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## Saudi Arabia's Adoption of Ehealth and Mhealth from the Perspective of Healthcare Professionals

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### Abstract

*Background: The landscape of healthcare needs globally. In this case, maintaining care aspects such as follow-ups would be difficult. This limitation would have a significant impact on the care process, as some patients may be unable to effectively consult with the practitioner. The purpose of this study is to examine healthcare practitioners' perceptions on Mobile health (mHealth) and electronic health (eHealth) and their utilization in Saudi Arabia. Methods: This research follows a systematic review of articles (n=59) examining the perception of medical practitioners on mHealth and eHealth applications to deliver care and others examining their use in Saudi Arabia. Articles were searched in credible medical databases such as PubMed, Embase, and Google Scholar. These databases were selected randomly due to their relevance in having studies related to the issues being examined in this research. Boolean operators were also used with keywords such as mHealth, eHealth, and practitioner perception. Results: eHealth and mHealth applications have significantly improved care delivery, with the majority of study participants expressing a high level of satisfaction with their use. Healthcare practitioners' perceptions of mHealth and eHealth had significant similarities regarding the efficiency and applicability of the tools to deliver care. Conclusion: According to the findings of this study, mHealth and eHealth applications are generally accepted by healthcare practitioners if certain challenges are effectively addressed. Healthcare practitioners' perceptions viewed these technologies as useful in managing various care needs, which were critical in improving care quality without the need for human contact.*

**Keywords:** eHealth, mHealth, practitioners' perspective, efficiency, applicability

### Introduction

The landscape of healthcare needs demands a new approach to care provided to ensure an improvement in Saudi Arabia's public health and globally. Saudi Arabia is the most populous country in the Arabian Peninsula. It has a well-established health-care system that is available to all people for free. There are 494 hospitals in the health-care system, with 22.5 beds per 10,000 persons. The country had 113 000 physicians in 2019 (KSA, national report 2020). Trends in the COVID-19 pandemic ranged significantly across the World Health Organization (WHO), Eastern Mediterranean Region in terms of virus transmission, number of COVID-19 cases, deaths, and hospitalizations (Al-Mandhari et al., 2020; Hamburg Statista, 2019). These disparities could be attributed to measure the public health sector's preparedness, such as early preventative actions, prohibitions on

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mass gathering events, restricted international immigration, and the proportion of the population with risk factors (older individuals and those with comorbidities).

mHealth is a phrase used to describe mobile applications and programs that are intended to deliver information to both patients and their care team. These programs can track prescription adherence, the patient's heart rate, and fitness levels, among other things. Fitbit, Google Fit, Samsung Health, and Apple Heart Study are a few examples (DeNicola, & Marko, 2020). They are designed to provide health care via electronic methods. These technologies lay the groundwork for internet access to health records, patient files, test results, and general administration needs ((DeNicola, & Marko, 2020).

The recent encounter with the COVID-19 pandemic led to the establishment of social contact restrictions creating more difficulties for patients to access health services (Aldekhyyel et al., 2021). In the eventuality of this case, it would not be easy to sustain care aspects such as patient follow-ups. This limitation would significantly affect the care process, where some patients may not consult with the practitioner effectively. With the possibility of more of such situations limiting contact medical care, mHealth and eHealth services have become increasingly important. mHealth and eHealth offer solutions to some care need requiring contact with the healthcare practitioner (DeNicola & Marko, 2020; Van den, et al., 2018). In this case, some of the innovations in these approaches provide contactless communication, effectively achieving similar outcomes as contact communication.

Researchers have cited eHealth as an innovative solution to challenges affecting face-to-face care delivery that sequentially increased the quality of care (Al-Kahtani et al., 2022). On the other hand, Elfaki and Alotaibi (2018) suggest that mHealth provides opportunities for countries globally to effectively provide care services through symptom assessments, psychoeducation, and tracking of treatment progress with cost-effective and accessible means. This means that mHealth and eHealth can provide sufficient support for developing positive healthcare management approaches. Despite the usefulness of these innovative solutions to healthcare challenges affecting different individuals globally, it is important to understand the subsequent perceptions of healthcare providers on their use and effectiveness from their perspectives as the care providers (Van den, et al., 2018). Healthcare practitioners are a key group in the success of utilization of mHealth and eHealth technologies as they facilitate the necessary services being delivered to patients. Therefore, their perceptions towards the effectiveness of these innovative solutions to most problems associated with the delivery of healthcare is important. Following the focus of this research on Saudi Arabia, it is also necessary to investigate on the applications of mHealth and eHealth services in the country to understand its importance in improving the overall healthcare of the population. understand their benefits in improving healthcare service delivery.

Despite existing studies comprehensively targeting the adoption of mHealth and eHealth in improving healthcare delivery, there are significant gaps in research (Aldekhyyel et al., 2021; DeNicola, & Marko, 2020; Van den, et al., 2018). While the effectiveness of mHealth and eHealth has been shown to improve healthcare delivery in most of the literature, there is limited analysis of physicians' perspectives regarding their use and effectiveness in care delivery. In this case, the literature only examines the opportunities and challenges associated with these technologies with a limited examination of how physicians perceive them. In addition, there is

a limited examination of these technologies in Saudi Arabia, thus limiting evidence-based practice following these innovations. In this case, most studies that examine the use of mHealth and eHealth applications only focus on their benefits in improving healthcare and the challenges associated with their uptake. As there is a limited examination of practitioner perspectives, there is also a lack of literature examining how the technologies are useful in Saudi Arabia's healthcare system.

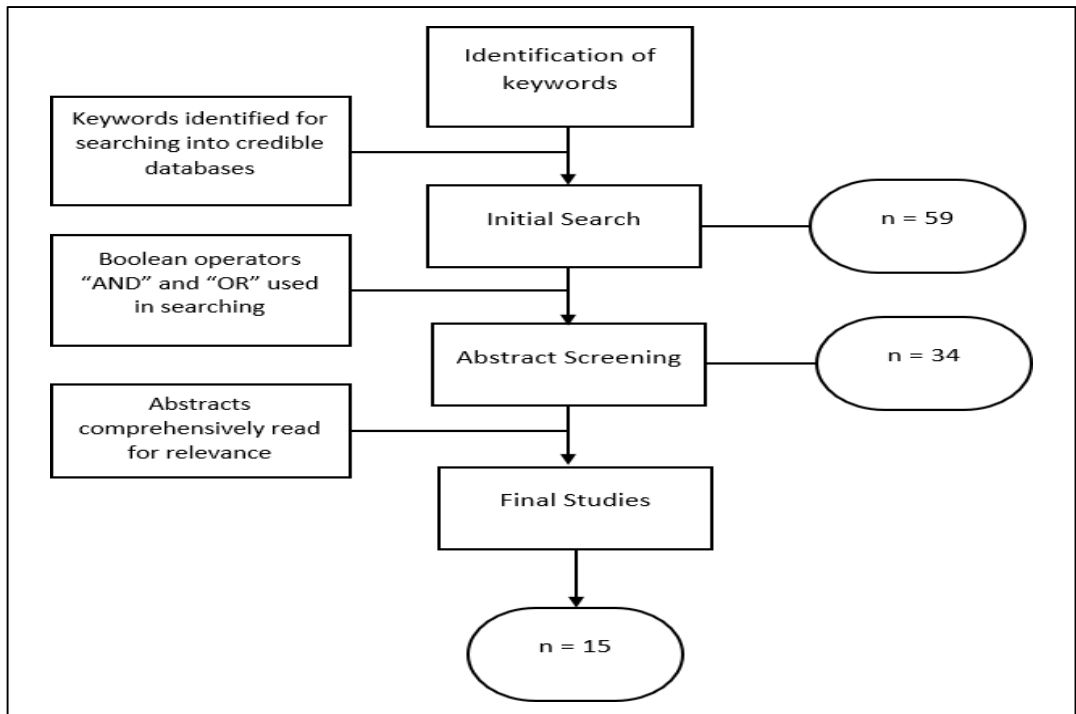
Saudi Arabia has been at the forefront of establishing contactless medical care services with the recent roll-out of Ministry of Health (MOH) for improving accessibility to the healthcare services (Al-Kahtani et al., 2022). During the pandemic, such interventions were seen as the alternative to provide quality care within the existing health measures. With mHealth and eHealth utilization, different global benefits were observed, which can be used to improve the overall quality of care (Olaniyan, et al., 2021).

Different challenges have hindered the effectiveness of healthcare delivery in the country. One of these challenges include the human contact limitation with the pandemic. As mHealth and eHealth applications introduce non-contact medical services delivery, this paper aims to examine the use of these technologies (mHealth and eHealth) in Saudi Arabia to effectively examine these technologies and their utilization in Saudi Arabia. In this way, the effectiveness of these services will be established, creating the foundation for their use in different capacities in order to provide improved care services.

## Methods

This study follows a systematic review of 59 articles (n=59) examining medical practitioners' perceptions of mHealth and eHealth applications for care delivery, as well as others examining their use in Saudi Arabia. Articles were found by searching credible medical databases like PubMed, Embase, Cinhal, and Google Scholar plus the ministry of health in Saudi Arabia database. These databases were chosen at random according to availability of data to authors, because they contained studies relevant to the issues being investigated in this study. With keywords like mhealth, eHealth, and practitioner perception, Boolean operators were used. The data were searched from September to December 2022. These operators, which include "AND" and "OR," were used in conjunction with the above-mentioned keywords to find relevant articles. Articles were thoroughly reviewed to identify those that specifically addressed the objectives of this study. Articles published in English as the primary language and those with at least one of the keywords in the abstract and keywords met the inclusion criteria for this review. Some (n = 34) of the identified articles (n = 59) were chosen for the abstract analysis phase, in which the abstract was thoroughly read to determine whether the papers addressed the specific needs of this study. From this list, 15 studies were chosen as the primary data sources for this study. To make it easier to identify different applications in healthcare, these articles were codified to separate those that address mHealth and eHealth technologies. Figure 1 summarizes the process of identifying and filtering studies to find those that are more appropriate for this research.

Figure 1 Below Summarizes Identifying and Filtering of the Studies to Obtain Those Considered More Suitable for This Research.



**Figure 1:** Search Process.

## Results and Discussion

The most significant advantage of eHealth in providing care, according to the literature, was the accessibility of the healthcare service. Among the key benefits of eHealth applications, according to general practitioners interviewed by Brandt et al., (2018), is improved patient follow-up. According to the practitioners, eHealth was primarily viewed as a tool to improve communication between the practitioner and the patient by other researchers. This includes the use of tele-audiology, as investigated by Elbeltagy et al., (2022), consultative communication, as investigated by Aldekhyyel et al., (2021), and psychological support via online communication and virtual multidisciplinary care, as investigated by Banaser and Alshammary (2021).

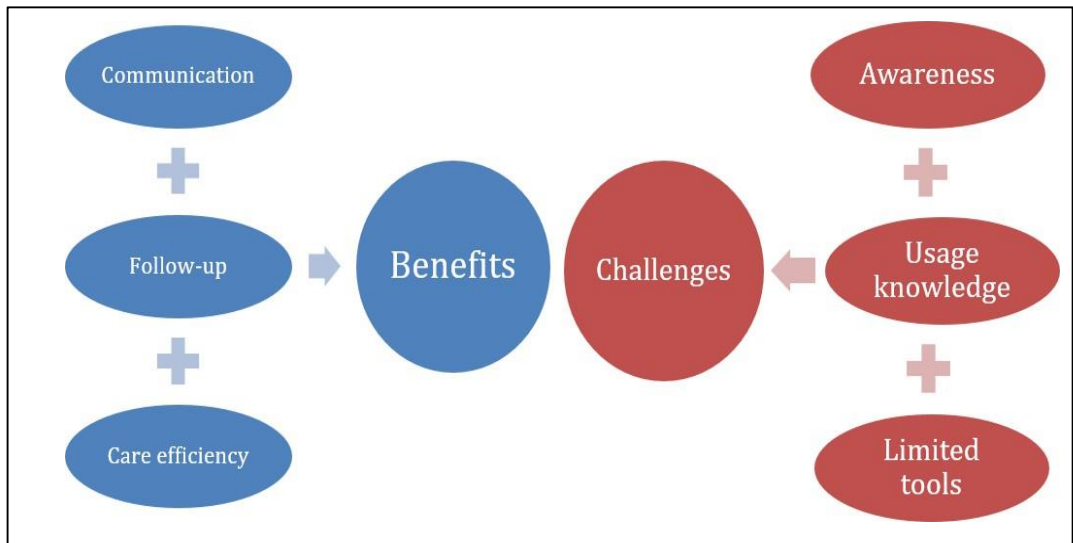
Similar benefits have been observed in the use of mHealth in the delivery of care. Khusial et al. (2022) discovered that mHealth was a useful tool for improving patients' ability to self-manage their care process in their study. Other researchers investigated different domains of practitioners' perspectives on the use of mHealth and discovered varying benefits to healthcare provision. For example, Alwashmi et al. (2019) present reduced healthcare system costs and ease of use, and Chong et al. (2019) present improved communication between patient and practitioner (2019). Other studies discovered significant levels of satisfaction with various mHealth and eHealth technologies in terms of improving care through efficiency (Bitar & Alismail, 2021; Sharbini et al., 2022). Despite the benefits of mHealth and eHealth in healthcare delivery, different researchers find that challenges limit their widespread adoption. While Leppla et al. (2020) discover that some practitioners perceive eHealth as a replacement for human contact and advise against this viewpoint, Aboalshamat (2022) discovers that eHealth applications, particularly the use of AI in dentistry, remain underutilized due to a lack of

awareness. The awareness and sufficiency of information available in mHealth applications to provide nutritional support to pregnant women was also discovered to be limited (Wit et al., 2021). Various mHealth and eHealth applications have been implemented, and others are being recommended for use in Saudi Arabia to improve the quality and efficiency of care. While Aljabri et al. (2021) look at tele-rehabilitation to provide physiotherapy in Saudi Arabia as a key application of eHealth, Alghamdi et al. (2018) look at the Dijkstra as a potential to improve ambulatory services by making them more efficient. Other researchers discover that telemedicine is commonly used in Saudi Arabia to provide communication, follow-up, training, caregiver support, medication, and consultation to patients (Bitar & Alismail, 2021; Elfaki & Alotaibi, 2018). Artificial intelligence is another eHealth application that researchers have studied, with its efficiency predicted in Saudi dental care services (Aboalshamat, 2022). As the COVID-19 pandemic posed significant challenges in healthcare delivery, eHealth and mHealth services provided critical healthcare support. In Aldekhyyel et al. (2021), three mobile applications that delivered care during the pandemic, Dr.Sulaiman Alhabib, Seha, and Cura, were used, thus improving the care provided in the country. Other researchers have investigated telehealth and its use in providing psychological support for cancer patients in Saudi Arabia during the pandemic, indicating its utility in patient follow-up and management without physical contact (Banaser & Alshammary, 2021). As a key mHealth application, researchers discovered that virtual follow-ups were associated with improved care during the COVID-19 pandemic in Saudi Arabia. Sharbini et al. (2022) discover in this case that developing a smartphone app to track children with type 1 diabetes during the pandemic resulted in significant improvements in the patients' healthcare conditions and high satisfaction among practitioners and patients. These findings highlight a key application of mHealth and eHealth in the delivery of care in Saudi Arabia, thereby improving the general healthcare status of the public by improving care delivery efficiency. Some of the key applications of mHealth and eHealth in Saudi Arabia are summarized in table 1 below.

**Table 1:** Mhealth and Ehealth Applications in Saudi Arabia.

<b>mHealth</b>		<b>eHealth</b>	
Study	Application	Study	Application
(Sharbini et al., 2022)	Smartphone Application for follow-up for children with type 1 diabetes	(Alghamdi et al., 2018)	Dijkstra algorithm for ambulatory service efficiency
(Elfaki & Alotaibi, 2018)	Mhealth solutions for Alzheimer's disease	(Aljabri et al., 2021)	Telerehabilitation for physiotherapy
(Khusial et al., 2022)	Mhealth for asthma self-management	(Aboalshamat, 2022)	Artificial intelligence for dentistry
(Aldekhyyel et al., 2021)	Dr.Sulaiman Alhabib, Cura, and Seha mobile applications	(Banaser & Alshammary, 2021)	Cancer care hotline

These applications have resulted in significant improvements in the delivery of care, with the majority of study participants expressing a high level of satisfaction with their use. Despite the fact that different uses of mHealth and eHealth technologies in Saudi Arabia are useful in the provision of care, healthcare practitioners' perceptions of their use vary, with the majority supporting the technologies. Most healthcare practitioners agreed that mHealth and eHealth have provided significant opportunities to improve global access to healthcare services.



**Figure 2:** Perceptions of Ehealth and Mhealth.

mHealth and eHealth have provided significant opportunities to enhance the accessibility of healthcare services globally, as most healthcare practitioners agreed. From the pool of literature, the most significant advantage of eHealth in providing care was the accessibility of the healthcare service. According to general practitioners included in Brandt et al. (2018), improving patient follow-up is among the key benefits of eHealth applications. In other researchers, eHealth was primarily seen as a tool to improve communication between the practitioner and the patient, as the practitioners reported. This includes the use of tele-audiology as examined by Elbeltagy et al. (2022), consultative communication by Aldekhyyel et al. (2021), and psychological support through online communication and virtual multidisciplinary care examined by Banaser and Alshammary (2021). Similar advantages were also observed regarding the applications of mHealth in the provision of care. In their study, Khusial et al. (2022) found that mHealth was a useful tool to improve the capacity of patients to self-manage their care process. Other researchers examined different domains of practitioners' opinions regarding the use of mHealth and found varied benefits to healthcare provision. For instance, the reduced cost of the healthcare system and ease of use, as presented by Alwashmi et al. (2019), and improving communication between the patient and practitioner by Chong et al. (2019). Other studies found significant satisfaction levels with different mHealth and eHealth technologies in improving care through efficiency (Bitar & Alismail, 2021; Sharbini et al., 2022). Despite these benefits associated with mHealth and eHealth in care delivery, different researchers find that challenges limit their comprehensive utilization. While Leppla et al. (2020) find that some practitioners would perceive eHealth as a replacement for human contact and recommend against this perspective, Aboalshamat (2022) finds that eHealth applications, in particular, the use of AI in dentistry remains low due to low levels of awareness. Awareness and sufficiency of information available in mHealth applications to provide nutritional support to pregnant women was also found to be limited in mHealth applications (Wit et al., 2021).

Various applications of mHealth and eHealth technologies have been implemented, while others are recommended for use in Saudi Arabia to improve the quality and efficiency of care. While Aljabri et al. (2021) examine the use of tele-rehabilitation to provide physiotherapy in



Saudi Arabia as a key application of eHealth, Alghamdi et al. (2018) examine the use of the Dijkstra as a potential to improve ambulatory services by making it more efficient. Other researchers find that eHealth is generally used in Saudi Arabia through telemedicine to provide communication, follow-up, training, caregiver support, medication, and consultation to patients (Bitar & Alismail, 2021; Elfaki & Alotaibi, 2018). Artificial intelligence is another application of eHealth that researchers have examined with its efficiency predicted in dental care services in Saudi Arabia (Aboalshamat, 2022). As the COVID-19 pandemic had significant challenges in delivering healthcare, eHealth and mHealth services provided significant healthcare support. In Aldekhyyel et al. (2021), three mobile applications that delivered care during the pandemic, Dr. Sulaiman Alhabib, Seha, and Cura, were used, thus improving the care provided in the country. Other researchers have examined tele-health and its use in providing psychological support for cancer patients during the pandemic in Saudi Arabia, indicating its usefulness in patient follow-up and management without physical contact (Banaser & Alshammari, 2021). Researchers also found that virtual follow-ups were associated with improved care during the COVID-19 pandemic in Saudi Arabia as a key mHealth application. In this case, Sharbini et al., (2022) find that the development of a smartphone app to follow children with type 1 diabetes during the pandemic led to significant improvement in the patient's healthcare conditions and high satisfaction among practitioners and patients. These findings portray a key application of mHealth and eHealth in the delivery of care in Saudi Arabia, thus improving the general healthcare status of the public through improving the efficiency of care delivery.

The findings of this research indicate that mHealth and eHealth use in the provision of health care offers significant opportunities for more effective care. According to Rahman & Alsharqi, 2019, the eHealth technology could help solve some of the system's enduring issues, including a lack of resources, lengthy wait times, and general dissatisfaction with healthcare. From healthcare practitioners' perceptions, mHealth and eHealth technologies have revolutionized healthcare provision by addressing some of the key challenges limiting its effectiveness. While in-person contact was a key issue present during the pandemic, mHealth and eHealth technologies facilitated contactless communication, improving care delivery. In addition, follow-up efficiency was achieved as physical contact was not necessary to ensure the practitioners could follow their patients at any moment. Regarding self-care services, mHealth and eHealth applications enhanced patient independence in their healthcare. Applications for eHealth self-care that provide information and also allow for human interaction are more likely to be successful. It now becomes possible for patients to make mistakes while measuring or reporting results. Patients may unintentionally tamper with measurement or the transmission process even though the process is autonomous, which could lead to mishaps. The safe sharing of responsibility between patients and professionals in these circumstances will require the development of protocols (Lewis, et al., 2016). For this reason, the quality of care can be seen as having significant improvements if the technologies are effectively implemented. Different factors highlighted by healthcare practitioners have to be considered in the effectiveness of implementing these technologies. Weakness in limited awareness, usage knowledge, and unavailability of good tools significantly affected the effectiveness of mHealth and eHealth in enhancing quality care. Saudi Arabia is a key region in applying mHealth and eHealth to improve the efficiency and quality of care. From the findings from studies selected from this research, Saudi Arabia utilizes mHealth and eHealth on different applications, including cancer care, dentistry, and ambulatory services for eHealth use and different mobile applications in managing various healthcare conditions such as asthma. These applications have significantly

improved healthcare quality in line with healthcare providers' perspectives. This study, therefore, finds that mHealth and eHealth provide sufficient healthcare support for healthcare services in Saudi Arabia, and medical practitioners have positive reviews for their use.

## Conclusion

The evidence from this research indicates that mHealth and eHealth applications are generally accepted by healthcare practitioners if certain challenges are effectively addressed. Healthcare practitioners considered these technologies useful in managing different care needs, which were essential in improving the quality of care without the necessity of human contact. As mHealth and eHealth require sufficient knowledge, tools, and awareness for their effectiveness, considering such necessities will mean improving the quality of care. Healthcare practitioners opined that these challenges would affect the effectiveness of healthcare service delivery and thus must be addressed before implementing mHealth and eHealth applications. The implications of this study to the healthcare practice, in general, is its influence of increased applications of mHealth and eHealth under different capacities in the provision of more efficient healthcare services. In this case, different utilization areas respective to the organization and care needs would influence the selection and uptake of mHealth and eHealth services to improve the quality and efficiency of care. The main limitation of this study is the use of studies primarily focusing on the self-reported perspectives of healthcare professionals on the use of mHealth and eHealth services. Future studies should focus on comparing the self-reported perspectives of healthcare practitioners on the use of mHealth and eHealth services and quantitatively compare them to actual benefits within the healthcare system.

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