The Use of a Mobile-Based Telehealth Service During the COVID-19 Pandemic: Provider Experience and Satisfaction

by

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Background:

Telehealth is a promising healthcare delivery model that uses telecommunication technologies to improve healthcare access by remotely offering health care services to people with limited access to these services. Due to the lockdown and restrictions caused by the COVID-19 pandemic, many healthcare organizations are now utilizing telehealth systems to remotely provide health care services and mitigate the spread of COVID-19 by minimizing physical interactions.

Objective:

To assess the providers' experience and satisfaction with a telehealth technology "Sehha" being used by physicians during COVID-19, examine the challenges faced by the providers, and identify possible opportunities to improve the use of telehealth in Saudi Arabia.

Method:

With the collaboration of the Saudi Ministry of Health, a 30-item questionnaire consisting of quantitative and qualitative questions was distributed to 362 physicians using the Sehha telehealth app. The questionnaire items were adapted from previous studies and then tested for content validity and reliability ($\alpha = 0.88$).

Results:

One hundred fourteen out of 362 questionnaires were analyzed with a response rate of 31%. The study showed that 67.6% of the physicians were satisfied with the work they have done through Sehha. Forty-four percent of the physicians preferred telehealth visits over traditional visits, while 35.1% did not prefer telehealth, and 21.1% reported to be neutral. However, the most commonly perceived challenge by the physicians using Sehha was difficulty in providing accurate medical

assessments (73.7%), followed by overlapping of consultations (71.1%), while the most frequently cited area of the platform needed for improvement was integration with other systems (86.8%), followed by involvement of other medical specialists (81.6%).

Conclusion:

Telehealth is the new norm of delivering health care service, and its benefits have been realized worldwide. Telehealth can increase access to care, improve the quality of care, and reduce cost. Besides face-to-face visits, health care providers are now embracing telehealth technologies and showing interest in virtual care. Thus, telehealth should remain sustained after the era of COVID-19, and healthcare leaders should reconsider the status of telehealth.

Keywords: telehealth, mHealth, digital health, Sehha, provider, physician, Saudi Arabia, satisfaction, experience, COVID-19

Table of Contents

List of Tables

List of Figures

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1.0 Introduction

The novel coronavirus disease (COVID-19) pandemic has dramatically affected many industries, including healthcare across the world. On March 11, 2020, The World Health Organization (WHO) officially declared COVID-19 a pandemic and announced the virus as a global health crisis due to its high prevalence and alarming levels of severity (WHO, 2020). As of December 31, 2020, there were approximately 79,600,000 confirmed cases of COVID-19, with about 1,800,000 deaths caused by COVID-19 worldwide (WHO, 2020). Nevertheless, in the Kingdom of Saudi Arabia (KSA), the first case of COVID-19 was reported on March 2, 2020, when a Saudi citizen was returning home from Iran. Since the traveler did not declare that he was exposed to COVID-19; as a result, the case was not identified as early as the traveler returned due to withholding travel information, other confirmed cases were also reported, which led to 362,549 confirmed cases of COVID-19, including 6,214 deaths as of December 31, 2020 (Algaissi et al., 2020; MoH, 2020).

Due to the rapid spread of COVID-19 in KSA, the Saudi officials and highest authorities have established strict regulations and movement restrictions across the country. Some of the regulations and precautionary measures include regional and international suspension of entry to the Kingdom, suspension of all public events and activities, implementing e-learning in schools and universities, imposing a curfew, and restricting local travels (UNDP, 2020). Nonetheless, the healthcare sector and healthcare organizations have been struggling in controlling the spread of COVID-19 because this virus is highly contagious and can be transmitted from one person to another through droplets and airborne particles that are made when a person carrying the virus sneezes, talks, breaths, touches, and coughs (CDC, 2020). As a result, healthcare professionals and

patients have been placed in a dangerous position where both need to communicate closely and interact with each other for diagnoses and treatments.

Since the unprecedented worldwide lockdown and nationwide curfew restrictions were implemented due to the rapid spread of COVID-19, health care providers and patients have been encountering many challenges inhibiting them from receiving and providing the necessary care. Thus, it has been witnessed that many healthcare organizations have either adopted or activated a telehealth system or platform in providing health care services virtually so that the virus can be contained and health care continues to be provided. Nevertheless, numerous countries across the world are facing various challenges in delivering telehealth and virtual care services to their residents, mainly due to inadequate financial resources, unclear policies and procedures for the use of telehealth and reimbursement, lack of interest in using such a technology, insufficient equipment and software, and lack of awareness of the telehealth benefits for both providers and patients (Alaboudi et al., 2016; Lin et al., 2020).

During the COVID-19 pandemic, KSA has been proactively implementing precautionary measures to ensure that the virus is contained and the provision of health care services is sustained. Digital health, including telehealth, has been quickly activated by the Saudi Ministry of Health (MoH) and widely utilized by the public and health care providers. To nationally implement telehealth, the MoH has used cutting-edge technology along with artificial intelligence (AI) technologies to expand telehealth services across KSA (MoH, 2018). The Sehha app, which translates to “Health”, is a mobile-based telehealth technology sponsored by the MoH, wherein health care services are virtually provided for Saudi and non-Saudi citizens at no cost (Hassounah et al., 2020; MoH, 2020).

2.0 Background

The number of COVID-19 cases across the globe has drastically increased since the first cases were reported in late 2019 in China. Consequently, the World Health Organization (WHO) declared the disease a pandemic (WHO, 2020). Since COVID-19 has adversely affected many industries, including healthcare worldwide, governments in various countries are troubled about burdening their healthcare capacity. Healthcare organizations are now experiencing challenges offering health care services to patients as these services are being interrupted due to lockdowns, inadequate protective gear, and the increased risk of spreading the disease between healthcare professionals and healthcare consumers. However, hospitals and healthcare facilities can better manage and contain the spread of COVID-19 by substituting several physical treatments with virtual care using a telehealth technology.

Numerous countries around the world have reconsidered the policies and regulations of telehealth and facilitated its use. According to the U.S. Department of Health and Human Services (HHS), health care providers have been encouraged to adopt and use telehealth as a method to safely provide care to patients in certain situations such as routine health care, wellness visits, medication consultation, dermatology consultation, and mental health counseling (HHS, 2020). Besides, many telehealth policies and regulations established by the Health Insurance Portability and Accountability Act (HIPAA) and the Centers for Medicare & Medicaid Services (CMS) have been relaxed to empower health care providers and consumers to use telehealth during the global health crisis (HHS, 2020).

Nonetheless, KSA has established a vision for the future, namely “Vision 2030”, which consists of abundant ambitions aiming to transform all industries for the betterment. Regarding the

healthcare industry's strategic objectives, the Saudi government and the MoH strive to increase access to health services, improve the quality and efficiency of care, and promote preventive medicine (Vision 2030, 2020). In KSA, the MoH is the leading health care provider, regulator, and payer, making the MoH the highest authority to oversee healthcare-related activities across the country (MoH, 2020). However, health care providers and consumers have been significantly exposed to telehealth and virtual care. It has been witnessed that virtual clinics and telehealth services have become the new norm of delivering health care services through telehealth technologies.

Hence, the MoH has encouraged and supported public and private healthcare organizations to adopt and utilize telehealth. To illustrate, King Abdullah Medical City (KAMC) has aggressively utilized virtual care, in which the KAMC has activated more than 626 virtual clinics operating weekly and serving 12,000 beneficiaries to provide a wide range of health care services such as medical consultation, medication consultation, prescriptions, and diagnoses (MoH, 2020). Additionally, the MoH has developed multiple mobile applications (e.g., Tabaud and Sehhaty) along with the unified free-of-charge number (937) to mitigate the spread of COVID-19 and continue to provide health care services (Alghamdi et al., 2020). The MoH has realized that enabling all the necessary health services through electronic information and telecommunication technologies would eliminate physical interactions between health care providers and consumers and facilitate social distancing, thus preventing the spread of the COVID-19 pandemic (Hassounah et al., 2020). Currently, the utilization of telehealth technology has become a new and patient-centered approach that has the potential to curb the spread of COVID-19 and protect both healthcare professionals and patients from exposing to the virus. Consequently, health care providers are now offering remote health care utilizing telehealth and virtual services.

3.0 Review of Literature

The novel coronavirus disease (COVID-19) pandemic has significantly damaged various industries and dramatically overturned many lives. The healthcare sector is the leading sector in the combat of the deadly virus, in which all individuals depend on it to receive care and treatment. Therefore, many governments and healthcare systems have leveraged technology to prevent the spread of COVID-19 and trace contacts (Mbunge, 2020). However, telehealth is defined as the use of electronic information and telecommunication technologies to remotely deliver and support health-related services (ATA, 2020). Also, telehealth is one technology that has the potential to increase access to health care services, reduce health care costs, and sustain the continuity of care (Wosik et al., 2020). Similarly, virtual care is a type of telehealth that uses telecommunication technologies without the need for physical interactions to provide care via video calls, voice calls, and chat messages.

The use of telehealth technologies can be traced back to Europe. In 1905, the concept of telehealth arose when a Dutch physician transferred electrocardiograms related to his patients to another specialty. Afterward, health care providers in Norway, France, and Italy started radio consultations for patients living in remote islands and underserved areas between the 1920s and 1950s (Bashshur & Shannon, 2009). However, telehealth in the United States of America was introduced in the 1950s by providing psychiatric consultations from a distance (Bashshur & Shannon, 2009). Rapid technological advancements in communication technology triggered the emergence of telemedicine programs globally.

According to the American Telemedicine Association, a telehealth service can be rendered in different approaches, which include real-time, interactive virtual visits via video, telephone, or

live chat “synchronous” and chat-based interactions (store-and-forward) via an online chat interface or mobile app “asynchronous” (ATA, 2020). Health care professionals can also remotely monitor their patients’ health synchronously or asynchronously using personal health technologies such as wearable devices, implanted health monitors, and mobile apps (ATA, 2020). Nevertheless, telehealth can offer various services that can benefit both health care providers and patients. Provider-to-patient teleconsultation is among the most common types of services, wherein providers can deliver medical consultations, order medication refills, and follow up with their patients after being discharged. Also, provider-to-provider teleconsultation has been widely adopted, in which health care professionals can consult with their colleagues, thus enhancing the decision-making process.

Although telehealth is mainly designed to deliver health care services to people who live in rural and underserved areas, the role of telehealth has radically emerged to mitigate the risk of the COVID-19 pandemic spread. However, the ubiquity of mobile health applications has increased in the past years due to significant improvements in telecommunications, hardware, and software of smartphones (Sampat & Prabhakar, 2017). Also, the increased affordability of smartphones and data transmission plans has contributed to greater adoption among individuals worldwide. According to Statista, approximately 3 billion people use smartphones worldwide, wherein China, India, and the USA are the countries with the highest smartphone users (Statista, 2020).

As a result, telehealth solutions have become essential tools to enhance the delivery of health care services. As many nations strive towards facilitating universal health coverage, the utilization of telehealth platforms to assist in increasing access to care and maintaining the

continuity of care will improve the performance of healthcare systems. Nevertheless, telehealth applications can target diverse audiences such as physicians, nurses, or health consumers.

3.1 COVID-19 in Saudi Arabia

The novel coronavirus disease (COVID-19) pandemic has seriously altered the economy, healthcare systems, and social life of all affected countries across the world. According to the General Authority for Statistics, KSA has an estimated population of 34,713,236 as of the year of 2020 (General Authority for Statistics, 2020). However, the first case of COVID-19 was identified on March 2, 2020, in the Eastern Province, where the virus started and spread all over the country (Algaissi et al., 2020). Consequently, KSA has registered 362,549 confirmed cases of COVID-19 with 6,214 deaths as of December 31, 2020 (MoH, 2020).

Since the outbreak of the Middle East Respiratory Syndrome Coronavirus (MERS-CoV) has previously hit KSA where about 90% of all cases around the world were identified in KSA, the Saudi government had gained enormous experience and knowledge from the outbreak and proactively started preparing for COVID-19 before it even invaded the country (Algaissi et al., 2020). According to Alumran (2020), KSA has implemented robust precautionary measures at an early stage of COVID-19, which helped reduce the mortality rate and contain the spread of the pandemic (Alumran, 2020). However, June had the highest number of COVID-19 confirmed cases (103,052), followed by July with 87,783 confirmed cases. On the other hand, March had the lowest number of confirmed cases (1,566), followed by December (5,473) and November (10,193). No cases were confirmed in January and February 2020. Figure 1 depicts the number of confirmed cases of COVID-19 (MoH, 2020).

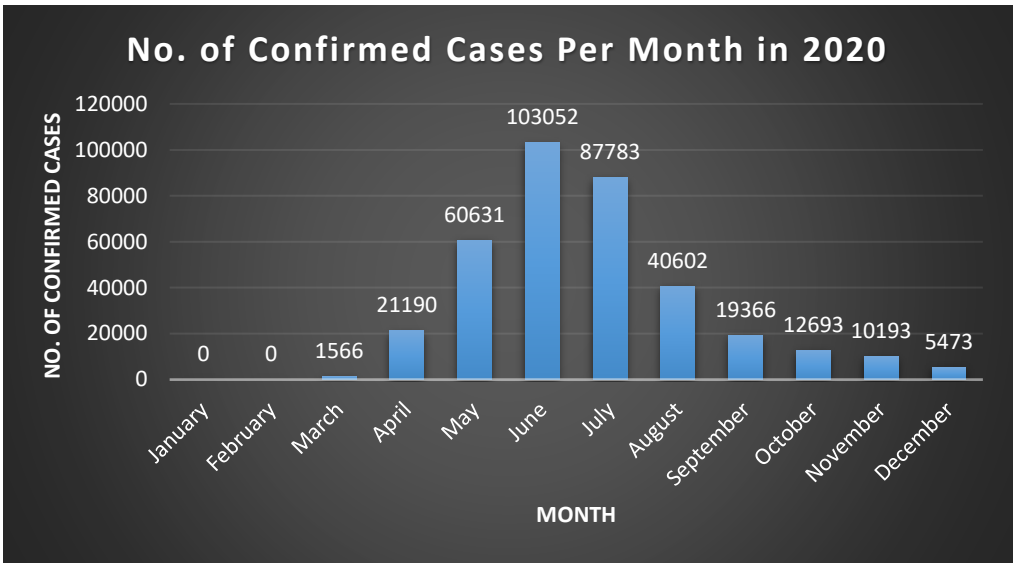

Figure 1 Number of confirmed cases of COVID-19 in KSA in 2020

Regarding the COVID-19 deaths, July had the highest number of COVID-19 related deaths (1,243 deaths). Other months with a high number of deaths include June (1,119) and August (1,028). On the contrary, March had the lowest number of COVID-19 related deaths (10 deaths). No COVID-19 related deaths occurred in January and February. Figure 2 shows the number of deaths from COVID-19 since the start of the wave till December 31, 2020 (MoH, 2020).

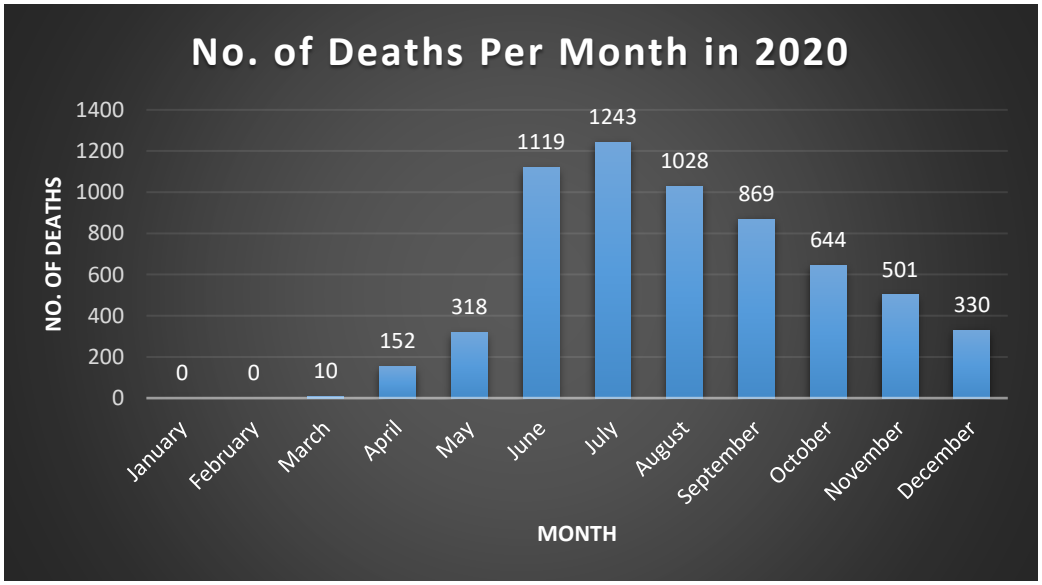

Figure 2 Number of deaths from COVID-19 in KSA in 2020

3.2 Digital Health Response to COVID-19

In the era of COVID-19, many countries worldwide have heavily relied on digital technologies, including telehealth services, to combat the spread of COVID-19, ensure the economy does not collapse, and continue offering education and health-related services for individuals. For example, China has enabled telehealth technologies and activated virtual care to be utilized by health care professionals to provide health services. The West China Hospital of Sichuan University in collaboration with ZTE China, has been utilizing 5G technology to provide remote medical services and treatment (Jnr, 2020). Also, China has been able to use AI-powered technology such as drone-borne cameras and portable digital monitors to minimize the gathering of people in public (Whitelaw et al., 2020).

In the USA, the government has facilitated the use of telehealth, in which several policies were waived or reduced such as HIPAA so that healthcare organizations and patients could utilize virtual care instead of traditional (face-to-face) care. On March 17, 2020, the CMS waived 1135 requirements and policies to expand telehealth coverage for all Medicare patients during COVID-19 (Lee et al., 2020). Three significant telehealth barriers in the USA have been eliminated to promote telehealth implementation, including lack of reimbursement, licensing restrictions, and HIPAA compliance (Lee et al., 2020). Although privacy and security rules were relaxed, healthcare organizations were advised to implement and utilize a HIPAA-compliant platform that could provide a secure connection between providers and patients, and thus protecting the privacy of patient data. Nevertheless, the USA has exploited digital technologies to provide remote medical services, monitor patients with chronic disease, and trace contacts by implementing digital thermometers to capture real-time data (Whitelaw et al., 2020).

Singapore, on the other hand, has developed a mobile application named “TraceTogether’ that can exchange short-distance Bluetooth signals when individuals are in proximity to each other, which allows the health authorities to access the data and trace contacts in a situation where a newly reported COVID-19 case is identified (McCall et al., 2020; Whitelaw et al., 2020). Like other countries, Singapore has harnessed the power of artificial intelligence to develop a mass temperature screening system (United Nations, 2020).

In Kuwait, the government has developed an app called “Shlonik”, which translates to “How Are You?”, to conduct mass surveillance on individuals (McCall et al., 2020; United Nations, 2020). Although digital technologies and telehealth services can eventually mitigate the spread of COVID-19, many controversial concerns have arisen about infringing on an individual's privacy and accidentally collecting personal and sensitives data (Jin, & Chen, 2015; Vidal-Alaball et al., 2020). Therefore, there must be well-established policies and procedures concerning data privacy and security (Zhou et al., 2019).

Similarly, KSA has been proactively developing e-health and telehealth applications to achieve its strategic objectives, increasing access to care, promoting public health, and improving health outcomes. Although most of the current digital technologies used to fight against COVID-19 are available to users, reprogramming and developments in these technologies are needed to effectively combat the spread of COVID-19. However, the MoH in collaboration with the other governmental agencies such as the Saudi Authority for Data and Artificial Intelligence (SDAIA), developed and launched about eight mobile apps and platforms aiming to attend to the needs of public health and provide health care services (Hassounah et al., 2020; MoH, 2020). The most commonly utilized mobile applications and services during COVID-19 are Tabaud, Tawakkalna, Sehhaty, Call Service Center (937), and Sehha (Alghamdi et al., 2020).

3.2.1 Tabaud

Tabaud, which means “Distancing”, is designed to mitigate the spread of COVID-19 by tracing contacts. This app is based on Bluetooth technology that collects location and interaction data of quarantined individuals to track movement patterns and sends de-identified data to individuals who may have physically interacted with confirmed cases of COVID-19. Regarding privacy, only health officials can access the data and take action accordingly (Hassounah et al., 2020; SDAIA, 2020).

3.2.2 Tawakkalna

Tawakkalna, which translates to "Our Trust in God", is an epidemiological GPS-based tool to contain the spread of COVID-19 by restricting individuals' movement during the curfew. This app's primary purpose is to allow employees and individuals to request and issue movement permits during curfew hours with the capability of tracking individuals during curfew, thus alleviating the impact of COVID-19 on social life, economy, and health. This app helps the government to return to normal life cautiously and gradually (Alsyouf, 2020; SDAIA, 2020)

3.2.3 Sehhaty

Sehhaty, which means “My Health”, is a newly developed app designed to support public health and enable all individuals to self-assess their symptoms if they suspect they have COVID-19. This app also allows individuals to directly book an appointment for COVID-19 testing at a specified site and time. Later on, the app provides individuals with their test results via the app or

SMS. This app helps in achieving the Expanded Testing of the COVID-19 initiatives. (Hassounah et al., 2020; MoH, 2020; Sehhaty App, 2020).

3.2.4 Call Service Center (937)

This freely accessible call service has been available since 2012, in which it aims to answer inquiries related to COVID-19 and other health-related matters. This service's main objective is to improve the quality of health care services and increase access to care. This service also provides 24/7 medical consultations through accredited doctors via voice calls and allows all individuals to file complaints and provide feedback about any health service across the country (Al-rayes et al., 2020; MoH, 2020).

3.2.5 Sehha

Sehha, which translates to “Health”, is a telehealth application primarily designed to provide telehealth services such as teleconsultation, e-prescription, and telediagnosis through the MoH’s accredited doctors via chat, voice, or video calls (Alsyouf, 2020; MoH, 2020). Also, Sehha allows induvial to upload images so that doctors can better diagnose the medical condition. However, this telehealth service is available to all Saudi citizens and non-Saudi citizens at no cost. Although Sehha was introduced in 2018 as part of the Kingdom initiatives of the 2020 National Transformation Program, the Sehha app has been recently updated to meet the needs of patients during COVID-19, as well as adding new features, such as COVID-19 self-assessment and AI-powered chatbot for providing medical information and addressing concerns related to the individual’s health (Alsyouf, 2020). Nevertheless, this particular app holds great promise for

increasing access to care, reducing unnecessary readmissions, cutting health care costs, and improving health care outcomes. According to the MoH, the whole Kingdom will be covered by telehealth through a mobile-based telehealth service, namely "Sehha" (MoH, 2018).

Table 1 Summary of the MoH digital apps used during COVID-19 in KSA

Name	Description	Primary Uses	Type/ Compatibility
Tabaud	GPS-based app with Bluetooth technology tracking the spread of COVID-19	- Tracing contacts and movement patterns. - Collecting location and contacts data of quarantined individuals	Smartphone app (iOS & Android)
Tawakkalna	A comprehensive GPS-based tracking app integrated with the main platform of the Ministry of Interior (Absher).	- Restricting movement of individuals during curfew - Issuing movement permits during curfew hours	Smartphone app (iOS & Android)
Sehhaty	Teleconsultation, self-assessment, and appointment booking for COVID-19 testing	- Booking appointments for COVID-19 testing - Self-assessing suspected symptoms of COVID-19 - Providing test results via the app or SMS	Smartphone app (iOS & Android)
Call Service Center (937)	Free-of-charge 24/7 call center comprehensively responding to any health-related issues	- Providing medical consultation via phone calls - Answering inquiries related to COVID-19 and other health-related matters - Filing and reporting complaints about a health service - Receiving and providing feedback	Freephone number
Sehha	Teleconsultation, e-prescription, telediagnosis. Synchronous; live video/chat. Asynchronous; SMS text messaging	- Offering online medical consultations - Prescribing medications - Ordering medication refills - Diagnosing medical conditions - Referring patients to health facilities	Smartphone app (iOS & Android)

3.3 Telehealth in Saudi Arabia

The COVID-19 pandemic has urged the Saudi government to maximize the use of digital health and telehealth technologies to control the spread of COVID-19 and keep delivering the needed health care services to people. However, the Saudi Telehealth Network (STN) is one of the MoH's initiatives established by the National Health Information Center (NHIC). On June 29, 2018, the final draft of the telehealth policies and regulations was approved by the Saudi Health Council (SHC) (NHIC, 2018). The STN aims to enhance healthcare services quality, reduce health care costs, and improve access to care (NHIC, 2018). Ultimately, the STN establishment will facilitate communication and operation between specialized healthcare facilities and primary healthcare facilities located in rural or remote areas by linking these facilities through the network. Recently, the NHIC has joined the International Society for Telemedicine & eHealth (ISfTeH) and become a member of this globally recognized telemedicine network, which aims to exchange experience and knowledge in telehealth and e-Health (ISfTeH, 2020)

In terms of the rules and regulations of telehealth, the NHIC solely addressed the requirements for telehealth practice with the approval of the SHC. The telehealth policy document consists of the regulations and definitions that facilitate the practice of telemedicine in KSA (NHIC, 2018). For example, the document explicitly states the regulations and requirements for telehealth implementation, training, malpractice insurance, and accreditation. It also covers essential rules concerning health information, in which the telehealth platform/system shall be compliant with the Saudi eHealth Exchange (SeHE) along with interoperability frameworks and data privacy and security measures/rules such as HIPAA (NHIC, 2018). Regarding patient rights, an informed consent shall be offered to the patient and then signed by the patient before any

telehealth activities are rendered. The patient also has the right to request education on telehealth and training sessions to use telehealth if necessary (NHIC, 2018).

Generally, telehealth requires an internet connection and data transmission plans, in which an individual is charged based on the duration of the service (e.g., minutes or hours) and the amount of data transmitted back and forth despite the actual cost of the telehealth service. Since the MoH provides all telehealth services at no cost, major telecom companies, including the Saudi Telecom Company (STC), Mobily SA, and Zain SA, have partnered with the MoH to offer free-of-charge data services. This partnership has enabled individuals to utilize these applications while staying at home to prevent the spread of the COVID-19 pandemic (Arab News, 2020; Hassounah et al., 2020). Additionally, STC and the MoH have been collaboratively working on increasing the capacity of the internet services usage by implementing and establishing 5G-based solutions in 22 healthcare centers, which are serving more than 5 million beneficiaries. Due to the importance of awareness about COVID-19-related matters among individuals, a joint campaign was launched by STC and the MoH, in which more than 1.7 billion text messages regarding the status of COVID-19, royal decrees, updates on the number of cases, and new precautionary measure, have been sent to individuals residing in KSA in 10 different languages (Arab News, 2020).

Although this paper focuses on digital and telehealth services being provided by the MoH, it is worth mentioning that many private healthcare organizations have enabled telehealth services to join the national campaign aiming to prevent the spread of COVID-19. For instance, Dr. Sulaiman Al Habib Medical Group is considered one of the leading healthcare providers in the Middle Eastern region due to its effective use of digital technologies. The Medical Group has recently launched a smartphone application that integrates all services provided by the Medical

Group (e.g., virtual consultation, appointment booking, e-prescription) (HMG, 2020; ZAWYA, 2020).

According to one study conducted on the perception and preference of telemedicine among public users (*n*=718) in KSA, 70% of the users have shown interest in utilizing telehealth for receiving care, while 52% of the respondents have reported that they have never used Sehha to seek care (Alshammari & Hassan, 2019). Another study carried out by Al-rayes et al. (2020), which was targeting the users of the Call Service Center (973), in which 258 out of 1303 respondents stated that they are using this service to obtain answers to concerns and inquires related to their health, while 601 respondents are aware of the telephone service but never used it (Al-rayes et al., 2020). However, the results of one comprehensive study targeting different clinical occupations (*n*=1523) conducted by Alaboudi et al. (2016) showed that 67.6% of clinical staff expect or extremely expect high performance from using telemedicine in KSA, while about 40.0% of clinical staff reported that using telehealth would not be easy as it required technical skills that they claimed challenging to excel in (Alaboudi et al., 2016). Nevertheless, it is evident that recent studies related to telehealth conducted in KSA mainly focused on the challenges and successes of telehealth, awareness, knowledge, and perception of users (Al-rayes et al., 2020; Alaboudi et al., 2016; Alshammari & Hassan, 2019; El-Mahalli et al., 2012; Jefee-Bahloul, 2014).

3.4 Significance

Although the Sehha telehealth app was developed early in 2018, based on the literature review, no scientific studies assessing the health care provider experience and satisfaction with the Sehha telehealth app have been conducted since it was first introduced “pre-COVID-19” until now

"during COVID-19." Also, the effectiveness, ease of use, usefulness, and challenges of the Sehha telehealth app have not been examined since the first wave of the COVID-19 pandemic hit KSA. Consequently, this study aims to:

- Assess the provider experience and satisfaction with the telehealth app "Sehha" during COVID-19 in KSA,
- Examine the challenges faced by the provider using telehealth technologies such as Sehha and,
- Identify possible opportunities to improve and expand the use of telehealth across KSA.

However, this study's findings may be a significant contribution to the future developments of telehealth across KSA. Evaluating the Sehha telehealth app and the provider's experience and satisfaction with Sehha during such a global health crisis may create new telehealth initiatives and developments based on the user's experience and eventually facilitate the adoption of telehealth systems and at a national level. Also, determining the impact of COVID-19 on the provider's perception and experience in telehealth will offer valuable insights to the government regarding the use of telehealth.

Since telehealth is a promising model of health care delivery and a vigorous approach to mitigate the spread of COVID-19 by reducing physical contact and face-to-face visits, it is imperative to ensure that telehealth stays effective and efficient post-COVID-19 with taking possible risks and privacy concerns into consideration (Khairat et al., 2020; Smith et al., 2020; Whitelaw et al., 2020).

4.0 Research Methodology and Design

A cross-sectional descriptive study was performed using an online questionnaire to evaluate health care providers' experience and satisfaction with the Sehha telehealth application being utilized to provide telehealth services for the public in KSA. An online survey system called Qualtrics was used to build the questionnaire and securely collect data properly. Qualtrics is an online survey software that securely collects data, analyzes responses, and provides a professional-quality presentation of data (Qualtrics, 2020). The developed questionnaire was the primary data collection instrument to obtain data on the provider experience and satisfaction. This study aimed to measure two dependent variables: physician satisfaction with telehealth "Sehha" and preference for telehealth visits over traditional visits. The independent variables were age, gender, nationality, years of experience, medical specialty, and physician's rank/grade (where a consultant is the highest rank in the medical professional hierarchy in KSA).

In general, health care providers have different perceptions about telehealth systems, thus different levels of satisfaction and preference for telehealth visits over traditional visits. Therefore, non-parametric tests (e.g., Mann-Whitney and Kruskal-Wallis H) and the Spearman's Rho correlation test were performed to test the following hypotheses:

- There are no significant differences in the participant demographics (e.g., age, gender, nationality, years of experience, medical specialty, and physician's rank/grade) in relation to the level of satisfaction with the Sehha telehealth app and preference for telehealth visits over traditional visits during COVID-19.
- There is no relationship between the level of satisfaction and preference for telehealth.

4.1 Setting

During the period from December 2020 to January 2021, the questionnaire was available in a web-based anonymous link and in English only because it was expected that all participants could speak and understand English, as it is the official second language in KSA. With the collaboration of the MoH, the questionnaire was effectively and officially distributed to the providers who have been using the Sehha telehealth application for providing care to patients during COVID-19.

4.2 Population

Since this study specifically targets the most common telehealth application "Sehha" used by the MoH's doctors, only those "physicians" who have been using this app were included in the study. Also, there were no specified criteria in the study in terms of the participant's nationality or medical specialty. As long as the participant used the Sehha app, their response was included in the study.

4.3 Data Collection Instrument Development

The questionnaire items (30) were obtained from different sources and related studies focusing on the provider experience and satisfaction with telehealth (Ayatollahi et al., 2015; Alaboudi et al., 2016; Baert et al., 2020; Becevic et al., 2015; El-Mahalli et al., 2012; Glaser et al.,

2010). In addition to that, questionnaire items developed by other researchers to assess the system usability and acceptance, satisfaction, and future use (e.g., Technology Acceptance Model (TAM), Telehealth Usability Questionnaire (TUQ), and Telemedicine Satisfaction and Usefulness Questionnaire (TSUQ)) were adapted as well (Bakken et al., 2006; Davis, 1989; Parmanto et al. 2016).

4.3.1 Questionnaire Validity and Scale Reliability

The questionnaire used in this study contains both closed-ended (quantitative) and open-ended (qualitative) types of questions with eight main parts. Part 1 includes participant demographics, characteristics, and information (eight questions), part 2 investigates the perceived impact of COVID-19 on provider's perception and experience in telehealth, which is coded as "PIC" (5 questions). Parts 3, 4, 5 are related to the perceived usefulness, ease of use, and effectiveness of the Sehha app, coded as "PU" (3 questions), "PEU" (3 questions), and "PE" (3 questions). Part 6 asks about the provider's satisfaction with the Sehha app and the willingness to use the app in the future, coded as "SFU" (3 questions). The last two parts 7 and 8, focus on the perceived challenges and concerns that the provider faces when using the Sehha app and areas where the provider believes that improvement is needed. Last, two open-ended questions related to the most liking and disliking aspects of the Sehha app were added, allowing the provider to share more insights into the Sehha app.

However, a 5-point Likert scale (where 5= strongly agree; 4= agree; 3= neutral; 2= disagree; 1= strongly disagree) was applied to all questionnaire items except for the following

parts where multiple-choice items were formulated with a blank text box in case of the participants wish to report anything other than the given choices:

- Participant Demographics and Characteristics
- Perceived Challenges and Concerns
- Areas of Improvement

Also, a question was added at the beginning of the questionnaire to capture the frequency of use of Sehha. If the participant states that they have never used the Sehha app, the questionnaire will be terminated, and their response will be excluded from the study.

Although the adapted questionnaire items have been already tested for reliability and construct validity in prior studies (Cronbach's Alpha 0.80-0.90), the initial draft of the questionnaire was tested for face and content validity by sending out the questionnaire for review by the thesis committee members and several experienced physicians who have been using the Sehha app. This technique is considered one of the best techniques for validating the questionnaire's understandability and content (Aiken, 2002; Sharp, 2008).

Based on the feedback and comments, the questionnaire was amended until the final draft was approved. Then, on December 3, 2020, a pilot study was conducted, wherein the questionnaire was sent out to 5 family physicians at the MoH, who voluntarily agreed to participate in the pilot study. According to Leon et al. (2010), the ultimate purpose of conducting a pilot study is to examine each item's applicability, understandability, and feasibility (Leon et al., 2011). Besides, the pilot participants were asked if they understood the questions, wanted to include or exclude a question, and if they wanted to add other comments.

The returned feedback and notes from the pilot respondents were considerably obtained, and the questionnaire was amended accordingly. Based on the notes and responses, none of the pilot respondents suggested including and excluding any questions, and they found the questions understandable and feasible to the study's subject. Although minor amendments (e.g., grammar, spelling corrections) were made to the questionnaire based on the pilot study notes, the pilot results and responses were used to calculate the Cronbach's Alpha using SPSS and then excluded from the final research sample.

The pilot study was also conducted to measure the adapted items' internal consistency and reliability, as it is imperative that all scales show high reliability for the corresponding factor. The questionnaire's reliability was measured through a Cronbach's Alpha test, which measures the internal consistency in a range from 0 to 1. The higher the value, the greater the internal consistency and reliability. According to George & Mallery (2019), Cronbach's Alpha of 0.90 and above is excellent, 0.80 and above is good, 0.70 is acceptable, 0.60 is questionable, 0.50 and above is poor, and any Cronbach's Alpha below 0.50 is considered unacceptable (George & Mallery, 2019). According to the calculated Cronbach's Alpha, Table 2 shows that all the questionnaire items "coded scales" in this study are more than acceptable and statistically reliable based on the pilot study's results.

Table 2 Cronbach's Alpha scale reliability measure and the numbers of scale items

Scale	N	Cronbach's Alpha
PIC	5	0.88
PU	3	0.87
PEU	3	0.86
PE	3	0.83
SFU	3	0.87
Entire Questionnaire	17	0.88

4.4 Sampling Method

Since the MoH holds all the contact information (e.g., phone number and email address) of the target population of this study “physicians”, the questionnaire was sent out to the MoH for data collection. This technique was used so that the MoH could privately and effectively distribute the questionnaire via email and other internal communication platforms used within the MoH and encourage the providers to participate in the study as it could improve the use of telehealth in KSA. According to the MoH, contact lists having all the staff contact information are usually used to distribute questionnaires to any staff group, and thus facilitating the data collection process for a research study. Therefore, since this study's target population included only the users of Sehha, the MoH sent the questionnaire to a list of clinical staff containing 362 physicians known and identified to be utilizing the Sehha telehealth app. However, in order to determine the needed sample size for this study, a simple size calculation was carried out to estimate how many responses this study needed (Appendix B).

4.5 Statistical Analysis

Since the assumed data distribution was deemed non-normal, non-parametric statistical data analysis was executed using the Statistical Package for Social Sciences (SPSS) software (SPSS v.27.0). However, descriptive statistics, including frequencies and percentages, were computed and displayed in tables and graphs for categorical variables such as the participant characteristics, perceived challenges and concerns of using the Sehha app, and aspects of the app needed for improvement. For continuous variables, the values of mean and standard deviation were

computed as well. The statistical significance of $p \leq 0.05$ was used to identify any statistically significant differences and associations between variables.

In this study, the researcher gathered specific demographic information, including age, gender, nationality, years of experience, medical specialty, and physician's rank. The primary reason for collecting those demographic data items was to better understand the study's participants and obtain insights into the Sehha telehealth app users. Moreover, the literature showed that previous studies indicated significant differences in the participant's demographic information using these data values, and therefore, these were chosen to be consistent with the literature. Therefore, the Mann-Whitney U test was used to examine whether there were any significant differences in gender (males and females) and nationality (Saudi and non-Saudi) concerning the level of satisfaction and telehealth preference. Also, the Kruskal-Wallis test was used to assess any significant differences among variables with more than two groups (age, years of experience, specialty, and rank) in relation to satisfaction and preference. The Spearman's Rho correlation test was performed to measure the strength and direction of the association between the variables. Regarding the qualitative data (open-ended questions), NVivo was used to perform content analysis and discover themes by coding them based on the amount of content coded at a particular node.

4.6 Ethical Considerations

This research study was approved by the Institutional Review Board at the University of Pittsburgh (IRB: STUDY20100022) and by the Central Institutional Review Board at the MoH (IRB: 20 –17 8E). The two ethical approvals were obtained from the mentioned departments before

any data collection to confirm that this research followed their codes and rules. The data collection instrument had a cover letter that stated the study's purpose, objectives, and other details related to the study and participation (Appendix A; Appendix C). The following statements are provided in the cover letter so that all participants are well-informed before taking part in the study:

- The collected data will be used for research purposes only.
- Data will be recorded anonymously, and no personal nor identifiable data will be linked to survey responses.
- Your participation in this study is voluntary, and you are free to withdraw your participation from this study at any time.
- The questionnaire has 30 items, and it is anticipated that it will take about 10 minutes to complete.
- Only the researcher and the research committee who are aware of data confidentiality and privacy will view the results, and all results will be disseminated in an aggregate form.
- There are no risks, benefits, and compensation associated with participation.

5.0 Results

This study's findings were intended to offer valuable insights and opportunities to enhance the use of the Sehha telehealth application widely used by different groups of population in KSA. All data were then collected and coded using SPSS v.27.0 to analyze the quantitative data and perform descriptive and inferential statistics. The NVivo software was also used to conduct a content analysis on the qualitative data and identify themes and categories.

Among all received responses from the questionnaire (138), only 114 responses were considered to be complete and valid, while 24 returned questionaries were excluded due to incompletion and invalidity. Therefore, the number of appropriate and complete questionnaires (n=114) represented the target population and for the degree of margin of error 5%. However, since the questionnaire was distributed to 362 physicians utilizing the Sehha telehealth app and only 114 complete responses were returned for this study, the response rate was reported to be 31%.

The majority of the participants were male (56.1%), in the age group of 31-40 years (51.8%), and were of Saudi nationality (72.8%). Most commonly, the respondents had less than 10 years and between 10 and 20 years of experience (36.0% and 42.1%, respectively). Regarding the specialty, the majority of the respondents were family physicians representing 75.4% of the study sample. Other specialties such as internal medicine and general surgery accounted for 8.8% and 6.1%, respectively. However, 9.6% of the respondents reported having other specialties that were not listed in the given choices, including gynecology & obstetrics (4.4%), palliative medicine (3.5%), pediatrics (0.9%), and colorectal (0.9%). Based on the findings, it was noted that some of the listed specialties were not chosen, such as psychiatry, dermatology, oncology, and orthopedics.

In terms of the respondent's rank/grade, most of them were consultants (47.4%), followed by specialists (33.3%) and then residents (19.3%). No medical students were found to be using the Sehha app to provide telehealth services. Table 3 summarizes the participants' characteristics who took part in this study.

Table 3 Descriptive statistics of participants' characteristics

Measure	Item	Frequency	(%)
Gender	Male	64	56.1%
	Female	50	43.9%
Age	20-30 years	16	14.0%
	31-40 years	59	51.8%
	41-50 years	15	13.2%
	51-60 years	14	12.3%
	Older than 60 years	10	8.8%
Nationality	Saudi	83	72.8%
	Non-Saudi	31	27.2%
Years of Experience	Less than 10 years	41	36.0%
	10-20 years	48	42.1%
	More than 20 years	25	21.9%
Specialty	Family medicine	86	75.4%
	Internal medicine	10	8.8%
	General surgery	7	6.1%
	Other	11	9.6%
Grade/Category	Consultant	54	47.4%
	Specialist	38	33.3%
	Resident	22	19.3%

Since this telehealth app is used differently by physicians, the frequency of the use of Sehha has been recorded to identify the workload and how many times a physician would use this app to provide telehealth services. Most of the physicians (28.9%) have been using Sehha 1 to 2 times a week, while 21.1% of the physicians reported that they have been using Sehha every day, which indicates that each physician had different shifts and workload depending on his or her specialty and agreement contract to work with the MoH. According to the MoH, the mobile-based telehealth service "Sehha" has been designed to enable audio-video communication between beneficiaries

and physicians from 8 AM to 12 AM during business days and from 4 PM to 12 AM on weekends (MoH, 2018). Figure 3 displays the percentage of the Sehha app usage by physicians.

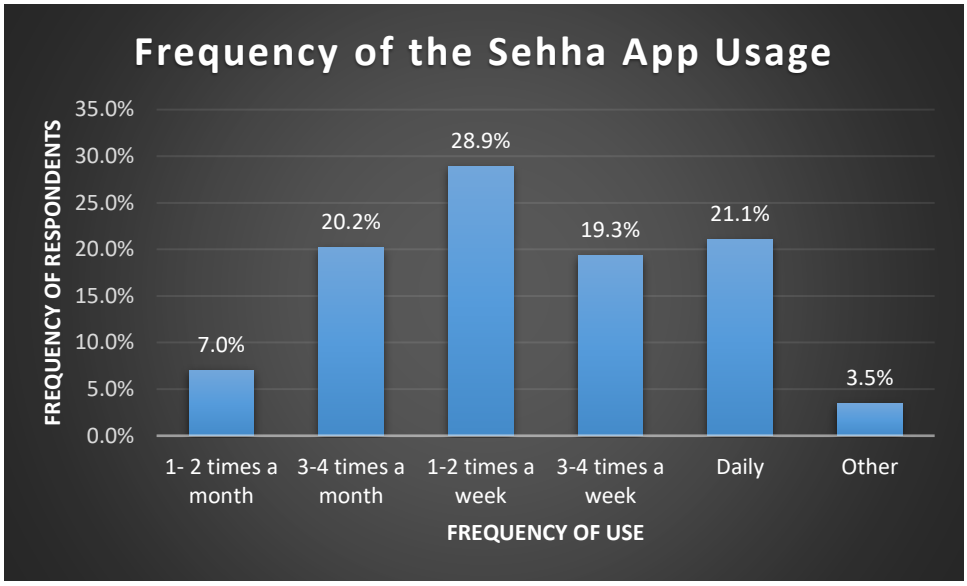

Figure 3 The percentage of the Sehha app usage by physicians

However, telehealth services vary and can be provided in many forms, such as medical consultations, diagnosis, treatment plans, prescription refills and requests, remote monitoring, and follow-ups. Also, telehealth services can be offered by different types of communication means such as live chat, video calls, voice chat, and voice calls (ATA, 2020). Similarly, health care providers using Sehha have been providing a variety of telehealth services for patients utilizing multiple communication methods.

About 98.2% of the physicians provided medical consultations via Sehha, in which a physician would deliver consultation to a patient who might have health-related concerns. Also, 89.5% of the physicians utilized Sehha to order medication refills and prescriptions, and 73.7% of the physicians were using the Sehha telehealth app for medical diagnoses. However, A small percentage of the physicians (5.3%) used the app to provide health education and promotion, in

which a physician would educate patients about their health and other health issues. Table 4 shows the types of telehealth services provided by physicians via Sehha.

Table 4 Types of telehealth services provided by physicians via Sehha

Type of Health Care Services Provided Via Sehha (*n*=114) *	**Frequency**	**(%)**
Consultation	112	98.2%
Prescription	102	89.5%
Diagnosis	84	73.7%
Other	6	5.3%
*Some respondents selected more than one service.		

The mobile-based telehealth service has many features that enable both the physician and the patient to communicate and interact effectively. According to this study results, 84.2% of the physicians delivered telehealth services via Sehha by mostly voice calls, followed by live chat messages (79.8%) and then video calls (69.3%). About 4.4% of the physicians stated using other methods such as voice messaging (2.6%) and sending/receiving images (1.8%). Table 5 displays the communication means used by physicians to offer telehealth services.

Table 5 Types of communication methods utilized by physicians in Sehha

Type of Communication Methods Used in Sehha (*n*=114) *	**Frequency**	**(%)**
Voice/phone calls	96	84.2%
Chat/text messages	91	79.8%
Video Calls	79	69.3%
Other	5	4.4%
*Some respondents selected more than one method.		

5.1 Quantitative Analysis of Closed-Ended Questions

This study used a questionnaire for data collection that had both open-ended questions and closed-ended questions to have a broader understanding of the Sehha telehealth app's mechanism and the users' perception and experience toward this app. The following sections analyze the

closed-ended questions presented on a 5-point Likert scale (where 5= strongly agree; 4= agree; 3= neutral; 2= disagree; 1= strongly disagree). For the sake of the data analysis, three categories were created, in which strongly agree and agree were combined as one category, neutral as another category, and strongly disagree and disagree were combine as the last category.

5.1.1 Perceived Impact of COVID-19 on Provider's Perception and Experience

Since this study was conducted during the COVID-19 pandemic, it was crucial to determine the impact of COVID-19 on the physician's perception and experience in telehealth and the use of Sehha during COVID-19. Due to the national lockdown, many physicians and patients were forced to provide and seek care virtually to mitigate the spread of COVID-19. However, 80.7% of the respondents stated that their use of the Sehha app has increased since the pandemic hit KSA, and 84.3% have improved their experience in telehealth because of COVID-19. Most of the respondents (88.6%) strongly agreed or agreed that more telehealth services would be utilized in the future in KSA as telehealth has proved its significance in providing care for patients living in remote, underserved, and restricted areas. When it comes to preference for telehealth visits over traditional visits (face-to-face), 43.8% of the respondents stated that they preferred telehealth visits over traditional visits, 35.1% of the respondents did not prefer telehealth over traditional care, while 21.1% of the respondents neither agreed nor disagreed "neutral" regarding the preference for telehealth. Table 6 shows the questions asked to measure their experience and perceptions toward telehealth during the COVID-19 pandemic.

Table 6 The impact of COVID-19 on participants' experience in telehealth

Code	Statement	Response (%)		
		Disagree/strongly disagree	**Neutral**	**Agree/strongly agree**
PIC1	Because of COVID-19, my use of the Sehha app has increased.	11.4%	7.9%	80.7%
PIC2	Because of COVID-19, my experience in telehealth has increased.	9.7%	6.1%	84.3%
PIC3	Because of COVID-19, I now have a better understanding of telehealth.	9.7%	10.5%	79.8%
PIC4	Because of COVID-19, more telehealth services will be utilized in the future.	6.1%	5.3%	88.6%
PIC5	Because of COVID-19, I now prefer telehealth and virtual care over traditional (face-to-face) care.	35.1%	21.1%	43.8%
Average		14.4%	10.2%	75.4%

5.1.2 Perceived Usefulness

According to Davis (1989), perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989). In this study, the perceived usefulness of the Sehha app was measured to identify whether or not the physician perceived it to be useful for providing telehealth services. Fifty-two percent of the respondents stated that Sehha helped them achieve their patients' needs more quickly compared to face-to-face visits, while 33.3% strongly disagreed or disagreed with this statement. The majority of the respondents (83.3%) strongly agreed or agreed that Sehha would increase access to care, and 42.1% of the physicians reported that they felt less productive when they used

Sehha compared to in-person visits. Table 7 shows the participants' responses to the three questions targeting the perceived usefulness of Sehha.

Table 7 The participants' responses on the perceived usefulness of Sehha

Code	Statement	Response (%)		
		Disagree/strongly disagree	**Neutral**	**Agree/strongly agree**
PU1	Sehha helps me achieve my patient needs more quickly compared to in-person visits.	33.3%	14.9%	51.8%
PU2	A telehealth technology such as Sehha increases access to care.	9.7%	7.0%	83.3%
PU3	I feel more productive when I use Sehha compared to in-person visits.	42.1%	23.7%	34.2%
Average		28.4%	15.2%	56.4%

5.1.3 Perceived Ease of Use

Perceived ease of use is defined as "the degree to which an individual believes that using a particular system would be free of effort" (Davis, 1989). It means that whether or not someone can use that system without much of a physical and mental effort. Therefore, it was imperative to assess the perceived ease of use of the Sehha app from a physician's perspective. More than half of the respondents (59.7%) reported that they felt comfortable interacting with their patients through Sehha, while the majority of the respondents (75.4%) stated that they could not easily access their patients' medical records/EHRs while using Sehha. Inability to access the patient data stored in other systems was due to lack of integration with other systems and lack of patient data availability within the Sehha app. Overall, 82.4% of the respondents found Sehha easy to use.

Table 8 demonstrates the participants' responses to the three questions about the perceived ease of use of the Sehha app.

Table 8 The participants' responses on the perceived ease of use of the Sehha app

Code	Statement	Response (%)		
		Disagree/strongly disagree	**Neutral**	**Agree/strongly agree**
PEU1	I feel comfortable interacting with my patient using Sehha.	23.6%	16.7%	59.7%
PEU2	I can easily access my patient's medical record while providing care via Sehha.	75.4%	12.3%	12.3%
PEU3	It is easy to use the Sehha app.	9.7%	7.9%	82.4%
Average		36.2%	12.3%	51.5%

5.1.4 Perceived Effectiveness

Since the Sehha app is considered one of the first telehealth systems operated by the MoH in KSA, it was necessary to measure the effectiveness of this system from a health care provider's perspective along with the quality of telehealth services and the privacy and confidentiality of patient data transmitting in and out of the Sehha app. This study's findings showed that more than half of the physicians using Sehha (57.9%) believed that the quality of care provided via Sehha was not as good as in-person care, while 71.9% of the respondents were confident that their patients' data were kept private and confidential. Overall, 68.4% of the respondents believed that the Sehha app was an acceptable way to remotely and virtually provide health care services. Table 9 shows the participants' responses on the perceived effectiveness of the Sehha app.

Table 9 The participants' responses on the perceived effectiveness of the Sehha app

Code	Statement	Response (%)		
		Disagree/strongly disagree	Neutral	Agree/strongly agree
PE1	I believe the quality of care provided via Sehha is as good as in-person care.	57.9%	12.3%	29.8%
PE2	I am confident that my patient data are kept private and confidential when using Sehha.	12.3%	15.8%	71.9%
PE3	I find the Sehha app an acceptable way to provide health care services.	20.2%	11.4%	68.4%
Average		30.1%	13.2%	56.7%

5.1.5 Satisfaction and Future Use

One of this study's main objectives was to measure the physician's satisfaction with the Sehha app. Thus, three questions were asked to identify whether or not a physician was satisfied with the work they have done through Sehha and their willingness to utilize such a technology to provide health care services in the future. The majority of the respondents (63.2%) strongly agreed or agreed that they would use telehealth technologies such as Sehha to deliver virtual care and telehealth services in the future. Also, 67.6% of the respondents believed that their patients seemed satisfied after the service was provided. Overall, 67.6% of the respondents were satisfied with the work they have done through Sehha. Table 10 shows the participants' responses on their satisfaction with Sehha and future use of such a technology.

Table 10 The participants' responses on satisfaction and future use

Code	Statement	Response (%)		
		Disagree/strongly disagree	Neutral	Agree/strongly agree
SFU1	I would use telehealth technologies such as Sehha	25.4%	11.4%	63.2%

	to provide care in the future.			
SFU2	My patient seems satisfied with the care I provide via Sehha.	13.1%	19.3%	67.6%
SFU3	Overall, I am satisfied with the work I have done through Sehha.	21.9%	10.5%	67.6%
Average		20.1%	13.7%	66.1%

5.2 Perceived Challenges and Opportunities

The adoption of telehealth has the potential to enhance operations and increase patient satisfaction with health care services. It improves patient care and increases patients' access to medical services. Nonetheless, its adoption and utilization carry some concerns and limitations. According to this study, 73.7% of the physicians selected inaccurate medical assessments as their primary concern while using the Sehha telehealth app. Whereas telehealth has the potential to enhance coordination of care, there are concerns of fragmenting medical care. Seventy-one percent of the physicians cited overlapping of medical consultations as a significant concern, in which past and current medical consultations would overlap and cause disruption in the patient care. However, the current telehealth regulations in Saudi Arabia lack clarity on significant concerns impacting the utilization of telemedicine. The current study revealed that 56.1% of physicians were concerned about the lack of clear rules and regulations regarding the use of telehealth, specifically the Sehha app.

According to the findings, 36.0% of the respondents believed that the management did not adequately support using the Sehha app. However, the least commonly perceived concerns and challenges by the physicians were the privacy and security of data in the Sehha telehealth app,

followed by lack of technical training, and then difficulties in using the telehealth app (17.5% 16.7%, and 8.8%, respectively). About 10% of the physicians reported other concerns, including increased workload (3.5%), trust issues between the physician and the patient (2.6%), lack of patient data available within the app (1.8%), and connection failure (1.8%). Table 11 shows the perceived challenges and concerns by the physicians using Sehha to provide telehealth services.

Table 11 Concerns and challenges faced by providers when using the Sehha app

Perceived Challenges and Concerns (*n*=114) *	**Frequency**	**Percentage (%)**
Difficult to provide accurate medical assessments	84	73.7%
Overlapping of consultations	81	71.1%
Lack of clear regulations and rules for telehealth services	64	56.1%
Lack of management support	41	36.0%
Data privacy and security	20	17.5%
Lack of technical training	19	16.7%
Other	11	9.6%
Difficult to use technology and technical devices	10	8.8%
*Some respondents selected more than one challenge.		

5.3 Areas of Improvement

Health care professionals' perspectives are a prerequisite for the successful implementation and use of telehealth across the country. Therefore, it was vital to obtain the aspects and areas of the Sehha app where the physicians believed improvement would be needed. According to the study's findings, 86.8% of the physicians indicated integrating the Sehha telehealth app with other electronic systems as the most significant area requiring improvement. However, patient’s access to various medical specialists is critical in improving the effectiveness and quality of care. As evidenced in this study, 81.6% of the physicians proposed involving other medical specialists such as dentists, dermatologists, and pediatricians in the Sehha telehealth app.

Online access to patient's medical records enhances the medical assessments and patient care as it helps the providers better understand the case they are treating. According to the study's results, 78.1% of the physicians noted access to patient data as one significant area needing improvement. Physicians also noted the continuity of care and technical aspects of the Sehha telehealth app as areas that needed improvement (47.4% and 43.9%, respectively). Other areas (3.5%) requiring more attention included implementing a user agreement policy that would define the rules and conditions of using the Sehha app for both physicians and patients, ability to conduct patient appointments and referrals, improving connectivity, and enabling notifications of waiting time for both physicians and patients and number of patients waiting to be served. Table 12 shows the areas and aspects and the Sehha telehealth app that needed improvement according to the physicians.

Table 12 Areas of the Sehha app needed for improvement

Aspects of Sehha Needed for Improvement (*n*=114) *	**Frequency**	**Percentage (%)**
Integration and connection with other electronic systems (e.g., electronic health records)	99	86.8%
Involvement of medical specialists (e.g., psychiatrist, dermatologist, oncologists)	93	81.6%
Access to patient data	89	78.1%
Continuity of care; involvement of the patient and all members of the health care team	54	47.4%
Technical aspects of the app (e.g., quality of video/voice)	50	43.9%
Other	4	3.5%
*Some respondents selected more than one area.		

5.4 Qualitative Analysis of Open-Ended Questions

The questionnaire used in this study contained two open-ended questions; one question asked the physicians about the areas of the Sehha app they liked the most, the other question was

about the Sehha aspects the physicians disliked the most. Additionally, a blank text box was added at the end of the questionnaire if the participants wished to provide other insights and comments regarding the study's subject. Among all selected questionnaires (114), only 19 questionnaires were found to have answers and comments to the open-ended questions. In NVivo, two figures 8 and 9 were created to represent how much of the source content was coded at a particular node in percent based on 19 respondents.

For the most liked areas of the Sehha app, four themes and benefits were discovered as physicians frequently mentioned them in their responses. Ease of use was the most common theme, followed by quick patient care, in which the physicians found the Sehha app a quick approach to provide care for patients. Also, effective communication between health care providers and patients and increased access to care were frequently mentioned in the questionnaires. Figure 4 shows the aspects physicians liked the most when using Sehha according to 19 responses.

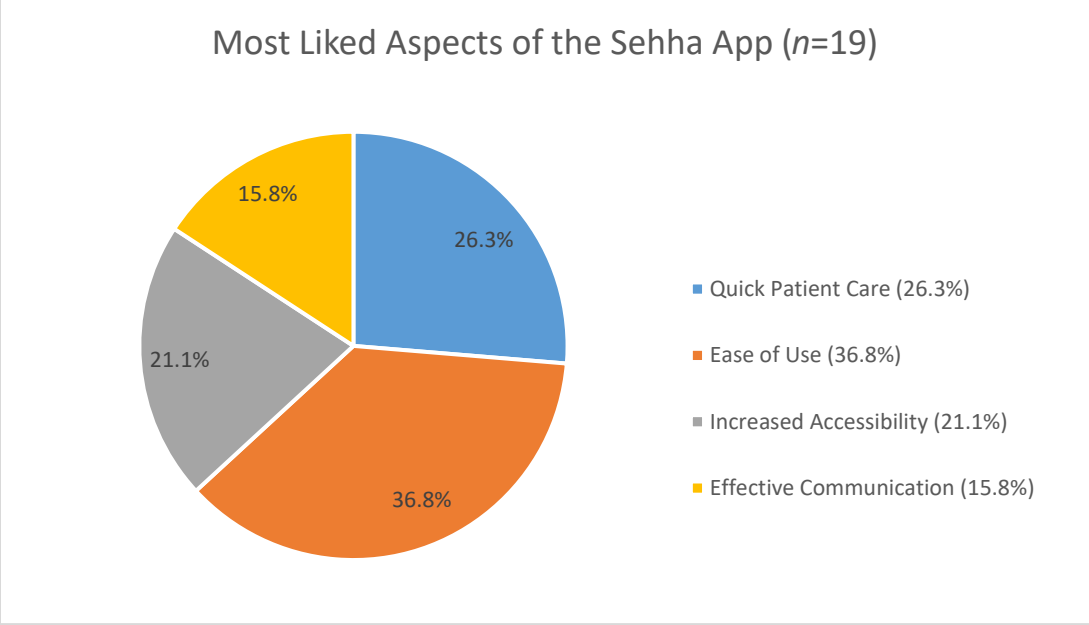

Figure 4 Most liked aspects of the Sehha app based on the participants' responses

Despite the benefits of the Sehha telehealth app, it had various limitations disliked by the end-users. As evidenced in figure 5, the increased workload was the most prevalent theme cited

by the physicians. Moreover, the inability to access patients' medical records and a high number of consultations at the same time were cited as limitations. The technical issues aspect was the least common theme in the qualitative analysis. Figure 5 shows the most disliked aspects of the Sehha app according to 19 responses.

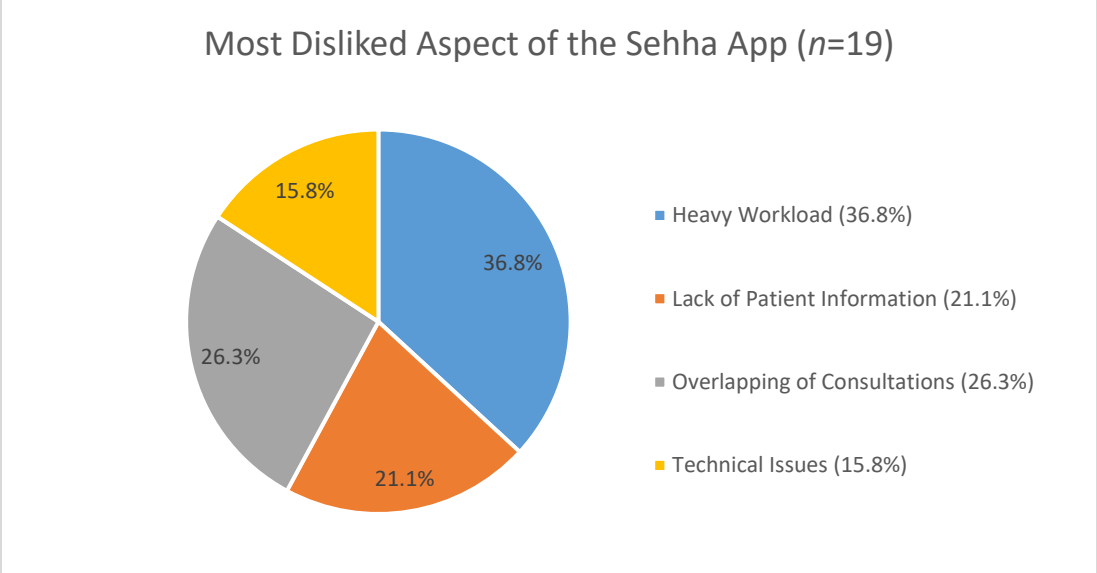

Figure 5 Most disliked aspects of the Sehha app based on the participants' responses

Several respondents considered the Sehha app helpful and beneficial, while most of the respondents indicated that the Sehha telehealth app needs additional development to be effectively optimized by all types of users, including healthcare organizations. Markedly, several respondents commented that this app requires clear roles, policies, and regulations for its use along with a triage functionality or filter for assigning a degree of urgency to a medical need requested by patients.

5.5 Findings from Statistical Analysis

Statistical analysis using SPSS was conducted to pinpoint reliable results, thus strengthening the significance of the study and establishing a valid conclusion (Ali & Bhaskar, 2016). One of this study's purposes was to find if there were any statistically significant differences among different groups in relation to satisfaction and preference. Therefore, the Mann-Whitney and Kruskal Wallis tests were performed for this purpose. The Mann-Whitney test showed no statistically significant difference between gender and preference for telehealth visits over face-to-face visits ($p= 0.898$). It also showed a significance value of 0.415 for gender and satisfaction with telehealth, and this value indicated no statistically significant difference between gender and level of satisfaction with the Sehha telehealth app. The Mann-Whitney test showed no statistically significant difference in the provider's nationality regarding preference for telehealth and satisfaction in relation ($p= 0.266$ and $p= 0.334$, respectively).

In terms of the variables with more than two groups, the Kruskal Wallis test showed no statistically significant difference between the groups of age and preference for telehealth visits over face-to-face visits ($p= 0.059$). However, it showed a statistically significant difference between the groups of age and satisfaction with telehealth services ($p= 0.005$), which means that the older the provider is, the less satisfied they are with using telehealth services.

The Kruskal Wallis test showed a statistically significant difference between the medical specialty groups and preference for telehealth with a p-value of 0.011, which indicated that medical specialties could impact preference for telehealth visits over traditional visits. Tables 13, 14, 15, and 16 summarize the significance values for the distribution of health care providers concerning preference and satisfaction.

Table 13 Mann-Whitney: preference for telehealth visits over traditional visits

Group Variable	Preference for telehealth visits over traditional visits (*n*=114)				
	Item	**Frequency**	**(%)**	**Mann-Whitney**	**P-Value***
Gender	Male Female	64 50	56.1% 43.9%	1622.00	0.898
Nationality	Saudi Non-Saudi	83 31	72.8% 27.2%	1116.00	0.266
***Significance is at 0.05**					

Table 14 Mann-Whitney: satisfaction with telehealth services using Sehha

Group Variable	Satisfaction with telehealth services (*n*=114)				
	Item	**Frequency**	**(%)**	**Mann-Whitney**	**P-Value***
Gender	Male Female	64 50	56.1% 43.9%	1736.500	0.415
Nationality	Saudi Non-Saudi	83 31	72.8% 27.2%	1141.500	0.334
***Significance is at 0.05**					

Table 15 Kruskal Wallis: preference for telehealth visits over traditional visits

Group Variable	Preference for telehealth visits over traditional visits (*n*=114)				
	Item	**Frequency**	**(%)**	**Kruskal Wallis**	**P-Value***
Age (in years)	20-30 31-40 41-50 51-60 >60	16 59 15 14 10	14.0% 51.8% 13.2% 12.3% 8.8%	9.083	0.059
Years of Experience	<10 10-20 >20	41 48 25	36.0% 42.1% 21.9%	5.381	0.068
Specialty	Family medicine Internal medicine General surgery Other	86 10 7 11	75.4% 8.8% 6.1% 9.7%	11.18 7	0.011
Grade/Category	Consultant Specialist Resident	54 38 22	47.4% 33.3% 19.3%	3.117	0.210
***Significance is at 0.05**					

Table 16 Kruskal Wallis: satisfaction with telehealth services using Sehha

Group Variable	Satisfaction with telehealth services (*n*=114)				
	Item	**Frequency**	**(%)**	**Kruskal Wallis**	**P-Value***
Age (in years)	20-30 31-40 41-50 51-60 >60	16 59 15 14 10	14.0% 51.8% 13.2% 12.3% 8.8%	14.658	0.005
Years of Experience	<10 10-20 >20	41 48 25	36.0% 42.1% 21.9%	5.006	0.082
Specialty	Family medicine Internal medicine General surgery Other	86 10 7 11	75.4% 8.8% 6.1% 9.7%	3.381	0.337
Grade/Category	Consultant Specialist Resident	54 38 22	47.4% 33.3% 19.3%	4.311	0.116
***Significance is at 0.05**					

Nevertheless, the Spearman's Rho test was performed to assess a correlation between the preference and satisfaction variables. Also, it was vital to identify the strength and direction of the association between the variables. The test showed a strong positive relationship between preference for telehealth and provider satisfaction (R_s= 0.709) with a p-value of 0.001. This correlation signified that the providers who preferred telehealth visits over face-to-face visits were also satisfied with the telehealth services they provided via Sehha. Table 15 shows that all items of the questionnaire had a mean score of 3.06 or higher except work productivity when using Sehha (2.95), access to patient data (1.93), and quality of care provided via Sehha (2.53).

Table 17 The values of the mean and standard deviation of each item

Perceived Impact of COVID-19 on Provider's Perception and Experience	**Mean**	**SD**
Because of COVID-19, my use of the Sehha app has increased	4.11	1.103
Because of COVID-19, my experience in telehealth has increased	4.13	1.069
Because of COVID-19, I now have a better understanding of telehealth	4.12	1.057
Because of COVID-19, more telehealth services will be utilized in the future	4.33	1.036
Because of COVID-19, I now prefer telehealth and virtual care over traditional (face-to-face) care	3.06	1.483
Perceived Usefulness	**Mean**	**SD**
Sehha helps me achieve my patient needs more quickly compared to in-person visits	3.18	1.209
A telehealth technology such as Sehha increases access to care	4.07	1.028
I feel more productive when I use Sehha compared to in-person visits	2.95	1.174
Perceived Ease of Use	**Mean**	**SD**
I feel comfortable interacting with my patient using Sehha	3.40	1.180
I can easily access my patient's medical record while providing care via Sehha	1.93	1.103
It is easy to use the Sehha app	4.04	1.025
Perceived Effectiveness	**Mean**	**SD**
I believe the quality of care provided via Sehha is as good as in-person care	2.53	1.312
I am confident that my patient data are kept private and confidential when using Sehha	3.85	1.123
I find the Sehha app an acceptable way to provide health care services	3.65	1.248
Satisfaction and Future Use	**Mean**	**SD**
I would use telehealth technologies such as Sehha to provide care in the future	3.54	1.434
My patient seems satisfied with the care I provide via Sehha	3.77	1.031
Overall, I am satisfied with the work I have done through Sehha	3.66	1.462

6.0 Discussion

To the best of the researcher's knowledge, no comprehensive scientific studies have covered the provider's experience and satisfaction with the Sehha telehealth services being utilized during COVID-19 across the country of KSA. Although the Sehha telehealth app was developed early in 2018, there have been no studies evaluating the health care provider experience and satisfaction with the Sehha telehealth app. Moreover, the effectiveness, ease of use, usefulness, and challenges of utilizing the Sehha telehealth app have not been examined since it was first introduced. Although multiple studies conducted in KSA have addressed the use of telehealth in KSA, these studies did not cover the central telehealth platform "Sehha" supported by MoH from a provider's standpoint (Al-rayes et al., 2020; Alaboudi et al., 2016; Alshammari & Hassan, 2019; El-Mahalli et al., 2012; Jefee-Bahloul, 2014).

During the COVID-19 pandemic, many healthcare organizations have switched from traditional care to virtual care using telehealth technologies to mitigate the risk of the virus. On one side, patients may see virtual care as an acceptable alternative approach to deliver health care services while they are in quarantine. On the other hand, health care providers may perceive it differently due to a lack of knowledge, awareness, and expertise. According to one study conducted in Saudi Arabia, 40.6% of clinical staff said that telehealth would be hard to use and implement in their practices (Alaboudi et al., 2016). Another study showed that clinicians had limited knowledge about telehealth technologies (Ayatollahi et al., 2015). More importantly, telehealth has never been utilized the way it is being utilized nowadays, so it was crucial to evaluate the Sehha telehealth app's efficiency to ensure that the quality of care would not be compromised. Lastly, analyzing and studying the level of satisfaction and experience of health care providers

with telehealth during such a difficult time would create new telehealth initiatives and developments and eventually facilitate the adoption of other telehealth systems across the country.

About five years ago, studies conducted in different places and locations had examined the health care providers' perceptions and knowledge toward telehealth and willingness to use it. Although those studies showed positive results, whereby health care providers showed willingness and interest in using telehealth, health care providers showed limited knowledge and skills needed for telehealth utilization (Althbiti et al., 2017; Ayatollahi et al., 2015; Alaboudi et al., 2016; Bradford et al., 2015). Similarly, older studies showed that health care providers' perceptions and knowledge toward telehealth were reported to be promising, but the studies showed a lack of telehealth training and experience (Demiris et al., 2004; Tudiver et al., 2007; Wakefield et al., 1997; Young & Iresonl, 2003).

According to one study conducted in KSA, 68.4% of health care professionals, including physicians working with the MoH, believed that the quality of care provided by a telehealth system would be as good as traditional interaction (Alaboudi et al., 2016), while this study showed that about 57.9% of physicians utilizing a telehealth system, stated that the quality of telehealth services provided via Sehha was not as good as traditional care. Moreover, this current study showed that about 82.4% of the physicians believed that it was easy and straightforward to use the Sehha telehealth app, while the other study showed that about 48.1% of the participants noted that using telemedicine would be easy for clinical staff (Alaboudi et al., 2016). The differences in this study and the previous study showed that the provider's perceptions toward the use of telehealth in KSA might contradict the provider's actual experience in telehealth.

However, a recent study also conducted in KSA, in which it assessed the users of a diabetes telemedicine clinic during COVID-19, showed that 71.4% (10 out of 14 providers) strongly agreed

or agreed that the telemedicine system was easy to use (Al-Sofiani et al., 2020), which aligns with the findings of this study, in which 82.4% (94 out of 114 physicians) using Sehha noted that it was easy to use the Sehha telehealth app. Also, the same study showed that 78.6% of the providers believed that the quality of care provided by the diabetes telemedicine systems was excellent, while this study showed that 57.9% of the Sehha users did not perceive the quality of care provided via Sehha as excellent as traditional care (Al-Sofiani et al., 2020). In terms of the provider satisfaction with such a telehealth technology, the other study showed that 71.4% of the participants were satisfied with the diabetes telemedicine system, which also supports the results of this study, in which 67.6% of the physicians were satisfied with Sehha and the work they have done via the Sehha telehealth app (Al-Sofiani et al., 2020).

Moreover, a study conducted by Becevic et al. (2015) showed that 86% of providers strongly agreed or agreed that they were satisfied with the work done through telehealth (Becevic et al., 2015). Another study showed that 82.2% of the providers were generally or completely satisfied with the telemedicine system used in a prison in Louisiana (Glaser et al., 2010). Those previous studies endorse the findings of this study, in which the majority of the providers (67.6%) were satisfied with telehealth. However, Becevic et al. (2015) reported that none of the providers stated preference for telehealth visits over in-person visits (Becevic et al., 2015), while the current study showed that 43.8% of the provider preferred telehealth visits over in-person visits. Those studies indicate that the majority of providers utilizing telehealth systems, regardless of the type and location, are satisfied with the system and the care they provide via these systems. Regarding the future use of telehealth technologies, this study's findings showed that the majority of the providers (63.2%) strongly agreed or agreed that they would use such a technology in the future. Similarly, the results of the study conducted by Al-Sofiani et al. (2020) showed that most of the

participants (92.8%) would use the diabetes telemedicine system in the future (Al-Sofiani et al., 2020).

Although telehealth has the potential to increase access to care and improve patient care and satisfaction, health care providers still face several challenges. According to one study, an inaccurate and unreliable medical assessment is one of the major telehealth concerns faced by providers (Khemapech et al., 2019), which aligns with the findings of the current study, in which 73.7% of the physicians stated that they were mainly concerned about the accuracy of their medical assessments while using the Sehha telehealth app. Another study conducted by Jefee-Bahloul (2014) discussed the barriers and challenges of telemental systems, including regulatory and legal challenges as one of the most perceived challenges in the Middle East (Jefee-Bahloul, 2014). Similarly, this study showed that 56.1% of the physicians were also concerned about the lack of clear rules and regulations regarding telehealth utilization, specifically the Sehha telehealth app. This finding proves why all clinical staff (100%) working with the MoH perceived that establishing telehealth regulations and medical licensure to practice telehealth was needed in KSA (Alaboudi et al., 2016). Even though the NHIC officially published a telehealth policy document that could be referred to when implementing or utilizing telehealth, the study showed that there was still a need for more vibrant, profound, and widely published regulatory and legal specifications of the practice of telehealth in KSA.

However, this study revealed a new significant challenge faced by the majority of the providers using the Sehha app (71.1%), which was overlapping of consultations, which could cause fragmentation of medical care and disruption in the patient care. Integrating telehealth systems with other electronic health systems makes remote care easier and improves patients care (Schwamm, 2014). Thus, 86.8% of the physicians noted integrating the Sehha telehealth app with

other electronic systems as the most significant area requiring improvement. Integration and connection of the Sehha app with other available electronic systems such as EHRs would also improve coordination and continuity of care. Telehealth is meant to extend access to medical consultations from a variety of specialists (Bradford et al., 2015). According to this study, 81.6% of the physicians suggested involving other health care specialists such as dentists, dermatologists, and pediatricians in the Sehha telehealth app. Involving other medical specialists makes it easier for primary care physicians to consult with the health care specialists on a particular patient case. Also, including other medical specialists would increase the quality and accuracy of medical assessments and resolve the issue of unreliable medical examinations.

Another study conducted by van Kuppenveld et al. (2020) stated that real-time access to patient data enables both physicians and patients to examine medical records at any time, thereby leading to improved health outcomes (van Kuppenveld et al., 2020). According to the results of this study, 78.1% of the physicians emphasized improving access to patients' data in the Sehha telehealth app as 75.4% of the physicians strongly disagreed or disagreed that they would easily access patient's medical records while providing care via Sehha. Although many healthcare organizations have been widely utilizing data sharing standards and platforms (e.g., Health Information Exchange (HIE), HL7, FHIR) to facilitate the exchange of patient data, lack of interoperable infrastructures and diversity of data standards have been recognized as significant challenges that hinder sharing and accessibility of data (Ancker et al., 2014).

The STN within the NHIC has emphasized the exchange of health information when practicing telemedicine, which will eventually increase access to patient data/EHRs, and thus making patient data available when needed. Regarding the privacy and security of the Sehha app and patient data within the system, this study showed that 71.9% of the respondents were confident

that the Sehha app kept the patient data private and confidential, and 17.5% of the respondents selected the privacy and security of data in the Sehha telehealth app as a challenge or concern when utilizing Sehha. This indicates that the app is secure and adheres to national privacy and security standards. Also, the telehealth policy document profoundly addresses this area of telehealth by defining the use of health information/EHRs, patient rights (e.g., informed consent and refuse treatment via telehealth), and other relevant activities around the practice of telehealth in KSA.

Although the Sehha telehealth app is considered the main platform for telehealth services available for all Saudi and non-Saudi residents at no cost with limited time, other privately-owned telehealth platforms are utilized at a fair amount of money with no time constraints. One of the renowned telehealth platforms is Cura, which is a telehealth platform that provides online medical consultations, diagnoses, and prescriptions by different medical specialists through live chat messaging, video calls, or voice calls via a mobile app (Cura, 2021). This platform also enables people to seek a medical service at any time (24/7) and accepts a variety of health insurances such as Bupa and MEDGULF (Cura, 2021). Comparably, Maya Clinic is another telehealth platform that enables digital communication between patients and providers and offers a range of health care services, including preventive care, checkups, and consultations at any time with acceptable fees (Maya clinic, 2020).

When comparing the MoH telehealth app “Sehha” with other telehealth apps, differences and similarities can be determined. The telehealth platforms aim to provide high-quality services and improve access to healthcare resources. However, it was evident in this study that the Sehha telehealth app lacks diversity in medical specialists, and the service is available during specified

times. Unlike other telehealth platforms, there is a wide range of medical specialists, and the service is available at one's convenience.

As part of the statistical analysis, it was assumed that significant differences among different groups (e.g., participant's nationality, rank, years of experience, age, and gender) in relation to satisfaction and preference would be identified in this study. However, only two groups (age and medical specialty) were found to have statistically significant differences. According to the current study's results, there was a statistically significant difference between the groups of age and satisfaction with telehealth services ($p= 0.005$), and there was a statistically significant difference between the specialty groups and preference for telehealth ($p= 0.011$).

7.0 Conclusion

Although the Sehha telehealth app was first introduced in 2018 by the Saudi Ministry of Health (MoH), the Sehha telehealth app has never been analyzed and assessed from a provider's perspective. Also, even though this telehealth solution is considered the main telehealth platform available for the public supported by the MoH at no cost, the effectiveness, ease of use, and usefulness of this telehealth solution had not been examined from a physician's point of view since the app was developed. Thus, this study aimed to assess the aspects of the app and the provider satisfaction and experience in the Sehha telehealth app, examine the challenges and concerns faced by the provider, and identify possible opportunities to improve the use of telehealth across KSA. Since this study was conducted during the COVID-19 pandemic, the impact of COVID-19 on the provider's perception and experience was determined.

Based on the study findings, more than half of the physicians (67.6%) reported being satisfied with the work they have done through Sehha, and 63.2% of them would use telehealth technologies such as Sehha to provide care in the future. However, most of the physicians (57.9%) believed that the quality of care provided via Sehha was not as good as in-person care, indicating an issue with the quality of care provided via Sehha.

Multiple factors might be the reasons behind the reported low quality of care, including inefficient workflows of conducting a telehealth visit, inability to optimize the app's features, and lack of interest in using Sehha as a method to practice medicine. Moreover, insufficient quality monitoring and auditing strategies could negatively impact the quality of care provided via Sehha. Since the physicians using the Sehha telehealth app stated that Sehha lacked patient data, inaccurate medical assessments and diagnoses could be made, leading to incorrect treatments.

In terms of the platform's ease of use, the majority of physicians (82.4%) noted that it was easy to use Sehha, and more than half of them (59.7%) felt comfortable interacting with their patients when using Sehha. However, this study revealed that the Sehha telehealth app lacked integration with other electronic health systems and access to patients' medical records. Seventy-five percent of the physicians reported that they could not access their patients' records while using Sehha as the majority of them (86.8%) suggested integrating the Sehha telehealth platform with other electronic systems. According to the results of this study, the Sehha telehealth app had limitations on integrating with other systems, and thus impeding access to patient data stored in other databases or electronic systems, which is why more than half (78.1%) advised increasing access to patient's data. Also, it was evident in this study that the number of medical specialists other than family physicians was reported to be very low, which proved that the lack of diversity in medical specialists needed to be reconsidered as 81.6% of the respondents suggested recruiting other medical specialists (e.g., dentists, dermatologists, pediatricians).

Similarly, like any other telehealth system, the Sehha telehealth app comes with multiple challenges and concerns. Difficulty in providing accurate medical assessments was the most perceived challenge by the physicians (73.7%), followed by overlapping of consultations, and then a lack of clear regulations and rules for telehealth (71.1% and 56.1%, respectively). Nonetheless, even though COVID-19 has negatively affected all types of industries, including healthcare, this study showed that COVID-19 positively impacted the provider's perception and experience in telehealth. This study's findings showed that 84.3% of the physicians improved their telehealth experience, and 79.8% stated that their understanding of telehealth was enhanced because of COVID-19. However, 88.6% of the physicians believed that because of COVID-19, more telehealth services would be utilized in the future in KSA. More importantly, COVID-19 has

revealed the precious core of telehealth and exposed numerous benefits of telehealth as it is an acceptable way of continuing to provide care while practicing social distancing.

Based on the findings of the study and participants' responses, 13 key recommendations have been articulated for the current telehealth platform "Sehha" and any future telehealth systems that the MoH or other healthcare organizations intend to develop:

1. Integrate the Sehha telehealth platform with other electronic health systems such as EHRs and mobile health apps available within the MoH for more effective communication, improved productivity, and increased interoperability.
2. Involve other medical specialists in the Sehha telehealth platform (e.g., dermatologists, dentists, psychiatrists) for better accuracy of medical assessments and quality of care.
3. Implement a User Agreement Policy as a standard requirement for all users (patients and providers), which should outline the users' rights and responsibilities and define the rules, terms, and conditions for using the platform.
4. Monitor and audit the visits and interactions conducted within the platform between patients and providers for quality improvement purposes.
5. Enable accessibility to patient data and promote sharing of health information for improved continuity and coordination of care.
6. Balance the workload and number of consultation requests to avoid overlapping of consultations and disruption of patient care.
7. Boost awareness of the telehealth benefits and encourage people and providers to leverage this technology by advertising the uses and benefits of Sehha through social media platforms and mass media.

8. Ensure the providers' devices and network are secure and safe to protect data privacy and confidentiality.
9. Establish security and privacy protocols that align with the national standards to support patient privacy, control the flow of patient data, delegate access to the data, and enable interoperability with other electronic systems
10. Provide a demonstration/tutorial video of how the app can be effectively optimized so both providers and patients can refer to it if needed.
11. Enable the platform to be downloaded and functional not only on smartphones but also on personal computers (PCs) and laptops to increase its utilization and flexibility.
12. Ensure the Sehha telehealth platform is regularly maintained, updated, and sustained post-COVID-19.
13. Identify use cases to locate errors and gaps in the process and design for improving the efficiency and effectiveness of the Sehha telehealth platform.

Last, telehealth has the potential to solve the most pressing issues of healthcare, including access to care, quality of care, and cost. The COVID-19 pandemic has impacted various industries, specifically the healthcare industry, and revealed numerous benefits of telehealth that were not even realized before the pandemic. Telehealth can be the new norm of delivering health care services and a key enabler of digital transformation, wherein quality health care services will be available at a modest cost.

8.0 Limitations and Future Work

For the first time, this study aimed to evaluate physicians' experience and satisfaction using the Sehha telehealth application supported by the MoH across KSA. Also, it examined the challenges and concerns that the provider faced when providing care through the app. Since this study was conducted during the COVID-19 pandemic, the impact of COVID-19 on the provider's perception and knowledge of telehealth was also reported. Although this study was carried out with the collaboration of the MoH, the researcher noted several limitations.

First, there was a lack of published studies assessing the provider experience in telehealth systems and platforms in KSA. This limitation caused several difficulties during the development of the data collection instrument, in which the researcher was unable to adapt questions related to the user experience and satisfaction with telehealth in KSA. Second, the researcher was unable to obtain the exact number of the physicians utilizing the Sehha app to accurately calculate the sample size, and thus the generalizability of the findings might be affected. According to the MoH, several physicians were working part-time and as contractors with the MoH, and thus they would leave for other opportunities, and other physicians would be then recruited. Even though the researcher strived to recruit as many as possible for the study, the response rate was reported to be low (31%). This might be due to multiple reasons such as ineffective distribution of the questionnaire and lack of interest in the research study. Also, since the target population was only physicians, time constraints or skipping the questionnaire might be a factor that led to this response rate.

In addition to the limitations, the researcher did not perform a factor analysis due to multiple reasons. First, this study involved fewer than 200 subjects, which could result in unstable, low-quality factor analysis solutions. Comrey and Lee (1992) stated that "the adequacy of sample

size might be evaluated very roughly on the following scale: 50 – very poor; 100 – poor; 200 – fair; 300 – good; 500 – very good; 1000 or more – excellent" (Comrey & Lee, 1992). Thus, the larger the sample size is, the higher the quality of factor analysis solutions. Second, Guadagnoli and Velicer (1988) concluded that absolute minimum sample sizes are more relevant than subject to item ratios (Guadagnoli & Velicer, 1988). As a result, factor analysis for this study was not conducted because the research sample (n=114) was considered poor and inadequate for factor analytic purposes (Comrey & Lee, 1992).

This study has unveiled some gaps to be addressed in future studies. Evaluating the patients' experience and satisfaction using the Sehha app is needed for future work. Furthermore, investigating the relationship between patient satisfaction and provider satisfaction "patient-provider relationship" using the Sehha app will improve the app's efficiency and create a better virtual environment for providers and patients. Also, identifying which features of the app are appraised by which medical specialty is needed for future analysis of the Sehha telehealth app so that the owner "MoH" and the developers can become aware of which aspect to improve and which aspect to maintain for the purpose of increasing diversity in medical specialties.

Since the MoH has multiple mHealth apps designed for specific purposes, it is vital to assess the Sehha apps' feasibility of integrating with other apps so that a more centralized, comprehensive app is developed and can be used to conduct more than just a telehealth service. However, since the Sehha app is a digital technology susceptible to cyber-attacks, critical analysis of the app's technical and administrative safeguards is required to ensure that the users' data, including sensitive medical information, are well protected and safe. Finally, data governance and storage were not explicitly examined in this study, and thus future work concerning data governance in the Sehha app should be considered.

Appendix A Letters of Approval

University of Pittsburgh | Institutional Review Board
Office of Research Protections

EXEMPT DETERMINATION

Date:	October 26, 2020
IRB:	STUDY20100022
PI:	Mohanad Alsaleh
Title:	The Use of a Mobile-Based Telehealth Service During the COVID-19 Pandemic: Providers' Experience and Satisfaction Study ID: STUDY20100022
Funding:	None

The Institutional Review Board reviewed and determined the above referenced study meets the regulatory requirements for exempt research under 45 CFR 46.104.

Determination Documentation

Determination Date:	10/26/2020
Exempt Category:	(2)(i) Tests, surveys, interviews, or observation (non-identifiable)

Approved Documents:	• Survey • Intro Scrip • MoH Approval Letter • Study Protocol

If you have any questions, please contact the University of Pittsburgh IRB Coordinator, [redacted]

Please take a moment to complete our Satisfaction Survey as we appreciate your feedback.

Kingdom of Saudi Arabia
Ministry of Health
Central IRB
GDRS

المملكة العربية السعودية
وزارة الصحة
اللجنة المركزية لأخلاقيات البحوث
الإدارة العامة للبحوث والدراسات

اللجنة المركزية لأخلاقيات البحوث بوزارة الصحة

Central Institutional Review Board

National Registration Number with NCBE-KACST, KSA: (H-01-R-009)

Approval Letter

Date: 07/09/2020
Central IRB log No: 20 – 178E
Category of Approval: Exempt
[redacted]

Dear Mohanad Mohammed Alsaleh

The Central IRB-MoH pleased to inform you that your study mentioned below has been reviewed and was approved according to ICH-GCP. Approval was given for **one year** from the date of this letter.

Protocol Title	The Use of a Mobile-Based Telehealth Service During the COVID-19 Pandemic: Providers' Experience and Satisfaction
Documents Reviewed	Study proposal, CV, Request for exempt status, PI statement, signed consent form, signed Data Sharing Agreement, study questionnaire, Ethics certificate

Approval Conditions:

- Abide by the rules and regulations of the Government of Saudi Arabia, NCBE, Central IRB and the IHC-GCP guidelines.
- To conduct research as per the approved documents.
- Research participant confidentiality should be protected at all times.
- All researchers are required to have current and valid certificate on Protecting Human Research Participants (NIH or NCBE certificate).
- Amendment to the approved documents, the Principal Investigator is required to advise the Central IRB for its approval before implementation.
- If PI is unable to complete his research within the validation period, he will be required an extension letter from the Central IRB one month before the expiry of the approval.
- Document Retention: all study documents should be kept by the Principal Investigator for a period of **5 years** from study completion.

e-mail: GDRS-IRB@moh.gov.sa

- This letter gives you an ethical clearance to implement your study according to the approved documents and you still need to obtain administrative approval from the site/s where the study will be conducted.
- **At the end of the study,** please submit Final Report including the results or copy of the manuscript intended for publication to MOH data base: e-review.marifah.gov.sa

We thank you for submitting your study for review by the Central IRB-MoH and wish you all the best with this study.

If you have any further questions, feel free to contact me.

Sincerely Yours,

[redacted]

المملكة العربية السعودية
وزارة الصحة
Ministry of Health
Approved
اللجنة المركزية لأخلاقيات البحوث
Central Institutional Review Board

Appendix B Sample Size Calculation

According to the MoH, it was estimated that about 500 physicians have been utilizing this app to provide various types of telehealth services for patients across the country. Thus, the sample size for this study was calculated as follows:

Sample size (n) = N (pq) / (N-1) D + (pq)

Where:

N= population size (500)

pq= (0.5) (0.5) = 0.25

B = 0.05

D= $B^2/4 = 0.05^2 /4 = 0.000625$

n = (500) (0.5) (0.5) / (499) (0.000625) + 0.25 = 125/ 0.561875

n = 222.46941 = 223

Although the needed sample size for this study was 223 physicians, the MoH sent the questionnaire to a list of clinical staff containing 362 physicians known to be utilizing the Sehha telehealth app.

Appendix C Data Collection Instrument

Provider Experience and Satisfaction with Telehealth (Sehha)

Dear Participant,

Thank you for being an integral part in fighting against the COVID-19 pandemic! It is very imperative to learn about your experience and satisfaction with telehealth during the era of COVID-19.

You are invited to voluntarily take part in a research study entitled "The Use of a Mobile-Based Telehealth Service During the COVID-19 Pandemic: Provider Experience and Satisfaction."

The goals of this research are:

1. To assess the provider experience and satisfaction with the telehealth app "Sehha" during COVID-19 in Saudi Arabia,
2. To examine the challenges faced by the provider using telehealth technologies such as Sehha and,
3. To identify possible opportunities to improve and expand the use of telehealth across Saudi Arabia.

Telehealth is defined as "the use of electronic information and telecommunication technologies to remotely deliver and support health-related services."

Please note that:

- The collected data will be used for research purposes only.
- Data will be recorded anonymously, and no personal nor identifiable data will be linked to survey responses.
- Your participation in this study is voluntary, and you are free to withdraw your participation from this study at any time.
- The survey has 30 items, and we anticipate that it will take about 7 minutes to complete.
- Only the researcher and the research committee who are aware of data confidentiality and privacy will view the results, and all results will be disseminated in aggregate form.
- There are no risks, benefits, and compensation associated with participation.
- This study has been approved by the Ministry of Health Central IRB, Saudi Arabia (20-178E), and the University of Pittsburgh IRB (STUDY20100022).
- By completing and submitting this survey, you are indicating your consent to participate in the study.

If you have any questions regarding the research study, please contact Mr. Mohanad Alsaleh at mma110@pitt.edu or my advisor Dr. Valerie Watzlaf at valgeo@pitt.edu. If you have any questions concerning your rights as a research participant, please contact the University of Pittsburgh Human Subjects Protection Advocate toll-free at 866-212-2668.

This research study will be conducted by Mr. Mohanad Alsaleh with the support of the research committee from the Department of Health Information Management at the University of Pittsburgh. Your response is highly appreciated and will be kept private!

☐ I consent to participate in this study. ☐ I do not consent to participate in this study.

- **Definition of the Sehha App:**

Sehha is a mobile app designed and sponsored by the Saudi Ministry of Health (MoH) to provide health care services remotely via chat, voice, or video calls through the MoH's accredited physicians, plus the feature of artificial intelligence technologies for providing safe medical information and health tips electronically.

- **How often do you use the Sehha app to provide health care services?**

☐ I have never used Sehha

☐ 1-2 times a month

☐ 3-4 times a month

☐ 1-2 times a week

☐ 3-4 times a week

☐ Daily

☐ Other_____

- **Part 1: Participants' Demographics and Characteristics:**

1. Gender:

☐ Male

☐ Female

2. Age:

☐ Between 20-30 years

☐ Between 31-40 years

☐ Between 41-50 years

☐ Between 51-60 years

☐ Older than 60

3. Nationality:

☐ Saudi

☐ Non-Saudi

4. Years of experience:

☐ Less than 10 years

☐ Between 10-20 years

☐ More than 20 years

5. Specialty (select all that apply):

☐ Family Medicine

☐ Emergency Medicine

☐ Internal Medicine

☐ General Surgery

☐ Psychiatry

☐ Oncology

☐ Orthopedics

☐ Dermatology

☐ Other _____

6. Grade/Category (select all that apply):

☐ Consultant

☐ Specialist

☐ Resident

☐ Intern/Medical Student

☐ Other _____

7. Type of communication method you use to provide care via Sehha (select all that apply):

☐ Voice/phone calls

☐ Video Calls

☐ Chat/text messages

☐ Emails

☐ Other _____

8. Type of health care services you provide via Sehha (select all that apply):

☐ Diagnosis

☐ Consultation

☐ Prescription

☐ Other _____

- **Part 2: Perceived Impact of COVID-19 on Provider Perception and Experience:**

9. Because of COVID-19, my use of the Sehha app has increased:

☐ Strongly agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly disagree

10. Because of COVID-19, my experience in telehealth has increased:

☐ Strongly agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly disagree

11. Because of COVID-19, I now have a better understanding of telehealth:

☐ Strongly agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly disagree

12. Because of COVID-19, more telehealth services will be utilized in the future:

☐ Strongly agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly disagree

13. Because of COVID-19, I now prefer telehealth and virtual care over traditional (face-to-face) care:

☐ Strongly agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly disagree

- **Part 3: Perceived Usefulness:**

14. Sehha helps me achieve my patient needs more quickly compared to in-person visits:
☐ Strongly agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly disagree

15. A telehealth technology such as Sehha increases access to care:
☐ Strongly agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly disagree

16. I feel more productive when I use Sehha compared to in-person visits:
☐ Strongly agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly disagree

- **Part 4: Perceived Ease of Use:**

17. I feel comfortable interacting with my patient using Sehha:
☐ Strongly agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly disagree

18. I can easily access my patient's medical record while providing care via Sehha:

☐ Strongly agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly disagree

19. It is easy to use the Sehha app:

☐ Strongly agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly disagree

- **Part 5: Perceived Effectiveness:**

20. I believe the quality of care provided via Sehha is as good as in-person care:

☐ Strongly agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly disagree

21. I am confident that my patient data are kept private and confidential when using Sehha:

☐ Strongly agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly disagree

22. I find the Sehha app an acceptable way to provide healthcare services:

☐ Strongly agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly disagree

- **Part 6: Satisfaction and Future Use:**

23. I would use telehealth technologies such as Sehha to provide care in the future:

☐ Strongly agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly disagree

24. My patient seems satisfied with the care I provide via Sehha:

☐ Strongly agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly disagree

25. Overall, I am satisfied with the work I have done through Sehha:

☐ Strongly agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly disagree

- **Part 7: Perceived Challenges and Concerns:**

26. The **concerns** and **challenges** I face when I use Sehha include: (select all that apply):

☐ Difficult to use technology and technical devices

☐ Difficult to provide accurate medical assessments

☐ Data privacy and security

☐ Overlapping of consultations

☐ Lack of clear regulations and rules for telehealth services

☐ Lack of management support

☐ Lack of technical training

☐ Other _____

- **Part 8: Areas of Improvement:**

27. The areas of the Sehha app that I would like to **improve** include: (select all that apply):

☐ Integration and connection with other electronic systems (e.g., electronic health records)

☐ Involvement of medical specialists (e.g., psychiatrist, dermatologist, oncologists)

☐ Continuity of care; involvement of the patient and all members of the health care team

☐ Technical aspects of the app (e.g., quality of video/voice)

☐ Access to patient data

☐ Other_____

28. What areas of the Sehha app do you **like** the most?

_____
_____

29. What areas of the Sehha app do you **dislike** the most?

_____
_____

30. If you have any other comments, please write them below:

_____
_____

Thank you for your answers. We really appreciate your time!

Appendix D List of Abbreviations

Abbreviation	Full Name
AI	Artificial Intelligence
eHealth	Electronic Health
HIPAA	Health Insurance Portability and Accountability Act
COVID-19	Coronavirus Disease
MERS-CoV	The Middle East Respiratory Syndrome Coronavirus
KSA	Kingdom of Saudi Arabia
MoH	Ministry of Health
SDAIA	Saudi Data and Artificial Intelligence Authority
STC	Saudi Telecom Company
WHO	World Health Organization
HIE	Health Information Exchange
SeHE	the Saudi eHealth Exchange
CMS	Centers for Medicare & Medicaid Services
KAMC	King Abdullah Medical City
STN	Saudi Telehealth Network
NHIC	National Health Information Center
SHC	Saudi Health Council
ISfTeH	International Society for Telemedicine & eHealth
TAM	Technology Acceptance Model
TUQ	Telehealth Usability Questionnaire
TSUQ	Telemedicine Satisfaction and Usefulness Questionnaire

References

Alumran, A. (2020). Role of precautionary measures in containing the natural course of novel coronavirus disease. Journal of Multidisciplinary Healthcare, 13, 615.

Algaissi, A. A., Alharbi, N. K., Hassanain, M., & Hashem, A. M. (2020). Preparedness and Response to COVID-19 in Saudi Arabia: Building on MERS Experience. Journal of Infection and Public Health.

Alaboudi, A., Atkins, A., Sharp, B., Balkhair, A., Alzahrani, M., & Sunbul, T. (2016). Barriers and challenges in adopting Saudi telemedicine network: The perceptions of decision makers of healthcare facilities in Saudi Arabia. Journal of infection and public health, 9(6), 725-733.

Alghamdi, S. M., Alqahtani, J. S., & Aldhahir, A. M. (2020). Current status of telehealth in Saudi Arabia during covid-19. Journal of Family and Community Medicine, 27(3), 208.

Ali, Z., & Bhaskar, S. B. (2016). Basic statistical tools in research and data analysis. Indian journal of anaesthesia, 60(9), 662.

ATA. (2020). Telehealth: Defining 21st Century Care. American Telemedicine Association. Retrieved from: https://www.americantelemed.org/resource/why-telemedicine/. Accessed November 1, 2020

Alaboudi, A., Atkins, A., Sharp, B., Alzahrani, M., Balkhair, A., & Sunbul, T. (2016, November). Perceptions and attitudes of clinical staff towards telemedicine acceptance in Saudi Arabia. In 2016 IEEE/ACS 13th International Conference of Computer Systems and Applications (AICCSA) (pp. 1-8). IEEE.

Alsyouf, A. (2020). Mobile Health for covid-19 Pandemic Surveillance in Developing Countries: the case of Saudi Arabia. Solid State Technology, 63(6), 2474-2485.

Al-Sofiani, M. E., Alyusuf, E. Y., Alharthi, S., Alguwaihes, A. M., Al-Khalifah, R., & Alfadda, A. (2020). Rapid implementation of a diabetes telemedicine clinic during the coronavirus disease 2019 outbreak: Our protocol, experience, and satisfaction reports in Saudi Arabia. Journal of diabetes science and technology, 1932296820947094.

Al-rayes, S. A., Aldossary, H., Aldoukhi, E., Alahmedalyousif, Z., Aldawood, G., & Alumran, A. (2020). The awareness and utilization of 937-telephone health services in Saudi Arabia: Cross-sectional survey study. Informatics in Medicine Unlocked, 20, 100393.

Althbiti, A. A. J., Al Khatib, F. M., & Al-Ghalayini, N. A. (2017). Telemedicine: Between Reality and Challenges in Jeddah Hospitals. The Egyptian Journal of Hospital Medicine, 68(3), 1381-1389.

Ayatollahi, H., Sarabi, F. Z. P., & Langarizadeh, M. (2015). Clinicians' knowledge and perception of telemedicine technology. Perspectives in health information management, 12(Fall).

Arab News. (2020). STC launches SR100m health care initiative. Arab News. Retrieved from: https://www.arabnews.com/node/1653311/corporate-news. Accessed December 1, 2020

Aiken, L. (2002). Attitudes and related psychosocial constructs: Theories, assessment, and research. Sage.

Alshammari, F. (2019). Perceptions, Preferences and Experiences of Telemedicine among Users of Information and Communication Technology in Saudi Arabia. Journal of Health Informatics in Developing Countries, 13(1).

Ancker, J. S., Miller, M. C., Patel, V., Kaushal, R., & with the HITEC Investigators. (2014). Sociotechnical challenges to developing technologies for patient access to health information exchange data. Journal of the American Medical Informatics Association, 21(4), 664-670.

Baert, S., Lippens, L., Moens, E., Weytjens, J., & Sterkens, P. (2020). The COVID-19 crisis and telework: A research survey on experiences, expectations and hopes.

Becevic, M., Boren, S., Mutrux, R., Shah, Z., & Banerjee, S. (2015). User satisfaction with telehealth: study of patients, providers, and coordinators. The health care manager, 34(4), 337-349.

Bakken, S., Grullon-Figueroa, L., Izquierdo, R., Lee, N. J., Morin, P., Palmas, W., ... & Starren, J. (2006). Development, validation, and use of English and Spanish versions of the telemedicine satisfaction and usefulness questionnaire. Journal of the American Medical Informatics Association, 13(6), 660-667.

Blandford, A., Wesson, J., Amalberti, R., AlHazme, R., & Allwihan, R. (2020). Opportunities and challenges for telehealth within, and beyond, a pandemic. The Lancet Global Health, 8(11), e1364-e1365.

Bradford, N. K., Caffery, L. J., & Smith, A. C. (2015). Awareness, experiences and perceptions of telehealth in a rural Queensland community. BMC health services research, 15(1), 427.Bashshur, R., & Shannon, G. W. (2009). History of telemedicine: evolution, context, and transformation. New Rochelle, NY: Mary Ann Liebert.

Comrey, A. L., & Lee, H. B. (1992). A First Course in Factor Analysis. Hillsdale, NJ: Lawrence Eribaum Associates.

CDC. (2020). Frequently Asked Questions. Centers for Disease and Prevention. Retrieved from: https://www.cdc.gov/coronavirus/2019-ncov/faq.html. Accessed November 26. 2020

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS quarterly, 319-340.

Demiris, G., Edison, K., & Schopp, L. H. (2004). Shaping the future: Needs and expectations of telehealth professionals. Telemedicine Journal & e-Health, 10(Supplement 2), S-60.

El-Mahalli, A. A., El-Khafif, S. H., & Al-Qahtani, M. F. (2012). Successes and challenges in the implementation and application of telemedicine in the eastern province of Saudi Arabia. Perspectives in health information management/AHIMA, American Health Information Management Association, 9(Fall).

Guadagnoli, E., & Velicer, W. F. (1988). Relation of sample size to the stability of component patterns. Psychological bulletin, 103(2), 265.

George, D., & Mallery, P. (2019). IBM SPSS statistics 26 step by step: A simple guide and reference. Routledge.

Glaser, M., Winchell, T., Plant, P., Wilbright, W., Kaiser, M., Butler, M. K., ... & Magnus, M. (2010). Provider satisfaction and patient outcomes associated with a statewide prison telemedicine program in Louisiana. Telemedicine and e-Health, 16(4), 472-479.

General Authority for Statistics. (2020). Population Stats. General Authority for Statistics, Saudi Arabia. Retrieved from: https://www.stats.gov.sa/en. Accessed November 10, 2020

HHS. (2020). Telehealth: Delivering Care Safely During COVID-19. HSS.gov. Retrieved from: https://www.hhs.gov/coronavirus/telehealth/index.html. Accessed December 1, 2020

Hassounah, M., Raheel, H., & Alhefzi, M. (2020). Digital Response During the COVID-19 Pandemic in Saudi Arabia. Journal of Medical Internet Research, 22(9), e19338.

HMG. (2020). Dr. Sulaiman Al-Habib Medical Group. Retrieved from: https://hmg.com/en/Pages/EServices.aspx. Accessed December 3, 2020

ISfTeH. (2020). Member directory - Saudi Arabia. International Society for Telemedicine & eHealth. Retrieved from: https://www.isfteh.org/members/directory/country/Saudi%20Arabia. Accessed November 29, 2020

Jnr, B. A. (2020). Use of telemedicine and virtual care for remote treatment in response to COVID-19 pandemic. Journal of Medical Systems, 44(7), 1-9.

Jefee-Bahloul, H. (2014). Telemental health in the Middle East: overcoming the barriers. Frontiers in public health, 2, 86.

Jin, Z., & Chen, Y. (2015). Telemedicine in the cloud era: Prospects and challenges. IEEE Pervasive Computing, 14(1), 54-61.

Khemapech, I., Sansrimahachai, W., & Toachoodee, M. (2019). Telemedicine–Meaning, Challenges and Opportunities. Siriraj Medical Journal, 71(3), 246-252.

Khairat, S., Meng, C., Xu, Y., Edson, B., & Gianforcaro, R. (2020). Interpreting COVID-19 and virtual care trends: cohort study. JMIR Public Health and Surveillance, 6(2), e18811.

Lee, I., Kovarik, C., Tejasvi, T., Pizarro, M., & Lipoff, J. B. (2020). Telehealth: helping your patients and practice survive and thrive during the COVID-19 crisis with rapid quality implementation. Journal of the American Academy of Dermatology, 82(5), 1213-1214.

Lin, C. C., Dievler, A., Robbins, C., Sripipatana, A., Quinn, M., & Nair, S. (2020) Telehealth In Health Centers: Key Adoption Factors, Barriers, And Opportunities. HealthAffairs. Retrieved from: https://www.healthaffairs.org/doi/abs/10.1377/hlthaff.2018.05125. Accessed November 23, 2020

Leon AC, Davis LL, Kraemer HC. J Psychiatry Res. 2011 May; 45(5):626-9. doi: 10.1016/j.jpsychires. Epub 2010 Oct 28.The role and interpretation of pilot studies in clinical research

McCall, M. K., Skutsch, M. M., & Honey-Roses, J. Surveillance in the COVID-19 Normal: Tracking, Tracing, and Snooping–Trade-Offs in Safety and Autonomy in the E-City. International Journal of E-Planning Research (IJEPR), 10(2), 27-44.

MoH. (2018). MoH: All the Kingdom Will be Covered by Telemedicine in Two Months. Ministry of Health. Retrieved from: https://www.moh.gov.sa/en/Ministry/MediaCenter/News/Pages/news-2018-03-06-006.aspx. Accessed November 25, 2020

MoH. (2020). Makkah: 12,000 Beneficiaries of Virtual Clinics at King Abdullah Medical City. Ministry of Health. Retrieved from https://www.moh.gov.sa/en/Ministry/MediaCenter/News/Pages/News-2020-04-05-004.aspx. Accessed July 8, 2020

MoH. (2020). Saudi Ministry of Health. Retrieved from: https://www.moh.gov.sa/en/Pages/default.aspx. Accessed July 8. 2020

Mbunge, E. (2020). Integrating emerging technologies into COVID-19 contact tracing: Opportunities, challenges and pitfalls. Diabetes & Metabolic Syndrome: Clinical Research & Reviews, 14(6), 1631-1636.

MoH. (2020). MOH Apps for Smartphones. Saudi Ministry of Health. Retrieved from: https://www.moh.gov.sa/en/Support/Pages/MobileApp.aspx. Accessed November 28, 2020

MoH. (2020). Expanded Testing. Saudi Ministry of Health. Retrieved from: https://www.moh.gov.sa/en/HealthAwareness/EducationalContent/PublicHealth/Pages/Expanded_Testing.aspx. Accessed December 1, 2020

MoH. (2020). COVID 19 Dashboard: Saudi Arabia. Saudi Ministry of Health. Retrieved from: https://covid19.moh.gov.sa/. Accessed December 31, 2020

MoH. (2020). MoH Portal: 937. Saudi Ministry of Health. Retrieved from: https://www.moh.gov.sa/en/937/Pages/default.aspx. Accessed December 1, 2020

MoH. (2020). MOH Apps for Smartphones. Saudi Ministry of Health. Retrieved from: https://www.moh.gov.sa/en/Support/Pages/MobileApp.aspx. Accessed December 7, 2020

MoH. (2018). MoH: All the Kingdom Will be Covered by Telemedicine in Two Months. Ministry of Health. Retrieved from: https://www.moh.gov.sa/en/Ministry/MediaCenter/News/Pages/news-2018-03-06-006.aspx. Accessed November 25, 2020

NHIC. (2018). Saudi Telehealth Network. National Health Information Center. Retrieved from https://nhic.gov.sa/en/Initiatives/Pages/communicationmedicine.aspx. Accessed November 29, 2020

Parmanto, B., Lewis Jr, A. N., Graham, K. M., & Bertolet, M. H. (2016). Development of the telehealth usability questionnaire (TUQ). International journal of telerehabilitation, 8(1), 3.

Qualtrics. (2020). Qualtrics for Higher Education. Qualtrics. Retrieved from: https://www.qualtrics.com/education/higher-education/

Sampat, B. H., & Prabhakar, B. (2017). Privacy risks and security threats in mHealth apps. Journal of International Technology and Information Management, 26(4), 126-153.

Statista. (2020). Smartphone users worldwide 2016-2021. Statista. Retrieved from: https://www.statista.com/statistics/330695/number-of-smartphone-users-worldwide/. Accessed November 15, 2020

SDAIA. (2020). Tabaud App. Saudi Data and Al Authority. Retrieved from: https://tabaud.sdaia.gov.sa/IndexEn. Accessed December 1, 2020

SDAIA. (2020). Tawakkalna App. Saudi Data and AI Authority. Retrieved from: https://ta.sdaia.gov.sa/en/index. Accessed December 1, 2020

Sehhaty App. (2020) App Store Preview. Retrieved from: https://apps.apple.com/sa/app/%D8%B5%D8%AD%D8%AA%D9%8A-sehhaty/id1459266578. Accessed December 1, 2020

Schwamm, L. H. (2014). Telehealth: seven strategies to successfully implement disruptive technology and transform health care. Health Affairs, 33(2), 200-206.

Smith, A. C., Thomas, E., Snoswell, C. L., Haydon, H., Mehrotra, A., Clemensen, J., & Caffery, L. J. (2020). Telehealth for global emergencies: Implications for coronavirus disease 2019 (COVID-19). Journal of telemedicine and telecare, 1357633X20916567.

Sharp, C. (2008). Designing and Constructing Instruments for Social Research and Evaluation [Book Review]. Evaluation Journal of Australasia, 8(2), 58.

Tudiver, F., Wolff, L. T., Morin, P. C., Teresi, J., Palmas, W., Starren, J., ... & Weinstock, R. S. (2007). Primary care providers' perceptions of home diabetes telemedicine care in the IDEATel project. The Journal of Rural Health, 23(1), 55-61.

United Nations. (2020). Countries step up innovation efforts, using over 500 digital apps to fight COVID-19. Department of Economic and Social Affairs. Retrieved from: https://www.un.org/development/desa/en/news/administration/countries-step-up-innovation-efforts-using-over-500-digital-apps-to-fight-covid-19.html. Accessed December 5, 2020

UNDP. (2020). Saudi Arabia's Ruthless Fight Against Coronavirus. Ministry of Media, Saudi Arabia. Retrieved from: https://www.sa.undp.org/content/saudi_arabia/en/home/library/saudi-arabia-s-ruthless-fight-against-coronavirus.html. Accessed November 21. 2020

van Kuppenveld, S. I., van Os-Medendorp, H., Tiemessen, N. A., & van Delden, J. J. (2020). Real-Time Access to Electronic Health Record via a Patient Portal in a Tertiary Hospital: Is it Harmful? A Retrospective Mixed Methods Observational Study. Journal of Medical Internet Research, 22(2), e13622.

Vision 2030. (2020). National Transformation Program 2018-2020. Vision2030.gov.sa. Retrieved from: https://vision2030.gov.sa/sites/default/files/attachments/NTP%20English%20Public%20Document_2810.pdf. Accessed July 8, 2020

Vidal-Alaball, J., Acosta-Roja, R., Hernández, N. P., Luque, U. S., Morrison, D., Pérez, S. N., ... & Vèrges, A. S. (2020). Telemedicine in the face of the COVID-19 pandemic. Atencion primaria, 52(6), 418.

Wosik, J., Fudim, M., Cameron, B., Gellad, Z. F., Cho, A., Phinney, D., ... & Katz, J. N. (2020). Telehealth Transformation: COVID-19 and the rise of Virtual Care. Journal of the American Medical Informatics Association, 27(6), 957-962.

Whitelaw, S., Mamas, M. A., Topol, E., & Van Spall, H. G. (2020). Applications of digital technology in COVID-19 pandemic planning and response. The Lancet Digital Health.

WHO. (2020) Saudi Arabia Dashboard. World Health Organization. Retrieved from: https://covid19.who.int/region/emro/country/sa. Accessed December 31, 2020

WHO. (2020). Timeline of WHO's response to COVID-19. World Health Organization. Retrieved from: https://www.who.int/news/item/29-06-2020-covidtimeline. Accessed December 1, 2020

WHO. (2020). WHO Coronavirus Disease (COVID-19) Dashboard. World Health Organization. Retrieved from: https://covid19.who.int/. Accessed December 31, 2020

Wakefield, D. S., Kienzle, M. G., ZOLLO, S. A., Kash, J. B., & Uden-Holman, T. (1997). Health care providers' perceptions of telemedicine services. TELEMEDICINE journal, 3(1), 59-65.

Whitelaw, S., Mamas, M. A., Topol, E., & Van Spall, H. G. (2020). Applications of digital technology in COVID-19 pandemic planning and response. The Lancet Digital Health.

Young, T. L., & Ireson, C. (2003). Effectiveness of school-based telehealth care in urban and rural elementary schools. Pediatrics, 112(5), 1088-1094.

Zhou, L., Thieret, R., Watzlaf, V., DeAlmeida, D., & Parmanto, B. (2019). A Telehealth Privacy and Security Self-Assessment Questionnaire for Telehealth Providers: Development and Validation. International journal of telerehabilitation, 11(1), 3.

ZAWYA. (2020). Dr. Sulaiman Al Habib Medical Group launches all its services in one mobile application. ZAWYA. Retrieved from: https://www.zawya.com/mena/en/press-releases/story/Dr_Sulaiman_Al_Habib_Medical_Group_launches_all_its_services_in_one_mobile_application-ZAWYA20200129125230/. Accessed December 1, 2020