

Utilization and impact of telemedicine among individuals in Egypt: a systematic review

Abstract

Background: Telemedicine in Egypt has shown sustainability while opening a way for more engagement in healthcare. This systematic review examines the use of telemedicine and its impact on Egyptians, focusing on the limited internet accessibility in Egypt.

Methods: An exhaustive search was conducted in the PubMed, MEDLINE, Scopus, Web of Science, and EMBASE databases, specifically in the years 2015–2024, to obtain valid articles. Studies were investigated within the framework of pre-designed inclusion criteria, which helped in the identification of 10 articles specific to the report. The JBI checklist was explored to improve the performance of these studies, and narrative synthesis was employed to compile the findings in textual form.

Results: The analysis identified five main themes: telemedicine knowledge and attitudes, usage by the public and healthcare practitioners, implementation barriers, impact on patient care, and community led monitoring. Despite the Egyptian community having positive attitudes towards telemedicine, barriers such as technology limitations, data privacy concerns, and reliance on physical wards for diagnosis remain. Private hospitals are more equipped than government facilities, affecting implementation. While challenges exist, telemedicine has the potential to improve patient care by increasing convenience and reducing wait times.

Conclusion: Telemedicine can enhance healthcare in Egypt by improving access and patient outcomes. However, success depends on overcoming obstacles such as policy development and institutional capacity. Policymakers must create governance standards, invest in infrastructure, and improve training.

Keywords: telemedicine, knowledge, utilisation, barriers, systematic review, Egypt

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Introduction

Telemedicine is an emerging service that involves the use of gadgets and information systems in the supply of healthcare services at a distance. The offering of this service allows for solutions to health disparities and enhanced international accessibility to healthcare.¹ Telemedicine is a project where futuristic technology has big potential, especially in places where healthcare is easier to access, such as Egypt.² In the World Health Organisation,³ annual data analysis, it was recorded that over 71% of countries are said to deploy telemedicine services as part of their response to the pandemic.

In Egypt, the government, together with healthcare providers, is proactively assessing the suitability of telehealth technologies to such ends as identifying healthcare problems and increasing accessibility.⁴ Telemedicine services as an intervention have increased fast, and a lot of the users are female.⁵ The online platforms based on telemedicine, health management, and anonymity have pushed Egyptians in many new directions in seeking medical advice and treatment for many health problems (Hamaed et al., n.d.).

The effect of telemedicine on transmission of disease, access to healthcare, and treatment processes has begun to be analysed in several studies on the Egyptian community. The telemedicine application was investigated by Alborae et al.,⁴ pointing out that according to the health specialists who participated in the study, they would not feel a decrease in the quality of care and doctor-patient relations, but they were concerned that patients' data would not be safe enough. Telemedicine, which by its nature is joyful and widely accepted among health care providers, deals with challenges with transmission. Furthermore, surveys conducted by Kamal Helmy and Said Abdelhady

Garf (2021) discovered that the implementation of the telehealth programme during the COVID-19 pandemic had positive effects that led to higher knowledge, a better attitude, and good practices. The study sheds light on the use of telemedicine to minimise healthcare disparities and improve underprivileged individual's health.

The rationale for selecting this topic is its importance in addressing healthcare inequities and improving individual health outcomes in Egypt. With the rapid expansion of communications infrastructure and the growing ubiquity of mobile technologies, telemedicine offers a potential way to eliminate geographical and socioeconomic barriers to healthcare access.⁶ Garfan et al.,⁷ for example, looked at the increasing telehealth use during the COVID-19 epidemic, stressing both its potential to improve healthcare access and the difficulties including technology infrastructure and patient adaptation. Alsswey et al., examined mHealth technology use in the Arab world, stressing in particular broad implementation difficulties including technological restrictions and cultural challenges. Emphasising telemedicine in Middle Eastern nations, Al-Samarraie et al.,¹ discussed developments made and suggested legislative reforms to remove ongoing obstacles. Notwithstanding these efforts, little is known about telemedicine's impact and use in the Egyptian context thus, this systematic review aims to address this vital knowledge gap. Understanding the existing landscape of telemedicine use among Egyptians, as well as its impact, will provide information needed for understanding the current state of telemedicine in Egypt and how it can change the way healthcare is delivered in the country. These findings can direct future telemedicine-related investment, regulations, and studies for improved health. Therefore, this review seeks to extensively examine telemedicine utilisation and its impact on the Egyptian population.

Methods

Study design

A systematic review technique was used to gather, analyse, and synthesise relevant literature on the issue. The review adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure transparency and rigour in the review process.⁸

Eligibility criteria

Studies on Egyptian populations that look at telemedicine use and its impact on health outcomes were included criteria for this review. The design of studies included comprise mixed-methods, qualitative, and quantitative investigations so enabling a thorough examination of both patient experiences and quantifiable health results. Only research released in English was considered to guarantee accessibility and gather pertinent data from the region. Research released within the past ten years were included to mirror Egypt's recent telemedicine technological and adoption progress. Prioritising peer-reviewed journal papers only, helps to guarantee reliability and academic integrity. Exclusion criteria involve studies emphasising unrelated technology, or those looking at telemedicine without particular effects on healthcare access or results all kinds of reviews including systematic reviews, commentaries, reports, and unpublished papers were also removed. These criteria are justified since they guarantee that the results are relevant and applicable for comprehending the present situation and implications of telemedicine in Egypt by concentrating on modern, contextually relevant, and properly examined research.

Search strategy

A comprehensive search of electronic databases such as PubMed, MEDLINE, Embase, Scopus, and Web of Science was done to find relevant research published up to the present as these databases provide a set of tools to discover related studies and develop new scientific directions. A combination of Medical Subject Headings (MeSH) and keywords were used to identify relevant articles, focusing on terms related to telemedicine, healthcare utilization, and health outcomes among individuals in Egypt. The primary search terms were used "Telemedicine," "Digital Health," "eHealth," "mHealth," and "Remote Consultation." To capture usage and impact, additional terms like "Utilization," "Health Outcomes," "Healthcare Access," "Patient Satisfaction," and "Health Services Accessibility" were involved. A specific set of MeSH terms were combined with Boolean operators to broaden the search while refining results to the topic of interest. For instance, search strings include: "Telemedicine OR Digital Health and (Utilization OR Adoption) and Egypt" and "Telehealth OR mHealth and (Impact OR Outcomes OR Effectiveness) and Egypt." Additionally, truncation and wildcard symbols were employed to capture variations in terminology (e.g., "telemed*" to include telemedicine, telemedical). Manual screening of reference lists of pertinent papers were conducted to help to find more studies fit for inclusion requirements. Filters were used to restrict the search to research released in the past ten years, therefore guaranteeing that only the most recent data and insights are considered. This extensive search approach guarantees the acquisition of pertinent, high-quality evidence to guarantee a strong knowledge of the use and impact of telemedicine among people in Egypt.

Study selection

After a systematic search across numerous electronic databases, the studies identified were first de-duplicated using the Zotero reference manager.⁹ To do this, the whole list of records was sent to

Zotero, which recognised and eliminated duplicates automatically. The number of duplicates removed was recorded in the PRISMA flow chart as shown in Figure 1. After this, the remaining records were screened according to the established requirements for inclusion and exclusion. For example, the titles and abstracts of the retrieved studies were assessed for eligibility using the already-stated inclusion criteria. Full-text articles from potentially qualifying studies were evaluated for final inclusion. The reasons for excluding research were recorded in the PRISMA flow chart⁸ (Figure 1). This review tried to reduce bias by including high-quality evidence relevant to the research topic by selecting studies systematically and transparently.

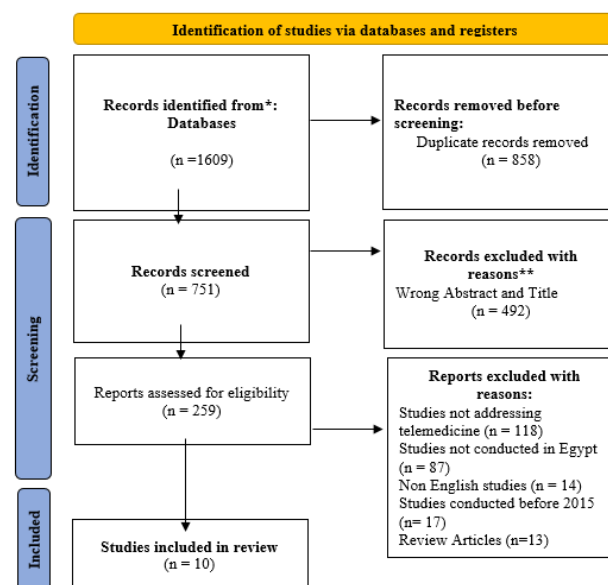


Figure 1 Study selection process.

Data Extraction

The data extraction for this systematic review was conducted systematically and thoroughly to ensure that all relevant information from eligible studies was included. A standardized data extraction form was created to facilitate the process, including crucial variables that aligned with the study's objectives. The data extraction form comprised fields for study characteristics (e.g., author(s), year of publication), study aim or title, sample size and participant characteristics, study design and methodology, telemedicine interventions, outcomes examined, and major findings, as well as the study setting (Table 1). The reviewer extracted these data from the included research to give a thorough synthesis of telemedicine utilization and its impact among Egyptians.

Quality assessment

The Joanna Briggs Institute (JBI) Critical Appraisal tools were used to assess the methodological quality and risk of bias in the papers included in this systematic review.¹⁰ The JBI Critical Appraisal Tool (cross-sectional, quasi-experimental) that is most applicable to the study designs under consideration was selected.^{11,12} Each included study was assessed by the reviewer using the JBI tool, taking into account characteristics such as study design, participant selection, and data collection methods, data processing, and findings interpretation. Studies were classified as high quality, moderate quality, or low quality based on their methodological rigour and transparency. This comprehensive quality assessment approach aimed to improve the reliability and validity of the systematic review findings.

Table 1 Data extraction of included studies

Study author and year	Study aim or title	Sample size and participant characteristics	Study design and methodology	Telemedicine interventions	Main findings
Alboraie et al., ¹⁵	Knowledge, applicability, and barriers of telemedicine in Egypt: a national survey	N = 686 participants (49.4% males, mean age 36.5 ± 11.2 years), from University Teaching Hospitals in eight governorates of Egypt.	Cross-sectional design using a questionnaire-based survey.	Telemedicine tools recognized by participants included video or phone calls (39.3%) and mobile applications (23.7%).	Majority exhibited high knowledge and positive attitude towards telemedicine. Concerns included patient privacy and medical errors. Participants preferred telemedicine over traditional methods.
Alboraie et al., ⁴	Healthcare providers' perspective about the use of telemedicine in Egypt: a national survey	Healthcare providers from different Egyptian governorates. N = 642 healthcare providers. 43.77% females; physicians (55.5%), nurses (27.3%), technicians (6.1%), administrative clerks (7.6%), medical directors (3.6%).	Cross-sectional study using a web-based survey.	Smartphone use was predominant among telemedicine users (65%). Smartphone applications were favored by 50% of participants.	Majority had not used telemedicine. Concerns included patient privacy. Implementation hindered by organizational issues.
Osman et al., ¹⁶	Telehealth utilization among Egyptian population and health institutional readiness: an exploratory study	N = 800 Egyptian citizens and 26 nursing administrators and IT personnel from 16 governmental hospitals and 10 private hospitals.	Cross-sectional study.	Telehealth utilization among the general population and hospital readiness for telehealth services.	35.1% of the population used telehealth services; 42% of governmental hospitals lacked initiative for telehealth implementation.
Shouman et al., ¹⁷	Awareness and attitude of primary healthcare patients towards telehealth in Cairo, Egypt	N = 170 attendees of primary health units in Cairo, Egypt. Majority females	Cross-sectional study.	Not specified.	64.7% awareness of telehealth; 78% willing to implement it. Age, residence, and PC ownership predicted awareness.
Eldoushy, ²³	Effect of applying telemedicine follow-up versus scheduled clinic follow-up on renal-transplanted patients' satisfaction	N = 42 renal-transplanted patients in Menoufia Governorate, Egypt.	Quasi-experimental design.	Telemedicine follow-up versus scheduled clinic follow-up.	No significant difference in overall satisfaction between groups. Telemedicine group had shorter commute and waiting times.
Tharwat and Gamal. ¹⁸	The attitude of Egyptian patients with autoimmune and rheumatic diseases towards telemedicine	N = 189 Egyptian patients with autoimmune and rheumatic diseases. Majority females (88.4%).	Cross-sectional questionnaire-based study.	Not specified.	Majority opposed telemedicine due to lack of physical examination and preference for direct interaction. Need assistance with technology.
Hegazy et al., ¹⁹	Telemedicine during the COVID-19 pandemic: Egyptian healthcare professionals' views	N = 262 healthcare professionals all over Egypt	Observational, analytical cross-sectional study using a web-based survey.	Not specified.	Limited knowledge of telemedicine among professionals. Majority believed telemedicine was necessary for patient care.
El-Mazahy et al., ²¹	Medical professionals' job satisfaction and telemedicine readiness during the COVID-19 pandemic: solutions to improve medical practice in Egypt	N = 959 medical professionals in governmental and private health sectors in Egypt.	Qualitative study: survey using an online questionnaire.	Not specified.	Low to moderate job satisfaction reported. Telemedicine perceived as moderately beneficial.
Omar et al., ²²	Effect of an orientation program regarding utilization of tele-maternity care on pregnant women's awareness, attitude and willingness during COVID-19 pandemic	N = 300 pregnant women in Al-Hadeka Maternity and Child Health Centre (MCH) in Al-Fayoum Governorate, Egypt.	Quasi-experimental pre-post-test one-group-only design.	Tele-maternity orientation program.	Significant improvement in awareness, attitude, and willingness post-intervention.
Anwar et al., ²⁰	Medicolegal liability and telemedicine practice during COVID-19 pandemic: Egyptian physicians' perspectives	N = 385 Egyptian physicians of various specialties.	Online survey.	Not available	Majority believed physicians should be protected from liability during the pandemic. Concerns over sharing patient data on social media.

Data synthesis

A narrative synthesis approach was used in this systematic review to synthesise the data from the included studies.¹³ The narrative synthesis entailed summarising major findings, identifying recurring themes or patterns, and investigating the links between various components of telemedicine utilisation and their impact on an individual's health outcomes.¹⁴ The synthesis also took into account the quality and context of the included studies to provide a more nuanced perspective on the evidence base.

Results

Characteristics of included studies

A total of 10 studies were included in this review. All the studies were conducted across various healthcare facilities in Egypt. All the studies were of quantitative methodology, with six studies utilising cross-sectional study design,^{4,15–19} two studies utilized surveys,^{20,21} while two used the quasi-experimental study design.^{22,23} Table 1 shows the characteristics of the included studies.

Quality assessment of included studies

The quality assessment for the selected studies was conducted using the JBI tool. The JBI checklist for analytical cross-sectional studies assessed the quality of the included cross-sectional studies and the surveys, while the JBI checklist for Quasi-experimental studies assessed the studies under included quasi-experimental studies. Studies were appraised using “Yes” “NO” and “Not Clear” in each domain. “Yes” was awarded 1 point, “No” was given 0, while “Not clear” was given 0.5. studies that scored from 7–9 were graded as “High quality,” Studies that scored from 5–6 were graded as “Medium quality” while studies with a score of less than 5 is graded as “Low quality.” All the selected studies scored from 9.5 to 10 indicating that they are of high methodological quality, and were used for the synthesis of this review. Appendix One illustrates the critical appraisal/quality assessment of the selected studies.

Themes identified

Five themes were identified across these included studies including knowledge and attitude towards telemedicine; utilisation and adoption rates; barriers to telemedicine implementation; the impact of telemedicine on patient care; community-led monitoring.

Knowledge and attitude towards telemedicine

Telemedicine studies in Egypt provide a comprehensive examination of the general population's knowledge and attitudes towards this technology, as well as those of healthcare providers, as highlighted by six included studies.^{4, 15,17–19,23} A common characteristic among Egyptians is their high degree of awareness and good attitude towards telemedicine. For example, Alborae et al.,¹⁵ discovered that the general populace had a high degree of understanding and a favourable attitude towards telemedicine, with 60.8% preferring it over conventional approaches.

Alborae et al.,⁴ found that healthcare providers take a more cautious yet hopeful position. Although 64% of healthcare providers had never utilised telemedicine, they recognised its benefits while also raising concerns about patient data protection and the possible impact on doctor-patient relationships. Similarly, Hegazy et al.,¹⁹ found a

moderate degree of perspective among healthcare workers, with many accepting the need for telemedicine for patient care despite their low knowledge of the technology. Contrarily, Shouman et al.,¹⁷ found high knowledge and desire among primary healthcare unit attendees, with the key barrier being a lack of experience with telecommunications equipment. The use of telemedicine in various medical contexts, such as kidney transplant follow-ups Eldoushy,²³ and rheumatology,¹⁸ demonstrates the variety in acceptance and satisfaction.

Utilisation and adoption rates

The adoption and use of telemedicine in Egypt gave a diverse but promising picture, with eight included studies revealing varying levels of engagement among the general public and healthcare providers.^{4,15–18,20,21,23} Alborae et al.,¹⁵ found that nearly half of their participants had previously utilised telemedicine technologies, primarily to follow up on laboratory results (67.3%). This suggests a high level of familiarity and participation with telemedicine among the general population. However, Osman et al.¹⁶ found a lower use rate of 35.1% among their participants; however, 43% stated a willingness to use telehealth services in the future.

According to Alborae et al.,⁴ 64% of healthcare providers have never used telemedicine, despite its apparent benefits. Smartphones and applications were the most popular tools among individuals who used telemedicine.⁴ In contrast, Eldoushy,²³ found that 90.7% of medical professionals used telemedicine during the COVID-19 pandemic. Similarly, Anwar et al.,²⁰ highlighted physicians' medico-legal concerns, with 63% practicing telemedicine while simultaneously acknowledging the necessity for specific licenses and training to reduce liability risks. Tharwat and Gamal¹⁸ provide more insights, noting that only 29.6% of patients with autoimmune and rheumatic disorders were willing to use telemedicine.

Barriers to telemedicine implementation

Concerns about patient privacy and data security have emerged as a significant barrier and six studies addressing the theme.^{4,15–19,21} Alborae et al.,¹⁵ discovered that 21.9% of participants were afraid that telemedicine would threaten patient privacy, while 32.8% were concerned about the unauthorised disclosure of medical information. Alborae et al.,⁴ reiterate this concern, stating that healthcare providers are likewise concerned about patient data protection.

Technological limits and the digital divide are significant barriers. According to Osman et al.,¹⁶ 72.5% of the general population perceives technological hurdles, which greatly reduces telehealth utilization. Similarly, Tharwat and Gamal,¹⁸ discovered that the majority of patients with autoimmune and rheumatic disorders required telemedicine technology. Communication obstacles also play an important role. According to Osman et al.,¹⁶ 97.6% of participants reported considerable communication obstacles. According to Shouman et al.,¹⁷ socioeconomic position and technical availability significantly influence telehealth awareness and willingness.

Healthcare providers' preparation and institutional support are further impediments. El-Mazahy et al.,²¹ found that medical professionals had moderate job satisfaction and a moderate perception of the benefits of telemedicine. Hegazy et al.,¹⁹ found that just 32.8% of healthcare professionals were knowledgeable about telemedicine, which influenced their desire to utilise the technology. Physical examinations and direct physician-patient encounters were also key concerns. Tharwat and Gamal,¹⁸ discovered that the absence

of physical tests and human connection were significant challenges for patients with chronic illnesses. Shouman et al.,¹⁷ supported this sentiment, discovering that the top reason for refusing to deploy telehealth was a preference for in-person consultations.

Impact of telemedicine on patient care

The selected research presented by six studies provides a multidimensional view of the impact of telemedicine on patient care quality, particularly in the Egyptian setting.^{15,17–19,22,23} Alborai et al.,¹⁵ and Shouman et al.,¹⁷ both highlight the Egyptian population's good attitude towards telemedicine, with a sizable proportion expressing a desire to use these services. Similarly, Eldoushy,²³ emphasises that telemedicine follow-ups for renal-transplant patients not only maintained high satisfaction levels but also dramatically reduced commuting and waiting times.

In contrast, Tharwat and Gamal¹⁸ observed that the majority of patients with autoimmune and rheumatic disorders opposed telemedicine since it required physical tests and additional procedures. Eldoushy²³ and Omar et al.,²² discovered significant increases in patient satisfaction when telemedicine was used, owing to shorter wait times and ease of access. Moreover, Hegazy et al.,¹⁹ state that the majority of healthcare workers recognised the importance of telemedicine during the COVID-19 pandemic.

Community-Led Monitoring

Several research included in this review shed important light on how the Egyptian community views telemedicine, including degrees of satisfaction, awareness, and readiness to use the service. Half of the whole population had already used telemedicine tools, mostly to retrieve results from laboratories, according to Alborai et al. (2021) national survey. Of the responders, a good number showed positive views; 60.8% of them favoured telemedicine above conventional approaches. But especially among older persons and those with less education, privacy issues and the possibility of more medical mistakes were also mentioned as causes of worry.

Similarly, in Cairo, Shouman et al.,¹⁷ evaluated awareness and attitudes among primary healthcare patients. Of the respondents, 78% indicated willingness to use telemedicine. Age, socioeconomic level, and digital access were clearly correlated with willingness and awareness. Only 35.1% of the overall population had utilised telehealth, according to Osman et al.,¹⁶ who also investigated public opinion and institutional preparedness and found that 43% of respondents expressed a desire to use it going forward. The survey identified as main community concerns communication problems (97.6%), and mistrust in healthcare practitioners (77.6%). These results highlight how important it is to include community perspectives in telemedicine design and execution.

Following an orientation session, Omar et al.,²² concentrated on pregnant women and revealed enhanced awareness, attitudes, and readiness to use tele-maternity services, therefore demonstrating the influence of focused education on community perceptions. These studies taken together show that although the Egyptian public is becoming more receptive to telemedicine, community-led monitoring and involvement are necessary to remove obstacles and raise satisfaction with telehealth technologies.

Discussion

Findings from this review show that Egypt's healthcare providers and the general public have a positive attitude and a high degree of

awareness regarding telemedicine. This review highlighted that a sizable proportion of the community is familiar with telemedicine tools and understands their potential benefits. The pandemic acted as a catalyst as compared with reviews by Omboni et al.,²⁴ and Bouabida et al.,²⁵ accelerating the adoption of telemedicine worldwide, as traditional healthcare systems were overwhelmed and social distancing measures were enforced. This global shift has been well-documented, with numerous studies indicating that the pandemic significantly influenced the public's perception of telemedicine, fostering greater acceptance and understanding.^{7,26,27} In Egypt, this global trend is mirrored, suggesting that the country is not isolated from the broader shifts in healthcare delivery observed worldwide.²⁸

However, the challenge lies in translating this awareness and positive perception into widespread practical use. According to the findings of his review, only 35.1% of Egypt's population has used telehealth services, indicating a gap between awareness and actual use. This is comparable with findings from other developing nations where infrastructure and technological barriers prevent broad use of telemedicine.²⁹ This gap between awareness and use underscores the importance of addressing infrastructural challenges, such as improving internet connectivity and providing affordable devices, to enable broader access to telemedicine.^{30,31} The Egyptian government's initiatives to enhance digital infrastructure could play a critical role in bridging this gap. For example, efforts to expand broadband coverage and increase internet speeds could facilitate greater telemedicine adoption.^{30,32} However, the review indicates that without addressing these infrastructural issues, the potential of telemedicine in Egypt may remain largely untapped.

Moreover, concerns about data privacy and security are prevalent, as noted by the findings of this study. These concerns are critical, especially in the context of digital health, where sensitive patient information is transmitted electronically, as asserted by a systematic review.³³ Similar issues, particularly in low- and middle-income countries with underdeveloped digital infrastructure, are not unique to Egypt.³² The review suggests that robust cyber security measures are essential to address these concerns and build trust in telemedicine systems. Comparative studies have shown that countries with strong data protection laws and advanced cyber security infrastructure have higher telemedicine adoption rates.^{30,32,34} Therefore, enhancing data privacy and security frameworks in Egypt could be a pivotal step towards overcoming these barriers and promoting telemedicine use.

Challenges to implementation of telemedicine identified in this review included technological constraints, privacy and data security issues, and the requirement for physical examination. Addressing the challenges requires thorough training programmes, improved technological infrastructure, and the development of strong privacy regulations. Successful telemedicine integration could improve healthcare access, reduce patient wait times, and minimize the pressure on healthcare facilities, particularly in rural and underserved areas.^{35–40}

This review highlights significant policy implications, emphasising the need for a supporting regulation to foster the growth of telehealth. Decision-makers have to surmount such hurdles as technological constraints and privacy issues by supporting the development of digital infrastructure and adopting comprehensive data protection laws. Additionally, governments should prioritise the equitable distribution of telehealth services across the public and private health sectors, specifically focusing on underserved rural areas. Standardised telemedicine rules and guidelines will be required to ensure uniformity of medical service and safety.

Limitations of this study

Despite its broad approach, this study has many limitations. One key disadvantage is the reliance on reported data, which may be prone to biases such as recall bias and social desirability bias. The convenience sample procedures used in several of the studies may limit the findings' generalizability to a larger population. Another drawback is the geographic concentration on Egypt, which, while offering extensive insights into the country's specific environment, may not be entirely applicable to other regions with varied healthcare systems and levels of technology infrastructure.

Conclusion

The results indicate a generally positive opinion towards telemedicine, accompanied by a relatively high level of awareness and readiness to use these services from the Egyptian public/community. Nevertheless, these technological limitations, privacy and security concerns, and the need for physical assessments are worth considering for a broad deployment. The influence on patient care is positive, i.e., more comfort and decreased waiting periods, with concerns about the level of doctor-patient interaction remaining. These implications state the need for extensive guidelines, specialized training, and sophisticated resource allocation to build up telemedicine services. Any further research should focus on the long-term results in the different locations and on the quality of telemedicine by using stronger experimental designs to fill in the gaps and help in the sustained incorporation of telemedicine into the healthcare system.

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Conflicts of interest

The authors declare there is no conflict of interest.

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Appendix Critical appraisal/Quality assessment of selected studies

S/N	Study author and date	Study design	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Overall assessment
1	Alboraie et al., ¹⁵	Cross-sectional study	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10/10 (High quality)
2	Alboraie et al., ⁴	Cross-sectional study	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10/10 (High quality)
3	Osman et al., ¹⁶	Cross-sectional study	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10/10 (High quality)
4	Shouman et al., ¹⁷	Cross-sectional study	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10/10 (High quality)
5	Eldoushy, ²³	Quasi-experimental	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10/10 (High quality)
6	Tharwat and Gamal, ¹⁸	Cross-sectional study	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Not clear	9.5/10 (High quality)
7	Hegazy et al., ¹⁹	Cross-sectional study	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Not clear	9.5/10 (High quality)
8	El-Mazahy et al., ²¹	Survey	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10/10 (High quality)
9	Omar et al., ²²	Quasi-experimental	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10/10 (High quality)
10	Anwar et al., ²⁰	Survey	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Not clear	9.5/10 (High quality)

The JBI checklist for analytical cross-sectional studies appraised cross-sectional studies and surveys under the following domain:

- Q1: Were the criteria for inclusion in the sample clearly defined?
- Q2: Were the study subjects and the setting described in detail?
- Q3: Was the exposure measured in a valid and reliable way?
- Q4: Were objective, standard criteria used for measurement of the condition?
- Q5: Were confounding factors identified?
- Q6: Were strategies to deal with confounding factors stated?
- Q7: Were the outcomes measured in a valid and reliable way?
- Q8: Was appropriate statistical analysis used?
- Q9: Was the response rate adequate, and if not, was the low response rate managed appropriately?
- Q10: Was the funding source or conflict of interest disclosed?

The JBI checklist for Quasi-experimental studies appraised quasi-experimental studies under the following domain:

- Q1: Is it clear in the study what is the 'cause' and what is the 'effect'?

Q2: Were the participants included in any comparisons similar?

Q3: Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?

Q4: Was there a control group?

Q5: Were there multiple measurements of the outcome both pre and post the intervention/exposure?

Q6: Was follow-up complete, and if not, were differences between groups in terms of their follow-up adequately described and analyzed?

Q7: Were the outcomes of participants included in any comparisons measured in the same way?

Q8: Were outcomes measured reliably?

Q9: Was appropriate statistical analysis used?

Q10: Was the funding source or conflict of interest disclosed?