.

Clinical mobile app are available medical users comes built with a robust search engine that allows the user to run complex searches using multiple terms and incorporating filters. Results are displayed to the users as list, downloadable PDFs, sharing options over email, messenger, social channels. The results are typically saved or marked as favorite for future references.

Being clinical reference app, the results and user experience are highly looked into. Results may contain text, html link, images, or videos and are made easy to read. Some of the apps also allows to provide CME credits for professionals using such applications

When you need drug information – to support safe dispensing, administration, prescribing, research, or anything in-between – we offer online and mobile app package options to suit your goals, no matter your practice

or business setting. Whether you choose to access evidence-based drug information on your computer, on your mobile devices, or both, you're connecting to the same timely, relevant content developed for the point of care.[31]

Online drug references connect you to databases and interactive modules including dosing and clinical decision support, comparative drug tables, retail-focused information, and medical calculators. Lexicomp is our clinically focused, point-of-care solution, and Facts & Comparisons eAnswers is developed more for the retail pharmacy setting[31]

Productivity apps

With devices enhanced with more and more smarter features, developers have started churning out more lifestyle, health focused app. It ranges from apps getting calorie intake, heart beat, pulse oxygen level, to even ECG features.

More advanced apps include IoT enabled functionality where physicians can view the trend and pattern of the patient remotely. Most of the productivity apps will offer functions while maintaining HIPAA compliance.

Most users downloaded an app to meet a goal and felt that the app helped them meet it. Two distinct groups emerged, those who used apps to support an established behavior and those who used them to adopt a new behavior. The majority of participants reported that acceptable apps were free, easy to use, provided visual/auditory cues, and had game-like rewards. Most participants strongly opposed linking their social media with apps and did not use those features.[32]

To assess whether mobile health apps may be contributing to potential new digital inequalities or divides, a better understanding is needed of the differences between people who use and people who not use mobile health apps, and which factors are associated with the use of different types of health apps[33]

	Leading apps in the respective segment			
Clinical & Diagnostic app	Ada	HealthTap	Web MD	Symptomate
Remote monitoring app	eVisit	Teladoc	Coviu	Cipherhealth
Clinical reference all	UpTo Date	epocrates	Good RX	Lexicomp
Productivity apps	Nike	Strava	JeFit	Sworkit
Health living apps	Calm	Headspace	Elevate	Healthpal

V. CONCLUSION

To summarize, Mobile apps have become inevitable part of human life style. And with devices getting smarter and more devices coming up in IoT segment, the mobile app market is poised to grow at rapid pace.

The article lists only 5 major categories of mobile app in healthcare segment, but a look at every category can spun off multiple branches which itself could be a huge study in itself.

Apart from utility value for the users, mobile app has become a ubiquitous part of the ecosystem. With mobile usage already crossing desktop usage apps are going to push the human race forward in terms of every aspect of life.

There are ways in which human fatalities can also be reduced using mobile app. A tele medicine application which gets a last mile connectivity through mobile app has potential to save patients life with proper diagnosis. The world has witnessed app for blood bank using which need for blood can be posted and nearest available donor/bank can respond immediately.

Combined with upcoming Artificial Intelligence Technologies and Cloud computing, we are just witnessing tip of the iceberg.

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