



Examining the Attitude, Knowledge, and Awareness of Professionals Toward Telerehabilitation



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Authors

Norouzi Aval R.¹ MSc
Kimiafar Kh.^{*2} PhD
Sarbaz M.² PhD
Mousavi Baigi S.F.¹ MSc

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ABSTRACT

Aims Telerehabilitation is a branch of telemedicine and an emerging method of providing rehabilitation services through information and communication technology between patients and healthcare providers. This systematic review aimed to examine healthcare professionals' attitudes, knowledge, and awareness of telerehabilitation.

Information & Methods A systematic search was conducted without a time limit in PubMed, Embase, Scopus, and Web of Science databases on May 27, 2024. We followed the PRISMA guidelines for reporting evidence from the studies included in this systematic review. Titles and abstracts were independently screened based on eligibility criteria. A checklist was used for data extraction. The Joanna Briggs Institute Critical Appraisal Checklist for analytical cross-sectional studies was used to assess the quality of the studies included in this review.

Findings A total of 33 eligible articles were identified through this review. Out of these, 25 studies investigated healthcare professionals' attitudes toward telerehabilitation. Additionally, 15 studies evaluated the knowledge of healthcare professionals regarding telerehabilitation, while 10 studies explored their awareness of telerehabilitation.

Conclusion All health professionals have a positive and promising attitude toward the use of telerehabilitation, but half of the specialists have insufficient knowledge and limited experience in telerehabilitation.

Keywords Telerehabilitation; Attitude; Awareness; Knowledge

CITATION LINKS

[1] Knowledge, attitudes, and practices of speech language pathologists ... [2] Telerehabilitation in response to critical ... [3] Telemedicine: History, applications ... [4] Breaking barriers: Exploring physiotherapists' willingness and challenges in embracing telerehabilitation ... [5] Telerehabilitation: State-of-the-art ... [6] Knowledge, attitude, and barriers to telerehabilitation-based physical ... [7] Perceptions and willingness of physiotherapists ... [8] Telerehabilitation: Review of the ... [9] Enhancing quality of life ... [10] Musculoskeletal physical therapy ... [11] Cost-effectiveness of telemedicine ... [12] Perspectives on the evolution of ... [13] Physical therapists' perceptions of telephone ... [14] Acceptability and attitude towards ... [15] A review of success/failure factors ... [16] The PRISMA statement for ... [17] The Joanna Briggs Institute critical ... [18] "We are so close; Yet too ... [19] Tele-audiology in India ... [20] Awareness, attitude, belief and ... [21] Knowledge, awareness, attitude ... [22] Awareness and expectations ... [23] Saudi physicians' awareness and practice ... [24] Perspectives of Saudi occupational ... [25] Knowledge and attitudes of rehabilitation ... [26] Telepractice among speech and ... [27] Tele-physiotherapy in Iran: Perceived ... [28] Speech therapists' perspectives about ... [29] Feasibility, satisfaction with, and ... [30] Telerehabilitation readiness, knowledge ... [31] Telerehabilitation perceptions and experiences ... [32] A web-based survey on the telerehabilitation ... [33] Parents' and carers' attitudes ... [34] Exploring perspectives from stroke ... [35] I was really pleasantly surprised ... [36] Clinician perceptions of a prototype ... [37] Implications and attitudes of audiologists ... [38] Feasibility of incorporating functionally ... [39] Attitudes and expectations of health ... [40] Feasibility, acceptability and limitations of speech ... [41] Investigation of physiotherapists' awareness ... [42] Physiotherapists' perceptions of and ... [43] Attitude toward virtual rehabilitation and ... [44] Knowledge, attitudes and practices survey ... [45] Knowledge, attitude and skills ... [46] The state of the art in telerehabilitation ... [47] Exploring physiotherapists' perceptions of telerehabilitation ... [48] Ethical issues linked to the development of telerehabilitation ... [49] 'Well, if the kids can do it, I can do it' ... [50] The effect of tele-rehabilitation on improving physical activity in patients ...

¹Department of Health Information Technology, School of Paramedical and Rehabilitation Sciences" and "Student Research Committee", Mashhad University of Medical Sciences, Mashhad, Iran

²Department of Health Information Technology, School of Paramedical and Rehabilitation Sciences, Mashhad University of Medical Sciences, Mashhad, Iran

*Correspondence

Address: Department of Health Information Technology, School of Paramedical and Rehabilitation Sciences, Mashhad University of Medical Sciences, Pardis Daneshgah, Azadi Square, Mashhad, Iran. Postal Code: 9138813944

Phone: +98 (51) 38846725

Fax: +98 (51) 38846728

kimiafarkh@mums.ac.ir

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Introduction

Telerehabilitation, a branch of telemedicine, is an emerging method of providing rehabilitation services through information and communication technology, establishing communication between patients and clinicians while minimizing the barriers of distance, time, and cost [1, 2]. In 1950, telerehabilitation was implemented for the first time between two hospitals located 35 km apart [3]. In the 1960s, clinicians began using telerehabilitation for the diagnosis and treatment of patients [4].

Specific telerehabilitation interventions, utilizing various computer-based applications, vary depending on the patient's rehabilitation needs and available resources. These interventions may include telephone consultations, video conferencing, wearable technologies, teleconsultations with specialists, teletherapy services (such as virtual exercise programs and home sports), or telephysiological monitoring using body sensor technology [3, 5]. Typically, telerehabilitation services are provided to individuals living in remote geographical areas or those unable to attend rehabilitation centers due to disabilities or financial limitations [6]. This approach serves as an economical alternative for these patients and individuals [7].

With the advancement of technology, the provision of telerehabilitation services has become more accessible, and an increasing number of clinicians and patients are utilizing this method to deliver healthcare [8]. Telerehabilitation is an innovative approach designed to reduce outpatient medical services, shorten waiting lists, enhance safe continuity of care, save time and costs of healthcare services, and decrease the workload of physicians. This method is used by various healthcare providers, including speech therapists, occupational therapists, physiotherapists, and other rehabilitation specialists [4, 9, 10]. Through telerehabilitation, patients can receive counseling and treatment in the comfort of their own homes while also gaining access to the diverse services offered by this technology [11]. Additionally, telerehabilitation is preferred for its ability to facilitate better communication between patients and physicians, extend the duration of treatment sessions, provide feedback on prognosis, and be applicable in countries with different income levels [12].

Evidence shows that healthcare professionals generally have a positive attitude toward the provision of telerehabilitation services. In a study by Lawford *et al.* [13], there are physiotherapists expressing concerns about the lack of physical and visual contact with patients during telephone consultations, believing that their relationships with patients would be damaged. However, after providing telerehabilitation interventions, they have found fewer problems than anticipated and were able to establish stronger relationships with patients,

reporting greater enthusiasm for the care provided over the phone [13]. Similarly, according to Mahmood *et al.* [14], more than 80% of participants acknowledge the benefits of a mobile phone-based home exercise program, 72% agree that this method reduced costs, and 70% believe that it ensured the confidentiality of information. Most participants (82%-94.2%) feel that the mobile phone-based home exercise program helped reduce the time spent using post-stroke care services. While most studies in the field of telerehabilitation have focused on its benefits, applications, and methods of service delivery, there are limited studies addressing the factors influencing the success or failure of the technology for healthcare professionals. In a systematic review, three key success factors and nine failure factors in the field of telerehabilitation are reported. Success factors include satisfaction and willingness, cost/financial benefits, and knowledge of e-healthcare. Failure factors include resistance to change, lack of knowledge, financial constraints, lack of awareness, limited use of hardware and software, insufficient skill optimization, connectivity issues, inadequate participation in planning, and inadequate training [15]. Considering the widespread emergence of information and communication technology tools and the importance of telerehabilitation as a user-friendly and cost-effective technology for providing services to patients, conducting a study to examine the attitudes, knowledge, and awareness of professionals in telerehabilitation is essential. According to surveys, no study has been conducted in this field, so the researchers decided to investigate professionals' attitudes, knowledge, and awareness regarding telerehabilitation.

Information and Methods

Study design

This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to report the evidence obtained from the studies included in this systematic review [16]. The PRISMA checklist is provided in Appendix A. A literature search was conducted on the PubMed, Embase, Scopus, and Web of Science databases on May 27, 2024. The Medical Subject Headings (MeSH) and Emtree keywords and terms, (Attitude OR View OR Attitudes OR Sentiment OR Sentiments OR Opinions OR Opinion OR utilization OR Knowledge OR Awareness OR Use OR Skill) AND ("Mobile Application" OR "Mobile App" OR "Smartphone Apps" OR "mHealth" OR "Telemedicine" OR "telehealth" OR "Mobile Health" OR "eHealth") AND "Rehabilitation") OR ("Telerehabilitation" OR "Telerehabilitations" OR "Virtual Rehabilitation" OR "Tele-rehabilitation" OR "Tele Rehabilitation") were used to search the databases:

Eligibility criteria

The included studies cross-sectional studies investigating the attitude, knowledge, and awareness of health professionals toward telerehabilitation. The exclusion criteria were publications other than journal articles (e.g., books, review papers, and letters), a lack of availability of full text in English, and an absence of relevance between the title or abstract and the aim of the study.

Data extraction and synthesis

All articles were collected from the literature search, and duplicate articles were excluded from the review. Titles and abstracts were independently screened based on the eligibility criteria. Articles that did not meet the inclusion criteria were excluded from the review. The complete texts of the remaining articles were retrieved and screened by two independent researchers based on the eligibility criteria. Discrepancies were resolved through discussion, and in case of disagreement, the third author made the final decision. The same checklist was used for data extraction. The data items in this checklist included reference, country under study, publication year, participants' characteristics, the telerehabilitation approach used, attitudes towards telerehabilitation, knowledge about telerehabilitation, awareness of telerehabilitation, study goals, and main study findings.

Quality assessment

To assess the quality of the studies included in this review, the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for analytical cross-sectional studies was used [17]. The checklist consisted of eight questions to evaluate the quality of these studies, categorizing the responses into two options: Yes and No. A "Yes" answer was marked as one, and a "No" answer was marked as zero. Therefore, the maximum quality score that each study could obtain was eight, and studies were excluded if their quality score was less than five.

Findings

Study selection

The search strategy for this review is summarized in a PRISMA diagram (Figure 1). Two authors conducted the database search on May 29, 2024, yielding 11,571 articles. After removing duplicates (3,988) and articles in other languages, 7,583 articles remained and were evaluated based on their titles and abstracts. Of these, 7,433 were discarded for not meeting the inclusion criteria, and 150 records were selected for full-text screening. Finally, 33 eligible articles were included in the review.

Quality assessment

The quality assessment results (Table 1) indicated no significant bias in the studies, and all high-quality studies were included in our review.

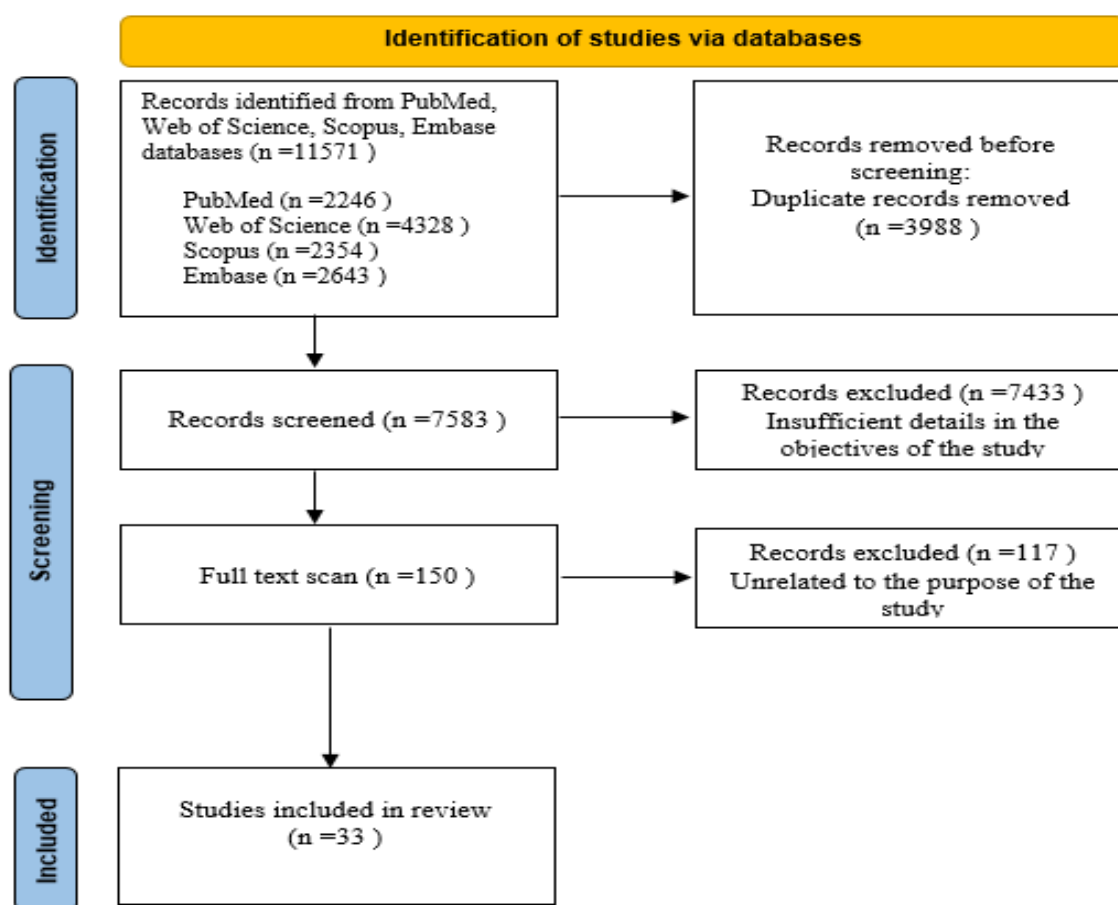


Figure 1. The steps of searching and selecting studies

Table 1. Summary of the quality assessment of articles using the JBI critical appraisal checklist

References	Questions								Score
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	
Bajaj & Karuppali, India, 2021 ^[1]	Y	Y	Y	N	Y	Y	Y	N	6
Erturan <i>et al.</i> , Ireland, 2023 ^[4]	Y	Y	N	N	Y	Y	Y	Y	6
Aloyuni <i>et al.</i> , Saudi Arabia, 2020 ^[6]	Y	Y	Y	N	N	Y	Y	Y	6
Lawford <i>et al.</i> , Australia, 2018 ^[13]	Y	Y	Y	N	Y	N	Y	Y	6
Mahmood <i>et al.</i> , India, 2019 ^[14]	Y	Y	Y	N	Y	Y	Y	Y	7
Bairapareddy <i>et al.</i> , India, 2021 ^[18]	Y	Y	Y	N	Y	Y	Y	Y	7
MR & Seethapathy, India, 2022 ^[19]	Y	Y	N	N	Y	Y	Y	Y	6
Ramanandi, India, 2022 ^[20]	Y	Y	Y	N	Y	Y	Y	Y	7
Kaur <i>et al.</i> , India, 2023 ^[21]	Y	Y	Y	N	Y	Y	Y	Y	7
Shah & Thakrar, India, 2022 ^[22]	Y	Y	Y	N	Y	Y	Y	Y	7
Al Maliki <i>et al.</i> , Saudi, 2021 ^[23]	Y	Y	N	N	Y	Y	Y	Y	6
Aljabri <i>et al.</i> , Saudi Arabia, 2023 ^[24]	Y	Y	Y	N	N	Y	Y	Y	6
Ullah <i>et al.</i> , Saudi, 2021 ^[25]	Y	Y	N	N	Y	Y	Y	Y	6
Mansuri <i>et al.</i> , Iran, 2021 ^[26]	Y	Y	Y	N	Y	N	Y	Y	6
Arzani <i>et al.</i> , Iran, 2022 ^[27]	Y	Y	Y	N	Y	Y	Y	Y	7
Bayati & Ayatollahi, Iran, 2021 ^[28]	Y	Y	Y	N	N	Y	Y	Y	6
Dadgar <i>et al.</i> , Iran, 2021 ^[29]	Y	Y	Y	N	Y	N	Y	N	5
Leochico <i>et al.</i> , Philippines, 2022 ^[30]	Y	Y	Y	N	Y	Y	N	Y	6
Leochico <i>et al.</i> , Philippines, 2022 ^[31]	Y	Y	Y	N	Y	N	N	Y	5
Sosa <i>et al.</i> , Philippines, 2024 ^[32]	Y	Y	N	N	Y	Y	Y	Y	6
Apps <i>et al.</i> , United Kingdom, 2024 ^[33]	Y	Y	Y	N	Y	Y	Y	Y	7
Morse <i>et al.</i> , UK, 2020 ^[34]	Y	Y	Y	Y	Y	Y	Y	Y	8
Lawford <i>et al.</i> , Australia, 2019 ^[35]	Y	Y	Y	N	Y	Y	Y	Y	7
Argent <i>et al.</i> , Ireland, 2018 ^[36]	Y	Y	Y	N	N	Y	Y	N	5
Kimball <i>et al.</i> , United States, 2017 ^[37]	Y	Y	Y	N	Y	Y	N	Y	6
Demers <i>et al.</i> , Canada, 2018 ^[38]	Y	Y	Y	Y	Y	Y	Y	Y	8
Biebl <i>et al.</i> , Germany, 2020 ^[39]	Y	Y	Y	N	N	Y	Y	Y	6
Cacciante <i>et al.</i> , Poland, 2021 ^[40]	Y	Y	Y	N	Y	Y	Y	Y	7
Süzer, Türkiye, 2023 ^[41]	Y	Y	Y	N	Y	N	Y	Y	6
Albahrouh & Buabbas, Kuwait, 2021 ^[42]	Y	Y	Y	N	Y	Y	Y	Y	7
Cho <i>et al.</i> , Korea, 2023 ^[43]	Y	Y	N	Y	Y	Y	Y	Y	7
Farah <i>et al.</i> , 2021, Lebanon ^[44]	Y	Y	N	Y	Y	Y	Y	Y	7
Saeed <i>et al.</i> , Pakistan, 2024 ^[45]	Y	Y	N	N	N	Y	Y	Y	5

General characteristics

Of the 33 studies included in this article, seven studies were conducted in India (23.5%) [1, 14, 18-22], four studies in Saudi Arabia (11.7%) [6, 23-26], four studies in Iran (11.7%) [27-29], three studies in the Philippines (8.8%) [30-32], two studies in England (5.8%) [33, 34], two studies in Australia (5.8%) [13, 35], and two studies in Ireland (5.8%) [4, 36]. Other studies were conducted in the United States [37], Canada [38], Germany [39], Poland [40], Turkey [41], Kuwait [42], South Korea [43], Lebanon [44], and Pakistan [45]. The various telerehabilitation approaches employed included virtual reality, telephonic exercise therapy, internet service delivery models, rehabilitation applications, computerized exercise therapy, video conferencing/webinars, mobile-based home exercise programs, and telerehabilitation using virtual training, phones, websites, online courses, telecommunications, Facebook Messenger, Google Meet, SMS communication, Viber, Zoom, OPD physiotherapy, wearable sensors, and video calling [6, 13, 14, 18, 21, 26, 29, 31-39, 43, 45]. The specialists involved in the studies came from nine fields, including physiotherapy, speech therapy, lung specialists, orthopedics, medicine, occupational therapy, audiology, surgery, and cardiology. The total sample size across the studies was 6,086 participants, with sample sizes ranging from 6 [34] to 1,111 [23]. According to "The State and Outlook of the World Economy" by Belzi, ten of the studies were conducted

in developed countries [4, 13, 33-39, 43], while 23 studies were conducted in developing countries [1, 6, 14, 18-32, 40-42, 44, 45] (Table 2).

Professionals attituded toward telerehabilitation

Out of the 33 studies included in this review, 25 investigated the attitudes of professionals towards telerehabilitation [1, 4, 6, 13, 14, 19, 20, 23, 24, 26, 27, 29, 30, 32-39, 42-45]. In all studies, professionals had a positive and promising attitude towards telerehabilitation in the clinical profession and its potential use in the future. Among these studies, ten were conducted in developed countries [4, 13, 33-39, 43], while 15 were conducted in developing countries [1, 6, 14, 18-20, 23, 24, 26-30, 40, 42]. In Albahrouh & Buabbas's study, most physiotherapists agree that telerehabilitation offers a practical solution for providing physiotherapy services to patients, particularly during the COVID-19 pandemic [42]. Similarly, Demers *et al.*, in their review of the integration of virtual reality intervention for cognitive telerehabilitation of the upper limb in people with acute stroke, report that all physicians are very satisfied with the VR intervention. They note that the intervention effectively addresses the motor, cognitive, and perceptual impairments of the patients [38]. Lawford *et al.* also report that 81% of physicians have had a positive attitude toward the use of telephone and internet-based exercise therapy methods for patients with knee and hip arthritis. They believe that the use of rehabilitation services through video care is useful, effective, and easy [13]. In

another study by Lawford *et al.* on the use of telephone services for patients with knee arthritis, physiotherapists have found this method convenient for patients, as it eliminates the need for in-person visits to the clinic. Physiotherapists also have reported a new enthusiasm for using this method [35]. Leochico *et al.* report that physicians agree that telerehabilitation is an effective method for providing rehabilitation services [30]. In Aloyuni *et al.*'s study, about 80.7% of physiotherapists have reported that telerehabilitation in physiotherapy is reliable and valid [6]. Additionally, 92.2% of participants believe that implementing telerehabilitation improves the quality of healthcare [5]. According to Mahmood *et al.* [14], over 80% of professionals have accepted the benefits of a mobile phone-based home exercise program, 72% agreed that it would reduce costs, and 70% believed it would ensure the confidentiality of information. In Erturan *et al.*'s study, most physiotherapists have had a positive attitude toward telerehabilitation, with 82.7% believing that telerehabilitation can reduce the energy spent by physiotherapists in rehabilitation [4]. In Biebl *et al.*'s study, approximately 77.2% (115.98) of participants welcome the integration of mobile application-based treatment methods for hip or knee osteoarthritis [39]. In Bajaj & Karuppali's study, speech therapists also have had positive attitudes towards telerehabilitation services [1]. In Saeed *et al.*'s study, 89.7% of physiotherapists have a positive attitude toward using telecommunication methods in telerehabilitation. Other studies have also shown that professionals across different fields have a positive attitude toward telerehabilitation [45].

Professionals' knowledge of telerehabilitation

Out of the 33 studies included in this research, 15 studies have evaluated the knowledge of professionals in the field of telerehabilitation [1, 6, 20, 21, 23, 24, 27, 28, 30, 32, 34, 36, 40, 43, 44]. Among these, eight studies have assessed professionals' knowledge levels as high [6, 20, 21, 24, 28, 32, 34]. Seven of these studies have been conducted in developing countries [6, 20, 21, 24, 28, 32], and one in a developed country [34]. Kaur *et al.* have found that 61.2% of physiotherapists have sufficient knowledge about telerehabilitation, 18% have moderate knowledge, and 19.5% lack knowledge in this field. Additionally, the majority of physiotherapists state that they have sufficient knowledge about telerehabilitation and more than 50% report that telerehabilitation can be used at every stage of the patient's rehabilitation [6]. Furthermore, more than half of the speech therapists (<50%) in the study by Bajaj & Karuppali state that they had little familiarity with telerehabilitation before the outbreak of COVID-19. [1]. In three studies, the knowledge of professionals in the field of telerehabilitation is moderate [26, 30, 32]. According to Mansuri *et al.* [26], the average knowledge score of speech therapists is 2.66 out of 5 (± 0.73), which is considered an average value. Additionally, in Sosa *et*

al.'s study [32], the average score for telerehabilitation knowledge among physiotherapists is 5.8 out of 9 points, with the majority of participants (50.3%) having an average level of knowledge. On the other hand, seven studies have evaluated the knowledge level of specialists as low [21, 23, 27, 31, 40, 43, 44], six of which have been conducted in developing countries [21, 23, 27, 31, 40, 44] and one in a developed country [43]. In Cacciante *et al.*'s study [40], the level of knowledge about telerehabilitation among speech therapists before the COVID-19 pandemic is very low, with only 11 therapists (9.40%) being familiar with telerehabilitation. Most physicians (61.5%) also have reported inadequate telerehabilitation knowledge in Leochico *et al.*'s study [31]. Furthermore, Farah *et al.* [44] state that almost one-third of cardiologists have good knowledge of telecardiac rehabilitation. More than half of the speech therapists in Bajaj & Karuppali's study [1] state that they have little knowledge of telerehabilitation before the outbreak of COVID-19 and that their knowledge have improved after the establishment and implementation of telerehabilitation services following the pandemic. In the study by Arzani *et al.* [27], physiotherapists have limited knowledge about the use of telephysiotherapy technology. Al Maliki *et al.* [23] also found that physicians have limited knowledge about pulmonary rehabilitation, as few of them have participated in pulmonary rehabilitation training. Cho *et al.* [43], in their study on the impact of using video games and virtual reality in physiotherapy, have reported that physiotherapists have the least necessary knowledge of AVG/VR, highlighting the need for educational interventions.

Professionals' awareness of telerehabilitation

Out of the 33 studies included in this research, ten have examined professionals' awareness of telerehabilitation [18-22, 24, 25, 27, 36, 41]. Nine of these studies have been conducted in developing countries [18-21, 24, 25, 27, 41] and one in a developed country [36]. In nine of the studies, professionals have demonstrated good knowledge of telerehabilitation. For example, all participants in Aljabri *et al.*'s study [24] have been aware of telerehabilitation as a practice modality used by health professionals in Saudi Arabia and have had a clear understanding of what it is and how it can improve access to occupational therapy services. Similarly, in Bairapareddy *et al.*'s study [18], most healthcare professionals (71%) are aware of the benefits and functionality of smartphone-based telerehabilitation. According to Süzer *et al.*'s study [41], the majority of physical therapists (76.26%) have been aware of telerehabilitation. In Ramanandi's study [20], 86.2% of physical therapists have been familiar with physical therapy services, obtaining information from other studies (25.5%), various media (24.1%), and other physical therapists (19.7%). Kaur *et al.* [21] also found that physiotherapists have a good understanding of telerehabilitation. In MR & Seethapathy's study [19],

63.2% of audiologists have been aware of telepractice guidelines from ISHA. However, two studies, both conducted in developing countries, have shown that professionals have limited knowledge of telerehabilitation. In Arzani *et al.*'s study [27], 84.37%

of physiotherapists have had little knowledge or familiarity with this technology and its benefits. Similarly, Ullah *et al.* [25] found that 46% of participants are aware of telerehabilitation service technology but did not use it.

Table 2. Summary of characteristics of the included studies

Author(s)/country/year	Type of Study	Type of instrument	Field	No. of participants	Rehabilitation approach	Attitude to TR	Knowledge of TR	Awareness of TR	Objective (s)	Result (s)
Bajaj & Karuppali, India, 2021 [4]	Cross-sectional	Internet-based questionnaire	Speech therapy	102	Telerehabilitation (TR) services	A positive attitude towards TR services in therapists	Over half of the therapists had limited knowledge of TR before COVID-19	-	Knowledge, attitudes, and practices of SLPs in India regarding TR	In India, TR SLP services remained important even after the pandemic.
Erturan et al., Ireland, 2023 [4]	Cross-sectional	Online questionnaire	Physiotherapy	219	-	PTs show a positive attitude toward TR and recognize its potential benefits.	-	-	Exploring PTs' desires, perceptions, and barriers in TR implementation.	PTs view TR positively and see its benefits.
Aloyuni et al., Saudi Arabia, 2020 [6]	Cross-sectional	Questionnaire	Physiotherapy	347	Video conferencing	80.7% (n=280) and (78.4%, n=272) of PTs reported that TR was reliable and valid in PT.	The majority of PTs reported having sufficient knowledge of TR.	-	Exploring PTs' TR knowledge, attitudes, and barriers.	There is a relatively high number of PTs in the KSA who are aware of TR.
Lawford et al., Australia, 2018 [13]	Cross-sectional	Internet-based survey	Physiotherapy	217	Telephone- and Internet-mediated service models	81% of PTs had a positive attitude towards phone-based PT exercise	-	-	Examining PTs' views on using phone and internet-based exercise	TR saves time and ensures privacy for osteoarthritis patients.
Mahmood et al., India, 2019 [14]	Cross-sectional	Questionnaire-based study	-	52	Mobile-based home exercise program	Most of the participants showed a positive attitude toward this treatment method.	-	-	Acceptability and attitudes of stroke survivors towards mobile home exercise	Stroke survivors and caregivers back mobile exercise in low-resource areas.
Bairapareddy et al., India, 2021 [18]	Cross-sectional	Online questionnaire	Physicians, rehabilitation nurses, and physiotherapists	52	Smartphones	-	Healthcare pros highly know smartphone-based TR for COPD	Most professionals were aware of smartphone-based TR	Feasibility of a smartphone-based TR program for COPD	Professionals and COPD patients are smartphone-based TR.
MR & Seethapathy, India, 2022 [19]	Cross-sectional	Questionnaire	Audiology	108	-	Most audiologists had a positive attitude toward telepractice.	-	63.2% knew ISHA telepractice guidelines	Studied audiologists' tele-audiology knowledge, attitude, and practice	Post-COVID, Indian audiologists increasingly accept telepractice
Ramanandi, India, 2022 [20]	Cross-sectional	Online questionnaire	Physiotherapy	500	-	58.9% deemed physiotherapy crucial in healthcare	-	427 participants knew about PT.	PTs' awareness, attitudes, and beliefs on TR	Positive views on TR services.
Kaur et al., India, 2023 [21]	Qualitative	Online survey questionnaire	Physiotherapy	200	Physiotherapy OPD, home visit, video call, phone	-	62.5% had full knowledge, 18.0% partial, 19.5% none	Most participants were aware of TR	PTs' TR knowledge, attitude, awareness, and practice in India	PTs had good knowledge and attitudes towards implementing TR.

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Shah & Thakrar, India, 2022 ^[22]	Cross-sectional	Online survey questionnaire	Physiotherapy	158	-	-	-	Most respondents were aware of the TR platform.	The awareness and expectations of TR among physiotherapists	PTs have good awareness and high expectations for future TR.
Al Maliki et al., Saudi, 2021 ^[23]	Cross-sectional study	Online questionnaire	Medicine	1111	-	37% of physicians showed a positive attitude towards pulmonary rehabilitation.	-	Few doctors lacked pulmonary rehabilitation training and knowledge.	Evaluation of knowledge and awareness, about the effectiveness of pulmonary rehabilitation	Physicians showed a positive attitude toward pulmonary rehabilitation.
Aljabri et al., Saudi Arabia, 2023 ^[24]	Qualitative	Semi-structured phone interviews	Occupational therapy (OT)	9	-	There was a positive attitude toward TR.	Saudi OT had a good knowledge of TR	All participants were aware of the TR	Effect of OTs' perspectives on TR	OT has good knowledge and awareness of TR.
Ullah et al., Saudi, 2021 ^[25]	Cross-sectional	Survey questionnaire	Rehabilitation professional	82	-	-	-	46% were aware of TR service technology	Exploring Saudi rehabilitation professionals' knowledge of TR.	Most cases were not involved in TR.
Mansuri et al., Iran, 2021 ^[26]	Cross-sectional	Online questionnaire	Speech-language pathologists	465	Tele-training	SLPs who participated in the study had good attitudes toward telepractice.	The mean knowledge score of the SLPs was moderate.	-	KAP of SLPs relative to telepractice during the COVID-19	Policymakers should take appropriate action in the field of effective telepractice for training SLPs.
Arzani et al., Iran, 2022 ^[27]	Cross-sectional, descriptive	Online checklist questions	Physiotherapy	192	Tele-physiotherapy (TPT)	Physiotherapists had a positive attitude towards remote physiotherapy.	PTs acknowledged that they had little knowledge of the use of this technology.	84.37% of PTs had little knowledge of this technology.	The PTs' perception of TPT and the barriers to its practical application during the COVID-19	During the COVID-19, a significant increase in the use of TPT has developed.
Bayati & Ayatollahi, Iran, 2021 ^[28]	Qualitative	Depth semi-structured interviews	Speech therapy	12	Tele-speech therapy (TST)	-	A relatively good knowledge and experience in using TST	-	Assessing the speech therapists' perspectives on using TST	TST offers advantages for both professionals and patients.
Dadgar et al., Iran, 2021 ^[29]	Cross-sectional	A web-based survey	Occupational therapists, speech therapists, audiologists, PTs	118	Virtual training and TR	All specialty professionals had a generally positive attitude toward TR.	-	-	Investigate the feasibility and attitude of professionals toward TR	Healthcare systems should create mechanisms for TR optimal use.
Leochico et al., Philippines, 2022 ^[30]	Cross-sectional	Online survey	Medicine	62	-	The doctors believed that using TR was a good idea.	Respondents had a mean TR knowledge score of 2.1±1.1 out of 5, interpreted as fair.	-	Determining the rehabilitation medicine residents' TR, knowledge, and acceptance	Subjects had mixed levels of TR adoption.
Leochico et al., Philippines, 2022 ^[31]	Cross-sectional	Online questionnaire	Rehabilitation medicine	161	Websites, online courses, conferences/webinars	-	Most medicines reported inadequate TR Knowledge (61.5%)	-	Determination of the perceptions and experiences of physiatrists regarding TR	Many physiatrists in the Philippines learned to adopt this service delivery method during the pandemic.

Continue of Table 2 from the last page.

Sosa et al., Philippines, 2024 ^[32]	Analytical cross-sectional	Online questionnaire	Physiotherapy	145	Facebook Messenger, Google Meet, call, SMS, Viber, Zoom	Most respondents had a positive attitude toward TR	The majority had average TR knowledge.	-	Determine the TR KAP of PTs during the COVID-19	The positive TR attitudes may represent a small group of PTs favoring TR.
Apps et al., United Kingdom, 2024 ^[33]	Cross-sectional study	Online survey	-	43	Computer, telephone	Parents/careers broadly have positive attitudes toward technology.	-	-	Exploring the views of UK parents and carers on the use of digital technology	Parents and caregivers positively viewed digital technology.
Morse et al., UK, 2020 ^[34]	Mixed-method	Focus groups and semi-structured interviews	Stroke clinicians	6	Virtual reality (VR)	Most clinicians agreed that VR rehabilitation could improve their work performance and effort.	Most physicians reported having sufficient knowledge to use VR rehabilitation.	-	Examining the opinions of clinicians about the use of VR in post-stroke care	End-users were positive and interested in using VR TR for spatial neglect.
Lawford et al., Australia, 2019 ^[35]	Descriptive qualitative	Semi-structured interviews	Physiotherapy	8	Telephone-delivered exercise therapy	PTs believed that the provision of medical services over the phone exceeded their expectations.	-	-	Investigating the perception of PTs before and after the implementation of the treatment method over the phone	PTs' initial skepticism about telephone services shifted to a positive perception of experience.
Argent et al., Ireland, 2018 ^[36]	Qualitative	One-to-one semi-structured interviews	Orthopedic	10	A single wearable sensor and an Android application	Experts have a positive attitude towards wearable technology.	-	Participants were aware of wearable technology.	Opinions of professionals regarding using wearable technology in rehabilitation	Clinicians were enthusiastic about real-time data tracking.
Kimball et al., United States, 2017 ^[37]	Cross-sectional	Online questionnaire	Audiology	258	Smartphones	Physicians had a positive attitude toward patients' use of smartphones.	-	-	Audiologists' attitudes towards integrating smartphones in audiology rehabilitation	Audiologists' attitudes probably do not hinder smartphone integration in audiological rehabilitation.
Demers et al., Canada, 2018 ^[38]	Mixed methods, including qualitative and quantitative approaches	Focus groups and semi-structured interviews	Medicine	9	Game-based VR	All clinicians were very satisfied with the VR intervention.	-	-	User satisfaction and safety of incorporating a low-cost virtual rehabilitation intervention	Functional activity game-based VR is effective in transferring clinical skills to real-world
Biebl et al., Germany, 2020 ^[39]	Cross-sectional	Questionnaire study	Surgical medicine	127	Mobile health programs	Most participants said they would welcome the integration of coaching procedures.	-	-	Determining the expectations and attitudes of medical professionals	A high acceptance of app-based therapy for osteoarthritis
Cacciante et al., Poland, 2021 ^[40]	Qualitative research	Survey questionnaire	Speech therapy	136	-	-	The level of knowledge about TR before the COVID-19 pandemic was very low.	-	Analysis of the Italian SLT opinions on the feasibility of the TR	Most Italian SLTs were not familiar with TR systems before the epidemic.

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Süzer, Türkiye, 2023 [41]	Cross-sectional	A web-based survey	Medicine	237	-	-	-	Most PTs were aware of TR.	Investigate the awareness and opinions of PTs in Turkey about TR	Most PTs were aware of TR.
Albahrouh & Buabbas, Kuwait, 2021 [42]	Cross-sectional	Electronic questionnaire/face-to-face semi-structured interviews	Physiotherapy	273	-	PTs surveyed had positive perceptions of TR.	-	-	Assessing PTs' perceptions of and willingness to use TR in Kuwait	PTs show overall positive perceptions towards TR.
Cho et al., Korea, 2023 [43]	Cross-sectional	Internet-based survey	Physiotherapy	350	Active video games and VR	Therapists experienced with AVG/VR had a more positive attitude towards it.	Therapists scored the lowest in the knowledge of AVG/VR.	-	Attitudes toward virtual rehabilitation	Therapists' attitudes towards VR/AVG are crucial for its implementation.
Farah et al., 2021, Lebanon [44]	Quantitative cross-sectional	Survey questionnaire	cardiology	77	-	Physicians had a positive attitude toward using cardiac rehabilitation (CR).	31.3% stated that they had good knowledge of cardiac rehabilitation	-	Assess knowledge, attitudes, and practices among physicians in CR	healthcare providers need more information and training on CR.
Saeed et al., Pakistan, 2024 [45]	Cross-sectional	Online questionnaire	Physiotherapy	350	Telecommunications	89.7% had a positive attitude towards the use of telecommunications in TR	-	-	Evaluation of the knowledge, attitudes, and skills of PTs regarding TR	PTs hold a positive view of TR, recognizing its importance in the care.

Discussion

This systematic review aimed to examine healthcare professionals' attitudes, knowledge, and awareness of telerehabilitation. Telerehabilitation is an emerging method for delivering rehabilitation services through information and communication technology. The attitudes, knowledge, and awareness of professionals in telerehabilitation are essential for successfully integrating this new technology and tool. While all health professionals had a positive and promising attitude toward using telerehabilitation to provide services to patients, half of the professionals had limited knowledge and experience with its use. This review included 33 studies that met all the inclusion criteria, evaluating the attitudes, knowledge, or awareness of professionals in the telerehabilitation field.

The attitudes of professionals toward telerehabilitation have been assessed in 24 studies. The majority of these studies (24 studies) have revealed positive and promising views on telerehabilitation [1, 4, 6, 13, 14, 19, 20, 23, 24, 26, 27, 29, 30, 32-36, 38, 39, 42-45], while participants in one study have exhibited a moderate attitude toward telerehabilitation [37].

The preservation of privacy and confidentiality is a significant concern and is often considered an obstacle to the use of telerehabilitation [46-48]. In Lawford *et al.*'s study [13], physiotherapists believe that using telephone and video-based exercise therapy for individuals with knee and hip osteoarthritis would help preserve patient privacy

and save time for patients. However, few agree that patients should not have any physical contact. Overall, physical therapists have had a positive attitude toward video-delivered care compared to telephone-delivered care and perceived video-delivered care as superior. According to Mahmood *et al.*'s study [14], most participants have had a positive attitude toward mobile app-based therapy. Over 80% of participants have recognized the benefits of a mobile phone-based home exercise program, with 72% agreeing that it would reduce costs and 70% believing it ensured the confidentiality of information. The majority of participants (82%-94.2%) have reported that the mobile phone-based home exercise program helps reduce time spent using stroke care services. On the other hand, regarding patient confidentiality and privacy, other studies have reported that patient safety and privacy can be compromised during the provision of telerehabilitation services [46-48]. Therefore, it seems that by implementing strong security solutions in telerehabilitation services, these concerns can be addressed to some extent.

A challenge in the use of telerehabilitation is the lack of physical contact between the patient and the provider [42]. There is a strong belief that telerehabilitation cannot completely replace the need or desire for face-to-face therapy [49]. Although the convenience of providing telerehabilitation services is consistently emphasized in various studies, there are instances where face-to-face treatment is preferred [42, 49]. While some participants in Shulver *et*

al.'s study [49] have preferred the face-to-face nature of counseling over video consultations, one patient has felt that videoconferencing therapy alone would be more suitable for someone primarily confined to the home due to a disability. Additionally, physiotherapists in Albahrrouh & Buabbas's [42] study have noted several disadvantages of telerehabilitation, including difficulties in diagnosing certain physical problems, lack of privacy for both the patient and therapist, limited practical interventions, and concerns about clinical effectiveness. In contrast, in Australia, physical therapists have expressed concerns about the lack of physical and visual contact with patients during telephone consultations before providing telephone exercise therapy to people with knee osteoarthritis [35]. This discrepancy between expectations and experiences may be partly due to the fact that physical therapists are not adequately trained to provide care remotely or without physical and visual contact with their patients. However, due to the lack of studies examining patient perspectives on telerehabilitation, it remains unclear whether using technologies and reducing face-to-face contact with therapists is an appropriate approach for patients, particularly elderly ones [49]. It seems that, according to the views of rehabilitation professionals in this field, a combined approach could be used in some cases. If necessary, certain meetings or initial examinations can be done in person, while the continuation of meetings, exercises, or evaluations of rehabilitation measures can be carried out using telerehabilitation technologies. This approach could likely address some concerns until the issues faced by professionals and patients in this field are resolved, proper infrastructures are created, and their attitudes, knowledge, and awareness are improved, especially in developing countries.

About half of the studies (50%) have examined professionals' knowledge of telerehabilitation. Half of these studies have reported that professionals' knowledge was high [6, 20, 21, 24, 28, 32, 34], while the other half have reported that knowledge of telerehabilitation was low [21, 23, 27, 31, 40, 43, 44].

Specific, hands-on training plays a key role in facilitating the adoption of telerehabilitation. According to Bairapareddy *et al.*'s study [18], professionals have a high level of knowledge regarding smartphone-based telerehabilitation in chronic obstructive pulmonary disease. Most participants have learned about smartphone-based telerehabilitation through lectures and symposia (18.9%), as well as peer group discussions (27%). On the other hand, in Sosa *et al.*'s study [32], physiotherapists have reported average knowledge of telerehabilitation (5.8 out of 9) and have considered their knowledge to be unskilled or average. This indicates a strong need to enhance the knowledge and skills of physiotherapists regarding telerehabilitation through seminars, training, and integration into the educational curriculum. These

initiatives would inevitably boost physiotherapists' confidence in digital practice and ultimately help to reorganize their practice by combining digital and face-to-face methods to improve patient treatment outcomes. In Leochico *et al.*'s study [31], most physicians (61.5%) have reported insufficient knowledge of telerehabilitation. Additionally, in the Philippines, telerehabilitation has not been part of the curriculum or internship training, which may have affected the respondents' understanding and confidence in using it [30]. Telerehabilitation has existed even before the COVID-19 pandemic, and we can draw valuable insights from reputable institutions with extensive experience in telerehabilitation training for professionals. However, curriculum design should be adapted and contextualized to the needs and resources available in the local environment. Considering that most professionals are already familiar with information technology skills, distance rehabilitation training content can extend beyond basic and technical aspects to include ethical, legal, and socio-economic principles relevant to their specific work area [44, 50]. On the other hand, the level of awareness of telerehabilitation was measured in only about a third of the studies (32%). The majority (86.2%) of the participants in Ramanandi's study [20] have been aware of physical therapy services and have reported receiving information about physical therapy from hospitals (25.5%), various media (24.1%), other physical therapists (19.7%), and other methods (20.8%). According to MR & Seethapathy [19], including tele-practice guidelines in the audiology curriculum could help many professionals become familiar with the ethical rules and guidelines related to tele-audiology.

This systematic review has several advantages. First, we adhered to the guidelines for systematic review techniques. Second, the JBI assessment checklist was used to evaluate the strength of the evidence in each of the included studies, enhancing the transparency of the study quality. Third, this review provides valuable insights for health policymakers regarding the use of telerehabilitation in medicine and healthcare. However, this study was limited to examining studies related to the attitudes, knowledge, and awareness of specialists toward telerehabilitation. It is recommended that future studies also investigate both successful and unsuccessful experiences of implementing telerehabilitation, along with the factors influencing the success and failure of such programs.

Conclusion

All healthcare professionals have a positive and hopeful attitude toward the use of telerehabilitation in providing services to patients.

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