

Evaluation and ranking of Persian mobile apps for COVID-19

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ABSTRACT

Introduction: Recently developed mobile apps for controlling COVID-19 have the potential to help fight the pandemic. But assurance regarding the quality of available apps is essential to proving their validity for usage. This study was aimed at evaluating and ranking the apps in Persian developed for COVID-19 in Iran.

Material and Methods: 122 apps for COVID-19 in the Persian language were founded in the Miket, CafeBazar, ParsHub, and Charkhooneh app markets. Based on inclusion criteria, 13 apps were selected. The apps were evaluated by two independent reviewers and ranked according to a validated evaluation and ranking tool specifically for the Persian apps for information content, usability, design, ethics, security, privacy, and subjective quality. Kendall's coefficient of concordance was used to calculate the agreement between two raters based on the mean of their scores for each app (p-value<0.05).

Results: Five functional and subjective quality criteria were used. Mask was the app with the highest level of the specific score (mean score: 4.10, subjective quality: 4). The Corona test-Davoudi was the app with the lowest level of the specific score (mean score: 1.85, subjective quality: 1.50), which needs more improvement. The reviewed apps mainly need improvement for data security and privacy, requiring more technical tasks.

Conclusion: There is a need for improvement, particularly in terms of privacy and data security, for Persian COVID-19 apps. Develop a valid guideline that could be effective in improving app quality. In addition, the modern technologies that have already proven successful worldwide should be considered by mobile app developers.

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INTRODUCTION

In December 2019, unknown pneumonia cases were reported in Wuhan, China, and then a new type of coronavirus was identified as the cause of these cases. The official name of COVID-19 was chosen, and later in March 2020, WHO announced the pandemic of COVID-19 [1]. To manage this situation and control the side effects of this pandemic, healthcare policymakers try to facilitate healthcare processes and make them as accessible as possible using

available technologies [2]. Nowadays, most 7 billion people use mobile phones around the world, which penetrate all aspects of their daily lives. 51.2% of them can use the internet, so facilitating the process makes it more accessible and convenient [3]. Mobile phones are really helpful for quickly communicating and sharing information with healthcare providers [4]. This is called "mobile health," or mHealth. The World Health Organization (WHO) says mHealth is when mobile devices like phones and tablets are used for medical and public health purposes. mHealth is

using technology to improve healthcare [5].

Mobile health has played an important role in helping COVID-19 related users, including patients and home caregivers, policymakers, and healthcare providers [6]. The apps have been developed for different purposes like education and awareness, contact tracing, knowing about the morbidity and mortality rate, online assessment, and online consultation [7].

For COVID-19 control and management, it is reported that mobile apps may help healthcare providers monitor patients. Therefore, there is no need to attend healthcare centers constantly, reduce unnecessary visits, and control high-risk areas [8]. On the other hand, mobile features allow people to receive updated information dynamically and rapidly. Some of them, which are nationally developed, are revised based on content and ranked [9]. Although the mobile apps are available in different languages and content, adopting them as interventions to improve required health-related regulations is essential [2]. That is, there are several concerns among healthcare providers and other users about the absence of transparency in services and the privacy of users [7].

In some cases, the dissemination of misinformation regardless of the health care guidelines may irreparably harm patients, which may cause more mistrust among users [10]. Since the quality of these apps is one of the main reasons for their success and widespread use in the community, reviewing the content and ranking them through recognizing their strengths and weaknesses will help to better understand them for their improvement and help to make their acceptance by users smoother [11]. This requires assurance regarding the quality of available apps, which can be done through an evaluation process to make sure that they are valid enough to be proposed for usage as a part of regular care.

During the different waves of COVID-19 in Iran, mobile apps in the Persian language were developed as a response to the pandemic of COVID-19 to tackle this pandemic rapidly; however, they have not been evaluated neither during the designing and development process nor after being published in the related markets. Reviews and analyses of the related mobile applications may help understand the advantages and shortcomings of the available apps for further upgrade in the future and use the highest-ranked one for intervention [7]. Although there are many studies about the evaluation of mobile health applications for COVID-19 in light of the coronavirus pandemic [9, 10, 12-15], here is a lack of a study to evaluate and rank the available Persian apps in Iran. However, there is a paucity of information on how to assess the reliability or value of commercially available apps. If an app is useless, inaccurate, or even hazardous, the choice to prescribe it to a patient might have major repercussions. Using a useless app

could put off getting diagnosed and receiving treatment for a disorder where early discovery has a big impact on survival chances. Healthcare organizations and providers are faced with a dilemma: more and more patients are using the numerous health apps that are already available, but organizations and providers are hesitant to take action because they are unsure which apps to recommend and have questions about the quality and validity of these apps [16]. Additionally, there is very little research on the subject of rating and ranking mHealth apps in the archival literature [17].

This paper is aimed at systematically searching the available apps for COVID-19 in Persian developed in Iran, evaluating and ranking them to provide knowledge that might be useful for developers, health-related policymakers, technological organizations, and even people to choose the right and appropriate apps.

MATERIAL AND METHODS

At the first step, the search for App developed for COVID-19 in the Persian language was conducted. The studied app markets for android include Miket, CafeBazar, ParsHub, Charkhooneh were checked.

Unfortunately, Apple's official company policy regarding sanctions against Iran. On the other hand, it was not possible for the authors to access the iPhone smartphones to check the related apps. So we encountered this limitation here and only searched in Android apps market. The search with keywords "COVID-19", "Coronavirus", "Corona-virus", and "COVID-19" in the Persian language in September 2021 was carried out.

The keywords were searched in combination with the OR operator. The original number of apps was 150 and after removing the duplicate ones, they were 122. Further analysis based on the inclusion and exclusion criteria was done. The inclusion criteria were all apps in the Persian language, related to COVID-19, developed in organizational and private section, were considered. Based on exclusion criteria, apps that were not developed in Persian, those which were not free (It means apps that charge for initial installation), apps with no active link, apps with no reference and introduction and those with problem in installation were omitted.

After primary analysis based on inclusion criteria, 13 apps were remained for evaluation. The process of systematic search and applying the inclusion and exclusion criteria using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) system in Fig 1 presented [18]. For apps content analysis and evaluation, two experts (RN and RS) in medical informatics and health information management discipline, reviewed the apps independently.

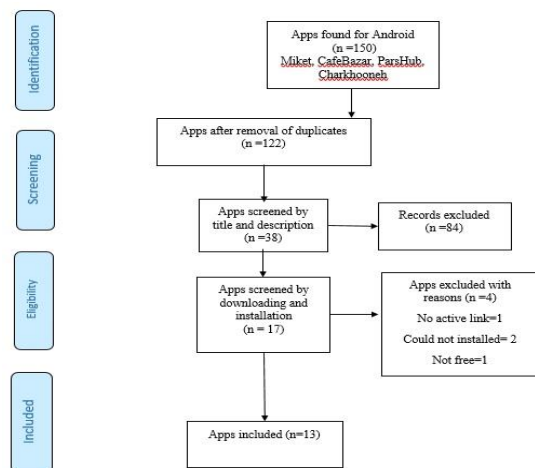


Fig 1: Flow diagram for app selection

The raised discrepancies were resolved by SRNK for the final decision. They used the evaluation tool, which has already been developed for Persian apps rating and assessment. This tool was created and validated via a thesis project approved by Tehran university of medical sciences with IR.TUMS.SPH.REC.1395.1868 ethical codes in 2018 [19].

The tool developed based on studying several available apps evaluator tool and then proved by content validity ratio (CVR) and content validity index (CVI). The mean of CVR and CVI were 0.50 and 0.8 respectively. The validated tool included six main parts including information content (16 questions), usability (12 questions), design (3 questions), ethics (3 questions), security and privacy (14 questions), and subjective quality (5 questions) in Persian with 53 questions in total. The subjective quality section evaluating users’ satisfaction. The response to them

rated on a 5-point scale (1=inadequate, 2=poor, 3=acceptable, 4=good, and 5=excellent) or not applicable. The applied tool has been provided in the Appendix.

After apps selection and preliminary analysis, the data of each app was extracted and analyzed using Excel software for descriptive and analytical statistics. The mean score of each section of the study tool was calculated. Kendall’s coefficient of concordance was used to calculate the interrater agreement between two raters based on the mean of their scores for each app according to the given evaluation criteria. Statistical analysis was done by SPSS version 19 (p-value <0.05).

RESULTS

Descriptive analysis of the apps

Out of the 13 included apps, 9 (70%) were developed by organizations and 4 (30%) were personal. According the inclusion criteria, all of the apps were free. There were 8 apps (61%) in Myket app market, 4 apps (31%) in Cafebazar app market and one app (8%) in Charkhooneh app market. The highest number of active installations was related to the “mask” app (more than 200000 active installations) and the lowest number of active installations was related to the “Introduction to Coronavirus” (10 active installations). Except for one of the apps that its star rating was not reported, the star rating of the other apps varied between 4 and 5 star. Seven apps (54%) were less than 10 MB in size and the rest (46%) were between 10 and 30 MB. In terms of the target of app development, 10 apps (77%) had educational purpose, nine app (70%) presented for news, four apps (31%) for screening and one of them (7.7%) was provided for tracing purposes (Table 1).

Table 1: Characteristics of included apps

App name	App Market	Developer	Target	App size (Mega Byte)	Active installation	Number of reviews	Stars rate	Last up-date	Cost	Type of developer
Mask	Myket	Specialist team	Educational, News, Tracing	27.70	200000	595	4.1	November 16, 2020	Free	Organizational
Soroush-Salamati	Myket	Soroushe-Salamati	Educational	7.00	200	Unknown	Unknown	June 1, 2020	Free	Personal
Taak	Cafebazar	Part app	Educational	4.99	5000	26	4.3	March 30, 2020	Free	Organizational
Amoozesh-Hamegani	Myket	Mohamad Mohamadi	Educational, News, Screening	12.00	500	18	3.9	March 16, 2020	Free	Organizational
Salamat Beman	Myket	Mohamad Mohamadi	Educational, News, Screening	18.00	1000	16	3.8	March 22, 2020	Free	Organizational
Corona Virus app-Qom University Medical Sciences	Cafebazar	Qom University of Medical Sciences	Educational, News	9	200	4	4	August 2, 2020	Free	Personal

App name	App Market	Developer	Target	App size (Mega Byte)	Active installation	Number of reviews	Stars rate	Last up-date	Cost	Type of developer
Introduction to Coronavirus	Cafebaazar	Mohsen 777	Educational	13.00	10	4	4.8	May 13, 2020	Free	Personal
Covid news-Safarzadeh	Charkhooneh	Alireza Safarzadeh	News	0.19	Unknown	17	4.93	September 19, 2020	Free	Personal
Corona Victims	Myket	Mhp software developer	News	21.00	900	9	3.4	November 18, 2020	Free	Personal
Anti-Corona	Myket	Merfanm	Educational, News	9.00	100	8	4.5	December 6, 2020	Free	Personal
Corona news and test	Myket	Super plus	Educational, News, Screening	1.90	400	14	4.4	October 18, 2020	Free	Personal
Corona test-Davoudi	Myket	Mahdi Davoudi	Educational, News, Screening	8.00	8000	21	4	April 6, 2020	Free	Personal
Corona Online Diagnosis	Cafebaazar	Salar Abbasi	News	12.12	200	2	5	March 16, 2020	Free	Personal

Table 2: The scores of each studied apps in several evaluation parts

App Name	Info/content	Usability	Design	Ethical Issues	Security and Privacy	Subjective Quality	App-Specific score	App Overall Score
Mask	4.27	3.54	4.50	4.50	3.71	4.00	4.10	4.05
Soroush-Salamati	3.36	4.23	3.83	3.83	1.00	3.80	3.25	3.53
Taak	2.63	3.32	3.33	3.33	1.30	2.90	2.78	2.84
Amoozesh-Hamegani	2.50	2.95	3.17	3.17	1.00	2.90	2.56	2.73
Salamat Beman	2.68	2.86	3.33	3.33	1.00	2.40	2.64	2.52
Corona Virus app-Qom University Medical Sciences	1.90	2.77	3.83	3.83	1.60	2.10	2.79	2.44
Introduction to Coronavirus	2.29	2.50	3.50	3.50	1.60	2.20	2.68	2.44
COVID19 news-Safarzadeh	2.43	2.18	3.67	3.67	1.00	2.10	2.59	2.34
Corona Victims	2.07	2.23	3.50	3.50	1.00	2.20	2.46	2.33
Anti-Corona	1.89	1.95	3.17	3.17	1.50	2.10	2.34	2.22
Corona news and test	1.82	1.70	3.00	3.00	1.00	1.80	2.10	1.95
Corona test-Davoudi	2.20	2.23	1.67	1.67	1.50	1.90	1.85	1.88
Corona Online Diagnosis	1.60	2.00	2.67	2.67	1.00	1.50	1.99	1.74
Mean	2.43	2.65	3.32	3.32	1.40	2.45	2.63	2.54

Evaluation and ranking

The included apps were reviewed and evaluated by two evaluators independently. The value of Kendall's coefficient of concordance were 0.912 (p-value<0.01) showing the satisfactory coefficient of the two raters. Subjective quality section evaluated users' satisfaction and specific score related to objective and technical areas. The app overall score represented the mean score of subjective and objective criteria's. The apps ranked based on their

overall scores.

The highest mean score in the information/content (4.27), design (4.5), ethical issues (4.5), security (3.71), and subjective quality (4) domains were related to "Mask app". Only in the usability domain, the Soroush-Salamati app had highest mean score (4.23). Overall, the Mask app received the highest score in the reviewed apps (4.10). The second and third ranks were assigned to Soroush-Salamati (3.25) and Corona Virus app-Qom University Medical Sciences (2.79) by specific score, respectively. Also,

“Corona news and test”, “Corona Online Diagnosis” and “Corona test-Davoudi” with the specific mean score of 2.10, 1.99, 1.85 and respectively were the weakest reviewed apps. Reviewers assigned the highest subjective quality score to Mask. Soroush Salamati could be in second, Taak and Amoozesh-Hamegani achieved the third score in subjective quality by reviewers (Table 2).

DISCUSSION

Among offered digital health solutions for COVID-19, mHealth has played important role to support health system to control COVID-19 [20]. Their main functions can support contact tracing, education, triage and screening, surveillance, diagnosis monitoring [21]. Results of the apps review study shows that, although they have supported the patients and care providers during the pandemic, they still need more improvement [9].

In a descriptive study conducted to analyze the apps in Persian for COVID-19 based on the users’ feedback and interactions, high level of users’ interest was addressed; only six months after the pandemic start, 941173 views for the apps was done in which the MASK with 700000 is in the top [22]. This high level of apps downloads in Iranian apps markets present the important of the apps content for public health promotion in one side and the user’s interest to use the higher quality apps on the other side.

Mask has been known as one the high quality apps here in this study too, Mask also could achieve the highest score in another study that conducted about Persian mobile apps for COVID-19 [23]. It has got the highest mean score for five fields as shown in table 2. The app has been developed by a technical university with tree main features of training, news, and patients tracing. Most of the apps in the top rank of Persian apps for COVID-19 has been developed by an organization mainly designed by a team rather than a developer, which is consistent with the results of Erfannia’s study [23]. They have features such as screening and tracing rather than only news and training. They have less advertisement and they are part of an intervention designed for control the pandemic. However, those apps which were developed by persons contain more advertisement and business aims are behind their development.

Developed apps for COVID-19 control in Persian language in Iran mainly focused on four main features including screening, education, tracing, and news. The mean scores for evaluation of these apps developed in Iran was 2.54 (1.74 – 4.05). This finding is consistent with the results of a study by Heydari et al, Who categorized the priorities of relevant experts for appropriate features in mobile apps for COVID-19 [24]. However, in the countries where mobile health supported the pandemic control more actively, more

functions were added to the applied apps such as using QR codes, GIS, wearable devices, and sensors for better tracing and identity checking of infected cases and patients [25]. The apps developed in other countries with more features has satisfying mean of ranking based on MARS [9]. Although still more improvement were suggested.

The least mean scores for the reviewed apps based on the evaluation parts belonged to the security and privacy of app (mean score: 1.40) In the study of Heydari et al, the importance of security for these app groups was not mentioned, too [24]. If this issue is always one of the effective aspect in accepting and using these apps and as a result their effectiveness.

This fundamental concern needs more attention to improve the apps usage for the crucial occasions such as pandemic. The most common app security issues are data leakage unintentionally, poor authorization/authentication, improper session handling, and broken cryptography, which need more technical consideration during the apps development. Design and ethical issue had the better score for the Mask and Soroush-Salamati as the mean score for both were 3.32 in which more works and consideration of these two parameters in future version of the apps may affect the better evaluation result in total. This is one of the most important factors influencing the successful implementation and use of apps [8].

Therefore, guidelines should be developed to address concerns arising from poor privacy. Of course, in addition to setting rules and guidelines, users can be reassured by providing additional information about publicly trusted institutions that support such studies and projects, in this study, it is clearly visible in popular Iranian apps such as Mask.

A various and wide range of mobile app users, including health care providers, patients and their families, authorities, evaluators, managers, and policymakers, have realized the importance and capabilities of these tools and, on the other hand, about potential risks compared to previous years.

However, it seems that creating and proposing a comprehensive and integrated set of all aspects of health mobile app evaluation tool due to the various aspects such as location, time and conditions of the society during app development, privacy and security issues and lack of standard and unit mechanisms is a complex and impossible process. However, studying and reviewing mobile apps can be useful and valuable in developing standard evaluation tools [26].

This study was the first study to evaluate the apps for COVID-19 in Persian with a valid evaluator tool in the same language and evaluate the apps in each criteria separately in content and functionality aspects. Although other works may claim of Persian apps evaluation, they have used the English tool for

evaluating the Persian apps which leads to invalid results. The results of this study showed that which apps can be suggested to be used as a part of disease control and in which sides they need more improvement in future versions. This need to consider the apps development process as a team working duty need different specialties such as medicine, computer science, public health and education, and informatics come together to result the better outcome.

CONCLUSION

Iranian apps developers have created products to help the pandemic control by support the digital technologies. The outputs still need to be improved specially regarding the privacy and data security. Higher technology based apps which have already been successfully used in the world should be considered. The periodical evaluation of the available apps by a valid tool in the same language can present the positive and negative points of the available apps and present the way for the future work.

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AUTHOR'S CONTRIBUTION

All authors contributed to the literature review, design, data collection and analysis, drafting the manuscript, read and approved the final manuscript.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest regarding the publication of this study.

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ETHICS APPROVAL

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