Study on Mobile Healthcare Applications for Self-Health Care

By

Saakshi Kaushik

Dissertation submitted for the partial fulfillment of the

MBA Hospital and Health Management

Academic year, 2015-2017

The IIHMR University, Jaipur

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INSTITUTE OF HEALTH
MANAGEMENT RESEARCH
(WHO Collaborating Centre for District Health System Based on Primary Health Care)

IIHMR UNIVERSITY

TO WHOMSOEVER MAY CONCERN

This is to certify that Dr. Saakshi Kaushik student of MBA Hospital and Health Management from The IIHMR University, Jaipur has undergone internship training at NTT DATA Services, Whitefield, Bengaluru from 6th February to 5th May 2017.

The Candidate has successfully carried out the study designated to her during internship training and her approach to the study has been sincere, scientific and analytical.

The Internship is in fulfilment of the course requirements.

I wish her all success in all her future endeavours.

(Col.) Dr. Ashok Kaushik
Dean, Academics and Student Affairs
The IIHMR University, Jaipur

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NTT DATA
Global IT Innovator

To whomsoever it may concern

This is to certify that **Dr. Saakshi Kaushik** of **The IIHMR University, Jaipur** has been working with NTT DATA Services for her summer project.

Project Details:

Project Name : Mobile Healthcare Applications: A study of various factors and their effects on Self-Healthcare delivery
Duration : 90 days
Location : Bangalore
Guide Name : Ranjith Mohan & Dr. Shweta Tripathi
Sponsor Name : Ajay Aiyar

She has successfully completed her project and her performance during the tenure of the internship has been found to be satisfactory.

Her findings in course of the project has been found to be practical and relevant and some of the recommendations will be incorporated on the floor on approval from the business.

Thanking You,

Regards,

Dilipkumar Santhanam
Business Partner Director, Services HRBP Team
NTT DATA Services

THE IIHMR UNIVERSITY, JAIPUR

CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled **A Study on Mobile Healthcare Applications for Self-Health Care** and submitted by Dr. Saakshi kaushik Enrollment No. IIHMR-U/01/2015-17/0340 under the supervision of Dr. Nutan P. Jain (Professor), for award of MBA in Hospital and Health Management of the University carried out during the period from February 6, 2017 to May 5, 2017 embodies my original work and has not formed the basis for the award of any degree, diploma associateship, fellowship, titles in this or any other institute or other similar institution of higher learning.

Signature

THE IIHMR UNIVERSITY, JAIPUR

CERTIFICATE BY SCHOLAR

This is to certify that all ethical issues have been considered while collecting data for my dissertation titled**A Study on Mobile Healthcare Applications for Self-Health Care.**

Signature of student

Abstract

Introduction: Mobile apps are enhancing overall consumer engagement in health care by improving the different aspects related to healthcare field like: flow of information; lowering costs through better decision-making, decrease in patient visits, greater adherence to treatment plans; improving satisfaction with the service experience; proper health outcome by keeping the track of self-health, fitness, diet etc. Technology is changing the healthcare industry and it is growing at a rapid pace of 17 percent per year and expected to expand $160 billion by 2017. A study of How Mobile Devices are Transforming Healthcare by Darrell West found that mobile application improves user's productivity in four ways: 1) by reducing unproductive travel time, 2) by improving planning, 3) by enabling faster decision-making, and 4) by improving communications. There was a national survey in which multiple people responded that how they want the mobile app and technology to be useful in their daily life; and the results show that 77 percent of the respondents would like to get reminders for a visit, followed by 75 percent who want to schedule a doctor's visit, and 74 percent would like to communicate directly with their doctor, for all this they prefer using different mobile health app or mobile devices.

Objectives:

a. To study factors related to use of mobile healthcare applications
b. To study perception of the users related to the factors' usefulness in self-healthcare using mobile healthcare Applications.
c. To identify the barriers faced by the users while using mobile healthcare application for self-healthcare.

Methodology: It is a concurrent and descriptive study was conducted during at February to May 2017. Users of Mobile app were approached in person or through voting email for data collection from three IT companies in Bangalore. A self-administered tool (having 15-item) either in the form of paper or Google Docs form was distributed to 112 respondents who have shown their willingness to participate.

Results: The results revealed that people were using multiple types of health apps. It was convenient for most of the respondents to manage their health through app. There were various features showing positive responses. However, along with that, they perceived that some additional features in the app to make the process effortless and easy. They also perceived that some improvement in features are required like: off line app, interconnectivity with other apps and providers, user-friendly navigation, data sharing, privacy and confidentiality of the data, data storage, etc. People were also facing few barriers like navigation layout in their app.

Conclusion: After reviewing the literature, four factors (functionality, usability, information management and engagement) were studied under the study. The respondents were using multiple types of health apps. They perceived that there is a requirement of an all-in-one App, with some additional features like, automation, user friendly navigation, timely reminder, graphical representation of results, sharing, and interconnectivity, motivation, etc, to make the process effortless and easy. They also perceived that some modifications are useful like off-line app, interconnectivity, user-friendly navigation, layout, pop up messages, data sharing, privacy and confidentiality of the data, and data storage. They identified barriers in their app like navigation layout language.

Keywords: Mobile healthcare app, self-healthcare delivery, factors.

Acknowledgement

A dissertation project is an excellent opportunity for learning and self-development. I consider myself very lucky and honored to have so many wonderful people lead me through in completion of this project.

I wish to express my deep gratitude and special thanks to **Dr. Nutan P. Jain** my mentor from The IIHMR University, Jaipur. **Mr. Rituraj Choudhu, Mr. Ranjith Mohan**, NTT DATA Services Bengaluru, **Dr. Shweta Tripathi**, NTT DATA Services, Noida who, despite being extraordinarily busy with his/her duties, took time out to hear, guide and keep me on the correct path and allowing me to carry out my dissertation project work at their esteemed organization and extended all help during the training.

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A special thanks to Dean, Academics and student affairs **(Col.) Dr. Ashok Kaushik** from The IIHMR University, Jaipur. From NTT DATA Services**, Mr. Ajay Aiyar**, for giving his special time and to give me the permission to use all required and necessary resources during the project.

I express my deepest thanks to all the managers **Ms. Avishkta Sarkar, Mrs. Archika Roy, Mr. Venkateshwar Rao, Mr. Ramkishore M.P**, NTT Data Services, Bengaluru for providing all the needful help, for taking part in decision making, and giving necessary advice and guidance. They also arranged all facilities to make this project easier and I choose this moment to acknowledge their contribution gratefully.

Furthermore, I would also like to acknowledge with much appreciation the role of all the participates, who gave their special time and participated in my study. Special thanks also goes to my team mates Anantvijay Sharma, my colleague Dr. Ritwik Chawla, and all my friends who help me in assemble the number of respondents for my study.

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List of Abbreviations

APP	Applications
BMI	Body Mass Index
EHR	Electronic Health Records
Et. al.	Et alia (and others)
FDA	Food and Drug Association
GPS	Global Positioning System
IMS	Intercontinental Marketing Statistics
IT	Information Technology
mHealth	Mobile Healthcare
N/A	Not Applicable
NTT	Nippon Telegraph and Telephone
PHR	Personal Health Records
PIM	Personal Information Management

1. Introduction

1.1. Mobile technology and Applications an Advancement in Healthcare

Mobile technology is expanding dramatically around the whole world with a rapid increase in number of mobile phones applications in healthcare. The utilization of mobile in almost all the cluster of people has transformed various fields like communications, healthcare, entertainment, and many more. Emergence of the technology has improved the service delivery in various business industries and altered the means in which cunsumers access data and make connections. This technology is now also altering the service delivery in health care in a positive direction, by influencing the time management, the cost of health care, and patient experience (West D, 1). In the recent scenario, like various other industries, Mobile Health technologies and applications are driving much of the demand among consumers. Overall consumer engagement in healthcare can be enhanced by mobile apps by improving the different aspects related to healthcare field like: better decision-making , flow of information, decrease in patient visits, service experience improving satisfaction, better adherence to treatment plans, proper well-being outcome by keeping the track of self-health, fitness, diet etc. (Greenspun H, 3). In Today world, mobile phones have become a necessity through which mobile technology in the healthcare industry is given a much-needed upgrade, from medical translation tools to mobile apps. One of the best outcome of this transformative trends in the healthcare industry are mobile applications. The commencement of various applications of mobile phones in healthcare has transformed healthcare delivery around the world by making it more accessible and reasonably priced across electronic markets. (Akter S, 8)

Exactly what Mobile health is all about? As per (Vital Wave Consulting, 9) Mobile health has been defined as, “the use of portable devices with the capability to create, store, retrieve, and transmit data in real time between end users for improving patient safety and quality of care.” Whereas as per the study (Akter S, 8) defined it “as a personalized and interactive service whose main goal is to provide ubiquitous and universal access to medical advice and information to any users at any time over mobile platform”. In this

study, an attempt is made to identify the various factors and how these are effecting the population who are using Mobile phones to solve Health related problems.

1.2. Evolution of the smart mobile phone

The acceptance of mobile technologies in all aspects of life has been remarkable. In two decades, many technologies related to mobile health has drastically transformed the means of communication and conducting business.

At the initial time, the mobile phones were bulky in size, costly, and some even required a base unit that had to be carried along with the phone (Agar J, 10). But now in the era of modern and advanced technology, the difficulties in using of cell phone have dramatically reduced, call reception has improved significantly due to the use of satellites and wireless services, including voice communication, messaging, personal information management (PIM) applications and wireless communication capabilities (Zheng P, 11).

In today's world, the health care and life sciences industry is recognized as one of the top three fields (along with consumer products and the financial services industry) likely to propel mobile device growth in the next five years (Gruessner V, 4). Now mobile devices are not just a small portion of hardware used to call somebody, but these mobile devices have transformed beyond helping with voice communications to develop into a "smart" piece of connectivity and movement of data, information, images, and text. More sophisticated Mobile devices and Healthcare Applications facilitates relations through social network, information, data, sharing photos, one to one interactions through videos, etc. Various

features of this technology made it a best friend of many individuals – it gives features like: GPS navigation, alarm, a wallet, filing cabinet, library, a personal calendar, storage of data and provides a plethora of healthcare applications that have capacity to make, store, take out, and transmit infomation in real time between the end users, making the phone's owner to exercise by poking, improve their overall health by losing weight, and so on (Greenspun H, 3).

1.3. History of Smart Mobile Devices

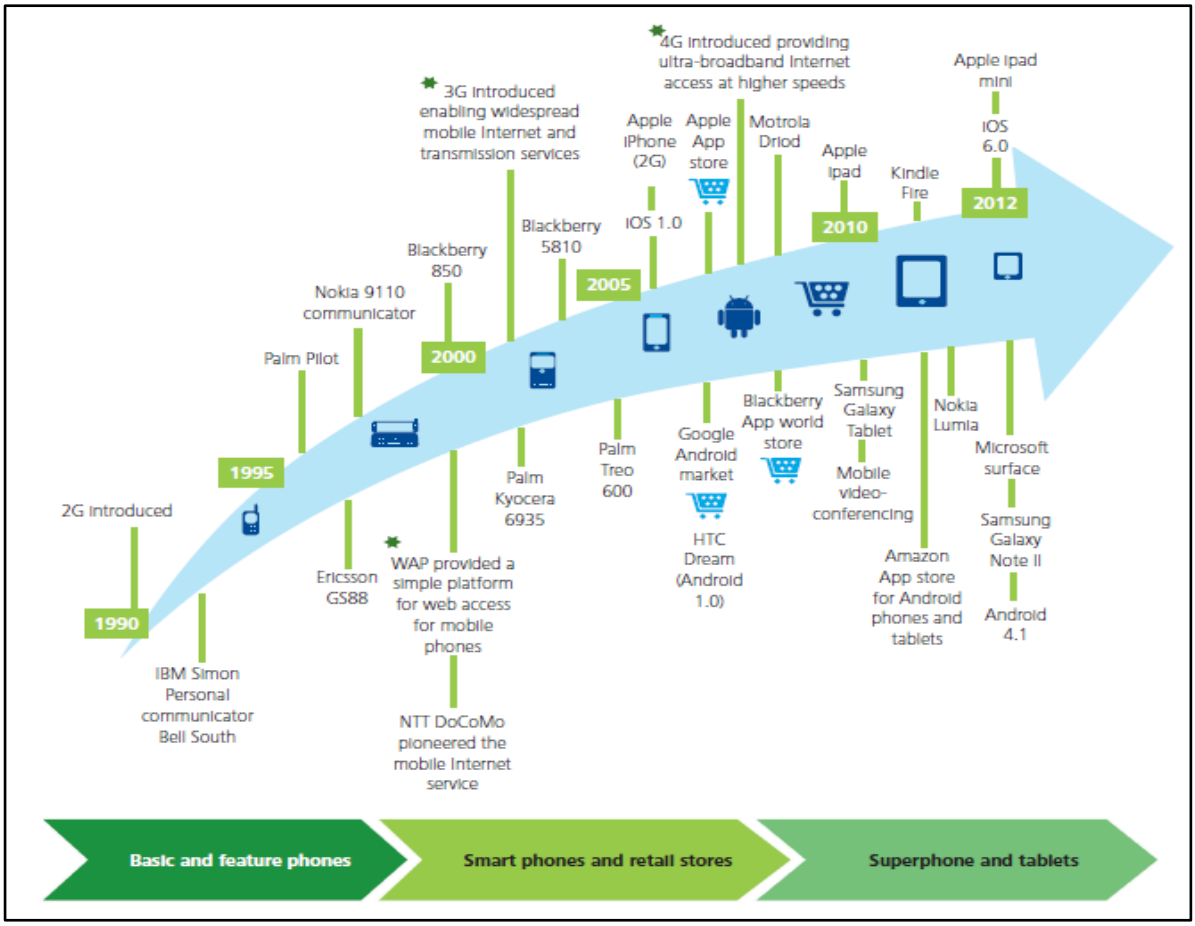


Figure 1.1: History of Smartphones

(Arthur C, 12) Source: https://www.theguardian.com/technology/2012/jan/24/smartphones-timeline

A brief evolution of major Mobile devices that had captivated the market has been shown in the (Figure No.1.1). Later in year 2013 Nokia Lumia 925 came into the market. This was

followed by Samsung Galaxy S5, and LG G Flex 2 Smartphone in 2014 and 2015 respectively.

1.4. What are mobile Healthcare Applications?

Mobile applications are software programs that run on smartphones and other mobile communication devices. They can also be accessories that are attached to a smartphone or other mobile communication devices, or a combination of accessories and software (FDA Gov, 5). Mobile Healthcare Applications are medical devices that are Mobile apps which meets the definition of a medical device and are an accessory to a regulated medical device or transform a mobile platform into a regulated medical device. Mobile apps functions span a wide range and many carry minimal risk; those that can pose a greater risk to patients will require FDA review (Devarajan S, 22). There are various Applications that meet the regulatory definition of a "device" but pose minimal risk to patients and consumers, FDA will exercise enforcement discretions on those mobile Apps. These include mobile medical apps which:

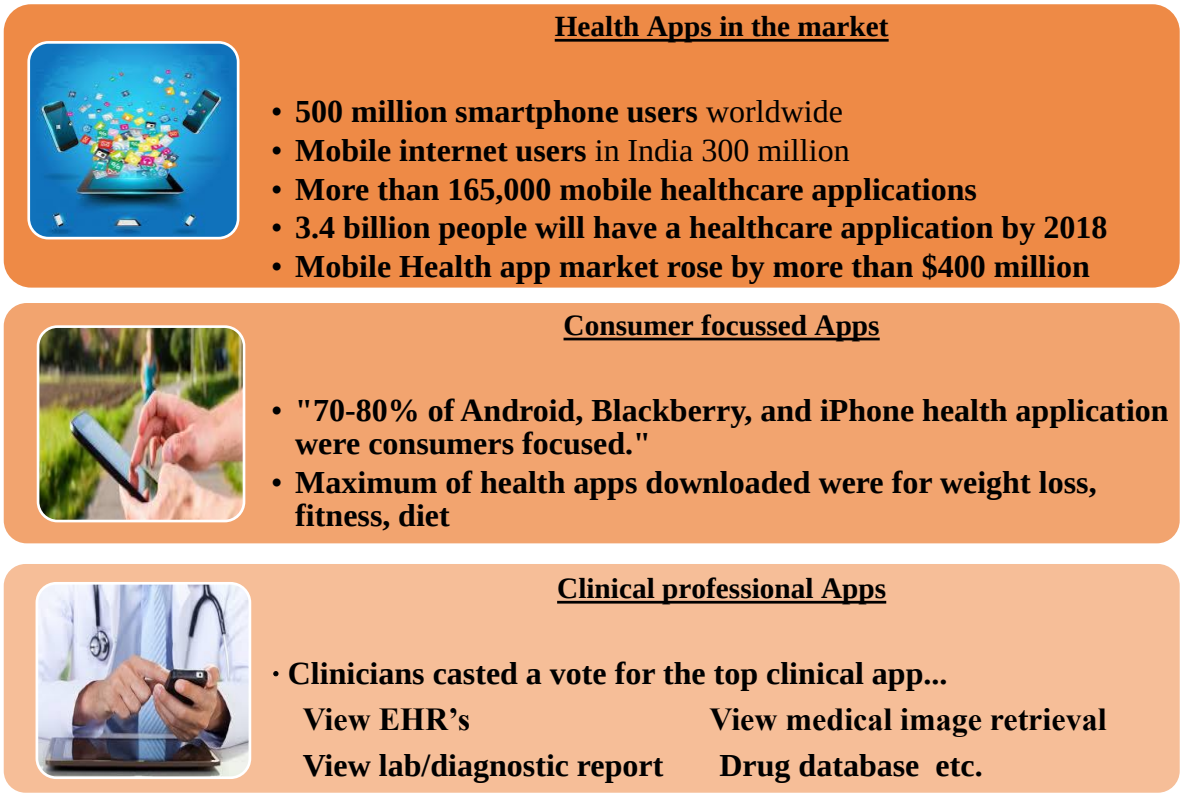
- Help patients/users self-manage their disease or condition without providing specific treatment suggestions.
- Provide patients with simple tools to organize and track their health information.
- Provide easy access to information related to health conditions or treatments.
- Help patients document, show or communicate potential medical conditions to health care providers.

- Automate simple tasks for health care providers. or
- Enable patients or providers to interact with Personal Health Records (PHR) or Electronic Health Record (EHR) systems. (FDA Gov, 5)

1.5. Market and Opportunity of mobile Health App

Mobile applications help people manage their own health, wellness, besides promoting healthy living, and help gain access to useful information when and where they need it. According to a report by the internet and Mobile Association of India, "the number of mobile internet users in India is projected to double and surpass 30 crores by 2017 (cited, 24)". As per the industry records, 500 million smartphone users worldwide are predicted to use a health care application by 2015. By 2018, 3.4 billion smartphone and tablet users will have downloaded some form of mobile health application (FDA Gov, 5). As per March 2012 "Mobile Health Applications study", "an estimation of 40,000 mHealth applications are available across multiple operating systems (West D, 1)". Whereas as per the 2015 report of IMS Institute for Healthcare Informatics, this number now increase to more than 165,000 mobile health apps in the market, which simply doubled over the past two – three years (Misra S , 7). Further to this when various mobile phone users were surveyed in a study published in the Journal of Medical Internet Research, it was seen that out of all users who were surveyed 58 percent have downloaded at least one mobile health app onto their device. It was seen that medical Apps are growing very quickly, the Mobile Health app market rose by more than $400 million as compared to the data of 2010, Moreover, the number of

physicians who are using medical apps has grown from 50 percent in 2010 to 70 percent in 2015 (Gruessner V ,4).



Sources: (7), (3)

Figure 1.2: Mobile Health App Market

Most of the App are Fitness, Lifestyle, Stress, Diet, and Nutrition related. In the same study, it was also observed when physicians prescribed an App, they found that "fill rates" ranged from 28% (respiratory apps) to 72% (mental health apps). Continued use of these apps was highest for fitness apps (76%), diabetes apps (67%), and smoking apps (63%). (Misra S , 7)

1.6. Your Health now in your Hand

One of the biggest connection between healthcare and technology is mHealth. The expanding of healthcare devices makes faster and easier for the users to access healthcare services and generates prospects to update the healthcare business through high personalized care and quality standards.

Mobile technologies, have a wide range of apps, and other programs which are developed to target the chronic conditions, telemedicine, remote monitoring, patient data capture, electronic records, e-prescribing, the parallel industries of fitness and wellness, information sharing , diet management, empowering the elderly and expectant mothers, reminding people to take medication at the proper time, extending service to underserved areas, and improving health outcomes and Medical system efficiency (Greenspun H, 3).

The embracing of mobile technologies in every aspect of life has been incredible. In the span of two decades, mobile technology has fundamentally altered the ways in which users communicate and conduct business. In this technical world, there are various fields getting benefits from mobile technologies, among all those, Healthcare and life sciences industry are recognized as the top field. There are various Mobile Healthcare Apps giving a large contribution in digital healthcare. These Apps not only make doctors and hospitals more accessible to patients, but also connect Doctors with other doctors, and patient with other patients across the world.

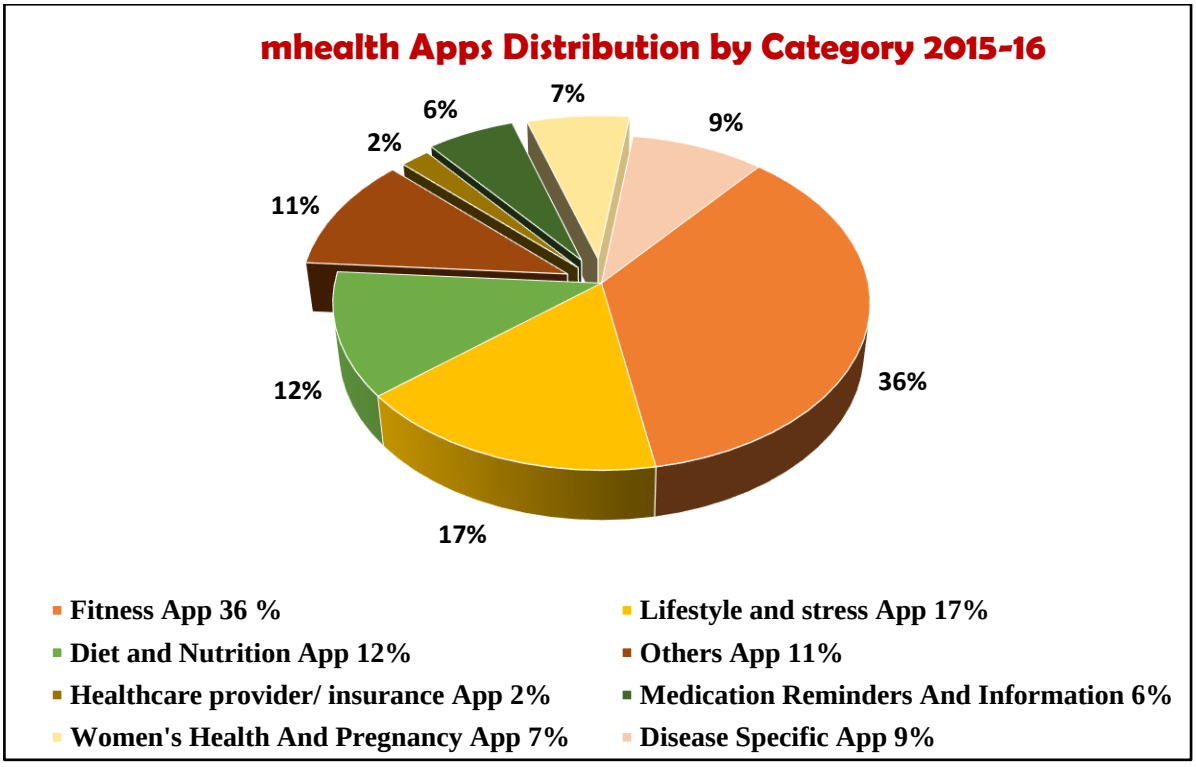
This global shift in digital healthcare is making it possible for the people to receive more personalized and precise medicine and health services. With the help of these applications doctors don't have to be in the physical presence of a patient to judge his or her condition which results in easier access to medical facilities and allows people to overcome the limitations of geography in health care and access information at a distance (West D, 1). Furthermore, mobile health Apps assist people to learn more about their bodies and give all kinds of health information to potential patients- making them aware of various treatment options and preventive measures available for their disease (Peng W, 17).

Mobile technology has high range of capabilities, possession rates, and connectivity, which make it fit to use in healthcare business. It offers greater flexibility and suitability for both providers and patients. Mobile apps enable various services like supply tools for better adherence and compliance, access to real-time data and monitoring, and facilitate routine monitoring of chronic care management (self-management, clinical care, and care coordination), etc.

There are various type of Healthcare apps, playing a big role in Digital Healthcare industry

Table 1.1: Types of Healthcare apps

Types of Mobile Healthcare Apps		
▪ Exercise	▪ Tools /instruments	▪ Stress/ relax
▪ Medical reference	▪ Medical adherence	▪ Strength training
▪ Weight loss	▪ Diet control	▪ Mental health
▪ Pregnancy	▪ Smoking, PHR apps	▪ Cardio/running
▪ Chronic Conditions	▪ Medical Adherence	▪ Health calculator
▪ Women's health	▪ Pharmaceutical info Apps	▪ Others



Source: (7)

Figure 1.3: mHealth Apps Distribution by Category 20

1.7. Mobile healthcare App giving a large contribution in digital healthcare

In today's scenario, people can make their smart phone or any other smart mobile device act like a dietitian, fitness expert and/or health counselor, just by installing the Mobile App for weight loss, diet maintenance, calories measurement, exercise sessions, fitness goals, etc. Mobile healthcare application give a large contribution in digital healthcare, people can use these application for many services like: managing medical records, keeping diet record and weight record, medical condition monitoring, tracking activities, physician appointments, medical consultation, general health education, pharmacy prescriptions, symptomatic checkers, multi- diagnostics portability etc. (Figure No. 1.4)

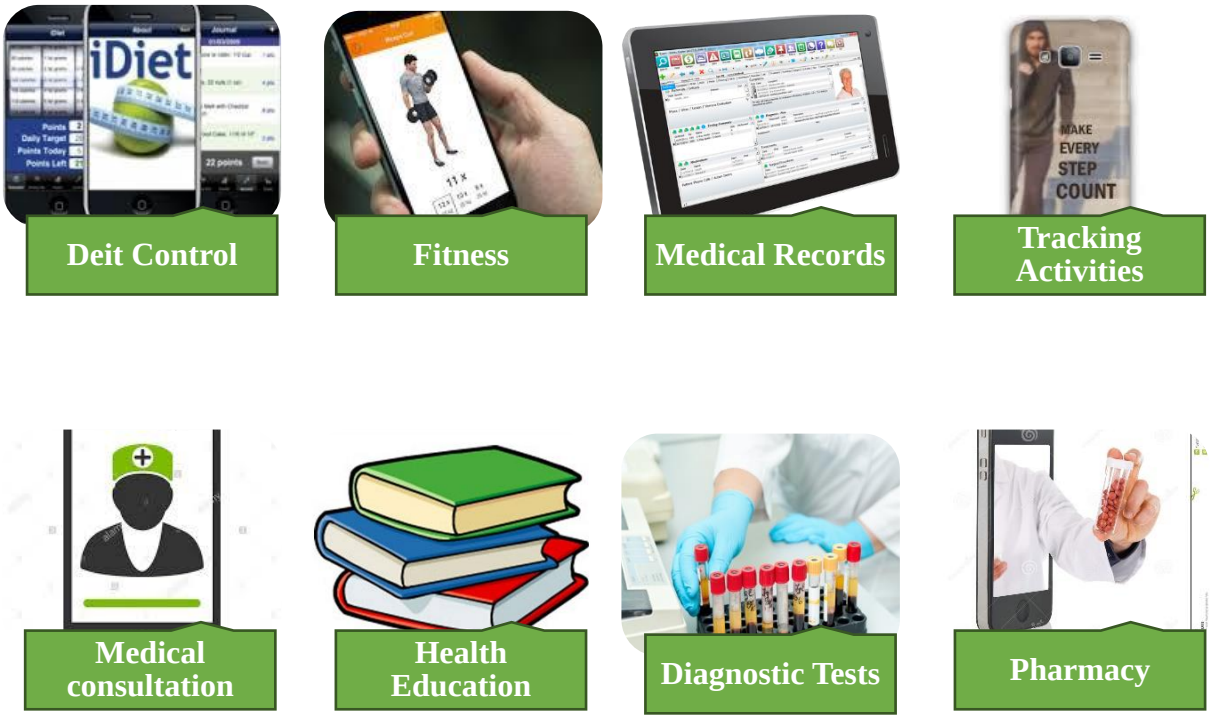


Figure 1.4: Type of mobile health apps

1.8. Top grossing Apps in the mobile healthcare application market

Source: (13)

Top Fitness Mobile Application

My Fitness Pal (50 million downloads)

My fitness pal is the most downloaded fitness app in the Google Play Store. It has 50 million downloads. The various feature include in this app are as follow:

- **Tracking food:** Biggest Food Database, Barcode Scanner, Recipe Importer (import the nutrition information), Restaurant Logging, Food Insight (Learn how to make healthier choices), Personalized Experience (Create your own favorite meal), Calorie Counter, Nutrients, and water tracker.
- **Reaching Goals:** Choose a goal, get plan, goal setting, change habits (nutrition coach).
- **Log Your Exercise and Steps:** Connect 50+ Apps & Devices, Log of various type of Exercises, Track Steps see a graph of your step history**.**
- **Support and Motivation**: One can add their Friends, Join with the Community, Newsfeed updates**.**
- **Motivate to celebrate success**: Chart Progress, Progress Photos, nutrition Reports, allow to share the progress.

Top Diet Mobile Application

My Diet Coach – Weight Loss (10 million downloads)

My Diet Coach – Weight Loss is the most downloaded diet app in the google play store. It has 10 million downloads.

This app motivates with inspiring tips, photos, good points, and virtual rewards. It is natural and get the user into fitness by taking up small healthy lifestyle changes. They have a diet coach that offer a full set of lifestyles changing and motivation tools: inner motivation, keep the track, resist food cravings, avoid exercise laziness and other weight loss difficulties. In additional, this app also has various other features like:

- **Setting up a goal**, tracking of the progress, getting reminders of what's important (goal, motivational photos), inspiring tips and quotes, reward for the success**.**
- Customized reminders, visual weight tracker, daily challenges program, they suggest healthy lifestyle points for doing the right thing and improving nutrition, steps counter, helpful tips, and tricks for common weight loss setbacks, they give attractive chances by redeeming the points for virtual fashion items.
- **Pro UPGRADE –** Food cravings panic button and tips, measurements charts (syncs with the tracker), barcode scanner for foods, more points, BMI calculator, advance features etc.

Top Medical Consultancy Mobile Application

Practo- Your Health App (1 million downloads)

Practo is a complete health app, now it also includes Qikwell. It is used for various purposes like, to book a doctor appointments at clinics and hospitals, set medicine reminders, to consult a doctor online, to manage your digital health records & read health related tips.

Practo is a user-friendly application which allow users to have direct view to the doctor's calendar and then give them option to pick a time that works for them. Give genuine feedbacks from patients.

It provides user an appointment reminders, auto-detect user's location while booking and give a quick option to book a Cab.

- **Online Doctor Consultations** This app has 100% secure, private, and confidential consultation from a long list of consultants of various specialties, which also have alternative medicine (Ayurveda and homeopathy). It also allows user to make direct calls to the doctors from the app.
- **Stay on-the-record with Digital Health Records** it allows user to upload all their health records, and pictures of their reports and prescriptions on Practo account and then share that with other doctors for second opinions - directly from your Practo account.
- **Medicine Reminders**: Timely alerts from automated or manual medicine reminders.
- **Order medicines online** With Practo user can choose their delivery slots and get medicine delivery at home. They will also get reminders to re-order their medicines.
- **Health Tips**: Practo keep user up to date with interested nifty health & fitness tips.

Top Pharmacy and laboratory Mobile Application

1 mg- Save on Medicine/ Lab Tests (1 million downloads)

1 mg- Save on Medicine/ Lab Tests – Weight Loss is the most downloaded medicine/ lab test application on the google play store. It has 1 million downloads.

1mg is a complete Health App that tells user about any kind of medicines they are searching for, their substitutes and side effects. With 1mg, user can have regular health tips, can order medicines online (from online pharmacy store)**,** book health tests and packages from the nearest certified labs with free sample pickup, consult with best doctors online, book appointments with nearest doctors, and have health information (health tips written by expert doctors).

Top Pregnancy Mobile Application

Pregnancy + (plus) 5 million downloads

Pregnancy + is the most downloaded pregnancy app on the google play store. It has 5 million downloads.

Pregnancy plus app is the personalized app use by the users to see and follow their pregnancy week by week. It is a one in all Pregnancy App which include: daily pregnancy info, color and scan images, personal diary, pregnancy weight log, doc visits log, diet, exercise and labor

info, kick counter, contraction timer, baby shopping list, 1000s of baby names, baby size visualizer, pregnancy week by week info etc.

2. Background

Mobile applications are an irreplaceable part of our lives today. Like other industries, healthcare industry is also rapidly accepting the mobile revolution. These days, smartphones are an instrument that allow both doctors and patients to effectively manage and access health information, anywhere, anytime.

As per study by (A. Nair, 19) there were 3 ways how mobile apps can help improve automation in the healthcare industry:

1. **By better access to improved healthcare**: With the help of healthcare mobile applications one can have an easy access to quality healthcare facilities, without visiting that facility. Thus, now through this mobile health apps doctors can now deliver healthcare services virtually.
2. **By improving patient engagement**: With the help of mobile health apps now there are more waiting in queues to visit a doctor, no more lack of transparency in quality and cost. However, with the help of the app, patients can be easily notified that their doctor is running late for the visit, or they can even access healthcare consultation and services virtually. Additional to this mobile apps can also minimize complexity. Patients now have real-time access to post-visit instructions, medical records, pill reminders, next doctor appointment, and much more.
3. **By making communications streamlined**: With the help of healthcare mobile apps doctors now have a great way to communicate effectively with their patients and with other doctors in a fast and convenient manner.

In the study, (West D, 1) found that mobile application improves user's productivity in four ways: 1) by reducing unproductive travel time, 2) by improving planning, 3) by enabling faster decision-making, and 4) by empowering small businesses and improving communications. In that study, it was estimated that one-third ($11.2 billion) of the total productivity gain (that was $33 billion) came from the medical area. It was projected that productivity gains will be $305.1 billion over the next 10 years in medicine. The study

continued saying that there were many patients who want to use digital and mobile technologies in their medical care. There was a national survey in which multiple people responded that how they want the mobile app and technology to be useful in their daily life. For instance, 77 per cent in a national survey said they would like to get reminders via app from their doctors when they are due for a visit, 75 per cent want the ability to digitally schedule a doctor's visit, 74 per cent would like to use the app to communicate directly with their doctor, 67 per cent would like to receive the results of diagnostic tests directly on their mobiles with the help of app, 64 per cent want access to an electronic medical record to capture information, and 57 per cent would like to use a home monitoring device that allows them to e-mail blood pressure readings to their doctor's office etc. For all this, they prefer using different mobile health app or mobile devices.

There were many such studies which suggest how mobile health apps were beneficial to people when they used them in different ways in their daily life. For example, people were using the mobile health app for managing their chronic disease, which represents the greatest healthcare challenge in many locales. With the help of these mobile health app it was easy for all those patients who were suffering from serious problems to record their own health measures and send them electronically to their physicians or specialists. Second biggest problems for elderly patients was forgetting to take their prescription drugs. It is also estimated that only 50 per cent of the patients take their prescribed medication. Either they forget to take the drug or they do not take it at the time or dosage set by their physician. Hence, people use mobile health app which give them timely reminders to take their medicines. (Yach D, 18)

A new survey by Accenture reveals that the number of consumers who use wearable devices or mobile apps for monitoring their health has doubled in the last two years. According to one survey more than 8,000 consumers in seven countries, 33% of respondents said they use mobile health apps, compared to 16% in a similar survey in 2014. Furthermore, 77% of respondents said that using wearables or using a mobile health app make them feel more engaged with their health. 90 per cent of respondents were ready to share data from their devices and apps with healthcare providers. The survey showed that consumers most often use wearables and mobile apps to track their fitness, diet, and nutrition, but the data showed that these devices and apps could have broader uses. For instance, 29 per cent respondents said they prefer virtual doctor appointments as compared to face-to- face (Meola A, 26). The

healthcare sector is undergoing a revolutionary transformation, now patient can get treatment solutions anywhere and in real time on their smart phones. A flood of healthcare mobile phone applications, really made simpler for the patients to seek care. Technology is changing the healthcare industry and it is growing at a rapid pace of 17 percent per year and expected to expand $160 billion by 2017. Mobile Healthcare applications have become a key tool of taking the care to the hands of people (The Indian Express , 15)

2.1. Barriers

Mobile health app exists in large numbers today, but many times consumers do not continue to use them after a brief period of initial usage, or opposed using them at all, or some time many people are unaware that such apps even exist. As per the existing literature, there are various barriers which hinders adoption of Healthcare Apps among doctors and patients. Barriers may range from macro-level systemic barriers (like lack of enabling healthcare policy) to micro level individual barriers (such as perceived complexity and resistance from physicians, etc.) (Dehzad F, 16).

It was seen that there are not much clear regulations and policies in the mobile Health ecosystem. In many countries, none of the insurance plans, public nor private covers mobile health applications. There are also many barriers documented in different studies, which limits physicians' interest towards mobile health. Physicians were often never reimbursed for their consultations made through e-mail or phone (West D, 1). Mindset adjustment of physicians and patients was another challenge, where some patients and physicians were used to the traditional healthcare system, and it was hard for them to embrace the new technologies in health. Moreover, in many rural areas it was difficult for the patients to understand English. That's why some of the patients and doctors prefer communicating in their mother tongue. On top of this, if we see barriers from the patient side some of the challenges in the adoption of mobile technology in healthcare include confidentiality. Patients were not comfortable using any mobile health application until they were assured of privacy and security protection (Hoque M, 2). In some studies, it was seen that people also have a fear that they might lose their smartphone or tablet that contains their personal material and their medical information, which might end up in some unknown hands. (West D , 1). As per (Greenspun H, 3) study of over 2,000 consumers who were online and have commercial insurance, also own a cell phone revealed that only twenty three percent had used any sort of mobile health solution.

Sixty-seven percent said they would like to do “nothing at all” on their mobile phone in support of their health and 77 percent had never used their phone for health-related activities. As per the (Peng W, 17) study there were many people who were using the mobile apps for healthcare, but still there were some barriers like lack of time and effort, and lack of motivation and discipline which restricted them to continue the use of these health apps. Many people in the survey said that “they have to individually input everything and doing that was really a time-consuming task.” They also felt that unless an individual was already motivated or had the discipline or dedication towards his/ her health, it would be hard for them to continue using health apps. Even, cell phone radiation, storage space taken by the app in the phone or drainage of battery due to application, network issues, technicality of the app etc. were some other barriers faced by people which restrict them to use the mobile.

3. Objectives

a. To study factors related to use of mobile healthcare applications
b. To study perception of the users related to the factors’ usefulness in self-healthcare using mobile healthcare Applications.
c. To identify the barriers faced by the users while using mobile healthcare application for self healthcare.

4. Rationale

Mobile technology has expanded dramatically around the world. It’s clear that technology is giving the healthcare industry a much-needed upgrade, from medical translation tools to mobile apps. This transformative trend in the industry are conducive to remarkable growth in mobile applications. So, with the help of the study I want to identify what are the different factors of healthcare application, how they are affecting the self-healthcare management and what all challenges people are facing while using these applications.

5. Scope

All people who were above 18 year of age, working in IT organizations of Bengaluru city and using any kind of mobile health Apps like Fitness, Medical Consultancy, Diet Control, Pharmacy, and Health Educations apps etc. for self-healthcare, come under the scope of this study.

6. Research Methodology

6.1. Study Design: Concurrent and Descriptive study.

6.2. Study Respondents: Staff working in IT Companies, and using any type of Mobile Healthcare Applications..

6.3. Study Setting: The study was conducted in IT Companies of Bengaluru city.

6.4. Duration of Study: Three months (February 2017 to April 2017).

6.5. Sampling Technique: Collection of the contacts who was using any type of mobile Healthcare Application , was approached in person or through voting email, and who were willing to respond was responded through email.

6.6. Sample Size: As per the convenience, people who were using any type of mobile Healthcare Application were found out either by sending a Voting mail to the study population as "Yes or No" or by asking randomly. In this way hundred and twelve participants were selected as the study sample.

6.7. Sample Selection:

Inclusion Criteria: People who were using any kind of Mobile Healthcare Application working in IT companies, living in Bengaluru city and are above 18 years of age.

Exclusion Criteria: People who were not using any type of Mobile Healthcare Application, below 18 years of age and not living in Bengaluru City.

6.8. Data Collection Instrument: A self-administered tool (having 15-item) both in the form of paper and Google Docs form. (Annexure 1 and Annexure 2).

6.9. Data Collection Procedure: The data collection procedures were divided into following steps:

Step 1: Step 1: Literature review of various studies using key words: mobile health care app, self-health care delivery, factors.

Step 2: Permission was taken from different IT Companies to conduct a study. A list of all the people who was using any type of mobile healthcare app was prepared.

Step 3: Information related to study was given to the staff who was ready to participate in the study.

Step 4: Data collection by approaching the staff of one IT company where I was working.

Step 5: The soft version of questionnaire was sent to rest of the respondents (of other companies) who was willing to participate.

Step 6: The data gathered was fed into Microsoft Excel. Descriptive analytics technique (Percentage, mean, etc.) was applied.

7. Methodology

The study was conducted on 112 respondents living in Bengaluru City and working in IT companies. The data was gathered through a prepared structured questionnaire based on the various factors identified through secondary review. These factors have been described below.

7.1. Four Major Factors:

- Usability
- Functionality
- Information Management
- Engagement

Table 7.1: Sub Factors for Usability

Sub Factors for Usability
1. Perceived ease of use
3. Using the app for which services **a) Medical Record** **b) Diet Record** **c) Weight Record** **d) Medical condition monitoring and management** **e) Tracking activities** **f) Managing physician appointments** **g) Medical Consultation** **h) General Health Education** **i) Pharmacy Prescriptions** **j) Symptomatic Checkers** **k) Multi-Diagnostics portability**

Table 7.2: Sub Factors for Functionality

Sub Factors for Functionality
1. Layout of the App
2. Navigation of the App
3. Independency and ease in handling the App
4. Importance and Effect of the various functions in the App **a) Automated Voice Commands** **b) Timely Reminders** **c) Graphical Results** **d) Data Sharing** **e) Storage & Retrieval of data**

Table 7.3: Sub Factors for Information management

Sub Factors for Information management
1. Result Accuracy and Reliability
2. Privacy and Security
3. Quality
4. Accessibility to the personal Data
5. How relevant the pop up message in response to query?
6. How easily one can enroll it on the app?
7. Technology personal friendly?
8. Inter-connectivity of the app with another app and Dr. lab etc.

Table 7.4: Sub Factors for Engagement

Sub Factors for Engagement
1. Frequency of using the app
2. Motivation
3. User Experience
4. Conscious for health
5. Convenience
6. Recommendation (from whom)
7. Negative Experience with app
8. Satisfaction
9. Loyalty Toward the app
10. Do they enjoy the app

Source: (6)

The data was collected from the respondents who were working in the IT companies, and using any kind of mobile health app. Firstly, by asking randomly or by sending a voting mail, people using any kind of mobile health app were found. In the study, out of all the people who were asked to vote, 50 said Yes, they are using the app and 60 said No. When the same

question was asked to people randomly (without mail), 62 said Yes and 40 said No. After getting all the responses, 112 “Yes” responded were selected.

All the respondents were informed regarding the questionnaire. 50 questionnaire forms were distributed in the form of hard copy and remaining 62 were distributed in the form of Google Docs form (Online form). The questionnaire consisted of 15 questions which were based on all four factors that was identified by secondary review i.e. functionality, usability, information management, and engagement. Full consent was obtained from the participants after the questionnaire completion.

8. Results

In the study, the percentage distribution of respondants is shown in (Figure No. 8.1) Most of the respondants were in the age group of 25-40 years working in different IT companies of Bengaluru city. All the respondants were an owner of a Smartphone and using mobile healthcare applications. The statistics of peoples’ consciousness about their health, showed that 45% of people follow healthy diet and exercise occasionally. Around 11-19 per cent followed only healthy diet or followed regular exercises and healthy diet, respectively. There were only 15 per cent who had sedentary lifestyle with no or little concern about health and 10 per cent who had no lifestyle pattern with not much concerned about health. (Figure No. 8.2)

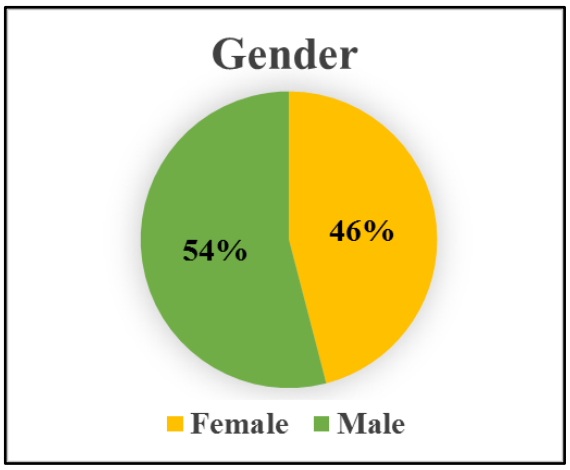


Figure 8.1: Per cent distribution of respondents as per gender

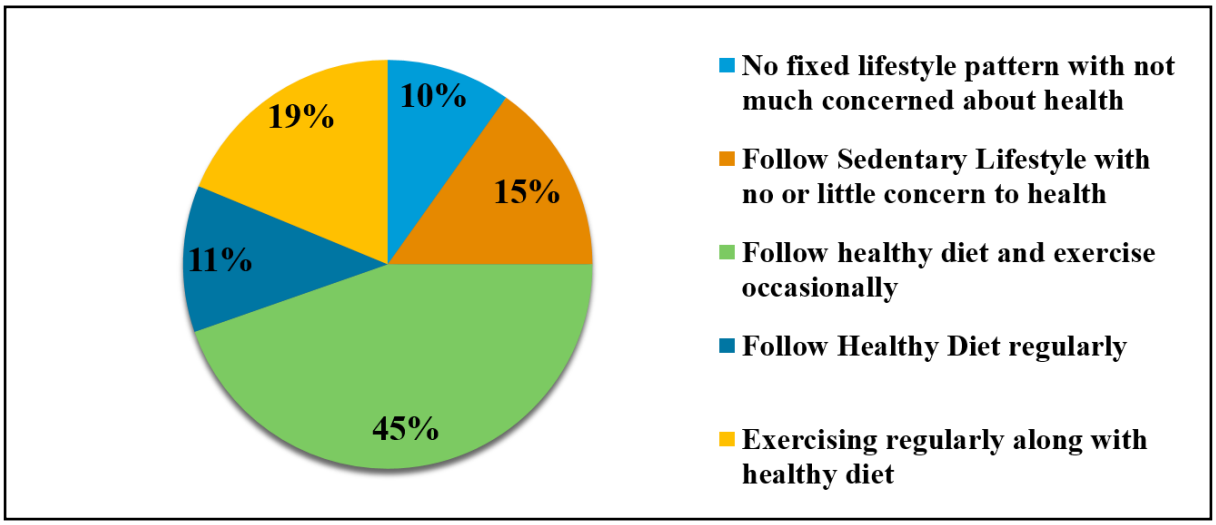


Figure 8.2: Per cent distribution of Consciousness of people about their health

In the study, there were four major factors. When the result was divided, it was seen that various factors have different impact on healthcare delivery.

Before describing the result based on different factors it was seen that all the respondents were using different types of health apps in their daily life. Few names have been mentioned below (Refer Table no. 8.1).

Table 8.1: Type of Mobile Health Apps Respondents were using

Types of Apps	Percentage
Fitness and Diet App	
Google Fit	10.4
Nike-Training Club	3.0
Mi Fit	1.5
Others (Fitness) (Fitness and Body building, Lifelog, Sportsactive, My Fitness Pal, Fit net, Workout App)	4.5
Others (Diet) (GM Diet App, Pedometer Diet, Weight loss coach, Kayla is tines, Noom coach)	3.7
Tracking App	
FitBit	9.7
Pacer	2.2
Rutastic	1.5
Run	1.5

Pedometer	**1.5**
GOQii	**1.5**
Nike Runing	**0.7**
Health App	
iHealth	**11.9**
S Health	**7.5**
HealthifyMe	**4.5**
Others (M Health, Health Pie, Health-Care, Quit Now_PRD)	**3.0**
Medical Consultation and Record Apps	
Practo	**20.9**
Lybrate	**2.2**
PSTakeCare Consult	**1.5**
Others (Medical) (Web MD)	**0.7**
Others (Record/Assistant) (My Medical Record, Haptik, My Calendar)	**2.2**
Pharmacy App	
1mg	**2.2**
Pharmeazy	**1.5**
Others (Pharm-X)	**0.7**

8.1. Result of first factor: Usability

Under **Usability factor**, (Refer Table No. 7.1) it was found that respondents were using those Apps for what all services, it was found maximum percentage of respondents were using the App mostly for Fitness based activities like tracking (80 per cent), weight record (58 per cent), diet records (55 per cent). Following this were, the medical related apps categories like physician appointments, medical consultation (54, 47 per cent respectively). 39 and 37 per cent of respondents used pharmacy and health education apps, respectively. The least percentage of respondents were using the apps for diagnostic purpose, medical condition monitoring, medical records, and symptomatic checkers. These number mostly lied between 34 to 27 percentage.(Figure No. 8.3)

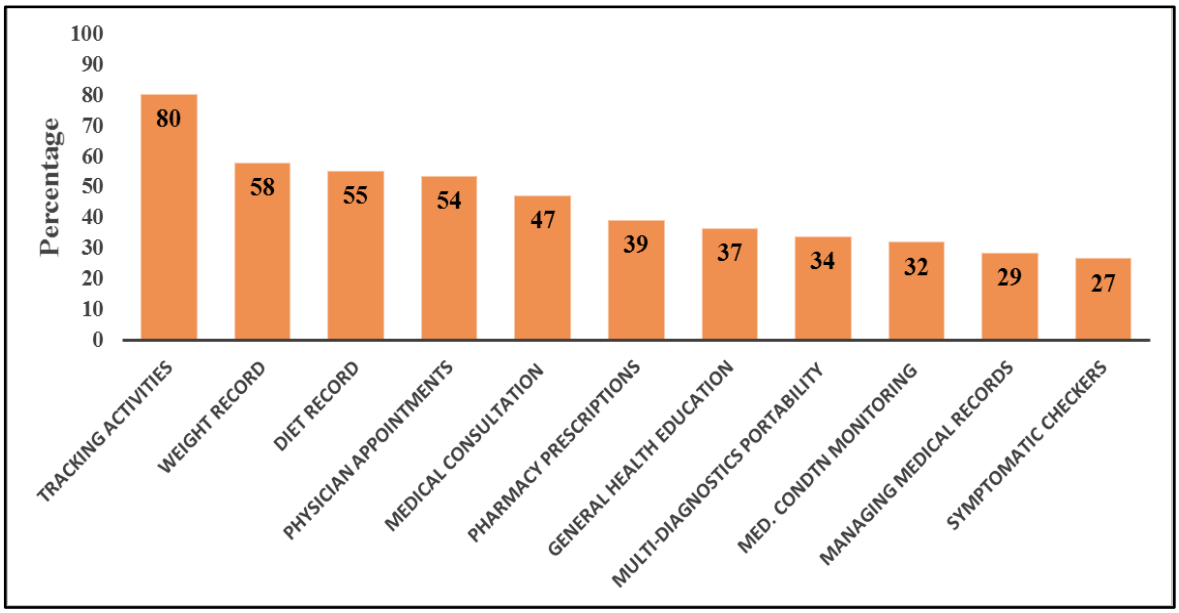


Figure 8.3: Per cent distribution of the Services for which people were using the apps

8.2. Result of second factor: Functionality

In the study, **functionality factor** included various Sub factors like: timely reminder, graphical representation etc. (Refer Table No. 7.2). When various respondents were asked, to what extent these features were helping them in managing their heath through mobile apps, it was found that timely reminder lies towards the range of most dependable feature. When it comes to managing health, maximum numbers of respondents (almost 29 per cent) were highly dependent on this feature. As a graphical representation, this lies between helpful to very helpful feature which was 25 to 26 per cent. 12 per cent who were not using it included those who were it for pharmacy, education etc. Third was storage of data and information sharing, which needed a high attention. In case of storage of data, respondents were distributed equally among positive ranges (25 per cent to 19 per cent). But at the same time equal percentage of respondents (19 to 12 per cent) were facing some challenges related to this feature falling in least range criteria. Lastly maximum number (26 per cent) of respondents under Information sharing had some fear like privacy and interconnectivity etc., hence falling towards negative range. These features were not helping the respondents much in managing their health. (Figure No. 8.4)

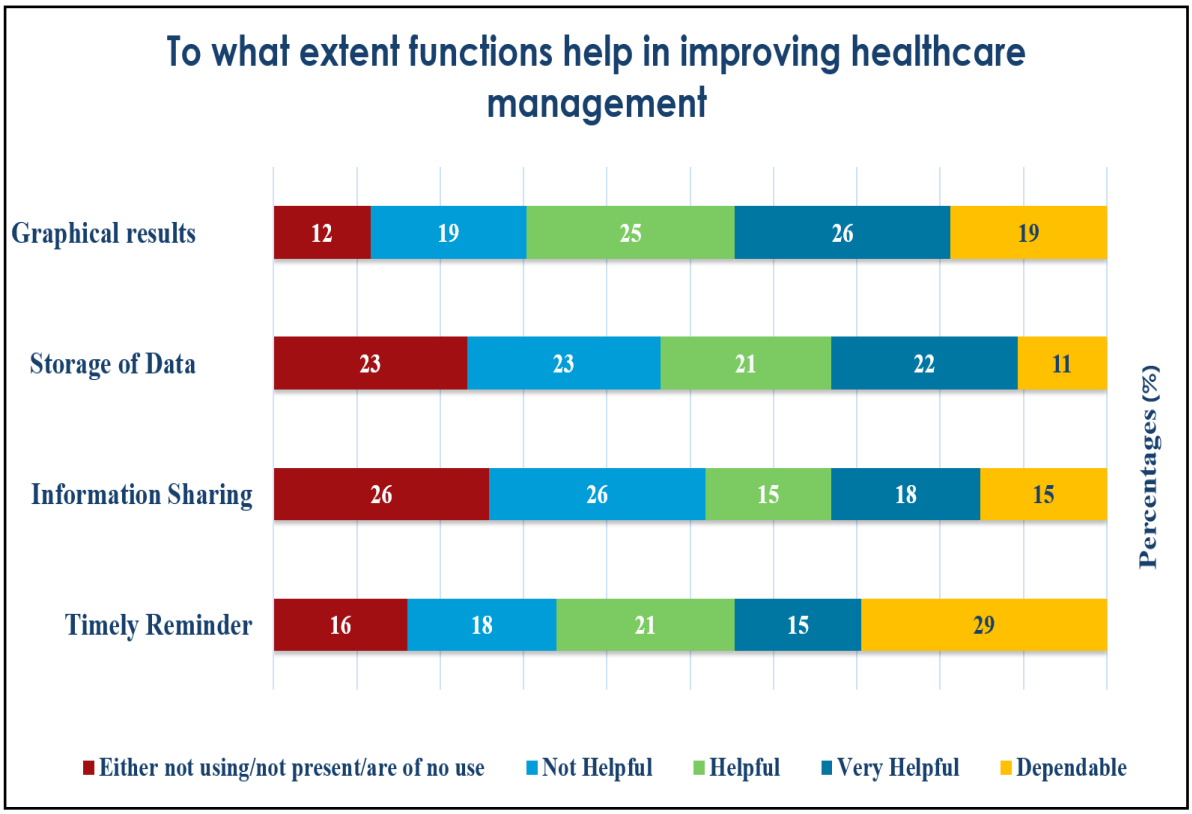


Figure 8.4: Per cent distribution of the respondents by their perception on functiality factor

Additionally, Ease of use was also a part of functionality factor. It was found that, 92 per cent respondents were able use their app easily and independently. (Figure No. 8.5) Rest 8 per cent respondents faced some difficulties like, navigation (41 per cent), layout (42 per cent), complexity (language) of the app (17 per cent). These affected the functionality of the App, and only decide how easy it is for the user to use his/her App. (Figure No. 8.6)

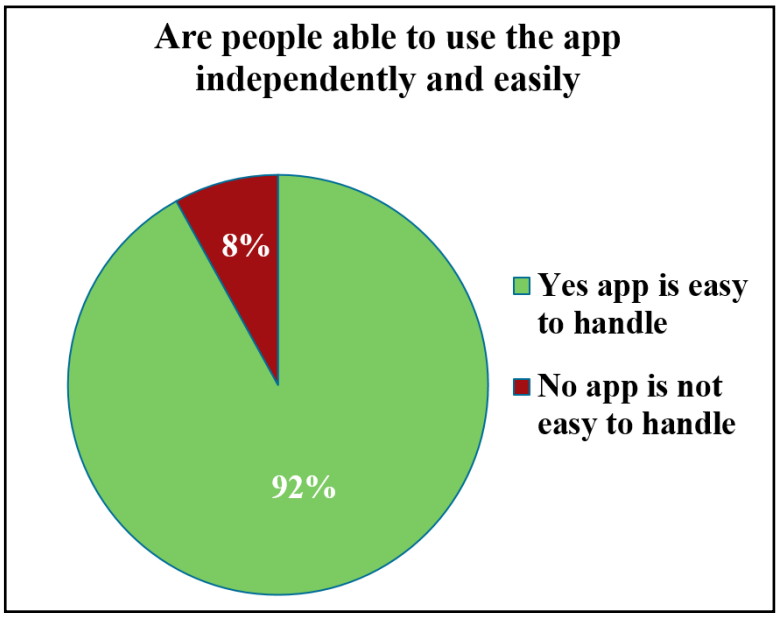


Figure 8.5: Per cent distribution of the respondents by their ease of using an app

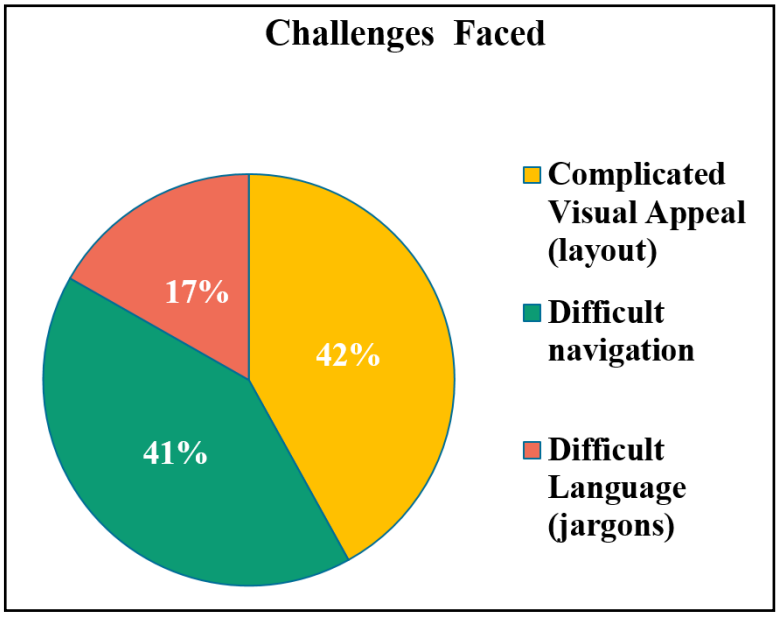


Figure 8.6: Per cent distribution of the challenges faced by user in ease of use

8.3. Result of Third factor: Information management

Third factor in the study, was **Information Management**. Under this, to what extent respondents were satisfied while dealing with various criteria related to information management of the App were assessed. (This includes Result accuracy and reliability,

privacy and Security, quality, accessibility of data, inter-connectivity etc.). (Refer Table No. 7.3). It was found that, maximum number of very satisfied and satisfied respondents lie under User friendly navigation (23 per cent and 38 per cent respectively). This showed that one must always use this criterion to keep a user-friendly navigation experience while building an App. Various sub factors like Quality, Privacy, and Security of data, result accuracy and reliability mostly lie in between average to satisfied range. The maximum dissatisfied range lies under relevancy of popup message and its enrollment, i.e. 17 per cent and 18 per cent respectively. Interconnectivity of the app is one feature which really needs an attention. Maximum number of Apps do not have this feature (17 per cent) and even if it is present in the App, 12 per cent respondents were dissatisfied with this feature. To improve health care management through Apps and to connect providers with user, Interconnectivity is most important feature to be present in an App. (Figure No. 8.7)

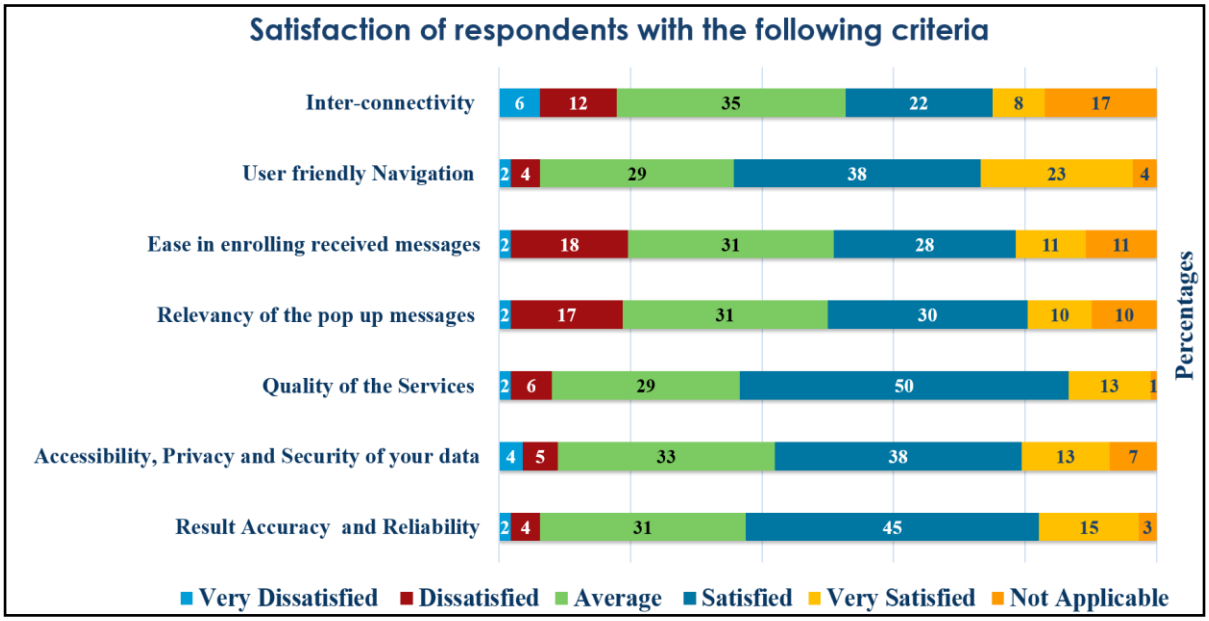


Figure 8.7: Per cent distribution of the respondents satisfaction with info management factors

Additional to all the above-mentioned features, when respondents were asked, how convenient it was for them to manage their health though App, maximum (42 per cent) responded that it was convenient for them. Whereas 39 per cent to 20 per cent respondents felt it was very convenient and normal to manage their health through health Apps,

respectively. Only 4 per cent to 7 per cent of respondents felt that either it was not at all convenient or not much convenient. (Figure No. 8.8)

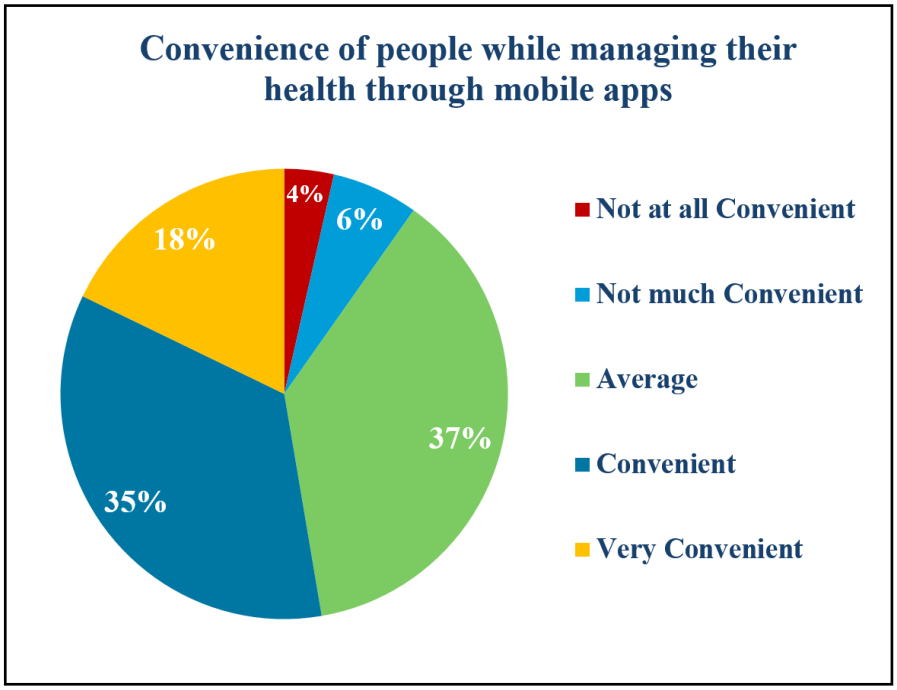


Figure 8.8: Per cent distribution of convenience of managing health through mHealth apps

8.4. Result of fourth factor: Engagement

Forth factor which was assessed, was engagement. In past studies it was seen, Engagement of the user with the app mostly lie with duration of use, motivation, recommendation, satisfaction, and on their experience with the services of the App. (Refer Table No. 7.4). In the study, it was seen that 84 per cent of respondents were using their Apps from years (42 per cent) and months (42 per cent) (Figure No. 8.9). Additionally, it was seen that 90 per cent use them as per the requirement (32 per cent), on the daily (28 per cent) or on weekly basis (30 per cent), depends on the type of the App they were using. (Figure No. 8.10)

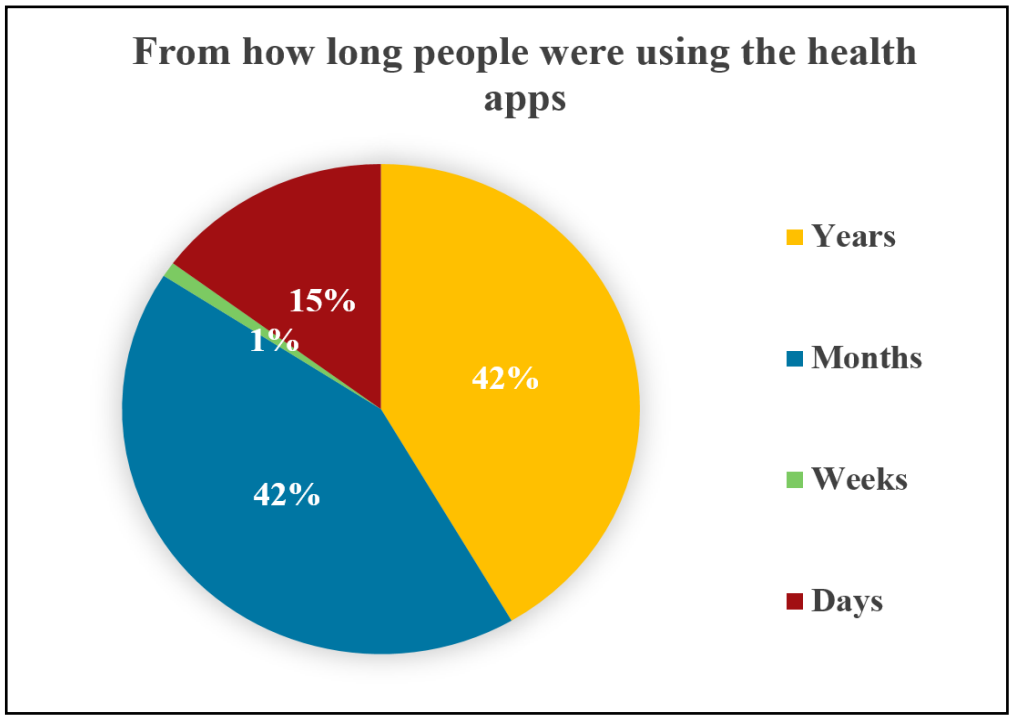


Figure 8.9: Per cent distribution, form how long respondents were using the apps

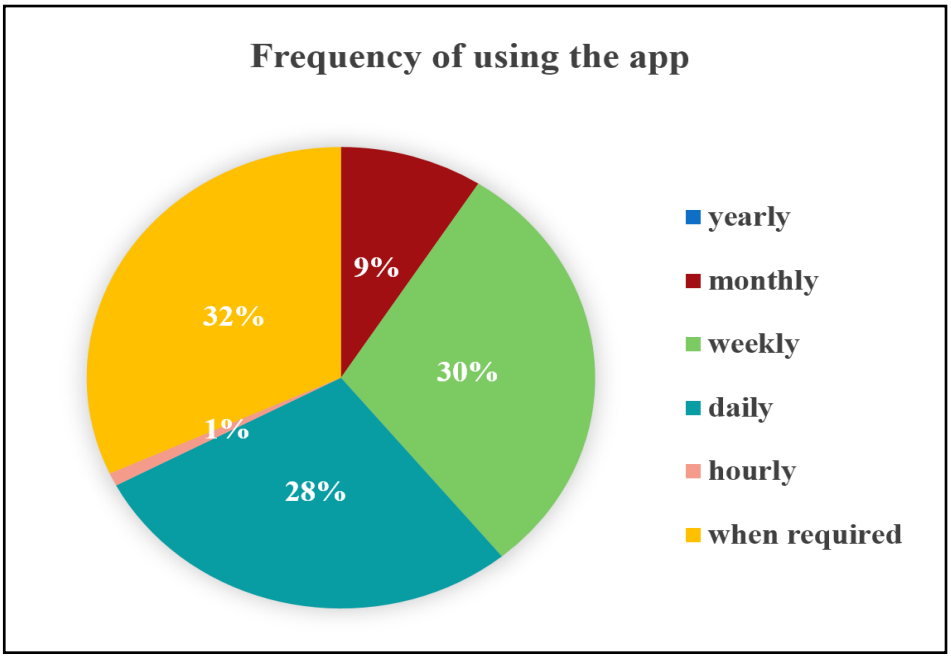


Figure 8.10: Per cent distribution of frequency of using the mobile health apps

Further to this, when the respondents were asked about motivation, management of health, and recommendation to others. It was seen that 74 per cent and 77 per cent respondents could

manage their health through the App and able to motivate themselves to be healthy with the help of App, respectively. (Figure No. 8.10) (Figure No. 8.11).

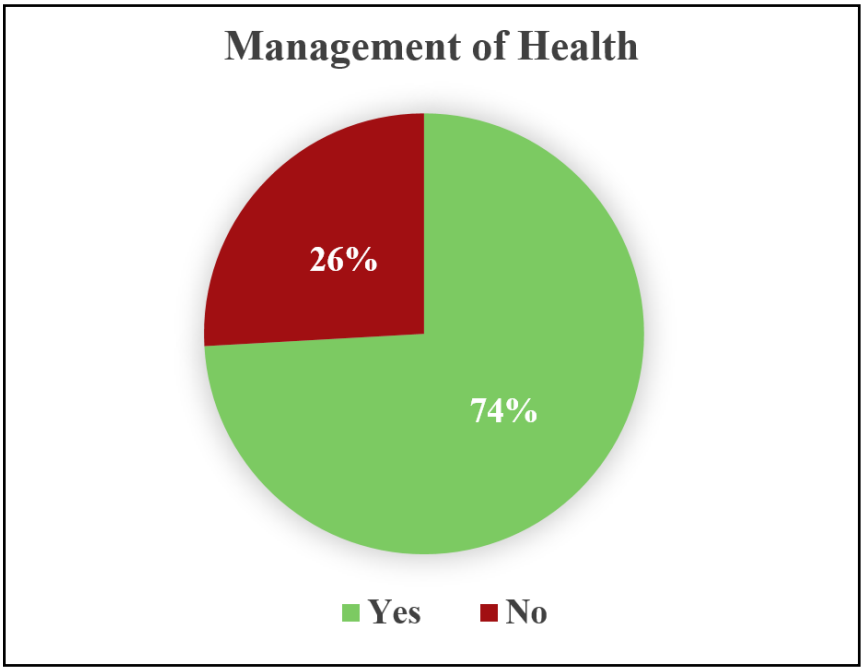


Figure 8.11: Per cent distribution of management of health through mobile health apps

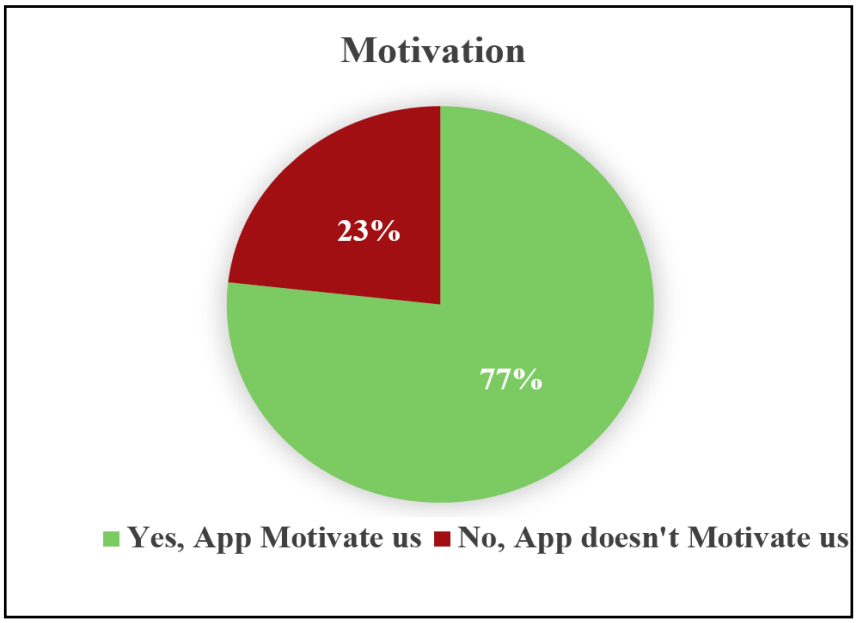


Figure 8.12: Per cent distribution of motivation through mobile health apps

It was seen that 90 per cent wanted to recommend the App to others. Reasons included: community connectivity, they get motivated to keep a track on their daily activities, getting the perceived benefit from the services in managing their health, easy to use, results are accurate etc. (Refer Table No. 8.2). But a reason for concern is why even that 10 per cent don't want to recommend the App. Firstly if the app is not a wholesome app, or the respondents were neither getting motivated as being a regular user of the app nor it brought any change in their life. (Refer Table No.8.3) (Figure No. 8.13)

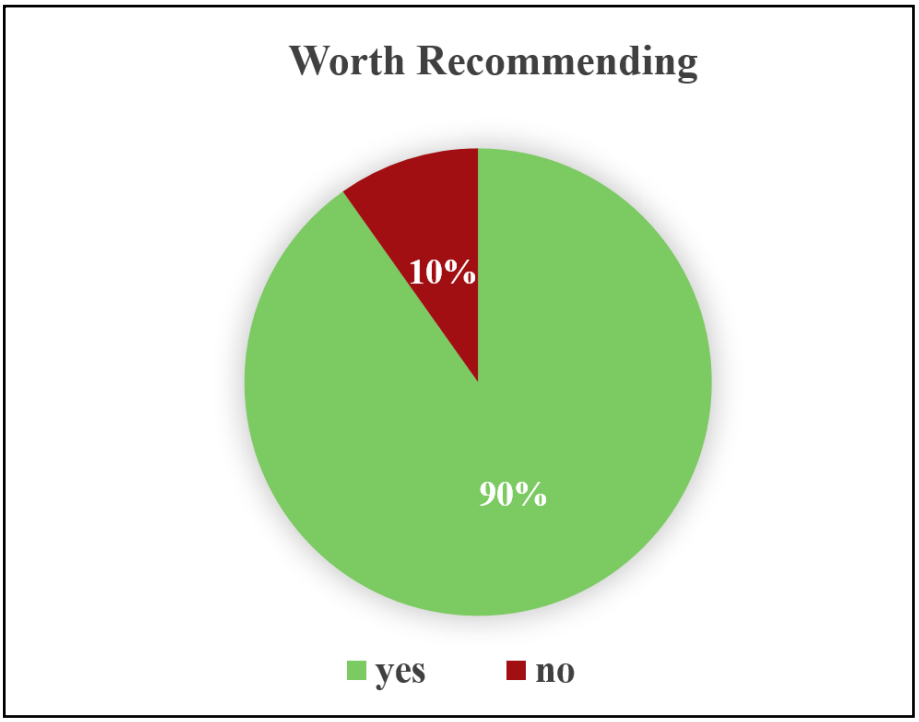


Figure 8.13: Per cent distribution , Are mobile health apps worth recommending

Table 8.2: Reasons why people want to recommend the apps to others

Reasons why people want to recommend app to others			
Functionality	**Percentages**	**Usability**	**Percentages**
Multiple options	7.5	**Keep proper track of daily life activities, calories steps etc. and keep user update**	18.3
To keep in touch what going on in the community	4.2	**To get all information and services for which users are using their app.**	20
Reminders	5.9	**To increase knowledge**	4.2
It notifies the gaps	3.3	**Easy to use**	6.6

Engagement	**Percentages**	**Information management**	**Percentages**
Motivation in achieving goal and healthy lifestyle	8.3	**Information at one click**	4.2
User friendly	10	**Accuracy of the result and analysis**	4.2
Engagement of the user by giving targets	3.3		

Table 8.3: Reasons why people don't want to recommend the app

Reasons why people don't want to recommend the app	Percentages
Not giving any motivation to be regular with the use	9.1
Professional assistance is always recommended for healthy diet and healthy life	9.1
Don't motivate me to get change in my lifestyle	9.1
"Health is totally a dependent on an individual priority choice and determination. I feel apps can only help if everyone is motivated and concerned enough for health."	9.1
Not a wholesome app	9.1
Have no reasons	54.5

Furthermore, when people responded about their satisfaction level, only 55 per cent fell under Satisfied category (45 per cent) and Very satisfied category (10 per cent). There were around 44 per cent respondents, which fell under normal range of satisfaction (Figure No. 8.14).

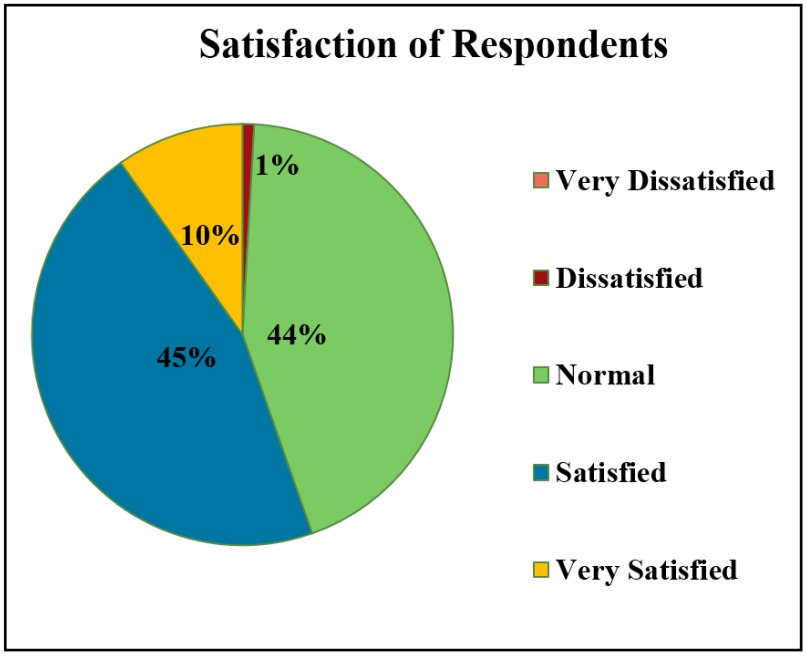


Figure 8.14: Per cent distribution of respondents satisfaction in managing health

Considering the reasons for dissatisfaction or even at average level of satisfaction, all respondents had to respond about their negative experience with the app. Out of 112, 71 per cent said No, whereas 29 per cent said Yes. (Figure No. 8.15). Out of all these, 29 per cent responded that biggest negative experience was app not being an offline App (as said by 17 respondents), followed by other issues like, too much information (10 respondents), technical breach (10 respondents), unexpected shut downs (8 respondents), and not a user-friendly app (4 respondents) (Figure No. 8.16).

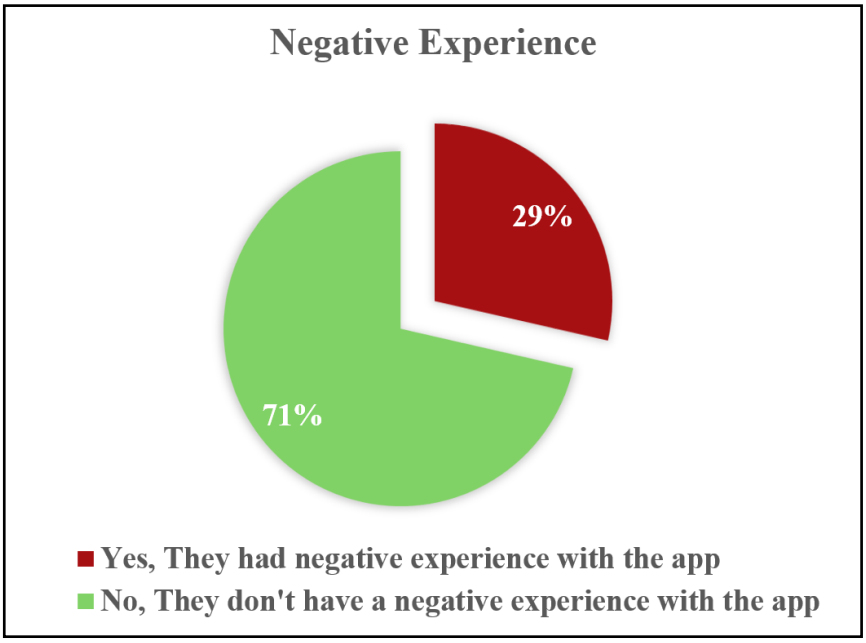


Figure 8.15: Per cent distribution of Negative Experience Response

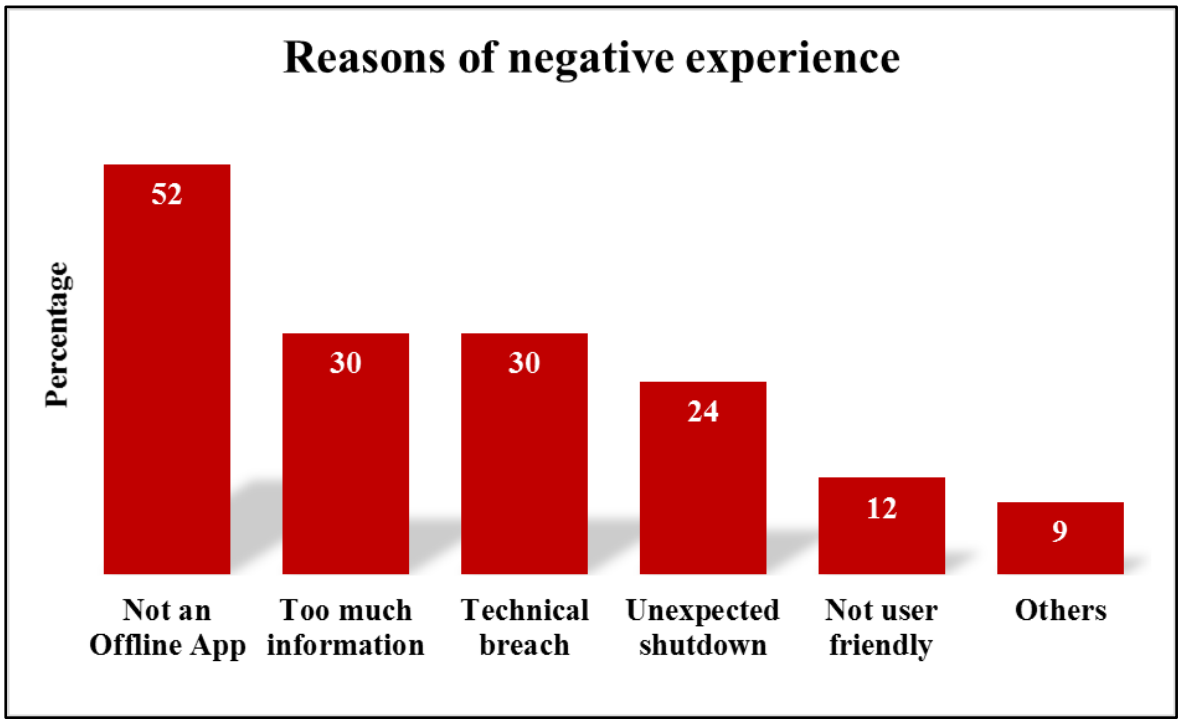


Figure 8.16: Per cent distribution of Reasons for Negative Experience

8.5. Results of Challenges and Barriers

After assessing all these four factor's impact on the healthcare delivery, various challenges and barriers faced by the users were also identified. There were around 127 barriers which were identified. In the study, out of these 127 barriers, 50 barriers (39.4 per cent) were identified to be due to network issue (also the biggest barrier), followed by hardware space (25 i.e 19.7 per cent), medical jargons used in the Apps (24 i.e 18.9 per cent), technical knowledge (12 i.e 9.4 per cent) (Figure No. 8.16). Except these, there were 16 other barriers (i.e. 12.6 per cent) also identified. All these, 16 other barriers have been divided under four major factors. (Refer Table No. 8.4)

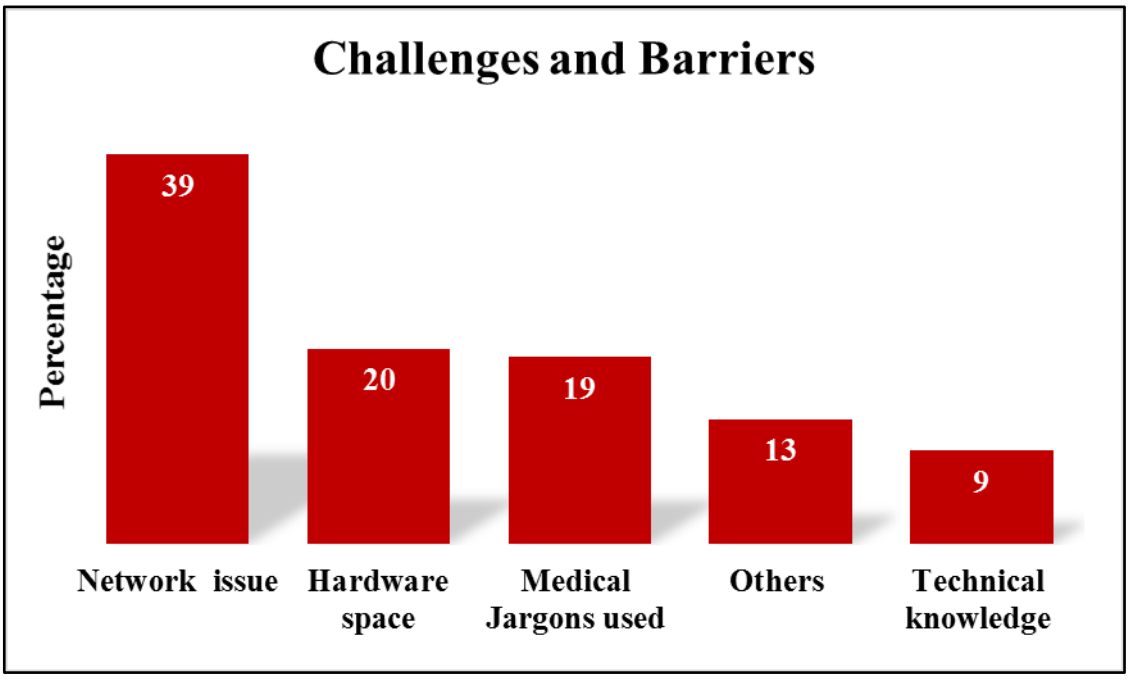


Figure 8.17: Per cent distribution of Challenges and Barriers

Table 8.4: Challenges and Barriers

Functionality	Usability	Engagement	Information management
Manual intervention	No guidelines for senior citizen	Install the app only when required	Can't share information
Extensive search	Regional Based (area)	Fear to lose the Smartphone or technical issue with hardware	Lack of Interconnectivity
Not an offline app	Time consuming procedure	User forget to start the app.	Data security, Accessibility, privacy confidentiality
No reimbursement of treatment cost, which was done through apps	No option for customizing the solution	Lack of motivation to continue its use for longer time	Interface is not user friendly

9. Conclusions

1. Four factors - Functionality, Usability, Information management and Engagement were identified through review.
2. Multiple types of health apps related to fitness, diet, physician consultancy, medical, pharmacy etc.
3. Most of them were somewhat satisfied with the apps
4. Over all they want an all-in-one App to get maximum benefits with minimum efforts.
5. Most of the respondents were convenient to manage their health with the help of app, but they wanted some additional features like, automation, user friendly navigation, timely reminder, graphical representation of results, easy language, data privacy, sharing, storage and interconnectivity, motivation, convenience, quali**ty of services, etc. in the app** to make the process effortless and easy.
6. Need modification on various features like: off-line app, interconnectivity with other apps and providers, user friendly navigation, layout, pop up messages, data sharing, privacy and confidentiality of the data, and data storage.
7. Challenges and barriers: network issue, hardware space, medical jargons, technical issues and various other.

10. Recommendations

Healthcare services need a technology integration to bring in accountability and efficiency in the system. Mobile healthcare applications must be built in such a way that health industry will keep a steady pace with that modern technology. This will get the best from the mobile health apps in the most affordable and accessible way.

To build, an "All-In-One App" firstly the app should be an Off-line app. Then, this app must have some features like: user friendly layout, customized & automated timely reminders, graphical representation, automation in storing data, user friendly navigation, easy and genuine search, privacy and security of data, customized pop-up messages, compressed size of the app, etc. It is extremely important to have a loyal user who have a trust in the app. To build that trust, an option of community involvement in the app where people can ask query, opinion etc. must be there. This will bring the transparency of app services among the users. Moreover, an App must motivate the users to increase their engagement with app, and to

keep them healthy. Finally, a developer can add video walkthroughs for any technical difficulties and can give an inbuilt dictionary for language issues.

If an app offers, the Right Information (elaborative analysis of health-related data) from the Right Source (Provider), in a Right Format (by offering user-friendly layout), to a Right person, at the Right time (when the need arises). This will give rise to an application that would serve the best in an Indian Healthcare setting by connecting the providers with the users.

11. Ethical considerations

During the study, full consent was obtained from the participants after the questionnaire completion. Anonymity of respondents and organizations participating in the research was ensured as none of the respondents' and organization's name was disclosed. Any type of communication with the participants in relation to the research was done with honesty and transparency. No misleading information was ensured, as well as representation of primary data findings was also not biased.

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13. Annexure

Questionnaire

Thank you for participating in my study. This questionnaire is designed to assess the mobile health application contribution to self-health care. With this study I will identify how the different factors of mobile health Application affect the self-healthcare delivery

Name:	**Age :**	**Gender: M/F**	**Software: Android/ IOS/ Other**

1. **From the options below, how conscious** you are for your Health?

What lifestyle pattern you follow	**(✓)**
No fixed lifestyle pattern with not much concerned about health	
Follow Sedentary Lifestyle with no or little concern to health	
Follow healthy diet and exercise occasionally	
Follow Healthy Diet regularly	
Exercising regularly along with healthy diet	

2. **Which** Mobile health care **applications** are you using and **for how long**?

_____ | Years | Months | Weeks | Days | From

3. How **frequent/often** do you use your application?

Yearly	Monthly	Weekly	Daily	Hourly	When required

4. Do you feel the **mobile application motivates you** to keep yourself healthy? | Yes | No |

5. Are you **able to manage your health** in a better way with the help of this mobile App**?** | Yes | No |

6. Is the **app worth recommending** to any | Yes | No | one?

   If Yes why _____

   If No why _____

7. Are you able to use your app **independently and** | Yes | No | **easily**?

1. Complicated Visual Appeal (layout)	
2. Difficult navigation (information is not on one touch)	
3. Difficult Language (jargons)	

If No, what are the **challenges** that you faced?

Any Other (please mention)_____

8. In your opinion, **to what extent** the following **functions help you out in managing your health** through mobile App (1 being Minimum and 5 being Maximum)

Functions	Minimum				Maximum
Timely Reminder	1	2	3	4	5
Information Sharing	1	2	3	4	5
Storage of Data	1	2	3	4	5
Graphical results	1	2	3	4	5

9. Kindly tick the **services for which you a**re using the healthcare app and rate **to what extend the App, enhance/ improve that service** for which you are using that respective app.

SERVICES Related to the app	You are using the app for(✓)	RATING						
Managing Medical Records		**MINIMUM**	1	2	3	4	5	**MAXIMUM**
Diet Record			1	2	3	4	5	
Weight Record			1	2	3	4	5	
Medical condition monitoring			1	2	3	4	5	
Tracking activities			1	2	3	4	5	
Physician appointments			1	2	3	4	5	
Medical Consultation			1	2	3	4	5	
General Health Education			1	2	3	4	5	
Pharmacy Prescriptions			1	2	3	4	5	
Symptomatic Checkers			1	2	3	4	5	
Multi-Diagnostics portability			1	2	3	4	5	

If any other service kindly mention and rate here _____

10. Taking 1 as minimum and 5 as maximum kindly rate, how **convenient is to manage your health** through the mobile app.

Minimum	1	2	3	4	5	Maximum

11. Kindly **rate how much satisfied are you**, while **dealing** with the following **criteria of the apps**?

CRITERIA Related to the app	RATING					Not Applicable
Result Accuracy and Reliability	Very Dissatisfied	Dissatisfied	Normal	Satisfied	Very Satisfied	N/A
Accessibility, Privacy and Security of your data	Very Dissatisfied	Dissatisfied	Normal	Satisfied	Very Satisfied	N/A
Quality of the Services you get from the App	Very Dissatisfied	Dissatisfied	Normal	Satisfied	Very Satisfied	N/A
How relevant are the pop up messages in response to your queries	Very Dissatisfied	Dissatisfied	Normal	Satisfied	Very Satisfied	N/A
How easily you can **enroll /apply** those popup messages?	Very Dissatisfied	Dissatisfied	Normal	Satisfied	Very Satisfied	N/A
The **navigation** of the App is **user friendly**?	Very Dissatisfied	Dissatisfied	Normal	Satisfied	Very Satisfied	N/A
Inter-connectivity of your app with other apps, Doctors, lab etc.	Very Dissatisfied	Dissatisfied	Normal	Satisfied	Very Satisfied	N/A

12. Do you have any **negative experiences** while receiving the services from the App? If yes, what was the **reason? (✓)**

Yes	No

Not user friendly	
Not an Offline App	
Too much information	
Unexpected shutdown	
Technical breach	

Any Other _____

13. How **satisfied** are you, after using this mobile health App for your healthcare management?

Very Dissatisfied	Dissatisfied	Normal	Satisfied	Very Satisfied

14. What would be your **biggest Challenge/barrier** while using the mobile App for Self- healthcare

1. Network (internet) issue	
2.Hardware(mobile) space	
3.Technical knowledge (don't know how to run a app	
4.Medical Jargons used (words)	

Any Other _____

15. If you want **to get the maximum benefits from the app**, which **customized features you think are must for the app, _____**

Consent

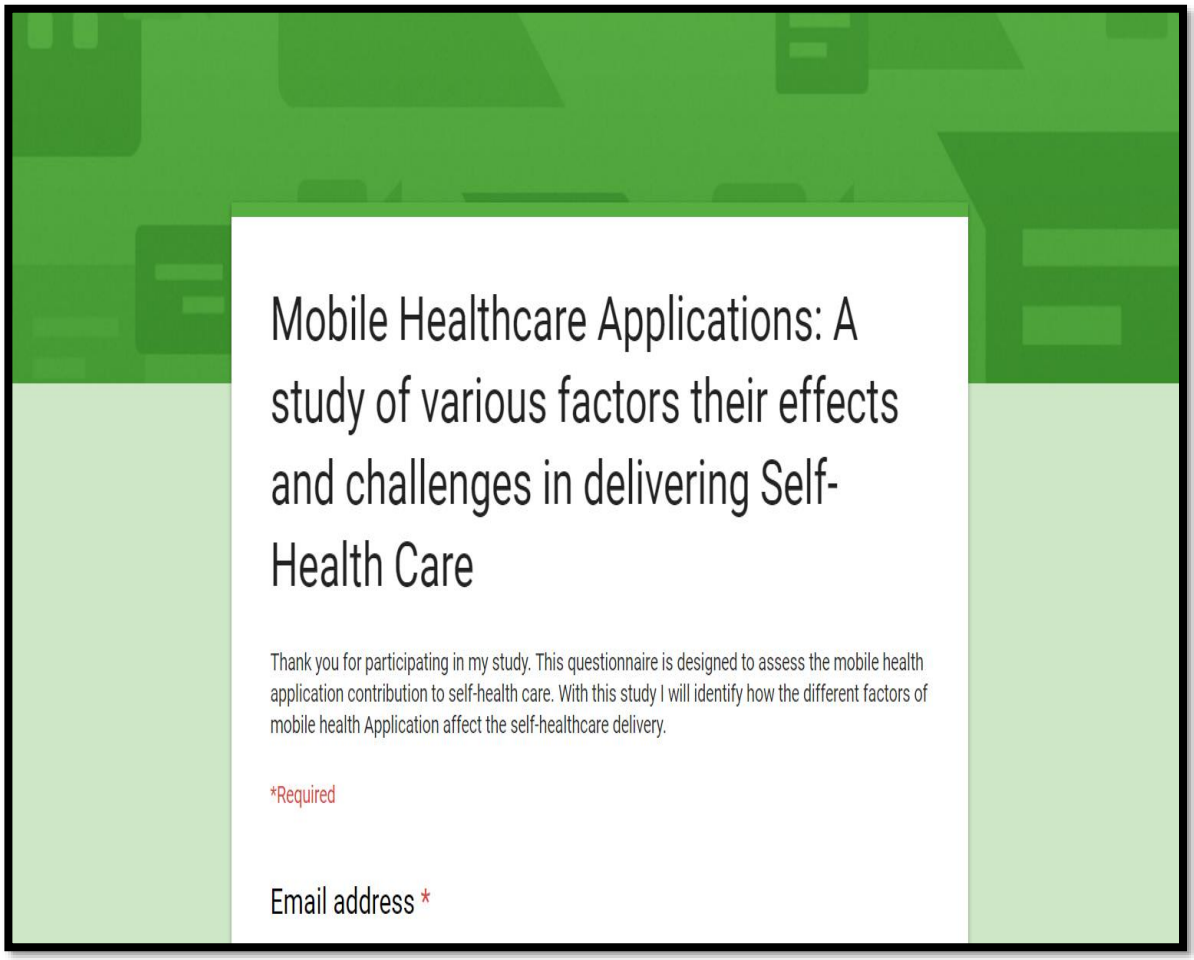
I allow the researcher to use my responses for her study by maintaining the confidentiality of the personal information for identification used in the questionnaire of the survey.

Agree (✓) or sign

Annexure 2

Google form link

https://docs.google.com/forms/d/1rsmwA3bvVMd5TkDro-R9-KGgaUclLU_0QBrtHx-NscU/viewform?chromeless=1&edit_requested=true



Annexure 3

Calculation of sample size

For quantitative analysis, a review of related literature suggested probability of this study to be 50%.

Based on the above findings, sample size was calculated using the formula:

$$\mathbf{n = Z^2\, pq/e^2}$$

Where,

n = desired sample size

Z = the standard normal deviate, usually set at 1.96, which corresponds to 95% confidence level

p = the proportion in the target population estimated to have a particular characteristic

q = 1-p

e = degree of accuracy desired (taken as 5%)

$$n = \frac{(1.96)^2(0.5)\,(0.5)}{(0.05)^2} \Rightarrow 384$$

The Total sample size = 384