

# Assess Perspective and Knowledge of Healthcare Providers Towards Elehealth in Saudi Arabia: A Systematic Review

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## ABSTRACT

**Background and Objective:** Telehealth has become a well-known tool for the delivery of health care in Saudi Arabia, and the perspective and knowledge of healthcare providers are influential in the implementation, adoption and advancement of the method. This systematic review was conducted to examine the current literature base regarding telehealth and the related healthcare professional perspective and knowledge in the Kingdom of Saudi Arabia.

**Materials and Methods:** This systematic review was conducted by searching 7 databases including, MEDLINE, CINHALL, Web of Science, Scopus, PubMed, PsycINFO, and ProQuest Central. Studies on healthcare practitioners' telehealth knowledge and perspectives published in English in Saudi Arabia from 2000 to 2023 were included. Boland directed this comprehensive review. The researchers examined each connected study using the AXIS tool, which evaluates cross-sectional systematic reviews. Narrative synthesis was used to summarise and convey the data.

**Results:** Out of 1840 search results, 10 studies were included. Positive outlook and limited knowledge among providers were seen across trials. Healthcare professionals like telehealth for its ability to improve quality, access, and delivery, save time and money, and be successful. Age, gender, occupation, and work experience also affect health workers' knowledge. In Saudi Arabia, healthcare professionals face inadequate expert assistance, patient privacy, internet connection concerns, lack of training courses, lack of telehealth understanding, and high costs while performing telemedicine.

**Conclusions:** Healthcare practitioners' telehealth perceptions and knowledge were examined in this systematic study. Its collection of concerned experts' different personal attitudes and expertise would help enhance telehealth's implementation in Saudi Arabia, develop its healthcare delivery alternative, and eliminate frequent problems.

## INTRODUCTION

Virtual healthcare technology is widely used<sup>50</sup> and is accepted by patients and health professionals alike.<sup>50,66</sup> Telehealth also known as telemedicine<sup>70</sup> – refers to distance health care using technologies of electronic information and telecommunications.<sup>50</sup> Telehealth has been implemented in different clinical settings<sup>33,42,62</sup> and it is considered similar to or better than traditional care visits.<sup>63</sup>

Telehealth can involve the synchronous delivery of care in real-time, or it can be asynchronous, which is

also referred to as store-and-forward<sup>45,68,70</sup> and remote patient monitoring.<sup>45</sup> While it provides various benefits to health care, it also presents it with some challenges.<sup>49,50</sup> Of note, benefits include overcoming geographical challenges<sup>49</sup>, improving providers' practice<sup>16,39</sup>, improving access to health care,<sup>47,56</sup> saving effort and transportation costs, and minimising waiting lists,<sup>7</sup> while some of the barriers include the inability of patients or health professionals to access the internet or services,<sup>38</sup> poor digital infrastructure,<sup>47</sup>

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**KEYWORDS:** Telehealth - Saudi Arabia- Systematic review - Health care providers - Perspective – Knowledge

engagement issues,<sup>56</sup> the potential effect on patient confidentiality and the lack of knowledge of how to use the technology.<sup>11</sup>

The government of Saudi Arabia is enabling eHealth in the country, and the Saudi government has funded electronic health technologies in healthcare settings that are unable to afford them; it has also provided educational courses to healthcare professionals regarding electronic health and its possible effects on the healthcare industry.<sup>15</sup> Saudi Arabia is a geographically big country and it is important that its rural areas have access to healthcare services.<sup>30</sup> In addition, offering high-quality care to the public and enhancing access to healthcare are challenges the Ministry of Health (MOH) in Saudi Arabia has faced.<sup>30</sup> The Ministry of Health in Saudi Arabia provided the initiatives to increase information communication technology (ICT) to deliver health care services in the country.<sup>5</sup> MOH conducted a study in 2010 on the adoption of telemedicine, and in 2011, launched the first version of a national project for telemedicine called Saudi Telemedicine Network (STN). This network planned to cover all healthcare settings, in collaboration with Canada Health Infoway and Ontario Telemedicine Network, and was issued in 2013.<sup>4</sup> Additionally, the adoption of the mobile application 'SEHA' played a primary role in improving the delivery of health care remotely.<sup>5</sup> Presently, in Saudi government hospitals, private hospitals, community care and primary care facilities, utilising digital technologies in a variety of forms<sup>71</sup> and telemedicine in Saudi Arabia has become a recognised method of providing health care.<sup>71</sup>

Healthcare providers play the main role in the advancement of healthcare services.<sup>24</sup> Before the implementation of telehealth, it is most important that health care providers be aware of telehealth benefits and users' conceptual learning in order to have good knowledge and perspective, which are crucial elements for health providers in implementing and using telehealth.<sup>26</sup> The main factor behind telehealth's success and sustainability is health professionals' acceptance, as a physician who accepted telehealth would continue to provide it regardless of other barriers such as technology issues or low demand.<sup>67</sup> A good attitude plays a role in its acceptance and successful implementation<sup>37</sup>, and the knowledge of health providers toward telehealth influences its adoption,<sup>16</sup>

Dongre et al.<sup>26</sup> conducted a study in India to identify health care providers' knowledge and attitude toward telehealth, which observed that 52.57% of providers had a good level of knowledge and 57.45% of them had a positive attitude. In Petimani et al.'s<sup>51</sup> study,

healthcare providers displayed a fair knowledge of and a positive perspective on telehealth, and they especially depended on it with patients in distant areas. However, a study conducted among physicians in Iran showed that while only 35.5% of them were aware of telehealth, good attitudes toward telehealth were observed.<sup>32</sup> In another study conducted in the United Kingdom, health professionals indicated positive perceptions toward telehealth and also found gaps in education to guarantee that health care providers' knowledge of telehealth.<sup>47</sup> Additionally, health professionals from Philadelphia, noted that there is a need for guidance, training and supervision in telehealth.<sup>56</sup> Importantly, healthcare providers' knowledge level could affect their attitudes.<sup>32</sup>

### Aim

This study aims to assess the existing literature on the perspective and knowledge of healthcare providers towards telehealth in Saudi Arabia.

### Objectives

1. To identify the reasons that affect health providers' perspective
2. To determine the factors that affect providers' knowledge
3. To know the challenges providers face in practising telehealth.

The research question in this review is: What studies are currently examining the perspective and knowledge of healthcare professionals regarding telehealth, as well as the associated reasons and factors, and the challenges they face?

The successful implementation of telehealth in Saudi Arabia and further advancement of services can be made possible with a thorough understanding of the perspective and knowledge of healthcare providers toward telehealth. There is no systematic review conducted in Saudi Arabia on this subject in the current literature. Therefore, will conduct a systematic review to address this gap in the literature and provide a comprehensive overview of the topic, which will help in the effective implementation and further development and advancement of telehealth services.

### Materials and Methods

This study is a systematic review carried out using Boland et al.'s<sup>72</sup> guidance. It provides a set of items to plan and report systematic reviews.

### Search strategy

A systematic search across various electronic databases was carried out in mid-June 2023, and an additional search was conducted in mid-August 2023 to ensure that all relevant articles were included. The seven electronic databases included were: MEDLINE,

CINHAL, Web of Science, Scopus, PubMed, PsycINFO and ProQuest Central. The search terms included were: Saudi Arabi\*, telehealth, telemedicine, perspective, attitude, opinion, knowledge, healthcare providers, physicians and healthcare professionals, and used Boolean 'AND' and 'OR' operators. Medline search terms are provided in Appendix A.

### Inclusion–Exclusion Criteria

The current literature covers a wide range of telehealth topics, which provides many sources that deviate from the wanted results requiring inclusion and exclusion criteria. The selected articles conformed to the PICOSS criteria for inclusion and exclusion, which is a mnemonic tool to help create inclusion and execution criteria for the synthesis of quantitative studies Boland et al.<sup>72</sup>; PICOSS Table appears in Appendix B. The articles included met these criteria: studies were published in the English language from 2000 to 2023 in Saudi Arabia, were primary research and were full-text available articles that assessed the perspective or knowledge of healthcare providers toward telehealth. The exclusion criteria were healthcare providers not the end-users of telehealth, studies not about perspective or knowledge of telehealth, studies about healthcare providers'

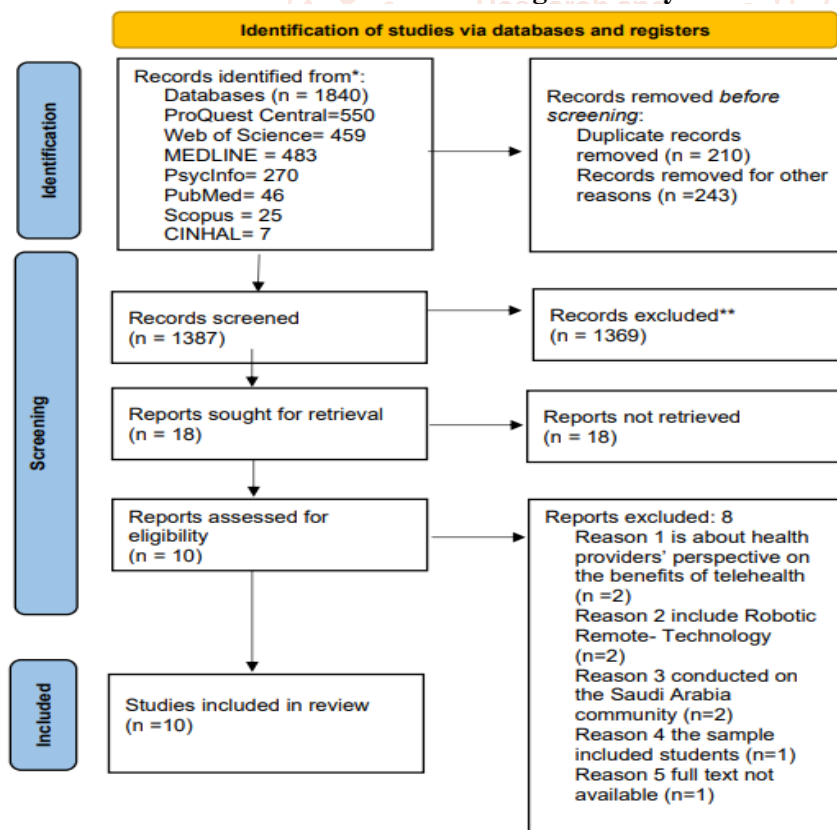
perspective or knowledge on only benefits of telehealth, studies on healthcare providers' perspective or knowledge on telehealth just during COVID-19, and studies published in a language other than English and conducted outside of Saudi Arabia; also, conferences and articles that did not have full texts available were excluded.

A total of 1840 documents were obtained from the seven databases. After the removal of 210 duplicates, and 243 for other reasons, 1387 studies were entered into the selection process. The titles and abstracts of 1387 studies were screened; 1369 studies were excluded from the review, as they did not suit the inclusion criteria. Eighteen articles were read as full texts, and 10 studies were found suitable. Fig. 1 illustrates the PRISMA flow chart for the search process for included articles.

### Data Extraction

Data extraction was conducted by the researchers. The data extraction from the final full-text papers was compiled onto one table on an Excel (Microsoft) spreadsheet. The table contains the author/year, data collection period, sample characteristics, measurement tool (validity and reliability) and key findings.

**Fig. 1 PRISMA 2020 flow diagram for new systematic reviews which included searches of databases and registers only.**



From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71. doi: 10.1136/bmj.n71. <http://www.prisma-statement.org/>

## Quality assessment

Quality assessment, also known as validity assessment or critical appraisal, is a process of evaluating the methodological quality of studies.<sup>73</sup> The selected articles were all in a cross-sectional design, therefore, the quality assessment of the chosen articles was done based on the AXIS tool, which is used to assess the quality of cross-sectional studies in a systematic review. It includes 20 items: 7 items for report quality, 7 for study design quality, and 6 for the potential of biases being introduced and contains spaces for 'yes,' 'no,' and 'don't know/comment' responses.<sup>28</sup> 1=Yes, 0 = No, 99= Don't know, (\*Items) is reverse scored (i.e. 0 is a positive, counts as a point), 99 counts as a no point<sup>34</sup> and study quality will rate as high, medium or low. The quality assessment of the studies was conducted independently on two occasions: first, prior to data extraction, and second, after data extraction. Consensus was achieved between the researchers during both assessments.

## Data Analysis

The key component of a systematic review is the synthesis, which refers to the process that combines the findings from included studies.<sup>73</sup> As a few studies were identified with a high level of heterogeneity between the studies, a meta-analysis could not be carried out; therefore, a narrative synthesis was adopted to report findings. A narrative synthesis is an approach to the systematic review, using words to describe and summarise the outcomes of the synthesis of multiple studies.<sup>72,73</sup> The data were broken into qualitative themes that related to healthcare providers' perspectives towards telehealth and the reasons affecting it, knowledge of healthcare providers on telehealth and associated factors and the challenges that health providers face in implementing telehealth. The 10 included papers were reviewed carefully and the findings were classified according to each of these themes.

## Results

### Study characteristics

The Table 1 below displays the study characteristics and key findings from the selected studies. All the ten studies were quantitative cross-sectional studies that used an online self-reported questionnaire.<sup>1,2,6,8,9,12,13,20,65,69</sup> One out of the ten studies used valid and reliable questionnaires,<sup>2</sup> three studies used valid questionnaires,<sup>1,8,69</sup> one study used an invalid and reliable questionnaire<sup>12</sup> and the remaining studies did not report the validity and reliability of their questionnaires. Most of the studies (n=7) were conducted between 2019 and 2022<sup>1,2,8,9,13,20,69</sup>, only one study was conducted earlier in 2016,<sup>6</sup> and two studies did not report at what time they were conducted.<sup>12,65</sup>

The participants' numbers ranged from 53 to 1034, all of the studies used both genders, nine studies showed a higher percentage of men than women,<sup>1,2,6,8,9,12,13,65,69</sup> and one study had a women percentage higher than men.<sup>20</sup> Regarding age, in seven studies were adults (20-59)<sup>1,2,6,8,9,13,20</sup>, except three studies did not report age.<sup>12,65,69</sup>

Participants in three studies were physicians,<sup>6,13,69</sup> two studies included all healthcare providers,<sup>8,20</sup> two studies were among pharmacists,<sup>1,2</sup> one study was among physical therapists (PTs),<sup>12</sup> one study was among rehabilitation facilities staff,<sup>65</sup> and one study among psychiatrists.<sup>9</sup>

**Table 1. Study characteristics and key findings.**

Author/Year	Data collection period	Sample characteristics	Measurement tool (validity and reliability)	Key findings
(Albarrak et al., 2019)	From April to July 2016	N=391 physicians: age (the majority were between 20-30), gender (77.0% male and 23.0% female)	A self-administered questionnaire (validity and reliability not reported).	90% of participants observed a high level of perception, 46.1% had low knowledge, 90% of the physicians were concerned about the equipment's high cost, lack of expert support, lack of training, and patient privacy.
(Alghamdi et al., 2022)	From 16 November 2021 to 16 March 2022	N=1034 health care providers: age 28-59, gender (65%	Online survey (valid)	Observed a positive perspective, challenges: (38%) lack of time/busy schedule, (36%) weak

		male and 35% females)		internet connection (36%) inadequate knowledge about telehealth, (31%) limited trained staff, (29%) insufficient expert support
(Alqahtani et al., 2022)	Between January and April 2022	N=151 Physicians, age (the mean age of 31.14 years), gender (most of the sample were male 74.8%)	Online questionnaire (validity and reliability not reported)	Participants found to have a positive attitude toward telehealth. Challenges: found that 43% of physicians, interacting with telehealth services were not good.
(Aloyuni et al., 2020)	Not reported	N=347 physical therapists: age (not reported), gender (male 106 and females 70)	Online questionnaire (not valid and reliable)	Participants had good attitude and knowledge. Challenges: 24%, technical problems; 23%, staff skills; 22%, high cost; and 20%, willingness of providers.
(Alghamdi et al., 2022)	From November 2020 to May 2021	N= 328 psychiatrist: age (the majority were between 25-35), gender (70.4% male and 29.6 % female)	Online questionnaire (validity and reliability not reported)	Providers had positive perception, and 51.8% of them had a poor level of knowledge. Challenges: the providers had concerned about patient privacy and confidentiality (64%), lack of expert support (49.1%), and lack of training (48.8%).
(Ahmed et al., 2023)	From March to May 2020	N=411, hospital pharmacists: age (the majority were between 30-39), gender (54.01% male and 45.99% females)	Online survey (valid)	The study was found that there was uncertainty amongst the participants regarding their attitude and level of knowledge toward telepharmacy, due to the lack of implementation of this technology.
(Ahmed et al., 2023)	From March to May 2022	N= 404, community pharmacists: age (the majority were between 30-39), gender (59.90% male and 40.10% females)	An online questionnaire (valid and reliable)	Pharmacists showed a positive perspective and excellent level of knowledge.
(Bashir et al., 2023)	From June 2019 to February 2020	N= 370, health care providers:	A self-administered questionnaire	Overall (3.26 ± 0.51), health providers had a

		age (the majority were between 30-40), gender (30.3% male and 69.7% female)	(validity and reliability not reported).	good attitude. Knowledge: 63.7% of participants observed poor knowledge.
(Ullah et al., 2020)	Not reported	N= 82, rehabilitation professional: age (not reported), gender (63.41% male and 36.59% female)	An online questionnaire (validity and reliability not reported)	Good attitude, and low level of knowledge. challenges: 43.90% 'Lack of knowledge on information and communication technology, high cost, rapidly changing information and communication technology, and patient compliance', and 52.44% 'Patient data security, patient privacy, and consultation with an unauthorized person'.
(Wali et al., 2023)	In 2022	N=53, primary health care physicians: age (not reported), gender (42% male and 58% female)	Online questionnaire (valid)	Good perception; challenges: 74% of the respondents had concerns about patients' over-utilisation of services, 72% patients' low technical knowledge, 70% low access to technology/devices, 60% about connectivity issues, 32% about patient privacy and 30% lack of adequate support.

**Quality Assessment**

Four of the 10 studies had a high-quality rating,<sup>1,2,20,69</sup> six had a medium rate of quality.<sup>6,8,9,12,13,65</sup> Table 2 in Appendix C illustrates the quality appraisal of the included studies.

**Table 2. Perspective of healthcare providers on telehealth**

Theme	Frequency
Perspective or attitude of healthcare providers on telehealth	10
<b>Reasons effect perspective or attitude of healthcare providers</b>	<b>Frequency</b>
Telehealth improves health care (quality, access, delivery)	4
Telehealth effective approach	4
Telehealth saves time	4
Telehealth saves money	3
Telehealth enhances health care providers practice	2
Easy-to-use	1
Saves effort	1
Reduce the number of referrals	1
Enable providers to contact patients who rarely came to the hospital	1
Decreases staff shortages	1

Table 2 shows the frequency of the articles that measured the perspective or attitude of health care providers, and the frequency of the reasons that affect them, showing all studies n=10 that measured perspective or attitude, and the majority n=9 found a positive trend in the attitudes and perspective towards telehealth.<sup>2,6,8,9,12,13,20,65,69</sup> Except, one study, found that there was uncertainty among the participants regarding their attitude toward telepharmacy.<sup>1</sup> In addition, telehealth was found to improve health care (quality, access, delivery) (4),<sup>2,9,12,65</sup> be an effective approach (4),<sup>2,6,8,9</sup> and save time (4),<sup>2,6,9,13</sup> and money (3),<sup>2,6,9</sup> the reasons that had the most frequency of use among the studies.

**Table 3. Knowledge of healthcare providers on telehealth**

Theme	Frequency
Knowledge of healthcare providers on telehealth	7
<b>Factors associated with knowledge level of health providers</b>	<b>Frequency</b>
Age	2
Gender	2
Work experience	2
Profession	2
Education	1

Table 3 shows the frequency of articles that measured the knowledge level of healthcare providers towards telehealth and the frequency of factors associated with providers' knowledge. Seven out of 10 articles measured providers' knowledge.<sup>1,2,6,9,12,20,65</sup> Four out of 7 studies found poor knowledge among healthcare providers about telehealth.<sup>6,9,20,65</sup> However, two articles reported good knowledge among the participants.<sup>2,12</sup> Moreover, one study indicated hospital pharmacists show uncertainty regarding their knowledge of telepharmacy.<sup>1</sup>

In addition, age (2), gender (2), work experience (2), and profession (2), were found as common factors related to the knowledge level among professionals. Bashir et al.<sup>20</sup> found a statistically significant ( $P < 0.001$ ) association between the age, gender, education, nationality, profession and knowledge scores of telehealth. While Alghamdi et al.<sup>9</sup> observed that healthcare providers in the age group 35 and older, consultants and those with 11–15 years of experience had significantly higher knowledge scores ( $P < 0.001$ ). However, pharmacists with work experience of fewer than 5 years have a higher average knowledge score compared with pharmacists with work experience of five or more years (p-value lower than 0.05).<sup>1</sup> Also, Ahmed et al.<sup>2</sup> indicated that females had higher knowledge scores ( $P$  value 0.003). Nevertheless, as reported by Ahmed et al.,<sup>1</sup> Ahmed et al.,<sup>2</sup> Albarrak et al.,<sup>6</sup> Alghamdi et al.,<sup>9</sup> and Alqahtani et al.<sup>13</sup> training courses on telehealth technology are necessary to increase knowledge.

**Table 4. Challenges health care providers face in implementing telehealth**

Theme	Frequency
Challenges health providers face in implementing telehealth	7
<b>Challenges</b>	<b>Frequency</b>
Insufficient expert support	4
Patient privacy	4
Internet connection issue	3
Lack of training courses	3
Lack knowledge of telehealth usage	3
High cost	3
Patients' data security	1
Patients' confidentiality	1
Patients overusing services	1
Lack of patient knowledge	1
Willingness of providers	1
No time for use telehealth	1
Fast change in technology	1
Interacting with telehealth services is not good	1
Patient compliance	1

Table 4 shows the frequency of articles that identify challenges health providers face in implementing telehealth, where 7 out of 10 studies identified challenges.<sup>6,8,9,12,13,65,69</sup> The most frequent obstacles that health providers faced were: insufficient expert support (4),<sup>6,8,9,69</sup> patient privacy (4),<sup>6,8,65,69</sup> internet connection issues (3),<sup>8,12,69</sup> lack of training courses (3),<sup>6,8,9</sup> lack of knowledge of telehealth usage (3),<sup>8,12,65</sup> and high cost (3).<sup>6,12,65</sup>

## Discussion

The present study provides a systematic review of the studies on perceptions and knowledge of telehealth services among healthcare providers. Further, it identified the reasons and factors associated with providers' perception and knowledge in addition to the challenges to the adoption of telehealth, as reported by health care providers. Ten studies that were full text, obtained after systematically reviewing the current literature in different databases, and met inclusion and exclusion criteria.

### Perspective of healthcare providers on telehealth

The majority of studies indicated that health care professionals in Saudi Arabia have a positive perspective and attitude toward telehealth, and this is consistent with the results of previous studies from around the world, from Northwest Nigeria,<sup>21</sup> the United States,<sup>25</sup> Indonesia,<sup>35</sup> and Iran.<sup>53</sup>

There are different reasons that could lead to this positive perspective and attitude. This review identified some frequent reasons – because telehealth improves health care quality, access, and delivery; it saves time and money; and for other reasons expressed across the included studies. Landes et al.,<sup>41</sup> Reynolds et al.,<sup>54</sup> and Shittu et al.,<sup>59</sup> all had similar findings that telehealth improves health care in different aspects. In addition, it reduces the cost of health care<sup>59</sup> and saves transport costs.<sup>7</sup> Moreover, Butzner and Cuffee's<sup>23</sup> findings comply with this review, that telehealth saves health providers' and patient's time. Telehealth effectiveness is one of the most frequently identified reasons in this review. However, in another study, the majority of health providers believed that telehealth was important and effective, but some saw it as an ineffective approach.<sup>27</sup> Health providers in Jordan also said telehealth is effective for following-up patient status and monitoring medical outcomes, but that it could not completely replace in-person visits.<sup>3</sup>

### Knowledge of healthcare providers on telehealth

This systematic review found a low level of knowledge among healthcare providers about telehealth in Saudi Arabia, as findings from Iran reported that clinicians showed an inadequate understanding of telehealth,<sup>58</sup> and in a study conducted in Trinidad and Tobago (T&T), the providers showed a low level of knowledge.<sup>31</sup> Other studies have also shown that the knowledge of health professionals about telehealth is low.<sup>48,57</sup> However, found just two studies that preserved good knowledge, consistent with Naqvi et al.'s<sup>46</sup> outcome that health care professionals had good knowledge of telemedicine, and another study in Bhubaneswar reflecting a good level of knowledge as well.<sup>22</sup>

In this review, it was found that healthcare providers noted training courses to be important for knowledge level. Most health providers in Karachi complained about insufficient seminars for telemedicine.<sup>17</sup> Also, Ezinne et al.<sup>31</sup> and Omran et al.<sup>48</sup> identified limited levels of knowledge due to a lack of training courses. Shouman et al.<sup>60</sup> conducted an intervention study to measure and evaluate the knowledge of healthcare staff before and after an educational program about telehealth. The study found that the knowledge level dramatically increased before and after the program, which was  $15.94 \pm 9.431$  before, and  $25.00 \pm 5.841$  after.<sup>60</sup> This may potentially explain the different knowledge levels of health care providers, and additionally, this review identified factors associated with the knowledge level of health professionals.

Age, gender, profession and work experience were identified as frequency factors associated with knowledge level. Results for these factors have varied between studies; in this review, one study found who had more than 10 years had higher knowledge, but another found who had 5 or fewer years had better knowledge. One study in this review found women and another found providers at a young age had better knowledge as well. Ezinne et al.<sup>31</sup> found optometrists with job experience of five years or more in teleoptometry had higher knowledge scores than those with fewer than five years of experience. In addition, a study in the Eastern Region of Ghana found male health providers in a group aged 50 years or less had better knowledge than women in a group aged 50 years or more.<sup>74</sup> Moreover, Assaye et al.<sup>18</sup> found males were better in their knowledge of telehealth than females. Also, one study in this review identified consultants as having better knowledge, with Sheikhtaheri et al.<sup>58</sup> finding that physicians and nurses had higher knowledge compared to other professions.

However, there are some studies that did not find these factors associated with knowledge level. Sheikhtaheri et al.<sup>58</sup> reported that age, gender and work experience were not related to the knowledge level, while Singh et al.<sup>61</sup>



also found no significant differences among age, gender and knowledge level. Knowledge scores were not substantially different between healthcare professionals from various departments, and there were no differences in the mean score of knowledge between men and women.<sup>29</sup>

This shows that these factors are not always associated with the level of knowledge, and there is not always a specific age, gender, job experience or profession that would be associated. In addition, one article in this review, uncertainty was found among the participants regarding their attitude and knowledge toward telepharmacy, which could be due to the lack of implementation of this technology. Al-Hazmi et al.<sup>10</sup> indicated that, up until the present time, one still cannot answer questions about whether telehealth is accessible and safe in Saudi Arabia. Healthcare providers in the Canadian critical care department expressed scepticism and uncertainty about the potential impact of Tele-ICU, due to limited implementation and education.<sup>57</sup>

### **Challenges healthcare providers face in implementing telehealth**

Even though the Saudi Vision (2030) seeks to develop digital healthcare, the country still faces barriers to the adoption of telehealth, such as technical issues.<sup>10</sup> The barriers identified in this review were consistent with those found in a study in North Texas conducted among providers in primary care clinics; the providers reported barriers that restricted telehealth use, including inefficient technical infrastructure, concern about confidentiality and security, inadequate support and equipment expense.<sup>43</sup> In addition, other studies agree that privacy is a barrier; Lipschitz et al.<sup>44</sup> reported that telehealth has less privacy compared to traditional visits, and Tran et al.<sup>64</sup> noted that patients' and providers' privacy could be at risk while using telehealth. Moreover, this review found the lack of training courses or programs as a barrier, similar to the findings in the other studies.<sup>40,64</sup>

However, several various challenges were identified across the studies, which could be due to telehealth not being fully implemented and practiced in the country. Progress and development in telemedicine in Saudi Arabia are slow,<sup>14</sup> and requires more concerted efforts and research to improve telehealth in the country.<sup>19</sup>

### **Strength and Limitation**

The strength of this review is that it is the first of its kind in Saudi Arabia. It provided a comprehensive overview of the current perspective, attitude, knowledge and challenges of healthcare providers in the country. This review will help to better plan for introducing telehealth services and improve health care delivery as well, and it could be a reference for researchers to perform future research aimed at the improvements.

However, the present review had certain limitations, such as the review being conducted by one author. Publication bias could be a limitation here, which did not extend the search to grey literature. The search was limited to the English language and particular databases, which some studies in other languages and on other databases could be missed. All included studies were quantitative cross-sectional in nature, and some of the studies did use not valid and reliable surveys. A meta-analysis could not be performed due to the heterogeneity of studies, which had different variables and tools of measurement.

### **Conclusion**

This systematic review highlighted the existing perception and knowledge of healthcare providers toward telehealth. Overall, positive perceptions and attitudes, and a low level of knowledge, were observed among healthcare providers in Saudi Arabia. In addition, studies on the perspective and knowledge of health providers toward telehealth were useful, but there is a need for more evidence and studies with high levels of generalisation. The review identified reasons and factors associated with perception and knowledge and determined the challenges healthcare providers faced during the implementation and use of telehealth in Saudi Arabia. This review provides information that can be exploited for better implementation, greater advancement and reduced common challenges of telehealth.

For future studies, it is recommended that different types of study designs be employed, using valid and reliable tools with a high level of generalisation, and carry out qualitative research that provides an in-depth understanding of the perspectives and knowledge of healthcare providers. It is also recommended that longitudinal studies be conducted in order to have clear observations and documentation regarding changes in healthcare providers' perception, knowledge and other variables over a period of time.

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**Appendix A**

Search terms Midline database

S1	(Saudia Arabia*)
S2	(Telehealth) OR (Telemedicine)
S3	(Teleconsultation) OR (Telemonitoring)
S4	(Telepractice) OR (Telecare)
S5	(Perspective) OR (Attitude) OR (Opinion)
S6	(Knowledge)
S7	(Physician)
S8	(Clinician)
S9	(Health care providers) OR (Health care professionals)
S10	S1 AND S2 AND S5 AND S7 OR S8
S11	S1 AND S2 OR S3 OR S4 AND S5 AND S9
S12	S1 AND S2 OR S3 OR S4 AND S6 AND S9
S13	S1 AND S2 AND S5 AND S7 OR S8
S14	S1 AND S2 AND S6 AND S7 OR S8
S15	S1 AND S3 AND S5 OR S6 AND S7 OR S8 OR S9
S16	S1 AND S4 AND S5 OR S6 AND S7 OR S8 OR S9
S17	S1 AND S2 OR S3 OR S4 AND S5 AND S6 AND S9
Search limit	Age (adult)- Country (Saudia Arabia)- Language (English)-Time (2000-2023)

**Appendix B**

**Table 1. PICOSS (Population, Intervention, Comparison, Outcome measures, Setting, Study design) criteria.**

PICOSS items	Inclusion	Exclusion
Population	Healthcare providers	Patients-students
Intervention	Telehealth applications-services	Any other technology
Comparison	Not Applicable	
Outcome measures	Perspective/attitude- Knowledge-challenges	Telehealth use or other outcomes
Setting	Studies conducted in hospitals and facilities related to health care in Saudi Arabia	Studies conducted in any other places
Study design	Primary quantitative Studies	Qualitative and secondary studies

Appendix C

Table 2. AXIS tool

AXIS tool questions	(Albarrak et al., 2019)	(Alghamdi et al., 2022)	(Alqahtani et al., 2022)	(Aloyuni et al., 2020)	(Alghamdi et al., 2022)	(Ahmed et al., 2023)	(Ahmed et al., 2023)	(Bashir et al., 2023)	(Wall et al., 2023)	(Ullah et al., 2020)
Introduction										
1. Clear aims	1	1	1	1	1	1	1	1	1	1
Methods										
2. Appropriate study design?	1	1	1	1	1	1	1	1	1	1
3. Justified sample size?	1	0	0	0	1	1	1	1	1	0
4. Target population clearly defined?	1	1	1	1	1	1	1	1	1	1
5. Sample frame represented the target population?	1	1	1	1	1	1	1	1	1	1
6. selection process representative?	1	1	1	1	1	1	1	1	1	1
7. measures to address non-responders?	0	0	0	1	0	0	0	0	0	0
8. Measurement tool valid?	99	1	99	0	99	1	1	99	1	99
9. Measurement tool reliable?	99	0	99	0	99	0	1	99	0	99
10. Determined statistical significance (eg, p-values, CIs)	1	1	0	0	1	1	1	1	1	No
11. Were the methods sufficiently described?	1	1	1	0	1	1	1	1	1	1
Results										
12. Basic data described?	1	1	1	1	1	1	1	1	1	1
13. Concerns about non-response bias?*	0	99	99	99	0	0	0	0	0	99
14. Non-responders information described?	0	0	0	1	0	0	0	0	0	0
15. Were the results internally consistent?	1	1	1	99	1	1	1	1	1	1
16. Were the results for the analyses described in the methods, presented?	1	1	1	0	1	1	1	1	1	1
Discussion										
17. discussions and conclusions justified	1	1	1	1	1	1	1	1	1	1
18. limitations discussed?	1	1	1	1	1	1	1	1	1	1
Other										
19. conflicts of interest?*	99	0	0	0	99	0	0	0	0	0
20. Was ethical approval or consent of participants obtained?	1	1	1	1	1	1	1	1	1	99

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