Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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The role of the COVID-19 pandemic in expediting digital health-care transformation: Saudi Arabia's experience

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ABSTRACT

A comprehensive literature review of Research engines was conducted up to March 2022 to retrieve the articles. We considered all published data, press briefings, and announcements by the Ministry of Health of Saudi Arabia (MOH). The search included both sources in English and Arabic. Thus, this paper aims to give a comprehensive overview of the evolution and role of telemedicine and E-health represented in multiple informatics mobile applications during the COVID-19 pandemic in Saudi Arabia. As a component of its subjective drives, the MOH has launched and developed a total of 12 mobile applications from 2012 to 2019, three apps of which were developed during the COVID-19 pandemic. My health "Sehhaty" was the cornerstone of telemedicine services provided by the MOH in Saudi Arabia during the COVID-19 pandemic. Virtually booked physician appointments exceeded 3.8 million. Appointment "Mawid" app number of users sprinted from 4 million to 25 million users and the number of appointments booked in the same app went from 8 million to 100 million appointments in pre-COVID-19 compared to the post-COVID-19 period. Furthermore, the Health 937 hotline numbers grew to 24.6 million calls. The Health "Seha" app provided 2 million remote medical consultations with an almost 8-fold increase compared to pre-COVID-19 times.

1. Introduction

Digital health innovations are rapidly implemented to provide solutions to health-care challenges during the (COVID-19) pandemic [1]. The literature shows that the utilization of telemedicine for example, reduced the burden on the healthcare system significantly [2,3]. COVID-19 telehealth informatics applications were rapidly developed from all parts of the globe, Silva categorized COVID-19 telehealth informatics applications to five main groups: informational, self-assessment/medical reporting, contact tracing, multipurpose apps, and others [4]. On a more regional scale, in the other Arabian Gulf countries of Oman, Kuwait, Bahrain, and the United Arab Emirates, a total of only six COVID-19-related telehealth applications were developed from March 2020 till April 2020. These applications relied on the global positioning system (GPS) and Bluetooth technology to enhance better health-care outcomes through online channels that trace Positive cases and give preventative measures accordingly [4]. Compared to other countries, Saudi Arabia made many strides in the field of informatics healthcare by developing accessible and free of charge applications to combat the global pandemic of COVID-19 [4].

This qualitative content analysis aims to give a comprehensive review of the evolution and role of telemedicine and E-health represented in multiple informatics mobile applications during the COVID-19 pandemic in Saudi Arabia.

2. Materials and methods

A comprehensive scoping review of the following engines was conducted during June 2022 to include papers from June 2015 up to June 2022 to retrieve articles: MEDLINE (Covid), CINAHL, and PubMed. The keywords and subject headings used in the electronic search were: Saudi Arabia, digital health-care transformation, telemedicine, COVID-19, E-health, and mobile applications. The search included sources in English only. The initial scope retrieved 65 publications that were narrowed

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down to 29 based on the inclusion and exclusion criteria. Any study that discussed the utilization, evolution, and evaluation of healthcare informatics, telemedicine, and E-health in Saudi Arabia in response to the COVID-19 pandemic was included, while all articles that evaluated healthcare informatics applications usability not specific to Saudi Arabia were excluded. Then the qualitative findings were documented in a narrative form.

3. Results

The precautions followed to limit the spread of COVID-19 relied on cautious contact tracing, quarantine, and sterilization protocols. Telemedicine or mobile health played an essential role during this time to reduce potential disease spread and prevent overloading of the healthcare system [5]. As a component of its subjective drives, the Ministry of Health (MOH) launched and developed a total of 12 mobile applications between 2012 and 2019, three of which were developed within three months during the COVID-19 *pandemic.* These apps are Tawakkalna, My Health (Sehhaty), Tabaud, Rest Assured (Tataman), Health (SEHA), Appointment (Mawid), Qareebon, Anaat, Asafny, Eshar, and Wasfaty [6].

3.1. The preparedness for digital health-care transformation in Saudi Arabia to combat the global pandemic of COVID-19

Decision-makers in Saudi Arabia gained a lot of experience combating Middle East Respiratory Syndrome "MERS" which was and still is endemic to the region of the Middle East. One of the major systems adopted and evolved during the "MERS" endemic is the Saudi Health Electronic Surveillance Network "HESN", an interconnected and flexible web-based application, which is the prepared version of "Public Health Solutions for Diseases Surveillances and Management" (PHSDSM) developed in 2012. The system offers initiatives and services to keep the population healthy [4]. The "HESN" application was upgraded in April 2020 to exclusively focus on that work in order to build a seamless, straightforward system for reporting COVID-19 cases and characteristics connected to such cases. All Saudi Arabian healthcare facilities are now required by law to notify the "HESN" system of any cases of communicable diseases, including COVID-19 [4].

3.1.1. Health (Seha) center

The center was developed in 2013 by the Ministry of Health to be responsible for providing health services throughout the country through the hotline number (937), which can be reached by any means of telecommunications (phone or telephone), inside or outside Saudi Arabia, around the clock, in both Arabic and English. The center receives the calls of citizens, residents and visitors alike to answer their queries, provide medical advice or related information, and receive and handle complaints by linking all areas of the beneficiaries to the health services system [7]. The beneficiary predominance was rapidly increasing at the call center, as shown in Fig. 1 where the numbers from pre-COVID-19 compared to the post-COVID-19 period grew from 3 million to 24.6 million calls. Furthermore, the number of appointments booked skyrocketed from 0.4 million to 67 million bookings. The number of medical consultations increased from 1.2 million to 7.6 million medical consultations [8,9].

3.1.2. Health (Seha) E-health service

The Saudi Ministry of Health (MOH) released an E-health service named "Seha '' in 2018 [10]. The application gained rapid popularity receiving more than 260,000 remote medical consultations in the same year. Moreover, in 2020 [8], more than 2 million remote medical consultations were made through the Seha application, with an almost 8-fold increase compared to pre-COVID-19 times [10], as shown in Fig. 2. The app has been downloaded more than 1.5 million times via smartphones by 2020 [10], it uses artificial intelligence to provide

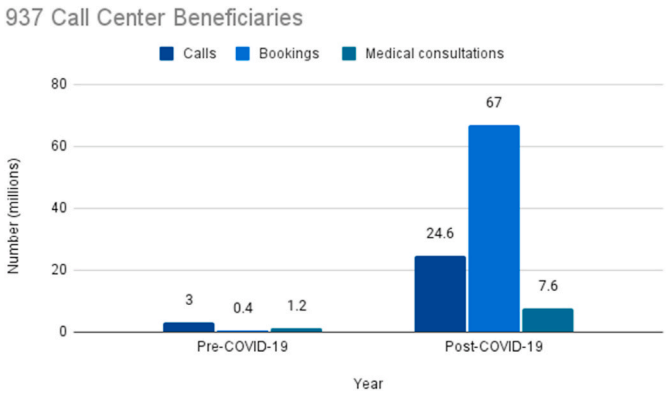

Fig. 1. 937 call statistics between pre-COVID-19 and post-COVID-19 periods [6].

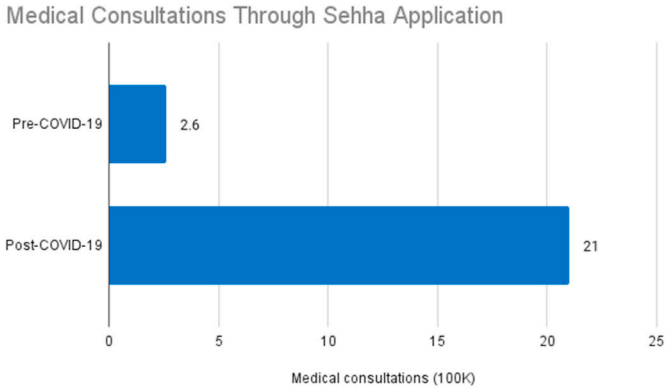

Fig. 2. Seha application statistics between pre-COVID-19 and post-COVID-19 periods [4].

individuals with healthcare and preventative care in their homes through audio-visual medical consultations by MOH specialists, enabling users to receive safe medical consultations and health care services electronically [10].

3.1.3. The appointment "Mawid '' application

The application was launched by the Saudi Ministry of Health (MOH) in 2018 to manage appointments at healthcare services and hospitals, with 8 million appointments booked by 4 million beneficiaries in the same year [8]. This service enables patients to book their appointments in primary healthcare centers in coordination with the department of interest electronically. Hence, patients can book, amend, or cancel their appointments at any hospital through the app [9]. The number of users increased tremendously comparing post-COVID-19 to pre-COVID-19 times, as shown in Fig. 3, where number of users rose from 4 million to 25 million users, and the number of appointments booked from 8 million to 100 million appointments [8].

3.2. The evolution of telemedicine and E-health during COVID-19 pandemic

The precautions followed to limit COVID-19 spread relied on cautious contact tracing, quarantine and sterilization protocols. Telemedicine or mobile health played an essential role during this time to reduce potential disease spread and prevent overloading of the healthcare system [5]. As a component of its subjective drives, the Saudi Ministry of Health (MOH) launched and developed a total of 12 mobile applications between 2012 and 2019, three of which were developed within three months during the COVID-19 *pandemic. These* apps are

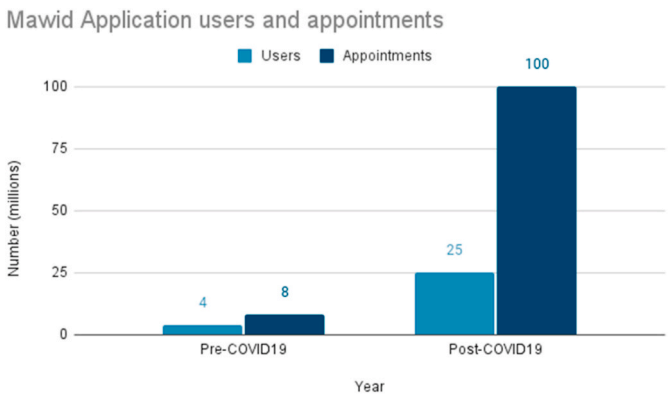

Fig. 3. Mawid application statistics between the pre-COVID-19 and post-COVID-19 periods [6,8].

Tawakkalna, My Health (Sehhaty), Tabaud, Rest Assured (Tataman), Health (SEHA), Appointment (Mawid), Qareebon, Anaat, Asafny, Eshar, and Wasfaty [6], as illustrated in Table 1 and Table 2. Sehhaty and Seha applications have the highest percentage of users among all apps; users exceeding 24 million users (68.5% of the population) [11]. MOH's strategy for digital health aimed to facilitate access to healthcare and healthcare services, making it more consumer-friendly and popular among the population. Through the Sehhaty app, this strategy enabled individuals to book COVID-19 vaccine appointments, COVID-19 testing, and report any side effects or symptoms they develop [4].

3.2.1. *My health (Sehhaty)*

E-health features in the application allow individuals to access their virtual medical files and monitor their records. This allows users to access medical reports, view medication prescriptions, do drug searches, Drug Track and Trace System (RSD), follow up with vaccination schedules, and access insurance cards. Furthermore, the Sehhaty app also enables individuals to monitor their COVID-19-related services. This is evidenced by the fact that more than 24 million testing appointments and more than 61 million vaccine doses were administered through this app. Users have also been able to receive sick leaves, as more than 9.5 million reports were provided through the app [4].

3.2.2. *Tele-medicine features*

The regulations define telemedicine as "Medical practice using information and communication technology (ICT) from a remote place involving a live or virtual interaction between the healthcare personnel and the patient. The location of two parties in such consultation shall be different and involve artificial intelligence or robotics to come under the ambit of telemedicine. Teleconsultations between patient and healthcare personnel or between the two healthcare personnel must involve video call and not exclusively audio to qualify as telemedicine" [4].

Table 1
Health care informatics mobile applications developed before COVID-19 pandemic and the added features to them to combat the pandemic.

	Seha(Health)	Mawid (Appointment)	Sehhaty(My Health)	"HESN"	937	Wasfaty(My prescription)	Asafny(Help me)	Ashanak(For you)	Qareboon(We are close)
The division that developed it	Ministry of Health	Ministry of Health	Lean Business Services Company	Ministry of Health	Ministry of Health	NUPCO	Saudi Red Crescent	Ministry of Health	National Center for Mental Health Promotion
Services	-Receive safe medical information electronically. Report symptoms [12]. -Receive medical tips [12]. -Health assessment [12].	Book, amend or cancel appointments in coordination with a specific department [13].	-Viewing medical records and vital signs [11,14]. -Medication search and view medication list [11,14]. -School screening and vaccination schedule [11,14].	Provides a common platform for all hospitals in Saudi Arabia to detect and contain any communicable diseases [4]. Provides decision-makers with high-quality relevant data [4].	provide a 24/7 hotline for medical emergencies and provide medical consultations by certified physicians [7].	Automatically checks for any recorded allergies the patient may have towards a specific drug [4]. -Facilitates patient access to a certain drug [15]. -Delivers medications to patients in their homes [15].	Saves individual information and location details to facilitate providing ambulatory services to them in case of an emergency [16].	Provides services to MOH staff, such as promotions, registration for trips and events, and follow up for activities [17].	-Provides Mental and psychological health awareness information [18]. -Provides access to psychological health consultations by specialist staff [18].
Beneficiaries	All citizens and residents of Saudi Arabia.	All citizens and residents of Saudi Arabia.	All citizens and residents of Saudi Arabia.	All governmental and private hospitals.	All citizens and residents of Saudi Arabia	All citizens and residents of Saudi Arabia	All citizens and residents of Saudi Arabia	MOH staff	All citizens and residents of Saudi Arabia
Features added after COVID-19	Provides awareness information about COVID-19 [12].	-COVID-19 Risk assessment. -Increase awareness about COVID-19. Precautionary measures [13].	Booking COVD-19 tests and vaccines. Viewing COVID-19 vaccination status. Report any symptoms or side effects of COVID-19 infection or vaccine [14].	Data A record for all COVID-19 patients who had a swab done [4].	Guide COVID-19 patients and those who got in contact with COVID-19 patients [7].	–	–	–	–

Table 2
Healthcare informatics applications developed during the COVID-19 pandemic.

	Tetamman	Tawakkalna	Tabaud	Anaat
The division that developed it	Ministry of Health	The National Information Center (NIC) and the Saudi Data and Artificial Intelligence Authority (SDAIA)	The National Information Center (NIC) and the Saudi Data and Artificial Intelligence Authority (SDAIA)	Ministry of Health (MOH) and the Saudi Commission for Health Specialties (SCHS)
Services	-Direct contact with 937 to ask for help [4]. -View COVID-19 test results. -Countdown indicator for isolation days [4]. -Educational content about COVID-19 [4].	Request permits for temporary movement during curfews. Request permits for Hajj and Umrah. View current health and immunization status. Functions as a health passport to allow access to facilities during the lockdown. Request ambulatory services. Book COVID-19 testing and vaccination. View COVID-19 testing results. View digital copies of governmental personal documents [3, 4].	Notifies individuals if they encountered a confirmed COVID-19 case [4].	Medical doctors can issue e-prescriptions in an authenticated manner via the Anaat application, the patient then can easily get their medicines dispensed from the nearest pharmacy participating in the system [5].
Beneficiaries	People who contacted a positive COVID-19 case, Suspected COVID-19 cases, and Arrivals from abroad [4].	All Saudi Arabian citizens and residents [3, 4].	All Saudi Arabian citizens and residents [4].	All Saudi Arabian citizens and residents [5].

Sehhaty was the cornerstone of telemedicine services provided by the Ministry of Health in Saudi Arabia during the COVID-19 pandemic. Virtually booked appointments for physicians exceeded 3.8 million, and more than 1.5 million real-time consultations were provided [4].

Furthermore, the Anaat application enables medical doctors to issue e-prescriptions in an authenticated manner via the application. The patient can then easily get their medicines dispensed from the nearest pharmacy participating in the system [5].

3.2.3. *"Qareboon" application*

The Saudi Arabian Ministry of Health did not disregard the importance of mental and psychological health, creating a service in 2015 named "Qareboon". The application uses the latest methods for information presentation such as text, infographics, and videos to provide users with countless resources on mental and psychological counseling, all supervised by a specialized working staff [18].

3.2.4. *"Seha" virtual hospital*

The "Seha" virtual hospital was one of the priority initiatives in the health sector transformation program that serves the vision. Virtual healthcare is the first in the Middle East and the largest of its kind in the world. It is a hospital that provides its telehealth services by empowering the best health consultants and practitioners even in uncommon specialties by using the latest medical technologies to provide the highest level of medical services to beneficiaries in all cities and governorates [4]. It supports 130 hospitals and more than 30 specialized services around the country. The number of beneficiaries has reached 58,550 and it aims to increase the capacity to more than 400,000. The specialized clinics in Seha hospital include Hematology, Psychiatry, Nephrology, Endocrinology, Diabetes, Genetics, Metabolic Diseases of Aging, and Medical Rehabilitation Cardiology [4].

Seha virtual hospital uses Internet of Things technology to provide remote patient monitoring services. It relies on electronic devices used by the patient to follow vital signs and send immediate alerts to the medical staff in the event of any negative readings with the aim of urgent intervention to avoid any complications and provide the necessary care promptly. Augmented reality accompanied by direct transmission of surgeries aims to provide advice to the surgeon during surgery and transfer knowledge and experience between doctors in complex surgeries [4].

Artificial intelligence prioritizes examinations that require urgent medical intervention using medical imaging algorithms and are tested on conditions such as cerebrovascular diseases on CT scans and chest diseases on X-rays. This raises the work quality of the doctor treating the case and makes the accuracy of diagnosing target diseases up to 95% [4].

3.3. *The role of informatics and mobile applications in limiting the spread of COVID-19*

3.3. 1. *Rest assured (Tatamman)*

The application targets giving protection and healthcare to citizens and residents who are self-isolating or in quarantine by enhancing their recovery procedures offering assistance in results, updating data of those who were in contact with confirmed cases, daily follow-up of the health status, epidemiological investigation, and communication with the health hotline number (937) [6].

3.3.2. *Social distancing (Tabaud application)*

It is a way to alert those who are in contact with people infected with COVID-19. The application sends data with camouflaged identifiers to smartphones during contact with people infected with COVID-19, by receiving direct and proactive notifications in case any registered infected person has been detected [4].

3.3.3. *Tawaklna application*

One of the most significant examples is the Tawaklna application. The Saudi Data and Artificial Intelligence Authority (SDAIA) launched the application in mid-2020 to facilitate the process of issuing permits during the curfew period, including movement permits for various reasons like jogging permits for 1 h, humanitarian cases, medical emergencies, Hajj and umrah, and permits for food supply purposes [4].

Since then, many features have been added through various updates in efforts to limit the spread of COVID-19, including a personal QR code showing the user's COVID-19 infection status. The ability to report suspected COVID-19 cases, and the ability to register for COVID-19 vaccination, report vaccine side-effects, and show vaccination status of users through QR code [4].

Several new Tawakkalna app services were launched during the "Return with Caution'' period. This includes:

Health passport – a feature including the user's personal and health information to confirm vaccination.

Sharing health condition cards – the health card of a dependent can be shared with other Tawakkalna members using this feature.

Caution mode – a color-coded health evaluation system identifying vaccination status, consisting of several color-coded indexed features.

On a different note, Tawakkalna was also linked to health-related applications like Sehhaty which allows easy access to vaccine status and appointments even when the appointment was not booked through Tawakkalna but Sehhaty.

3.4. Facilitation of the vaccination journey using health informatics mobile applications

The Ministry of Health has approved three types of COVID-19 vaccines to be administered in Saudi Arabia which are: Pfizer-BioNTech, Oxford-AstraZeneca, and lately, Moderna [19].

3.4.1. Booking a vaccine appointment

Since the beginning of the COVID-19 pandemic, the Ministry of Health has approved three types of vaccine which are Pfizer-BioNTech, Oxford-AstraZeneca, and lately Moderna and Johnson & Johnson [19].

Booking for a vaccine appointment has been completely digitized since day one, COVID-19 vaccine appointment is an optional service provided to all citizens and residents to receive the COVID-19 vaccine. An appointment is made in advance for beneficiaries to receive the vaccine at the nearest center at a chosen date and time. The service can be obtained through the 'Sehhaty' application. No conditions are required to book an appointment to receive the COVID-19 vaccine. To use the Sehhaty app, users must first have an account on the Absher website. The service response time varies from one channel to another; however, appointments are made instantly and electronically. Furthermore, multiple reservation channels were provided such as contacting MOH's unified line (937) [12].

3.4.2. Booking for a COVID-19 testing appointment

This service enables citizens and residents in the Kingdom to book for COVID-19 testing through many channels via Sehhaty App, Tawakkalna App, Tetamman App, and by contacting MOH on 937. COVID-19 testing can be done in many fixed and mobile locations across Saudi Arabia [35]. Since the service was launched on 10th April 2022, around 41.6 million tests were done and 0.857% of them were declared positive [19].

3.4.3. Providing reports regarding vaccine status

A service provided by the "Sehhaty" application allows citizens to check their vaccination status and enables them to view and follow up on all vaccinations approved by the Ministry of Health [4]. Reports can be reached through 'vaccines' in the health profile screen that shows details about previously taken vaccines and if eligible for a booster dose, there will be an option to book an appointment. The report can be printed or exported as a PDF version [4].

3.4.4. Side-effects (self-reporting)

A questionnaire will appear next to the vaccine taken within two weeks in the Sehhaty application. It provides common side effects and users can check the boxes of the side-effects they experienced, and the date of the event is required to fill the report [4]. Another channel to report side-effects is by contacting MOH by the unified line 937 [4].

3.5. eHealth services for travelers, tourists, and pilgrims

In matters of submitting requests for registering COVID-19 vaccines taken abroad in the Ministry of Health's systems, particularly "Tawakkalna" App, requirements include an ID and a certificate that includes personal data and clearly states the vaccine name, date, and batch number along with a copy of the passport and a copy of the vaccination certificate.

After reviewing the application, the Medical Committee can either approve the application or reject or enforce additional requirements as it deems appropriate. This service is automated and free of charge. The approved vaccines are Pfizer-BioNTech, Moderna, Oxford-AstraZeneca, Janssen, Sinopharm, Sinovac, Cova Xin, Gamaleya (Sputnik V), and Covovax [19].

3.5.1. Smart bracelets for Hajj (Nosok)

During Hajj 2021, about 5000 smart bracelets were distributed to pilgrims for the first time as a part of "Nosok'' project, which was launched by The Saudi Data & AI Authority (SDAIA) and Doyof Alrahman Program, in partnership with the Saudi Telecommunication Company (STC). The bracelet is designed to display full information and the health status of pilgrims (immune, immune by first dose, immune by recovery) through Tawakkalna app, and helps to follow them up by monitoring their health data including blood oxygen and heart rate. The bracelet played a role in locating those who needed help by providing emergency medical or security assistance request services. Furthermore, awareness was raised by sending messages through the bracelet to pilgrims. This service is through 'internet of things' and included in the process of testing [3].

3.6. Healthcare informatics applications in service of special needs

3.6.1. Hearing impairment, Signal (Eshara) application

Another service provided by the MOH is "Eshara" which provides a digital platform that supports visual communication between clients with hearing impairment and a call center for remote sign translation where the translator acts as a third party through the application by converting sign language into spoken Arabic and vice versa, and acts as a mediator between the customer with hearing impairment and the employee [18].

3.7. Application of developed technology beyond COVID-19

Because of the coronavirus (COVID-19) pandemic, Saudi Arabia has witnessed many changes concerning telehealth. Although these changes were mainly implemented during the pandemic, their application in the post-pandemic period would be valuable [10].

3.7.1. Health care initiatives

Saudi E-health services have expanded dramatically since the outbreak of the pandemic. Surpassing the limits of COVID-19, the utilization of telehealth encompasses many aspects of individual's healthcare. The importance of such progress is evident in the number of those who signed up for multiple online health-promoting campaigns, for example, more than 2 million people registered in a campaign that encouraged increased physical activity, and more than 700,000 individuals registered in another campaign targeted at monitoring one's health parameters [4].

The Know Your Numbers campaign, which was launched across the Kingdom in October 2019 aims to raise public awareness and educate them about the impact of knowing one's medical numbers on health and safety. This was achieved by bringing attention to important health indicators such as blood glucose, blood pressure, waist circumference, and body mass index (BMI) by adding readings either by the user or by linking a smart device to the Sehhaty app. The application helps classify user's readings and provides advice based on them [20].

3.8. What changes need to happen to realize the full potential of telehealth?

To sustain the incentive for reform and drive for change in telehealth services that the COVID-19 pandemic has produced, the situation must not regress to the pre-pandemic telehealth status [21]. Further regulations and creative approaches are needed to overcome barriers that were highlighted during the COVID-19 pandemic. Generally, telehealth is

divided into four categories: synchronous, asynchronous, remote patient monitoring, and mobile health [22]. Understanding these categories will help stakeholders and healthcare professionals realize the true and full potential of telehealth.

Privacy is a top priority in all categories, as the insurance of patients' private information is a crucial part of the healthcare process [23]. While informed consent is mandatory in the practice of clinical and telemedicine alike, emphasis on the importance of updating laws concerning consent and the way it is provided by patients in cases where written consent is necessary should be uniformly regulated by responsible authorities and explained to patients. Also, the use of videos, photos, conversations, and other personal information should be clarified for both healthcare providers and patients to ensure privacy and confidentiality and help facilitate the use of different telehealth services [12,23,24]. Telehealth poses new cybersecurity and privacy issues because a patient's home may not have the same security and privacy protections as a provider's office. Telehealth also opens new avenues for exchanging health data, like images and data shared via WhatsApp, as it is one of the most popular applications used during the pandemic, which has privacy and security consequences due to lack of integration with Digital Imaging and Communications in Medicine (DICOM). An analysis of the present regulatory environment is required to determine what additional cybersecurity and privacy regulation reforms are required [11,25,26].

Although it is relatively new, it is crucial to continue and improve the utilization of mobile health applications mentioned in this study like Twakkalna and Sehhaty after the end of the pandemic to encourage and simplify the use of telehealth in the Kingdom [27]. Some of the issues related to telehealth that existed before the COVID-19 pandemic continued to persist regardless of the rapid development throughout the pandemic. Technological issues, cultural factors, and provider's resistance can be overcome by proper IT support in institutes and through training of providers and the involvement of stakeholders [27–29].

4. Conclusions

The present review illustrated the shift in the public's behaviors, attitudes, and practices towards telemedicine and E-Health during the pandemic. How challenging times emphasized the importance of digital health-care transformation, resulting in expedited milestone achievements in telemedicine worldwide, was also highlighted. The lesson learned from the COVID-19 pandemic is that our infrastructures are not appropriately developed to deal with epidemics and pandemics. Telemedicine is one of the most effective strategic investments and solutions to these problems. The question that remains is, will the cumulative awareness and interest in telemedicine wash away upon the end of the COVID-19 pandemic?

Author contributions

All authors contributed equally to the conceptualization, visualization, study design, methodology, review of available data, resources, writing - original draft, Writing - review & editing, and project administration of this paper.

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Informed consent statement

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Data availability statement

Not applicable.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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The authors regret that the name of our intuition written wrong as the correct spelling is "king **Saud** University, College of Medicine, Riyadh, Saudi Arabia".

In addition, there should be number "1" after the intuition explaining and emphasizing that both authors contributed equally to the work. The format that we wish to see:

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