The Role of M-Government Application in the Saudi Health Sector in Light of the COVID-19 Pandemic: A Review

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Abstract – **The Kingdom of Saudi Arabia's government had taken an interest in digital health. This helped to speed up the development of services needed to confront the Pandemic. This paper aims to review the role of free mobile health apps available on Google Play and the App Store, and used in Saudi Arabia during the COVID-19 outbreak. This study relied on a review of the mobile applications currently used for COVID-19. Six applications were selected that included the specific search criteria. The study found that apps have met the inclusion criteria. The following characteristic of the applications have been described: Application overview (user rating, platform (Android, IOS), language, app ranking in the store). Also, application analysis and service criteria shown based on the functions that match the specified criteria (social distancing, isolation/quarantine, awareness). We noticed a redundancy of services between 6 applications. In conclusion, it proposes the design and integration of services through a mobile health application with most of the features and functions analysed in this study.**

Keywords–**COVID-19, digital transformation, mobile government, mobile health application, health.**

1. Introduction

With the emergence of the coronavirus COVID-19 in Wuhan city in China at the end of December 2019 came a worldwide reaction. The coronavirus spread globally with no known treatment. One of the virus's characteristics is the speed with which it can spread amongst people [1]. According to [2], COVID-19 has less severe symptoms than the Middle East and the SARS COVID viruses; nevertheless, the speed contagion for COVID-19 spread is faster than the two viruses, making COVID-19 more dangerous. With the lack of an effective treatment or vaccine for the virus in the beginning, countries and organizations began to take precautionary measures to limit infection spread, as this seemed the only weapon to confront the pandemic. On January 30, 2020, the World Health Organization declared COVID-19 a public health emergency requiring global attention [3]. It then announced that COVID-19 is an epidemic on March 11, 2020 [3].

From the start of the epidemic, Saudi Arabia has taken many precautionary and preventive measures to confront the Pandemic. Saudi Arabia has previous experiences in dealing with epidemic diseases such as the MERS COVID. Researchers Abdullah A. Al gaiss et al. [4] discussed how it helped the Kingdom develop the public health system, set the necessary plans and policies to combat infection, and determine the measures to be taken in the event of any new pandemic.

The first confirmed case of COVID-19 was recorded in Saudi Arabia on March 2, 2020; however, the government began to take measures before that. Those measures were reviewed in the Ministry of Health's report "The experience of the Kingdom of Saudi Arabia in the health preparedness and response to the COVID-19 pandemic" [3], which was published in August 2020. The Kingdom's efforts began with the formation of the Supreme Committee which was given the responsibility to take all necessary precautionary and preventive

measures to prevent the spread of the COVID-19 pandemic. The committee is chaired by the Minister of Health with six other ministries' participation in the first stage and later included 22 sectors and ministries that cooperate to confront the pandemic.

The role of technology has been prominent in light of the COVID-19 through various applications that have supported isolation/quarantine, case tracking. To help reduce the spread of infection and ensure the continuity and safety of life and business, and reduction many services and functions were transferred to be done remotely in the virtual environment.

To face the pandemic, the Kingdom has developed or updated several mobile applications to assess suspected cases or follow up on confirmed cases. The Kingdom provided tests, examinations, treatment, and vaccinations for free, without any compensation for all social segments, including citizens, residents, and violators of residency and work regulations without any consequences. This helped reach the largest possible number of community members, provide them with care and educate them. Based on what has been stated by the World Health Organization, Saudi Arabia's efforts helped to confront the COVID-19 pandemic and limit the spread of the epidemic [3]. We have noted several criteria that we will apply when choosing the applications whose role will be reviewed in relation to the pandemic. Those criteria are that the applications should be free, governmental, serving isolation/quarantine, social distancing, awareness, and be under the Ministry of Health's supervision.

The review is divided into several sections as follows: the first part of the review includes the background and related works, then the methodology, followed by the results of the search process, followed by discussion and conclusions, and concluding with Further research.

2. Background and Related Works

2.1. COVID-19 pandemic

COVID-19 has had a destructive impact on public health; It has affected social life and had an economic impact that has reached up to 10% of the Gross Domestic Product in affected countries [5]. According to the World Health Organization, since the first suspected case of COVID-19 on December 1 2019, a total of 116,135,492 confirmed cases and 2,581,976 deaths were reported [6] up to March 8, 2021, evoking international fear. According to the Saudi Ministry of Health Dashboard [7], Saudi Arabia recorded 387 292 confirmed cases and 6528 deaths up to March 2021.

Several procedures and protocols were initiated by the Saudi Government [3] to confront the COVID-19 pandemic. These procedures encompass equipping the public stations and airports with temperature screening to pinpoint people with fevers, suspending domestic and international flights, social distancing, and isolation/quarantine of suspected and infected cases. On the other hand, multimedia and TV channels sought to raise individuals' awareness to prevent infection. Academics, researchers, scientists, and doctors are working hard to analyze, identify and find solutions to this epidemic to mitigate the risks and avoid more social and economic consequences. Several countries have taken the initiative to develop vaccines for this epidemic.

The Saudi Ministry of Health [3] has approved three vaccines for COVID-19, developed by AstraZeneca, Moderna, and Pfizer-BioNTech for use in the Kingdom. Vaccines were distributed free of charge to all citizens and residents of the Kingdom. The dashboard of the Saudi Ministry of Health [7] recorded 30,558,607 total tests taken and 46,288,357 doses of vaccines administered up to November 7, 2021.

2.2. Importance of Mobile Government in Saudi Arabia

2.2.1. Transformation E-Government to M-Government

A study was conducted by Kushchu and Halid Kuscu [8] to highlight the moving from e-government to m-government and differentiate between them. The study states that Internet technologies have changed the way governments interact with citizens, how they present their different operations—making many government activities dependent on wireless mobile technologies. Also, despite the mobile government's importance, it is not considered an alternative solution to e-government. Still, both are complementary to the other to reach a successful digital transformation. The Saudi government's vision 2030 [9] has led to the implementation of the National Transformation Program to create a digital society. It accelerates the implementation of basic and digital infrastructure projects and sets various strategies for developing a robust information and communication technology (ICT) infrastructure, to enhance service provision and increase the economy's growth.

Starting in 2012, the Saudi government launched a complementary e-government initiative to assist government agencies in adopting the concept of mobile government by creating and launching mobile-based applications for e-services [10].

Recently, the Saudi government has contributed significantly to support the digital transformation in the Kingdom. The Saudi Cabinet approved the Digital Government Authority's launch to open new horizons in digital government services and enrich the citizen's experience through proactive and integrated digital services.

2.2.2. M-government in Saudi Arabia

Alotaibi, Houghton et al. [11] stated that the mobile government applications in the Kingdom of Saudi Arabia are still in their early stages. They found that the Technology Acceptance Model (TAM) is appropriate for knowing and measuring the factors that affect users' intentions to use government applications for Saudi Arabia's government. Alonazi, Beloff, et al. [12] proposed the Mobile Government Adoption and Utilization Model (MGAUM) to analyze and evaluate factors affecting user adoption and use of mobile government. Moreover, a study was performed by N. Alkhaldi [13] to explore the significant factors affecting users' intention to use m-government services using a research model.

Moreover, Al Sunaidi and Ahmed [14] stated that M-Government provides visible benefits to the citizens and Agencies in Saudi Arabia. However, specific challenges are encountered when implementing mobile government, such as trust issues, additional infrastructure cost, mobile device usage, user acceptance, and privacy and security concerns. These challenges vary from place to place.

2.2.3. M-government in Saudi Arabia during COVID-19 pandemic

According to the data released by the Communications and Information Technology Commission (CITC) [15] in the Kingdom of Saudi Arabia, mobile phone users in 2018 amounted to 42 million users. The proliferation of mobile devices in Saudi Arabia is among the main factors that revolutionized e-governance across the Kingdom.

During the COVID-19 pandemic, the Ministry of Health developed several applications to confront the pandemic and limit its spread, such as Tetamman.

The application aims to provide health care and protection for citizens and residents or those in isolation/quarantine. Another application developed to help prevent the spread of COVID-19 is Tabaud. The application works to track the spread of COVID-19. The Tawakkalna application also was developed during the pandemic; the application allows individuals to report any violation of gatherings or injuries and issue travel permits during the curfew period [16]. In contrast, the existing applications like Sehha, Sehhaty, and Mawid were used to facilitate and support during the pandemic.

According to the Ministry of Health (MOH), those applications maintain the privacy and security of their users. The Ministry of Health provides text messaging (SMS) service as part of many of its electronic services to subscribers of these services by sending SMS alerts at every stage of the electronic service. It is also used to attract subscribers' attention to everything new on the Ministry of Health's portal, including news, announcements, and health awareness to prevent diseases, epidemics, and viruses. More than 6.6 billion awareness and educational text messages have been sent regarding COVID-19 to fight rumors and urge citizens to take information from official sources [3]. The information is provided in different languages. Figure 1. shows some of the application timeline developments or announcements based on the MOH website. More than 200 pages were searched at an average of 9 news headlines per page, starting from March 27, 2021, and going back to previous dates in the period of the beginning of the COVID 19 epidemic [3].
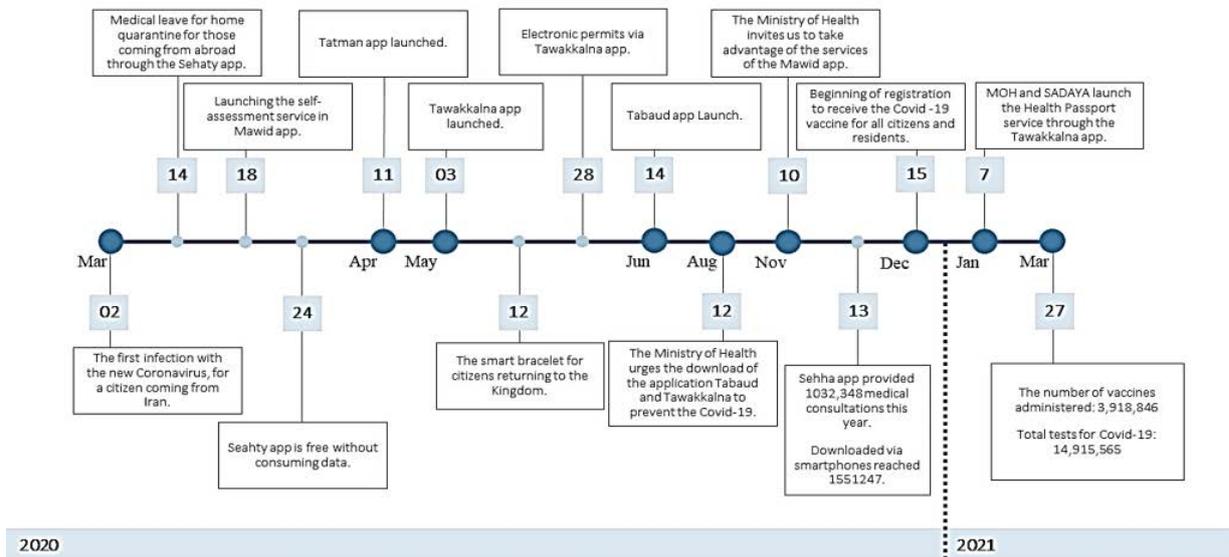

Figure 1. App Development /Announcement

Al-Ghamdi et al. [17] concluded that mobile phone applications used in the pandemic are effective tools to facilitate health care delivery for people infected with COVID-19, and to track COVID-19 patients. Applications have also been essential in controlling the spread of it.

3. Method

This study adopted a research strategy to identify the mobile applications developed or updated to manage the COVID-19 pandemic in the Kingdom of Saudi Arabia.

3.1. Research Question:

What is the role of free mobile health apps available on Google Play and App Store used in Saudi Arabia during the COVID-19 outbreak?

3.2. Inclusion and Exclusion Criteria:

In the review, we relied on the mobile applications available and supported by the Saudi Ministry of Health; after that, we reviewed the applications **available** in the Android Google Play, and IOS App platforms. The inclusion criteria used to select these applications were:

1) a free and non-paid application;
2) approved by government agencies;
3) applications contain one of the keywords such as COVID-19 KSA and MOH Saudi Arabia.

The applications that do not meet these criteria are excluded from the review process.

3.3. Description of the Search:

The Google Play and IOS App platforms were used in the search process to look for apps and compare them to those on the Saudi Ministry of Health's website. The following texts were used as search strings/keywords when looking for applications: "COVID-19", " KSA", "coronavirus", "corona".

We decided that the search process for the data should be conducted on the official Ministry of Health website as it is the main engine to confront the pandemic and is ran by the head of the Supreme Committee, represented by the Minister of Health. The website has a section dedicated to the mobile applications they supervise.

They were all free and for public use, whether citizens or residents.

Figure 2. illustrates the Model of the Review search, which will be mentioned in the Results We used this mechanism in the review to identify the applications to be reviewed which achieved the following characteristics: governmental application in Saudi Arabia, implemented or supervised by the Ministry of Health, free of charge, and aimed at the general public, generic, related to the COVID-19 pandemic, available in more than one language - at least English in addition to Arabic - and available on both platforms (Android, IOS). Then, we reviewed each of the apps to extract their services and features. Each author of this article separately explored the application services.
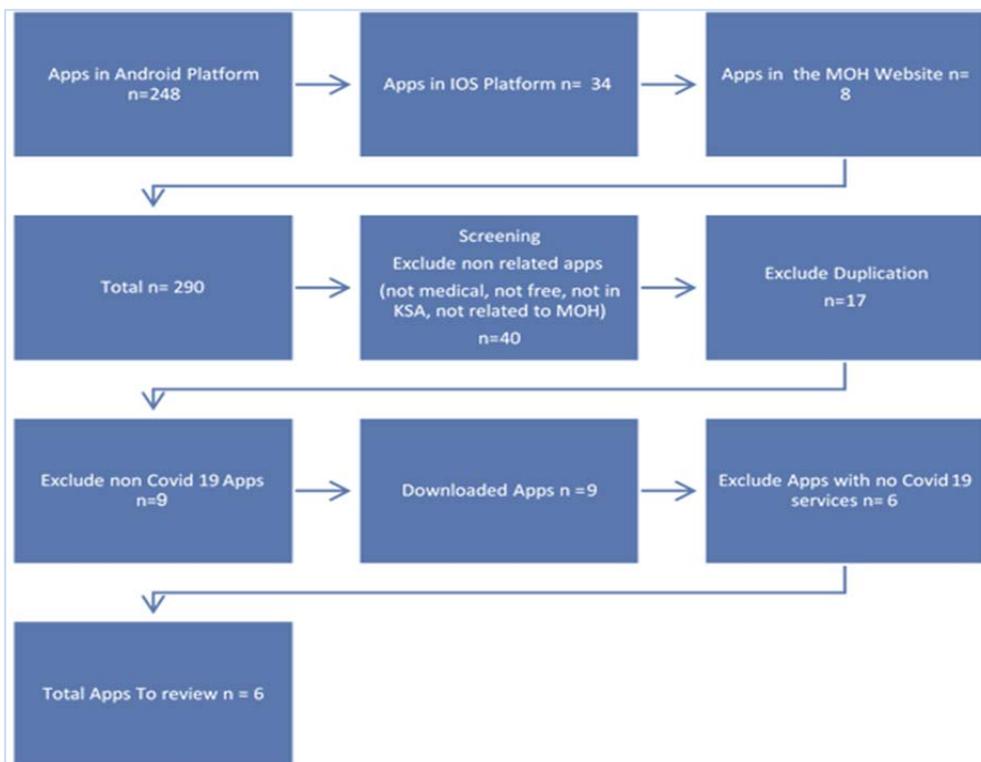

Figure 2. Model of the review search

Firstly, each author extracts all the services for each application; after that, they meet to compare and verify the extracted services. Second, each researcher has individually classified services based on specific.

Secondly, isolation means based on the infection control center [18]: separation between infected and non-infected persons, whereas quarantine is intended to isolate suspected infected persons, with the need to monitor the condition of the infected and, when any symptoms appear, seek medical help; accordingly, any service monitors the location of the infected or suspected infected person while ensuring that they do not leave the area of the isolation or quarantine, monitors their health status and provides them with medical care when needed, meets the isolation/quarantine criterion.

Finally, awareness is defined as knowing what exists or currently fully understanding a situation or subject based on facts or experience. Accordingly, any services that contain awareness or educational resources aiming to raise awareness in dealing with or understanding the pandemic fit the awareness criterion.

4. Results

This section will show the findings of the selected mobile applications, after the review of the mobile applications. The review result was (n =290); after that, we excluded non-related apps which resulted in (n= 40) applications. Then we excluded any duplications and reached (n=9) apps that we downloaded and researched finding that three of them do not have any service related to COVID-19. They were not excluded from the beginning because there was insufficient information about them in the application description. Consequently, the number of applications to be reviewed has become (n=6)

4.1. App brief & Features

The applications identified from the methodology to be reviewed are Sehhaty, Tabaud, Tawakkalna, Tetamman, Mawid, Sehha. As a result, 28 functions of the six mobile applications were found. The services in each application are presented, analyzed, and assigned according to the three criteria (isolation/quarantine, social distancing, awareness) (see Table 2.) in the next section (Analysis section). Most of the applications were developed for multiple purposes, but no application was found to address all goals or situations. The functions and features of these applications are discussed below briefly.

Sehhaty App

Sehhaty is an application [16] to provide health services to individuals in Saudi Arabia. It allows the user's access to health information and several health services provided by various authorities in the health sector in the Kingdom. One of the essential services is booking an appointment for a COVID-19 test after conducting a self-evaluation for the virus's symptoms and services such as sharing sick leave.

Tabaud App

The Tabaud application [19] was created to warn people who have encountered people who have COVID-19. The app operates by sending subliminal data from smartphones used by people with COVID-19 with their device data, under Google and Apple's policies to protect users' privacy. Users can get notifications through the app that they might have been in contact with an infected case or have been infected in the last 14 days. They can seek help from the Ministry of Health through the app.

Tawakkalna App

When the Tawakkalna app [19] was developed, the aim was to automate granting permits during the lockdown curfew in collaboration with the Ministry of Health. This helped restrict the virus's spread while maintaining the ability of citizens to be mobile for emergency humanitarian purposes. The application was designed to address other needs and help a cautious return to normal process after the precautionary measures were eased and the curfew was lifted. It has become the authorized application in all areas for determining the user's health status using color codes. The green color represents the user has not been infected. In contrast, the brown color represents confirmed cases, and the orange color represents contacts who must adhere to home isolation/quarantine. The yellow color represents contacts permitted to return to work while taking preventive measures.

Tetamman App

Tetamman is an application of the Saudi Ministry of Health [16], which provides protection and health care to citizens and residents in Saudi Arabia who were referred to health isolation/quarantine or home quarantine due to suspicion of or infection with the COVID-19. After logging into the application, the user must agree on an E-charter (it is a commitment to isolation/quarantine for 14 days and the obligation to respond to communication channels). The application is linked to a bracelet to monitor the location of the infected user.

Mawid App

Mawid is one of the Ministry of Health's applications [20]. It aims to enable the patient and the recipient of the service to book appointments at the primary health care centers in coordination with the Appointments department and to determine the nearest health center to the user. The application books the appointment remotely without the need to attend, amend, or cancel it in any hospital the patient is referred to.

Sehha App

The Sehha application [16] is designed to provide online medical consultations. The app allows users to seek medical advice from doctors who have been certified by the Ministry of Health in all medical specialties.

4.2. App characteristic (User ratings and languages)

As shown in Table 1., the summary of the applications was developed on both the IOS and Android platform and available in the App Store and Google Play. All of them were free and for the general users, whether citizens or residents. Each application has its privacy policy. 66% of the apps were developed in both Arabic and English. Some apps support more than two languages; for example, the Tawakkalna app supports seven languages, while the Tabaud app supports 22 languages. On the other hand, the Tawakkalna application received the highest rating in IOS 4.6, with 221K users. In comparison, the application of Mawid received the highest rating in Android 4.5 with the participation of 59K users.

The summary of the six evaluated apps, as shown in Table 2., shows that among the existing applications, we found that there are 8 services that serve the isolation/quarantine criteria. We found that 13 services serve the social distancing criteria for the distancing criteria, and 16 services that raise the criterion of awareness and education for the user. The following figure shows the percentage of services for each criterion, with the awareness service as the highest percentage (43%) followed by the distancing (35%) and isolation/quarantine (22%) (see Figure 3.).
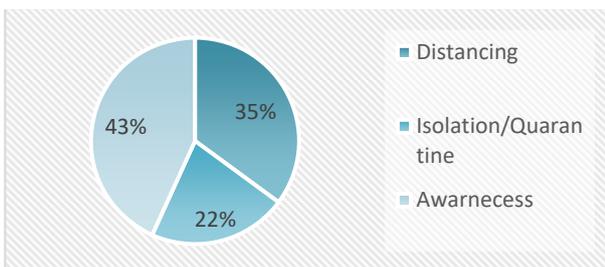

Figure 3. Mobile Health Services based on criteria

5. Discussion

5.1. Apps Effectiveness During COVID-19 Pandemic

According to our research, our review is one of the first reviews about the evaluation of mobile applications used explicitly in Saudi Arabia during the COVID-19 pandemic. Our results identified six active applications used for different functions in the pandemic. In general, the review revealed the primary purposes for which mobile applications were launched and updated and the functions necessary to achieve these goals to prevent, mitigate, and contain COVID-19. The applications focused most of their services on three main criteria: isolation/quarantine, social distancing, and awareness.

The applications that are accessible and meet the inclusion criteria are Sehhaty, Tabaud, Tawakkalna, Tetamman, Mawid, Sehha. In particular, Tawakkalna, and Sehhaty are the two advanced applications for booking an appointment for COVID-19 testing and displaying test results. The Sehhaty application is the official application to book an appointment to obtain a COVID-19 vaccine. Based on the user's closest center health, Sehhaty and Mawidout, provided appointment booking at health centers. The Tawakkalna application has been distinguished in providing services to obtain a travel permit during the outbreak of COVID-19 or permits to exit the home during the home quarantine period and displays the user's health passport. Also, three out of six apps Tabaud, Tawakkalna, Tetamman have a contact tracing feature. Four out of six apps, Sehhaty, Tabaud, Tawakkalna, and Tetamman serve the standard of isolation/quarantine, sharing the diagnosis and adding contacts. On the other hand, Sehhaty and Sehha can book remote appointments for medical consultations to support social distancing. On the other hand, Sehhaty and Sehha can book remote appointments for medical consultations to support the social distancing standard. Saudi Arabia has taken digital health as a top priority for developing health services in the Kingdom. A number of applications have been developed, and new services have been launched in existing applications. The mobile government succeeded in activating mobile applications' role in obtaining the COVID-19 vaccine electronically through the Sehhaty app, and booking an appointment to conduct a survey and display the tests' results through Sehhaty and Tawakkalna. The m-government achieved its effectiveness during the pandemic and helped the Ministry of Health manage a critical situation. According to the Saudi Ministry of Health [7], the number of COVID-19 tests reached 30,558,607, while the number of vaccine doses reached 46,288,357 doses as of March 27, 2021.

According to the Ministry of Health report [3] more than 6.6 billion awareness messages and educational text messages have been sent and received regarding COVID-19 by mobile app. While Mawid application, which provides a central appointment reservation service, has registered 14 million people, and more than 60 million appointments have been booked through it. The telehealth service or virtual health care through Sehha app allows anyone to communicate with a doctor remotely. Also, the Tawakkalna app has registered 17 million users nine months after its launch in May 2020. All six applications were provided in at least two languages, Arabic and English. In contrast, the application Tabaud supported 22 different languages and Tawakkalna Aplication supported 7 languages (see Table 1.), that helped to activate services for the largest possible number of people and benefits in terms of using services and accessing awareness information.

People's interaction and awareness led to advanced centers in the App Store and Google Play in the health, fitness, and medicine categories (see Table 1.).

Through this systematic review, we noticed a duplication of services between the applications. Booking an appointment for the COVID-19 test, displaying the test results in Sehhaty and Tawakkalna, and booking appointments in health centers in Sehhaty and Mawid, and booking appointments remotely for medical consultations in Sehhaty and Sehha. Also, self-isolation/quarantine services and add contacts in Sehhaty and Tetamman.

5.2. Limitations

Six applications identified and reviewed through the research process, followed in the methodology section. Still, other applications that helped and supported withstanding the pandemic at the health and awareness level in Saudi Arabia and served the same criteria were not among the results that appeared in the research.

The review relied on user ratings and app ranking in stores to study applications' effectiveness. On the other hand, we could not use the number of downloads because the information policy differs between the App Store and Google Play, as the App Store does not share the number of downloads.

The available sources of information about the pandemic and the extent of its response are widely available. It was noted that more than one source when researching could be referred to from ministries' websites, official reports, and official news sources, which requires a great effort to research them and extract the required data.

Table 1. Mobile health app characteristic

Application	Android Platform			IOS Platform		Languages
	Ranking	Rating (out of 5)	Download	Ranking	Rating (out of 5)	
Sehhaty	No 1 in (Category Health and Fitness)	4.4(58k)	+1 million	No 1 in (Category Health and Fitness)	3.9 (8.4k)	Two languages Arabic & English
Tetamman	No 1 in (Category Medical)	3.9(5k)	+1 million	No 1 in (Category Medical)	303(1.4k)	Two languages Arabic & English
Mawid	No 5 in (Category Health and Fitness)	4.8(98k)	+1 million	No 3 in (Category Health and Fitness)	4.5(59k)	Two languages Arabic & English
Tabaud	No 3 in (Category Health and Fitness)	4.5(12k)	+1 million	No 4 in (Category Health and Fitness)	4.6(4.3K)	23 Languages English, Amharic, Arabic, Bengali, Spanish, Burmese, Portuguese, Filipino, French, German, Hindi, Indonesian, Urdu Japanese, Kazakh, Turkish Korean, Malay, Russian, Simplified, Chinese, Swahili, Singhalese.
Tawakkalna	No 2 in (Category Health and Fitness)	4.6 (221k)	+10 million	No 2 in (Category Health and Fitness)	3.9(32k)	Seven languages English, Arabic, Bengali, Filipino, Hindi, Indonesian, Urdu
Sehha	No 3 in (Category Medical)	4.3(5k)	+ 500k	No 3 in (Category Medical)	4.2 (506)	Two Languages Arabic, English

Table 2. Mobile Health app evaluation

Application		Social Distancing Criteria	Isolation/ Quarantine Criteria	Awareness Criteria
Sehhaty	Book appointments (COVID-19 vaccine, rimary healthcare centers, medical consultations remotely).	✓		
	Sick leave.		✓	
	Book an appointment for COVID-19 test, and view test results.	✓	✓	
	Prevention and control of infection (add contacts, starting self-isolation/quarantine, review the awareness and educational content about COVID-19, isolation, and quarantine).		✓	✓
	Keep track of the vital signs (blood pressure, diabetes).		✓	✓
	Search for medication in the nearest pharmacies that provide it.	✓		
	View the patient's medication list.			✓
	Physical activity (calculating steps and walking).			✓
Tetamman	Advice and tips about isolation/quarantine and the corona infection.			✓
	Starting self- isolation/quarantine. Determine the isolation/quarantine location. Show descending indicator of the isolation/quarantine.		✓	
	Add contacts and update their information.	✓	✓	✓
	Activate bracelet Tetamman.		✓	
	Book an appointment for COVID-19 test. View test results.	✓	✓	
	Notifications, text messages, and calls alerts.	✓	✓	✓
Mawid	Book an online appointment according to the appropriate time	✓		
	Determine the nearest health center to the user	✓		
Tabaud	Share the diagnosis.	✓		✓
	An awareness file about COVID-19, prepared by the Ministry of Health			✓
	The Ministry of Health's dashboard displays new cases, the number of vaccinations, and the total number of people infected with COVID-19			✓
	Share the diagnosis	✓		✓
Tawakkalna	Request movement and exit permits electronically and view current permits.	✓	✓	
	Caution Mode.	✓	✓	✓
	Book an appointment for COVID-19 test. View test results.	✓		✓
	Ask for help.			✓
	Health passport.	✓		✓
	Health card.	✓		✓
Sehha	Health assessment.			✓
	Medical consulting.		✓	✓

6. Conclusions and Further Research

The review presented in this paper included three criteria (distancing, isolation /quarantine, awareness) based on the World Health Organization recommendations, which the Kingdom of Saudi Arabia has used to define preventive measures and manage the pandemic. The selection of criteria was not subjective because it relied totally on the official apps announced by the Ministry of Health which served the instructions of the Ministry of Health during the pandemic. Saudi Arabia's advanced technical infrastructure helped confront the pandemic and facilitate cooperation between sectors.

The growing number of smartphone users in Saudi Arabia aids the government in combating the pandemic. Smartphones have made it possible to swiftly reach the largest number of people to raise awareness and deliver instructions and processes in two or more languages, from defining roaming hours to arranging swab appointments. The applications offered the data needed to support pandemic decision - making. Quarantine, spacing, and isolation operations are all organized. As a result,

we can see how effective the applications were during the pandemic and what impact they made. The apps' availability on both IOS and Android helped them reach most smartphone users. The government supported the apps by providing them free, with no expenses or legal consequences.

The services that have been provided through mobile applications have proven their effectiveness. Simultaneously, the duplication of services in the applications would confuse the user and reduce service effectiveness. In contrast, if the services were standardized and classification was made for them, a unified application that includes all services based on classification will help facilitate their use and increase their effectiveness.

Further research studies can be conducted in this field, such as a study to measure users' satisfaction with the services provided through government applications, a study to undertake the classification of services based on their purpose or type of service and a study on the possibility of developing a unified application based on the classification.

In addition, more research can be done using deferent data collection techniques such as conducting a survey to measure the ability of elderly citizens to use mobile applications in light of the Covid-19 pandemic could provide valuable insight. Since the data used in this study were secondary data, future studies such as beneficiary satisfaction or the effectiveness of the application can be measured and analyzed by collecting primary data.

Furthermore, to expand the scope of the study, it may be conceivable in the future to add non-government and private-sector applications that aided in facing the pandemic through a study. Because smartphone applications are only available through their respective stores, there is a difference in access to information number of download times between the Android and Apple stores to overcome this limitation, the platform that is missing data can be emailed a request for the information for research purposes in the future.

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