Usability Evaluation of Pandemic Health Care Mobile Applications

M Mubeen¹, M W Iqbal², M Junaid³, M H Sajjad⁴, M R Naqvi⁵, B A Khan⁶, M M Saeed⁷, and M U Tahir⁸

¹,²,³ Department of Software Engineering The Superior College, Lahore 54700 Pakistan
⁴,⁵,⁶,⁷,⁸ Department of Computer Science The Superior College, Lahore 54700 Pakistan
Email: mses-s19-005@superior.edu.pk⁶

Abstract. This study was conducted to evaluate the usability of health care apps and its significance in the field of health care. As health care centers are the settings working 24/7 for providing health services to patients. For this study a systematic review, comparison and functionality assessment of selected COVID19 mobile apps was performed. The assessment was performed on two digital platforms, App store on Apple iPhone and Google play store on Android smartphones. Further online search of keywords on Google was also conducted in order to ensure the reliability and validity of apps on these stores. And only those apps were selected which were in English because of the language proficiency of authors. The mobile apps selected were having five features of assessment, a questionnaire, Privacy statement, Precautionary measures if test positive for COVID19, after plans of Pandemic and Region based. The sample was a blend of participants from different fields including students, doctors, patients and software developers. This is a quantitative study; a questionnaire was distributed among the selected participants who were familiar with the use of health care mobile apps. The data was analyzed on the basis of gender and age. The results were made on the basis of responses towards effectiveness, efficiency and satisfaction of users towards mobile phone apps. The results show that apps were found 64.5% informative for participants as they helped in fast communication of doctors and patients while sitting at the other corner of world.

1. Introduction
For upgrading health and health care delivery, a widespread use of mobile phone technology is being adopted. And for this purpose a vast variety of health apps are being introduced. For monitoring, planning and attaining health goals some health apps could be considered effective and beneficial in this field. Smartphones are gradually making their place in our lives and has a great value in our everyday routine work. Smartphones nowadays are serving huge range of functions and features as compared to the ones in the past. In our daily tasks IOS applications and Androids are commonly used. Currently in Apple App Store (operating system: IOS, developer: Apple), more than 900,000 applications are available and in Google Play store (operating system: Android, developer: Google) over 700,000 applications are available [1].

In the past few years, the adaptability of smartphones has resulted as an important innovation in health care department. Use of mobile phone technology has made millions of lives easy and quick all around the globe, not just as a fun gadget but as a lifesaving technology too, from implantable medical devices to the instruments that tracks even a vital signs of mobile phones such as smartwatches. Use of healthcare applications as a game changer in the healthcare industry. Firstly, for significantly improving patients experience and secondly, boosting their productivity are the two most critical areas of healthcare
that call for immediate attention. Speed and efficiency playing a key role in defining healthcare organizations, and trying to improve patients experience turning towards technology for high quality treatment. In 2013 the number of apps related to health has been increased to 31,000. Using various health apps, widespread adoption and use of mobile technologies open up new and innovative ways to improve the delivery of health and health care [2-3]. Patient's satisfaction is derived both subjectively and also based on objective facts from the measures observed by their interaction with different factors at health care setting and its influence on their perception towards internet of health things and quality of health care setting delivery [4-5-6].

Experience of patients is an important outcome of medical care and is regarded as one of the central pillars of health care quality. Worldwide decision makers generally tend to use data on patient experience rather than performance metrics to determine the quality of health care services. Patient experience is strongly associated with the quality of delivery of health care setting, which is including outcomes such as medication adherence, access to preventative services, and patient safety. Medical applications are available for many purposes including electronic prescription, diagnosis and treatment, coding and accounting, practice management and CME or e-learning [7]. Brucso, 2012 concluded that in China the relationship between physicians and patients is not at its best in terms of communication. According to National Health Service, 2014 the patient-physician relationship can be improved by the use of mobile technology as it provides more effective communication channel to individuals and health care setting for building strong relation.

After the invention of mobile health applications, the relationship between physician and the patient has become even stronger as a patient can communicate easily while sitting at home to the physician and can ask for next appointment, medical consultation and can discuss easily other health issues by just one click. Studies have established clear correlation between patient's participation in decision-making processes and effective communication with better self-reported clinical outcomes [8]. There are several improved mobile health applications for handling a variety of chronic diseases, such as obesity, diabetes and stroke; health care information education; and for gathering reliable information and storing this data on a central repository that is accessible to skilled caregivers. Even though many chronic disease applications help in improving patient's provider communication and assist in disease management [9].

Through smart devices, patients have become closer to health care workers and with their help they are trying to keep themselves healthy by taking part in their health care programs and getting information about health care. In patient and doctor experiences health care apps are playing major role. The Usability of health care applications is becoming significant in building strong relationship between physician to and patient, removing he high fees of doctors, increases the productivity of doctors, improving the patient experiences and saving a lot of time of doctors and patients. Health care centers are places which have a busy routine 24/7 and to keep eye on every task and get quick information, it needs the source which is none other than smartphone.

2. Background and Literature Review
COVID-19 (Coronavirus disease 2019), caused by Severe Acute Respiratory Syndrome Coronavirus2 (SARS-CoV-2) has received attention all over the world. The number of confirmed cases across the world continues to rise at the time of writing in April 2020. On 11th of March, 2020 the World Health Organization (WHO) announced the COVID-19 disease as a pandemic. In terms of lockdown and mortality the SARS-CoV-2 pandemic has demolished. The public is now keener to get information about this pandemic outbreak and use digital channels such as social media sites, news bulletins and radio news to keep COVID-19 up to date. Jayan, 2020 concluded that reading digital news articles and scrolling through reliable official websites seems to be the main option for tech-savvy individuals. This provides an incentive for developers of mobile applications to improve the app which will potentially help the users to access the information they are looking for and also for self-assessment in order to prevent any inconvenience. There is still ongoing research on the role of mobile health, also known as m-Health in healthcare services. Access to healthcare and health information is made easy by the use of m-Health applications [10].
The usability of such health care apps has also reduced the frequent visit to hospital by stable patients, thus reducing the mobility of immunocompromised patients to high-risk areas. Implementing standardized functionality of health care apps that can assist of self-assessment, diagnosis, and monitoring of symptoms has tremendous potential for infection control. This research aimed to examine and evaluate the content of COVID-19 mobile apps and their functionality. The results are critical in helping health care workers identify appropriate mobile devices for self-monitoring COVID-19. The results of the evaluation of mobile apps that potentially help developers of mobile apps enhance or change their current mobile app designs to achieve optimal results [12].

3. Methodology

3.1. Selection of smartphone apps and their frequent features
A systematic review, comparison and functionality assessment of selected mobile apps for COVID19 were performed. Firstly, a search for COVID-19 mobile apps was performed in two digital platforms: App Store on the Apple iPhone and Google Play Store on android smartphones. The keywords “Covid19”, “Coronavirus self-assessment”, “Corona treatment” and “COVID-19 apps” were used to find COVID-19 mobile apps in the App Store and Play Store. In order to ensure that all relevant mobile apps were included, an online search on Google using the key terms “mobile app”, “Health apps Coronavirus”, “Covid19”, “Coronavirus”, “Corona” and “COVID-19” was also conducted. Then all mobile apps were filtered according to the relevancy of COVID-19 apps. The authors are mainly proficient in the English language, so only apps that support an English language user interface were assessed and reviewed. The included mobile apps were assessed based on their basic features. The basic features included 1. Assessment through a questionnaire 2. Privacy statement 3. Precautionary measures if you test positive for COVID19. 4. Plans after Pandemic ends 5. Region based assessment. Finally, five features including Assessment through a questionnaire, Privacy statement, Precautionary measures if you test positive for COVID19, plans after Pandemic ends and Region based assessment are selected due to their rich pattern-ability.

3.2. Experimentation
In this study, the participants were from different professions students, Doctors, patients, Software Developers etc. The questionnaire was developed to find out the participants to for best user experimentation. The Male participants were found 77% and Female participants were found 23%. Two major age group was found in which age varies from 15 to 35 were 94% and 31-45 were 6%. The user of this app was found 58% who used the apps we selected. The factors which was calculated on the base of questions which were asked in questionnaire. Participants used this app for symptoms tracking of Covid-19. These apps were found 69.3% helpful in symptoms tracking and 64% helpful in treatment of this Covid-19. Participants use these apps to test these features. These apps were found 64.5% informative for participants because these apps are providing enough information about disease to understand what actually the disease is. All questions are used to evaluate the usability of these apps.

3.3. Usability evaluation
Amelio and Brodic in 2016 suggested that there are three parameters for checking the usability evaluation of mobile phone applications: effectiveness, efficiency and satisfaction. Bevan, 1995 founded that ISO 9241-11 standard can be used to measure the effectiveness and efficiency and Lewis, 1991 suggested Scenario Questionnaire (ASQ) for measuring user's satisfaction. Following are their formulas:

\[
\text{Time based Efficiency} = \frac{\text{Nij}}{\text{R}} \times 100 \\
\text{Effectiveness} = \frac{\text{Total number of tasks completed successfully}}{\text{N}} \times 100 \\
\text{R} = \text{the number of users} \\
\text{Nij} = \text{the result of task i by user j; if the user successfully completes the task, then Nij = 1, if not, then Nij = 0} \\
\text{tij} = \text{the time spent by user j to complete task i. If the task is not successfully completed, then time is measured till the moment the user quits the task.}
\]
Lewis, 1991 said that satisfaction is measured by the amount to which user finds the use of product acceptable. Usability is dependent on the context of use and on the specific circumstances in which a product is used. The context of use consists of user’s task, hardware, software and material. There are many post task evaluation techniques available (e.g. SEQ, UME, SMEQ) but in this study the satisfaction is measured through ASQ technique. The ASQ is particularly a short questionnaire which takes little time, easy to understand and tremendous practical considerations of participants for usability studies. It contains three questions of seven points scale (strongly disagree=1, disagree=2, somewhat disagree=3, neither agree nor disagree=4, somewhat agree=5, agree=6, strongly agree=7). With important aspects of user satisfaction with system usability. The first question shows the aspect of ease in task completion, second question provides the aspect of time to complete a task while third question analyzes the satisfaction level on capability of support information.

4. Results and Discussion

4.1. Satisfaction

(a) Corona Check app:

In the wake of the emerging global COVID-19 pandemic, the Corona Check app [13] provides users with authentic, essential information shared by international experts, agencies and organizations regarding the novel coronavirus. Its authenticated assessment tool, driven by Artificial Intelligence, helps users conveniently conduct self-assessments in the comfort of their home, limiting risk of infection that comes with seeking medical advice. The app’s awareness videos, adopted from the World Health Organization and Ministries of Health for respective countries, aim to raise awareness about what COVID-19 is, measures to take to avoid spreading infection, precautions for parents to keep children safe, the need for physical distancing and guidelines on wearing PPE. Emergency contact numbers are also listed. The testing was done on different users and the results are as follows:

Table 1. Response of male and female towards the satisfaction of this app

| Have you ever used this app? | Female | Male |
|------------------------------|--------|------|
| No                           | 67     | 211  |
| Yes                          | 85     | 305  |
| Total                        | 152    | 516  |

(b) The COVID Safe app

The COVID Safe app [14] is part of our work to slow the spread of COVID-19. Having confidence, we can find and contain outbreaks quickly will mean governments can ease restrictions while still keeping Australians safe. The new COVID Safe app is completely voluntary. Downloading the app is something you can do to protect you, your family and friends and save the lives of other Australians. The more Australians connect to the COVID Safe app, the quicker we can find the virus. The testing was done on different users and the results are as follows:

Table 2. Response of male and female towards the satisfaction of this app

| Is this app useful in symptoms tracking | Female | Male |
|----------------------------------------|--------|------|
| No                                     | 41     | 134  |
| Yes                                    | 111    | 382  |
(c) COVID Symptoms Study App

In symptoms study app of Covid-19 user has no need to register himself only sign in. User has no need to go outside and through mobile phone by installing this app [15] and providing about his physical condition can get about his report. It is easy to use, have great idea and informative. It has good health service and user can easily contribute himself in it. Through WhatsApp, insta and snapchat user can engage with this app features. The testing was done on different users and the results are as follows:

| Are you satisfied with this app? | Female | Male |
|----------------------------------|--------|------|
| No                               | 62     | 195  |
| Yes                              | 90     | 321  |
| Total                            | 152    | 516  |

(d) HowWeFeel: The How We Feel Project

How We Feel, project recognize the patient that are suffering from most dangerous and harmful virus. User may not need to go anywhere from his house he must be provide data online. That may include details of his sex, gender, age and some history of patient [16]. This app may have an effective security user must be committed and feel secure himself that his history will be remain secure. User have to add firstly his country zip code, age, gender and about his physical condition. If user is not feeling well patient have to choose some symptoms in which he is lying and consistency of that symptoms. The testing was done on different users and the results are as follows:

| Information given on these apps about diseases is enough? | Female | Male |
|----------------------------------------------------------|--------|------|
| No                                                       | 49     | 149  |
| Yes                                                      | 103    | 367  |
| Total                                                    | 152    | 516  |

4.2. Effectiveness

The results in the figure 1, shows that the usability of mobile phone app in health care center’s by male and female separately.
Figure 1. Effectiveness of usability of health care apps

The effectiveness of usability of health care apps demonstrated that 305 male and female have used this app. 382 male and female considered this app useful in symptoms tracking, 363 male and female considered this app helpful in treatment, 321 male and female were satisfied with this app and 367 said that the information given on app about diseases is enough. 90 male and female were not satisfied with this app and 183 considers the information on this app about diseases is not enough. But overall the result is positive as mostly population has responded positive towards the effectiveness of this app.

4.3. Efficiency:

The efficiency of usability of health care apps demonstrated that 305 male and female have used this app. 382 male and female considered this app useful in symptoms tracking, 363 male and female considered this app helpful in treatment, 321 male and female were satisfied with this app and 367 said that the information given on app about diseases is enough. While on the other hand 85 male and female have not used this app. 111 thinks that this app is not useful for tracking symptoms, 116 male and female considered this app is not useful for treatment, 90 male and female were not satisfied with this app and 183 considers the information on this app about diseases is not enough. But overall the result is positive as mostly population has responded positive towards the efficiency of this app.

The following figure 2, shows the response of male and female towards the efficiency of health care apps.
Figure 2. Response of male and female towards the efficiency of health care apps

4.4. Frequency table:
This frequency table shows the number of responses made by male and female towards the satisfaction of health care app in respondent to the statements. Following figure 3, shows the graphical representation of responses made by male and female towards the satisfaction of health care apps.

Figure 3. Graphical representation of responses made by male and female towards the satisfaction of health care apps.

The graph shows that 85 females and 305 males have used this app. 111 females and 382 males showed positive response towards symptoms tracking feature of this app. 116 females and 363 males considered this app to be useful in treatment, 90 females and 321 males were satisfied with this app and 367 males said information given on this app about diseases is enough for treatment. Whereas, 67 females and 211 males haven't used this app. 41 female and 134 male consider this app to be failed in tracking symptoms. 36 females and 153 male said this app is not useful in treatment, 62 females and 195 males were not satisfied with this app. 49 female and 149 male responded that the information about
diseases on this app was not enough. The overall result shows that majority of user’s responded positive towards the satisfaction of this app.

5. Conclusion
This paper was based on the usability evaluation of pandemic health care mobile applications. We evaluated the usability on the basis of effectiveness, efficiency and satisfaction of app users. The results of the effectiveness of usability of health care apps demonstrated that 305 male and female have used this app. 382 male and female considered this app useful in symptoms tracking, 363 male and female considered this app helpful in treatment, 321 male and female were satisfied with this app and 367 said that the information given on app about diseases is enough. While on the other hand 85 male and female have not used this app. 111 thinks that this app is not useful in tracking symptoms, 116 male and female considered this app is not useful for treatment, 90 male and female were not satisfied with this app and 183 considers the information on this app about diseases is not enough. But overall the result is positive as mostly population has responded positive towards the effectiveness of this app. The efficiency of usability of health care apps demonstrated that 305 male and female have used this app. 382 male and female considered this app useful in symptoms tracking, 363 male and female considered this app helpful in treatment, 321 male and female were satisfied with this app and 367 said that the information given on app about diseases is enough. While on the other hand 85 male and female have not used this app. 111 thinks that this app is not useful in tracking symptoms, 116 male and female considered this app is not useful for treatment, 90 male and female were not satisfied with this app and 183 considers the information on this app about diseases is not enough. But overall the result is positive as mostly population has responded positive towards the efficiency of this app.

The overall result shows that majority of user’s responded positive towards the satisfaction of this app. In future the work should be done on some other beneficial features of health care apps. The limitations of this pandemic health care application is firstly not everyone has a smart phone, secondly app can crash anytime, and thirdly data privacy and security is the main issue. The recommendation is Method of payment, medical specialty of the provider, and initial health background of the patient should be carefully controlled in future studies or, preferably, studied in their own right, and measures of health status and function should be included in addition to simply noting the services provided.

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