Original Article

Access this article online

Quick Response Code:

Website: www.jehp.net

DOI: 10.4103/jehp.jehp_759_21

Persian mobile health applications for COVID-19: A use case-based study

Rasool Nouri, Raheleh Salari[1], Sharareh R. Niakan Kalhori[2,3], Seyed Mohammad Ayyoubzadeh[4], Marsa Gholamzadeh[4]

Department of Medical Library and Information Sciences, Health Information Technology Research Center, School of Management and Medical Information Sciences, Isfahan University of Medical Sciences, Isfahan, Iran, [1]Department of Ophthalmology, Poostchi Ophthalmology Research Center, School of Medicine, Shiraz University of Medical Sciences, Shiraz, Iran, [2]Research Fellow and Guest Scientists, Peter L. Reichertz Institute for Medical Informatics of TU Braunschweig and Hannover Medical School, Hannover, Germany, [3]Ph.D. in Medical Informatics, Associate Professor, Department of Health Information Management, School of Allied Medical Sciences, Tehran University of Medical Science, Tehran, Iran, [4]Department of Health Information Management, School of Allied Medical Sciences, Tehran University of Medical Science, Tehran, Iran

Address for correspondence:
Dr. Raheleh Salari, Department of Ophthalmology, Poostchi Ophthalmology Research Center, School of Medicine, Shiraz University of Medical Sciences, Shiraz, Iran.
E-mail: rahelehsalari@gmail.com

Received: 25-05-2021
Accepted: 24-07-2021
Published: 23-03-2022

Abstract:

BACKGROUND: Since the beginning of the COVID-19 outbreak, a significant number of mobile health apps have been created around the world and in Iran to help consequence reduction of this emerging pandemic.

OBJECTIVES: This study aimed to review the characteristics of Persian Android and iOS apps related to COVID-19 and determine their use-cases based on a reference model.

METHODS: This was a cross-sectional descriptive study conducted in three main steps. First, a systematic search was conducted via Iranian mobile apps' markets using the keywords related to COVID-19 in January 2021. Then, the retrieved apps were analyzed according to their characteristics. Finally, the use-cases of the given apps were determined and categorized based on a reference model.

RESULTS: Based on our inclusion criteria, 122 apps were selected and evaluated. Most of these apps (87.7%) was free. Small proportions (5%) of reviewed apps have been developed with participation of clinical expert and half of the apps mentioned the references they used. Furthermore, about half of the apps (50.8%) were provided contact information of the developers. The studied apps were classified into four use-case major categories, including educational (98%), fulfilling a contextual need (18%), communicating, and/or sharing the information (0.83%), and health-related management (2%).

CONCLUSION: The results showed that the Persian mobile apps for COVID-19 are not in a satisfying situation. Furthermore, although these apps are significant in quantity but in terms of use-cases, they are not widespread.

Keywords:

Coronavirus, COVID-19, mHealth, mobile-health, use-case

Introduction

The coronavirus disease 2019 (COVID-19) pandemic has killed many people worldwide since December 2019, and Iran has been among the most affected countries.[1] At the time of writing (January 10, 2020), the number of confirmed cases across the world reached to 90,580,796 and 1,941,200 deaths. As of January 10, 2020, 1,286,406 patients with COVID-19 have been identified in Iran, of which 56,171 deaths have been occurred by the virus. According to statistics, Iran ranks ninth among the countries of the world in the number of deaths due to COVID-19.[2] One of the key programs for tackling COVID-19 is the use of information technology, including mHealth. In recent years, mHealth capacities have been used in many countries as a new technology to control epidemic/pandemic outbreaks, with valuable results.[3] Mobile application development can be considered as a suitable solution in this field. They have already been used extensively around the world to prevent and control noncommunicable diseases.[4] Furthermore, health apps have been used to fight and help infectious diseases outbreaks management such as influenza, dengue, zika, and malaria;[5] however, due to the

How to cite this article: Nouri R, Salari R, Kalhori SR, Ayyoubzadeh SM, Gholamzadeh M. Persian mobile health applications for COVID-19: A use case-based study. J Edu Health Promot 2022;11:100.

special conditions created by the COVID-19 pandemic, these apps have received special attention and during in a short time, a considerable number of apps have been developed and used for various purposes such as Contact tracing, Public awareness, Patient education, and Home visit.[3,6] Given the importance of mobile Health apps in dealing with COVID-19 and due to the lack of review of apps on COVID-19 in Iran, this study aimed to assess the characteristics of all developed apps related to COVID-19 in Iran and investigate the use cases of these apps.

Methods

We performed a cross-sectional, use case analysis of Iranian COVID-19-related mobile apps, based on a proposed model by Yasini and Marchand.[7] We organized the study methods as follows:

Systematic search

First, a systematic review of Iranian mobile apps stores across two digital platforms was carried out. iApps, SibBazar, Sibche, SibApp, SibIrani was studied for iOS and, Miket, CafeBazar, ParsHub, Charkhooneh for Android were checked.

The methodology used for the selection of the apps was based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses system.[8] The search was conducted by "COVID-19," "Coronavirus," "Corona," "COVID-19" keywords on Janaury 5, 2021. Apps that were not developed in Persian, were not free, and could not be installed were excluded from the study and all remaining apps were explored.

Two members of the research team (RS, SMA) screened the apps by titles and their descriptions for the preliminary step. After that, removed the duplicate apps that were found in multiple stores or from multiple keywords or the apps that did not install or no longer available. Then, they downloaded all selected apps to iPhone and Android devices to investigate the app's features.

Data extraction

We observed and extracted data related to the apps include store name, developer name, the objective of application, size (MB), number of active installations, number of star rating, list of reference used in the development process, ability to contact developers (from within the application), the clinical expert used in the development process, user information registration, privacy policy, last date of update. The characteristics and objectives of the apps were extracted from the app description. Then each app was installed and explored by two members of the research team (RS, SMA), to verify by the experimental use. Any disagreement was discussed until consensus achievement.

Classification the apps

Selected apps were investigated to extract their functionalities and mapped to uses cases in the model[7] used. These use cases were grouped into four major categories: (1) communicating and/or sharing the information (for example, asking a question from a physician through the application in a forum, or an app that provides a multidisciplinary consultation platform for physicians, etc.), (2) fulfilling a contextual need (for example, using the mobile device as a diagnostic tool, a reminder in a decision support system, etc.), (3) educational tools (for example, serious gaming, sample educational questions, etc.), (4) health-related management (for example, managing the drug stock, locate a nearby health service, etc.)

Results

Apps screening

Our search with specified keywords resulted in 150 apps for Android and 27 apps for iOS. The apps were filtered according to the inclusion criteria and removing the duplicated cases, giving a total of 119 mobile apps for Android and 3 mobile apps for iOS. Therefore, finally, a total of 122 apps were selected, downloaded, reviewed, and evaluated. The screening procedure is shown in the flow diagram in Figure 1.

Apps characteristics

Most apps were on the Android platform and were available in Café Bazar (61 apps, 50%). Twenty apps (16.5%) were available on both platforms while

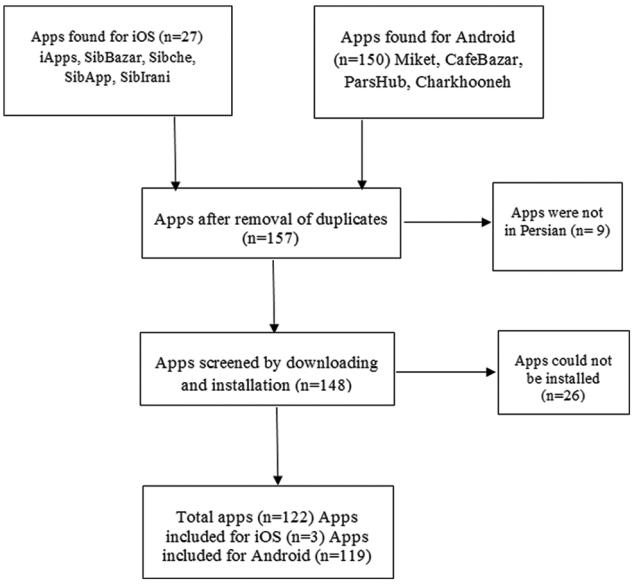

Figure 1: Flow diagram for app selection

three apps (2.5%) were only developed for iOS. The least number of Android apps were available in Pars Hub ($n = 2$, 1/7%). Almost a third of apps had 4 and more rating stars by consumers ($n = 45$, 37%). The average size of the apps was 15.3 MB (SD = 11.77). The median number of downloads of the apps was 20253 (SD = 120073) and the most active downloads (+1000000) belonged to the app developed by the government. Most apps did not mention whether they used clinical experts in the app's development process or not ($n = 115$, 94%). Eleven apps had <50 active installs (9%). The remaining characteristics are shown in Table 1.

Apps use cases

We used the use case model of mobile apps proposed by Yasini and Marchand in 2015.[7] Their analysis showed that mobile apps could be classified into six major categories and their related use cases based on their objective and functionalities including, communicating or sharing the information, fulfilling a contextual need, educational tools health-related management, consulting medical information references, and managing professional activities.

As shown in Table 2, the apps studied in this research were divided into four main categories from the six categories conducted by Yassini and Marchand. Most studied mobile apps were designed to provide educational tools ($n = 120$, 98%). The least important use cases were assigned to communicating and/or sharing the information ($n = 1$, 0.8%). Of course, it is worth mentioning 74 apps (60%) developed for only one use case, 26 apps (21%) had two, and 22 apps (18%) had three use cases. No app had all the proposed use cases altogether.

Discussion

Through this survey, a use case-based analysis was considered to investigate the Persian apps regarding COVID-19. As a result, a total of 122 mobile applications were recognized from different app stores. The results of studies showed that program developers prefer App stores as a distribution channel for health programs in the health domain.[9] As we expected, the majority of applications are developed for Android devices due to their popularity among users of health-related applications.[10]

Table 1: Characteristics and their frequency in analyzed apps

Characteristics descriptions	Frequency (%)
Support by government	53 (43.4)
Ability to contact the developers through the app	62 (50.8)
Rate 4 and more	45 (36.9)
clinical expert participation in app development	7 (5.7)
Existence a list of references	61 (50)
Existence of privacy policy for the collected data	1 (0.83)
Updated between 3-6 months	16 (13.1)
Free	107 (87.7)
Legal traceability	89 (72.9)

The results showed that most of the identified apps are free applications. Since the audience of such programs is usually the general public, it was expected. However, the provided information has not mainly been supported by approved references and experts. They are free with plenty of advertisements which might be due to not being supported by health-related officials. According to Fougerouse *et al*., providers preferred to publish their applications on free platforms to increase the download rate.[11] However, the development of health-related mobile apps with clinician consultation can lead to feeling confident about their recommendation.[12] Only a limited number of applications have been developed under the supervision of experts. It seems that these free applications have been developed more for commercial purposes than health-care improvement and promotion. According to the study's result, only 37% of applications have the rank 4 and more reviewed by the users.

Through this survey, a use case-based analysis was considered to investigate the Persian apps. This approach helped researchers to categorize the applications based on their applicability and usage according to the model presented by Yassini and Markand.[7] This classification model has already been used for analysis the health-related apps in Persian.[13] The results of this evaluation showed that the majority of applications are devoted to educational tools. In the second rank, applications related to fulfilling a contextual need are in this study. However, in other studies that have examined applications in the field of COVID-19, most applications have been devoted to subjects such as remote patient monitoring, teleconsultation, self-assessment, or contact tracing.[6,11,14, 15-17]

Since the nature of COVID-19 is still unknown, updated contents and education in various forms can also have a significant impact on controlling the COVID-19 disease.[18] Public awareness and sharing up-to-date information is kind of public health programs which can be used as the most important part of the control and elimination of pandemic outbreak.[3] For this reason, it seems that most of the programs developed in the field of patient education. Around the world, accessibility to COVID-19 information was the main concern of health policymakers. Our result is similar to the results of another conducted study on smartphone applications available for COVID19 worldwide.[15]

Although fulfilling contextual need applications accounted for only 22% of all programs, it ranks second

Table 2: Mobile app's use cases and their frequency of use cases in the analyzed apps

Major categories	Use cases of COVID-19-related mobile apps	Frequency of apps (%)
Communicating and/or sharing the information	Communication platforms or forums between patients	1 (0.80)
	Communication platforms or forums between health-care providers	0
Fulfilling a contextual need	Remote monitoring to follow-up a disease/physiological condition	0
	Diagnostic/screening tools	22 (18)
	Awareness alerts to remind to take medication/perform an activity/task	0
	Measurement tools	0
Educational tools	General information/recommendations/training programs for treatment or health care	66 (54)
	Medical news	60 (49)
	Games	41 (33)
	DBs of pharmaceutical	0
	Access to nutritional databases	0
	Access to databases of image	0
	Access to databases of scientific articles	0
Health-related management	Guide and DBs of physicians, medical centers, pharmacies	0
	Locating a health center or pharmacy with insurance	3 (2)
	Manage appointments, appointments	0
	management of medication inventory at home	0
	Contact a health-care institution/pharmacy/insurance	0

COVID-19=Coronavirus disease 2019, DBs=Data Bases

among other applications. Since such applications could have a significant impact on self-care during a pandemic, it seems that the development of such programs could have a significant impact on pandemic control.

Our classification showed that some health informatics-related subjects were missed in developing Persian mobile health domains. Topics such as developing mobile-based CDSS (clinical decision support systems) for more accurate diagnosis and consultations, contact tracing, self-assessment tools, developing virtual visit platforms, and quarantine monitoring could be considered in further research.[14,15,19] Concerning some other neglected issues in this field, we can point to issues such as artificial intelligence mobile health platform for early detection of COVID-19 with the aid of wearable sensors, home hospitalized applications, and cloud-based surveillance applications that have been considered by a very small number of researchers so far.[20-22] In the current pandemic, teleconsultation or virtual visit, digital learning and training, cloud and mobile-based system for self-care, wearable bases systems for real-time transmission, intelligent systems for early detection, screening and triage, and epidemiological analysis have been underlined by mobile apps platforms in countries such as China, USA, UK, Italy, France, Spain Netherland, Belgium, Taiwan, and South Korea through offering many advantages.[23] However, the result of this study addresses the limited usages of mHealth application to combat the pandemic in Iran, only focused on the restricted usabilities. This might be the lack of knowledge in the area of mHealth in theoretical, technical, and clinical points of view leading to the fact that Iranian developers neglected various kinds of applications. It may be due that most of these applications did not develop under clinical expert consultations or with collaboration with them.

This study encountered some limitations too. We investigated the applications which are published in the Iranian popular App stores. Apple's official company policy regarding sanctions against Iran can be one of the limitations that we have been encountered with it to find applications. In a pandemic era, some health-care organizations might be produced some applications based on their need and expectations, but the target group in this study is the general users and the majority of the community. In this study, we have selected all the apps in the Persian language. Further research with a multi-country survey such as Asian Persian-speaking countries is the real solution to validate these results.

Conclusion

The results of this study showed that the Iranian mobile apps for help in the management of COVID-19 in a remote manner are not in a satisfying situation. Since mHealth is one of the best solutions for better patient management and maintaining patient communication with the health-care provider team in critical situations such as COVID-19, the results of this study and similar studies can help developers, policymakers, and users choose the right path for development and reliable apps to use. It is suggested that further studies be done to examine the status of related mobile apps in similar situations and to create a basis for proper competition to improve quality.

Acknowledgments

This study is a part of a project that is financially supported by the Tehran University of Medical

Sciences (Grant: # 47400-102-1-99). Furthermore, we appreciate Dr. Mobin Yasini and Guillaume Marchand for their efforts in introducing mobile apps using case classification model development.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Alamdari NM, Afaghi S, Rahimi FS, Tarki FE, Tavana S, Zali A, *et al*. Mortality risk factors among hospitalized COVID-19 patients in a major referral center in Iran. Tohoku J Exp Med 2020;252:73-84.
2. Worldometers. Reported Cases and Deaths by Country, Territory, or Conveyance; 2021. Availble from: https://www.worldometers.info/coronavirus/. [Last Accessed on 05 Jan 2022].
3. Aslani N, Lazem M, Mahdavi S, Garavand A. A review of mobile health applications in epidemic and pandemic outbreaks: Lessons learned for COVID-19. Arch Clin Infect Dis 2020;15:1-7.
4. Nouri R, R Niakan Kalhori S, Ghazisaeedi M, Marchand G, Yasini M. Criteria for assessing the quality of mHealth apps: A systematic review. J Am Med Inform Assoc 2018;25:1089-98.
5. Mohanty B, Chughtai A, Rabhi F. Use of Mobile Apps for epidemic surveillance and response-availability and gaps. Glob Biosecur 2019 Sep 11;1(1).
6. John Leon Singh H, Couch D, Yap K. Mobile health apps that help with COVID-19 management: Scoping review. JMIR Nurs 2020;3:e20596.
7. Yasini M, Marchand G. Toward a use case based classification of mobile health applications. Stud Health Technol Inform 2015;210:175-9.
8. Moher D, Liberati A, Tetzlaff J, Altman DG, Group P. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. PLoS Med 2009;6:e1000097.
9. Larsen ME, Nicholas J, Christensen H. Quantifying App Store Dynamics: Longitudinal Tracking of Mental Health Apps. JMIR Mhealth Uhealth. 2016;4(3):e96.
10. Hussain M, Al-Haiqi A, Zaidan AA, Zaidan BB, Kiah M, Iqbal S, *et al*. A security framework for mHealth apps on Android platform. Computers & Security. 2018;75:191-217.
11. Fougerouse P-A, Yasini M, Marchand G, Aalami OO. A Cross-Sectional Study of Prominent US Mobile Health Applications: Evaluating the Current Landscape. AMIA Annu Symp Proc. 2018;2017:715-23.
12. Wyatt JC. How can clinicians, specialty societies and others evaluate and improve the quality of apps for patient use? BMC Medicine. 2018;16(1):225.
13. Saeedi MG, Kalhori SR, Nouri R, Yasini M. Persian mHealth Apps: A Cross Sectional Study Based on Use Case Classification. Studies in health technology and informatics. 2016;228:230-4.
14. Salehinejad S, Niakan Kalhori SR, Hajesmaeel Gohari S, Bahaadinbeigy K, Fatehi F. A review and content analysis of national apps for COVID-19 management using Mobile Application Rating Scale (MARS). Informatics for Health and Social Care. 2021;46(1):42-55.
15. Davalbhakta S, Advani S, Kumar S, Agarwal V, Bhoyar S, Fedirko E, *et al*. A Systematic Review of Smartphone Applications Available for Corona Virus Disease 2019 (COVID19) and the Assessment of their Quality Using the Mobile Application Rating Scale (MARS). J Med Syst. 2020;44(9):164-.
16. Alanzi T. A Review of Mobile Applications Available in the App and Google Play Stores Used During the COVID-19 Outbreak. Journal of multidisciplinary healthcare. 2021;14:45-57.
17. Anglemyer A, Moore TH, Parker L, Chambers T, Grady A, Chiu K, *et al*. Digital contact tracing technologies in epidemics: a rapid review. The Cochrane database of systematic reviews. 2020;8:Cd013699.
18. Reddy BV, Gupta A. Importance of effective communication during COVID-19 infodemic. Journal of Family Medicine and Primary Care. 2020;9(8):3793.
19. Bassi A, Arfin S, John O, Jha V. An overview of mobile applications (apps) to support the coronavirus disease 2019 response in India. The Indian journal of medical research. 2020;151(5):468-73.
20. Gong M, Liu L, Sun X, Yang Y, Wang S, Zhu H. Cloud-Based System for Effective Surveillance and Control of COVID-19: Useful Experiences From Hubei, China. Journal of medical Internet research. 2020;22(4):e18948.
21. Lai SHS, Tang CQY, Kurup A, Thevendran G. The experience of contact tracing in Singapore in the control of COVID-19: highlighting the use of digital technology. International orthopaedics. 2021;45(1):65-9.
22. Wong CK, Ho DT, Tam AR, Zhou M, Lau YM, Tang MO, *et al*. Artificial intelligence mobile health platform for early detection of COVID-19 in quarantine subjects using a wearable biosensor: protocol for a randomised controlled trial. BMJ open. 2020 Jul 1;10(7):e038555.
23. Kalhori SRN, Bahaadinbeigy K, Deldar K, Gholamzadeh M, Hajesmaeel-Gohari S, Ayyoubzadeh SM. Digital health solutions to control the COVID-19 pandemic in countries with high disease prevalence: Literature review. Journal of medical Internet research. 2021;23(3):e19473.