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Original Research

Experiences of physical therapists applying telerehabilitation to neurological patients: A qualitative study

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ABSTRACT

Background: Telerehabilitation has been widely used in neurological diseases in recent years. The experiences of physical therapists and the difficulties they face are critical to the effectiveness of telerehabilitation.
Objective: To examine in depth the technical challenges, patient interaction strategies, and session management processes faced by physical therapists who use telerehabilitation for patients with neurological conditions and to assess the opinions of physical therapists about the advantages, disadvantages, technological infrastructure needs, and support strategies of telerehabilitation.
Methods: In this study, phenomenological qualitative research method was used. In-depth interviews were conducted with eight physical therapists who treated patients with neurological disorders with telerehabilitation in our country. Interview data were analyzed using content analysis.
Results: The analysis revealed seven key themes and 26 sub-themes, which were categorized into two main areas: telerehabilitation session management and perceptions of telerehabilitation sessions. In the area of session management, physical therapists reported challenges related to the adaptation of traditional rehabilitation techniques to the online environment, including difficulties with assessing patients' physical conditions remotely, ensuring patient engagement, and managing technical issues such as internet connectivity and software limitations. They also highlighted the importance of clear communication, structured session planning, and the need for additional training to effectively conduct telerehabilitation sessions.
Conclusions: Considering the advantages and disadvantages stated by physical therapists using telerehabilitation with patients with neurological conditions, solutions should be developed to increase the efficiency of telerehabilitation. Applications with simple interfaces, a home environment suitable for exercise sessions, and strategies to support technology adaptation can significantly improve the efficiency of telerehabilitation.

Introduction

Neurological disorders are emerging as a major cause of death and disability worldwide as the world's population ages and grows.[1] In particular, disorders such as stroke, Parkinson's disease (PD), Alzheimer's disease, epilepsy, and migraine are on the rise and have a negative impact on quality of life.[2] A recent major study shows that by 2021, >3 billion people worldwide will be living with a neurological disorder.[3]

Telerehabilitation (TR) is an approach that involves the delivery of rehabilitation through various technologies and encompasses a range of rehabilitation services, including assessment, monitoring, prevention, intervention, supervision, education, consultation, and coaching.[4] TR can occur through a variety of technological options, such as the telephone, video conferencing, virtual reality programs, apps, and software.[5] Rehabilitation with technological aids has been discussed for at least three decades due to the inaccessibility of some patients, mobility difficulties, distance, and severity of diseases.[6] However, with COVID-19, there has been a rapid digital revolution in the field of rehabilitation, as patients' access to rehabilitation centers had to be restricted for many reasons.[7] Especially after 2019, a significant increase has been observed in the number of TR studies.[8]

There are descriptive and qualitative studies in the literature examining the TR experiences of patients, caregivers, relatives, and

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clinicians.[9-14] The study, which examined the views of service users, their families, caregivers, and health professionals (speech and language therapists, physical therapists, occupational therapists, medical staff, nurses, and industry representatives) on telerehabilitation for individuals with neurological diseases in Ghana, highlighted the advantages of telerehabilitation, such as ease of access, time savings, and continuity of care, while also highlighting significant barriers such as access to technology, internet connectivity issues, and device costs.[10] It has been reported that physical therapists treating neurological patients and older adults in Sweden do not use telerehabilitation widely, and that this is due to physical therapists' inexperience in TR and lack of training programs. It was stated that it is therefore important to determine the experiences and attitudes of physical therapists in the field of TR and to develop various strategies.[9]

Some of the studies in the literature examine the experiences of TR stakeholders not through in-depth interviews but through surveys or similar measurement methods.[9,14] Our study differs from these studies in that it includes in-depth qualitative interviews. Studies on the TR experiences of physical therapists included physical therapists who worked with patients with musculoskeletal conditions and general patients.[10,12,13,15] As a result, there are limited studies in the literature that examine the TR experiences of physical therapists applying TR to neurological patients through in-depth qualitative interviews. Therefore, in this study, we aimed to perform an in depth examination of the technical difficulties, patient interaction strategies, and session experiences of physical therapists who use TR with patients with neurological conditions, as well as to determine the opinions of physical therapists about the advantages, disadvantages, and aspects that need improvement of TR.

Methods

Study design

The study was conducted using the phenomenological method, a qualitative research technique. In the study, a semi-structured interview was used with a non-participant observation method. All interviews were conducted individually. During the semi-structured interview, the researcher not only asked the predetermined questions, but also asked additional questions that would elaborate the answers without directing the participants according to their answers. The researcher conducted the semi-structured interview not only by asking predetermined questions but also by bringing up interesting topics mentioned by the participants.[16] Because the non-participant observation method was used in the study, the researcher only observed the participant and collected the data by taking voice recordings; otherwise, no intervention was made.[17]

Participants

A purposive sampling method was adopted, and physical therapists who have followed neurological patients with TR were included in the study. Before starting the study, approval was obtained from the Atatürk University Faculty of Health Sciences Non-Interventional Ethics Committee (decision no: 2024/03/15). Polkinghorne[18] recommends that the researcher interview 5–25 participants who have experienced a particular phenomenon. In addition, qualitative studies show that sampling should be terminated when data saturation is reached, when meaning saturation is reached, and when repetition occurs.[19] In this study, a total of 25 physical therapists who had experience in applying neurological rehabilitation through TR in our country were identified using national health databases and thesis archives. Physical therapists were informed about the study through various communication channels such as e-mail and social media. Interviews were planned with 15 physical therapists who agreed to participate in the study according to the order of contact. Data saturation guided the sample size for this study. When the interviews with eight physical therapists were completed, it was observed that data saturation was reached and the interviews were terminated at this point.[20] Of these physical therapists, four monitored patients in Ankara, two in Izmir, and two in Istanbul. The participating physical therapists were five females and three males, aged between 26 and 36 years. Their professional experience ranged from 4 to 11 years. Two of the participants had followed two patients post stroke, two with PD, and four with multiple sclerosis. The participants performed TR sessions for durations ranging from 4 to 12 weeks (Table 1).

Data collection

A total of eight semi-structured, in-depth interviews were conducted with eight physical therapists between March and May 2024. Each interview lasted between 30 and 45 min and was conducted in Türkiye. Documentation was done using field notes and post-interview notes. Written informed consent was obtained from all participants, and the data collected were securely stored with the removal of identifiers to protect confidentiality. The interview guides were designed based on previous literature and the researcher's expertise (Box 1).[21,22]

Data analysis

Braun and Clarke's six-step thematic analysis was used to analyze the data. The approach includes: (1) familiarizing oneself with the data through transcription and repeated reading; (2) generating initial codes; (3) searching for themes; (4) reviewing themes; (5) identifying themes; and (6) writing conclusions, including explanatory quotes.[23] The interviews were transcribed and coded using the MAXQDA software version 2020.2.2. Once familiar with the data, B.Ö used line-by-line coding to analyze the initial transcripts and identify the main themes that emerged. Combining this inductive approach with previous literature and written notes, he developed a preliminary coding framework, which was finalized by the team.[24] Thematic analysis was conducted within the categories of the coding framework, with constant comparison at different levels, between content, and code within an interview, between themes, and groups of themes.[25,26] The team met regularly to discuss emerging themes. Saturation of codes and meanings was reached after interviewing 8 physical therapists.

Results

The final coding framework consisted of semi-structured qualitative interviews with eight physical therapists. The two categories identified were "perceptions about telerehabilitation" and "telerehabilitation session management," with 98 and 52 coding references, respectively. We

Table 1
Information about physical therapists.

	Age	Professional experience (years)	Patient seen	Follow-up time
P01	36	9	Stroke	6 weeks, 3 days, 60 min
P02	30	8	Stroke	3 weeks, 5 days, 90 min
P03	26	4	Multiple sclerosis	8 weeks, 2 days, 30 min
P04	28	5	Parkinson	6 weeks, 3 days, 30 min
P05	27	5	Multiple sclerosis	8 weeks, 2 days, 30–60 min
P06	32	9	Multiple sclerosis	6 weeks, 3 days, 60 min
P07	28	6	Multiple sclerosis	8 weeks, 3 days, 60 min
P08	33	10	Parkinson	6 weeks, 3 days, 60 min

Box 1
Semi-structured In-depth Individual Interview Form

1. Why was the decision taken to use the telerehabilitation method?
2. What were your first impressions when telerehabilitation was introduced?
3. How do you interact with your patients via telerehabilitation?
4. What are you doing to increase patient participation?
5. Did you experience technical difficulties during telerehabilitation? How did you overcome them?
6. How did the patients interact with the technology? What kind of support do you provide when they need help?
7. How satisfied do you think patients are with the telerehabilitation experience?
8. What suggestions would you make to improve the telerehabilitation process?
9. What are the advantages of telerehabilitation for you?
10. What situations do you think telerehabilitation is not effective?
11. What are the challenges you face when dealing with technological problems, disconnections, or other difficulties?
12. What do you think are the shortcomings of telerehabilitation compared to face-to-face sessions?

reported the category of perceptions about telerehabilitation under three themes: advantages, disadvantages, and suggestions. We reported the category of TR session management under 3 themes: session decision-making process, problems during the session, and solution strategies. Table 2 presents the frequencies of the sub-themes. The relationships between categories, themes, and sub-themes are presented in Fig. 1. The views on the themes and sub-themes related to perceptions of telerehabilitation are presented in Table 3, and the views on the themes and sub-themes related to TR session management are presented in Table 4.

Table 2
Frequency distributions of categories, themes, and subthemes.

Category	Theme	Subtheme	n	%
Perceptions about telerehabilitation	Advantage	Flexibility	7	87.5
		Saving time	7	87.5
		Accessibility	7	87.5
		Comfort	6	75
		Lower cost	6	75
		Less physical effort	4	50
	Disadvantage	Lack of physical contact	8	100
		Safety	7	87.5
		Loss of session time	4	50
		Difficulty in assessment	3	37.5
		Difficulty understanding	2	25
		Failure to provide a standard environment	2	25
	Suggestions	Strengthening the technological infrastructure	6	75
		Simple interfaces specific to telerehabilitation	3	37.5
		Telerehabilitation specific environment	2	25
Telerehabilitation session management	Session decision making process	Pandemic	7	87.5
		Logistic	4	50
		Academic	3	37.5
	First impressions during the session	Inexperience	6	75
		Problem in compliance with the session	3	37.5
	Problems during the session	Internet outage	6	75
		Poor internet connection	4	50
		Failure to connect to session	4	50
		Lack of communication	2	25
	Solution strategies	Training	6	75
		Relative or caregiver support	6	75

Perceptions about telerehabilitation

Advantages-Accessibility: Many physical therapists in our study commented on the accessibility of TR. The most important opinions about accessibility were the elimination of the effects of weather conditions and transport problems. *"Today it is rainy, today there is snow in the air, there is no chance for them to say, 'I will not come'. Therefore, they participate more easily …… In a different situation, for example, one of my patients would come and go from a distance of one hour by car" (P02).*

Advantages-Flexibility: The flexibility of TR sessions was another advantage frequently reported by physical therapists. "When they had something to do, we could immediately change that time or day. We could plan it for another day. In other words, it is a method open to all kinds of manipulation so as not to change the treatment dosage" (P03).

Advantages-Comfort: Physical therapists stated that one of the most important advantages of TR sessions is the high level of comfort. "One of the most common things that patients say is the comfort in the home environment…" *P02.* "…He said that it was very comfortable for him to go home after work, eat his dinner, and then do online exercises" *(P01).*

Advantages-Less physical effort: One of the most important advantages that the physical therapists in our study emphasized was that the physical effort was less than in face-to-face sessions. *"Those who came to face-to-face sessions usually came tired. Some patients even said, "Let me come half an hour early, let me rest a little in the clinic, then let's do exercises. Since telerehabilitation sessions are attended from home, this is not the case." P08. "They said that starting exercise before fatigue occurs is really efficient for them in terms of exercise. Because of the time they spent on the road, some patients with physical mobility disorders stated that they were extremely tired while coming to the clinic" (P06).*

Disadvantages-Lack of physical contact: One of the main barriers perceived by therapists is the lack of physical contact with patients. In our study, physical therapists stated that this made it difficult to teach exercises to patients during the session, to receive feedback from patients, and to improve the patient-therapist relationship. *"The patient turns a screw during the treatment. I say, Look, now I want you to do this movement, ……, not just this movement. By touching the patient, I can explain something that I would explain in 10 s, without touching the patient, I can explain it in 1 min, I can explain it in 2 min" (P02). "I felt as if I had less control because I could not touch the patient. Of course, it is not possible in cases where I want to do manual application" (P01).*

Disadvantages-Safety: Another situation that physical therapists who followed neurological patients with TR saw as a disadvantage was patient safety problems. *"When I mobilised the patients more actively, there were situations where I could not mobilise them, or rather, let me put it this*

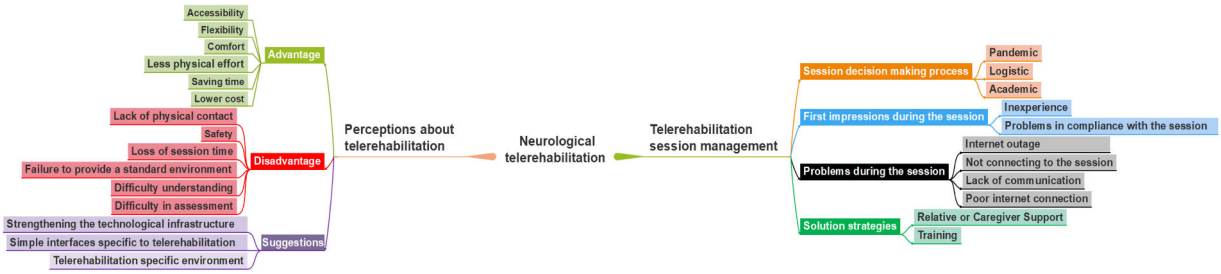

Fig. 1. Visualizing the Codebook.

way, when there was a loss of balance, I had to hold back from doing some things due to safety problems" (P05). "Another thing that is missing is patient safety. In order to ensure patient safety, it is necessary to provide a system for the patient. This is not possible. Therefore, it is a little difficult to ensure patient safety" (P02).

Disadvantages-Loss of session time: Physical therapists reported that they lost session time due to communication problems with patients during the session, internet interruptions, and freezes, and it was more difficult to explain exercises to patients online. *"I was explaining something that I could explain in 10 s in 1 min or even 2 min" (P02). "The internet coming back can cause temporal cost, so in this case, we actually lose session time" (P05).*

Disadvantages-Failure to provide a standard environment: The disadvantage stated by some physical therapists is the difficulty of providing a standard rehabilitation area in the home environment of the patients. *"The floor where the patients do their exercises can be different…. lighting can be different…Of course, there may be objects around, they can get stuck in the objects …. so the house is not suitable, again some features caused by the environment limit us in this case "(P04).*

Suggestions-Strengthening the technological infrastructure: "I think it can be integrated with technology. In other words, technical infrastructure can be established, future studies can be like this, but these are really expensive things. They really need infrastructure and support. It can be integrated with virtual reality applications or consoles" (P03). Physical therapists applying telerehabilitation in neurological patients stated that it is necessary to monitor the patients instantly. "…patients can be evaluated instantly with wearable sensors, smart watches or other sensor-based technological devices. Because we cannot monitor the patient and we cannot physically intervene with the patient" (P04).

Suggestions-Simple interfaces specific to telerehabilitation: One of the most important recommendations of physical therapists is the dissemination of TR applications with simple interfaces. During the interviews, therapists frequently complained that patients had problems in connecting to the session. *"We had problems in the connection part, so there should be simpler interface systems specific to TR. It can be combined with other technological possibilities" (P07).*

Telerehabilitation session management

Session decision making process-Pandemic: Most of the physical therapists in the study stated that they turned to TR as a necessity during the pandemic period. The most important reasons for preferring TR in this period were; they stated that it was safer for patients in that period and that hospitals were closed due to restriction decisions. *"Since it was the pandemic period, we could not reach every patient. Patients would not be able to come to the hospital due to restriction decisions. Therefore, we planned the treatment as TR" (P01).*

Session decision making process-Logistic: We can say that perhaps the most important effect of TR, especially by both patients and therapists, is that it eliminates transport problems. *"…Of course, the fact that our patients come from many cities was also a factor. Although our centre was in Izmir, patients came to us from all over Turkey" (P05).*

First impressions during the session-Inexperience: Physical therapists stated that because they had to adapt quickly due to the pandemic, both they and the patients experienced inexperience, especially in the first sessions of TR. *"Since I was doing it for the first time, there was also an amateurism for me. Of course, I got used to it in a few sessions, but for example, all patients have some difficulty in the first two sessions, to be honest. But after three sessions, the patients started to do the exercises very easily" (P01). "The patient group that I applied the TR session was a group that experienced it for the first time. I was also experiencing it for the first time, so there was a lot of uneasiness" (P06).*

First impressions during the session-Problems in compliance with the session: "Some patients looked at the screen themselves, sometimes the screen was looking at the ceiling, sometimes it showed the patient halfway, but I was following it somehow. I mean, the fact that the patients were a little unfamiliar with technology affected the process, of course" (P08). "The level of technology use of the patient is especially important here, patients whose technology knowledge is not very good had more difficulty in adapting to the TR session" (P02).

Problems during the session-Internet outage or poor internet connection: The most common problems during the session cited by physical therapists were internet outage and freezing or slowing down of the image due to poor internet. Physical therapists had to postpone sessions due to image freezing or slowing down. *"If these freezes, image disturbances were happening a lot because I could not see the exercise, I could not understand whether it was fully done or not, I had to postpone the session" (P06). There were also physical therapists who had to change the exercise area during the session for the same reason. "There were freezes in a few patients. The modems were in the living room and the exercises were usually done in other rooms, but the problem improved when the patients changed rooms" (P01).*

Problems during the session-Failure to connect to session: "I can state that some patients generally could not open the application we would use during the session" (P07) "There were many patients whose camera could not be opened. We solved them with video calling methods, such as allowing access" (P02).

Problems during the session-Lack of communication: Some physical therapists reported serious problems in communicating with patients. "Sometimes it is a little difficult for them to understand what is being explained. We experienced this a lot, especially in the elderly. In fact, one of my patients had a one-hour session. It was up to one and a half hours. The reason for this was difficulty in understanding" (P08).

Solution strategies-Training: Some physical therapists trained the patients on the interface to be used to avoid problems during the session and worked on scenarios during the session. During the interviews, many of the physical therapists mentioned the necessity of providing training to the patients on equipment, sessions, and other issues. *"We installed applications on their computers. We taught them how to use them. How will they enter the password, ID? …… We gave a training on possible scenarios, for example, the internet went out. The camera is switched off. Where will they switch on the camera? Where will they connect the sound? We gave training on these." (P02).*

Solution strategies-Relative or Caregiver Support: Many of the physical therapists who follow neurological patients with TR stated that

Table 3
Themes and Sub-themes Related to Perceptions of Telerehabilitation.

Theme	Sub-themes	Example participant quote
Advantage	Accessibility	For patients who live far away, it may not always be possible to travel by public transport. In such a case, telerehabilitation can be considered as a treatment option. I have also received patients from districts, so such an application may facilitate their access to treatment. P01
		In general, our working patients, who have difficulty in taking leave from work, have access to treatment thanks to telerehabilitation. P06
		Thanks to telerehabilitation, we eliminated this transportation problem and made access to treatment much more comfortable. P06
	Saving time	I think one of the most important advantages is time saving. For example, one of my patients told me, 'It took me 45 min to get there and 45 min to get back. When I added the waiting time for public transport, I was spending >3 h in total for a 1-hour session. Moreover, the minibuses were often very crowded, so it was often difficult to even find a seat. Now, thanks to telerehabilitation, we have eliminated all this trouble; a session of only 1 hour is now completed in exactly 1 hour instead of taking 3 h from my patient's day. P01
		It can sometimes take 1.5–2 h for patients to reach the clinic by public transport. Thanks to telerehabilitation, we eliminate this loss of time and provide easier access to treatment. P02
	Comfort	In my opinion, telerehabilitation is a very comfortable option for patients. People can focus on the treatment better when they are in areas where they feel comfortable. Being able to participate in treatment whenever and wherever they want is an important factor that increases participation. P03
		… patients were able to exercise at home and in a comfortable environment. This was very comfortable for them …P08
	Lower cost	There is an economic dimension for patients to reach the clinic. P02
		Especially patients who are not in a very good clinical condition have additional costs such as car hire to come to the clinic. Telerehabilitation sessions are cost effective for these patients. P05
		No transport costs. P07
	Less physical effort	It causes less fatigue in patients as they do not have to come to the clinic by public transport P04.
		Neurological patients really make a serious effort to come to the clinic. Telerehabilitation session eliminate this situation. P02
		With telerehabilitation, we reduced a 3-hour process, including the time to reach the clinic, to 1 hour. The sessions lasted only 1 hour and the patients were able to participate in the sessions without getting tired.
		They did not go home tired after the session. I think this made the process much more efficient. P01
	Flexibility	I think it is important that we can adjust the time of the sessions with more flexibility than traditional sessions. Obviously we didn't have to adhere to a specific time frame, even late in the evening if the patient had work commitments. P07
		If necessary, we could change the session times, we could relocate it. Telerehabilitation is more flexible in this regard than traditional sessions. P05
Disadvantage	Lack of physical contact	We have had such minor problems. Apart from that, we cannot fix it manually. Especially as physical therapists, there are things that we can intervene in the clinic or that we cannot show directly. P08
		I would say that the disadvantage of telerehabilitation is the lack of physical contact. For example, in face-to-face sessions, I can immediately observe whether the patient is doing the exercise correctly by making physical contact with the hand and correct it immediately if necessary. This opportunity is limited in telerehabilitation, so not being able to provide direct support for some movements can create a difficulty. P06
		As physical therapists, we like touching and palpation, so I think this may sometimes be needed. P05
	Safety	Patients with a high degree of disability may be at risk of falling in a telerehabilitation-based treatment, especially when performing balance exercises. In this case, the patient may need to have someone with them at all times to watch them. P03
		I have never had any safety issues because I do upper limb therapy …. Especially if I practiced balance or any exercise that requires balance I would have very serious concerns about safety. P08
	Loss of session time	If there is any problem during the session, it is more difficult to communicate with the patient and solve the problem than a face-to-face session. Therefore, we may lose session time. P04
		I used to schedule patients for consecutive sessions, and when one of them would disconnect, we would lose session time trying to sort it out. P06
	Difficulty in assessment	Because there is no contact, there are some applications that are not possible without contact. We cannot apply this in telerehabilitation. For example, we do not know whether there is a contracture condition or not. We do not know how the muscle strength is. P04
		As physical therapists, we would like to be able to evaluate patients during the exercise session. However, telerehabilitation sessions are currently far from realising this. P03
	Difficulty understanding	Because we gave pelvic floor muscle exercises, there were a few patients

(*continued on next page*)

Table 3 (*continued*)

Theme	Sub-themes	Example participant quote
		who did not understand this contraction. They did not benefit much from telerehabilitation. In other words, we could not explain the contraction to these people. P07 It is sometimes difficult for the patient to explain what they need to do and sometimes they do not understand what is being explained. P08
	Failure to provide a standard environment	… I have seen it in 2–3 of my patients, they want to behave comfortably like at home. I walked into a telerehabilitation session, he lit a cigarette. He is waiting for me. Because the patients are in a home environment, they try to do everything they would do at home. (P02)
Suggestions	Strengthening the technological infrastructure	It would be nice to set up systems that can see patients with 3–4 cameras, because we see them from a single angle, which is a disadvantage, and although we mostly see them while doing the exercises, we may have problems such as leaving the screen from time to time and re-entering. So it would be nice if they developed programs that use 3–4 camera angles. P01 We had problems in the connection part, so there should be systems with simpler interfaces specific to telerehabilitation. It can be combined with other technological possibilities. For example with things like sensors…P07
	Simple interfaces specific to telerehabilitation	I think that the process can be supported in some way with applications and mobile applications, that is, with more specific applications. P05 My patients were generally elderly individuals, so the most difficult thing for me was that the patients had difficulty in using the program we used. I think the development of simple telerehabilitation -specific applications can be good for both the patient and us. P08
	Telerehabilitation specific environment	If possible, to create an environment for this in their homes. Create a special environment. For example, I told them to clear the dining table for exercise. They need to know that it is a separate area for exercise. It is necessary to explain better that this is a treatment. P02

the support of relatives and caregivers is very important and that they play a key role in solving the problems experienced during the session. *"Some patients could not connect. We used to get support from the patient's relatives, and those who had no relatives with them used to get support from their neighbours" (P06). "We also asked the caregivers what we would do for each patient, what we expected from the caregiver, and if it was possible for the caregiver to be present in the session. We also trained the caregivers on some issues." (P02).*

Discussion

As a result of our study, physical therapists who applied TR to neurological patients stated that TR enabled patients to exert less effort to reach the session and this led to less fatigue. However, they

Table 4
Themes and Sub-themes Related to Telerehabilitation Session Management.

Theme	Sub-themes	Example participant quote
Session decision making process	Pandemic	Because we are in the pandemic period and we cannot plan face-to-face treatment, we decided to have a telerehabilitation session during this period. P07 We were in the pandemic period, to ensure session continuity. P08
	Logistic	Because it was the Covid period, we would not be able to reach every patient. Patients would not be able to travel to and from the hospital due to restraining orders. Therefore, we planned the sessions as telerehabilitation. P01
	Academic	Telerehabilitation was used very often during the Covid period. That's why we wanted to try it on our patients. P08
First impressions during the session	Inexperience	In the first few sessions, I started with a fear that I could not reach the patient, in fact, I think it was actually due to inexperience. P05 The first time I used telerehabilitation, I was worried that both the patient and myself would not be able to adapt to the session. P04
	Problem in compliance with the session	In telerehabilitation, a one-hour session lasted one and a half hours. However, as the sessions progressed, I saw that the adaptation problem disappeared and the duration shortened. P06
Problems during the session	Internet outage	The internet went down for a few sessions. Our interaction was completely cut off. I guided the patient by phone and told him to switch his modem on and off. We waited for the internet to come back. P02
	Poor internet connection	The internet quality of several patients' homes was really bad. We experienced a lot of freezing, so there was a serious loss of session time. P08
	Failure to connect to session	I mean, no matter how much we explain. The some patient doesn't know how to connect to the video conference, doesn't know how to turn it on, or doesn't know how to call me. We had these problems. The most challenging thing for me is the low technology usage skills of the patients. P08
	Lack of communication	The patient group I followed had Parkinson. I had serious difficulties in communicating with the patients on telerehabilitation . I thought this might be due to their old age and cognitive impairment. P04
Solution strategies	Training	I had already anticipated that they would need help. It is a little bit difficult. After the assessment sessions and before starting the treatment, I downloaded the application myself and showed the participants how to use it. P03 If the patient had no knowledge about the application we would do the session, we set up the application, gave information about the application and taught the patients how to use it. P05

(*continued on next page*)

Table 4 (*continued*)

Theme	Sub-themes	Example participant quote
	Relative or caregiver support	Very few of my patients were able to attend the session on their own. We usually received support from their relatives. P08 We received support from the patient's grandchildren, children, and spouse, and even neighbours if they had no relatives. P04

emphasized that patients had more difficulty understanding the exercises than in face-to-face sessions and had serious difficulties in connecting to the session or using the apps. Therefore, they stated that there is a need for apps with simpler interfaces for patients. They emphasized that some patients may have very relaxed and undisciplined movements at home, so a standardized environment at home specific to TR sessions is required. They also frequently mentioned the advantages of TR, such as accessibility, time saving, comfort, and flexibility, and the disadvantages, such as lack of physical contact, safety, and assessment difficulties, which have been previously reported in studies on different patient groups and various health professionals.[10,12,13]

Reason for session decision: A review of the literature shows that the number of TR studies increased significantly after the pandemic.[27] It can be seen that these studies generally conducted their sessions in the form of TR during the pandemic period.[27,28] In our study, the main opinion of the physical therapists we interviewed was that they decided to perform TR sessions because of the pandemic.

Advantage: Paul et al., in 2020, as a result of a study of people with neurological disorders, their caregivers, and health professionals, found that the main benefits of TR were easier access to rehabilitation, less time, distance, and cost.[10] In a systematic review by Nordio et al.,.[29] TR was found to improve patient compliance. In particular, they highlighted the benefits of TR services, such as reduced costs (both for public health and patients) and increased access to care for patients living in remote areas where traditional rehabilitation services are not readily available.[30,31] As a result of a study conducted to identify the barriers and facilitators perceived by patients with a stroke, accessibility was identified by patients as one of the most important facilitators.[22] Similar to the literature, in our study, the most frequently mentioned benefits by physical therapists applying TR were accessibility, flexibility, time saving, and convenience. Moreover, physical therapists in our study reported that patients with neurological disorders benefit from participating in TR sessions at home, avoiding the hassle and fatigue of going to the clinic.

Disadvantage: A comprehensive review of the feasibility, cost, and access to rehabilitation services for low and middle income countries found that the main barriers to TR were lack of knowledge and technical skills among service providers and service users, skepticism and resistance to change among patients and providers, lack of secure platforms, limited resources, connectivity issues, difficulties with equipment, and lack of access to technology.[32] Some studies in the literature have also found that most patients with neurological disorders can be treated with TR, except for procedures with treatments and applications that require physical contact. They have identified the lack of physical contact as a disadvantage of TR.[15,28,33] In our study, this was the most common disadvantage reported by physical therapists. Another commonly reported disadvantage in the literature is problems with patient safety during the session.[34,35] In our study, one of the other major disadvantages reported by physical therapists was safety. Some of the main reasons for this situation are that the patient group followed by physical therapists is patients with neurological disorders and the average age in this population tends to be higher. Fernandez et al. emphasized the importance of eye contact in clinical interactions; however, in TR, this may become difficult as clinicians have to focus on the camera lens.[36] Similarly, physical therapists in our study stated that interaction with patients was difficult, that patients had more difficulty understanding the exercises than in face-to-face sessions, and that they had serious difficulties in continuing the sessions or using the applications.

Problems during the session: A fast and high-quality internet connection is one of the most basic elements needed for both health professionals and patients who want to use TR. However, when the studies in the literature are analyzed, in the studies where barriers are reported, it is stated that connection problems (poor and slow internet connection) are a major obstacle for TR.[37,38] Poor quality and slow internet during TR will most likely result in a loss of connectivity and poor video and audio quality which will negatively affect both the health professional's and the patient's interest in using TR services.[39] The most important problem reported by physical therapists in our study was problems related to internet quality, and speed during the session. Another important issue is the lack of technical skills of patients to use necessary electronic devices such as computers, tablets, and smartphones, which may prevent patients from connecting to the session or the session from being conducted effectively.[40] The results of our study are similar to the literature in this respect. Physical therapists highlighted the lack of patient engagement as an important problem. It was evaluated that this may be due to the fact that the patient group was generally elderly and did not have sufficient technological knowledge and experience. Another important problem reported by some physical therapists in our study was the difficulty of creating a standardized environment at home. Especially during the sessions, they reported that more undisciplined attitudes and behaviors were observed in patients than in face-to-face sessions.

Solution Strategies: A serious obstacle to the effective use of TR is the lack of technical skills among service providers and service users to use the necessary electronic devices such as computers, tablets, smartphones, etc..[40] Training service providers and users can contribute to the development of knowledge and skills for the effective use of TR technology. The acquisition of this knowledge and technical skills can facilitate the use of the technology and support its acceptance.[41] In their study, Hwang et al. found that participants used a variety of strategies to overcome the restrictive effects of TR, including using the telephone as a backup means of communication, connecting to broadband networks rather than wireless internet, and relying on family members for computer support.[42] In our study, it is noteworthy that physical therapists have two important suggestions for solutions, which are in line with the literature: one is to provide training to patients about the TR systems, and the other suggestion is to get help from the patient's caregiver or family members during the session. We can say that the main reason for both the need for training and the need for help from family members and caregivers is the low technology skills of the patient groups. The fact that the patient groups followed by the physical therapists in our study were generally older people is also an important reason.

Limitation

The most important limitation of ours is that the physical therapists who participated in the study followed patients in the three largest cities in our country and shared their experiences specific to the patient populations in these cities.

Recommendations for clinicians and further studies

It is important for TR practitioners working in the field of neurology to remember that caregivers or family members are one of the most important stakeholders in TR sessions. For the sessions to be efficient, practitioners should educate both patients and caregivers about the TR system. Otherwise, there may be problems with communication and interaction with patients during the session. In addition, inexperienced patients may prevent the efficient use of the session time. Therapists in our study agreed that the technical infrastructure of TR systems should be improved, the systems should be developed in such a way that

patients can be assessed, and patients should be monitored in real time. Overcoming the lack of physical contact should be the most important goal for future studies. In this way, patients can participate in sessions in a safer and more confident manner. In addition, the TR application area must provide all the necessary physical conditions for exercise. Therefore, a standardized TR-specific space should be created in patients' homes. Physical therapists state that it is almost impossible to perform advanced exercises in TR sessions, and there is a widespread concern that such exercises may lead to adverse conditions. Future studies should work on the solution to this issue.

Conclusion

One of the most important advantages of TR reported by the physical therapists in our study was that it allowed patients to exert less effort to reach the sessions. The reported disadvantages were that neurological patients had significant difficulty in understanding the exercises compared to face-to-face sessions and that patients had difficulty adhering to the session. To implement TR sessions more effectively in these patients, physical therapists reported the need for simple interfaces that are easy for patients to use and the need to standardize the environment in which patients are at home during the TR session. In addition, another important result of our study was that physical therapists who applied TR to patients with Parkinson often reported communication problems and problems with session adherence, while those who applied TR to patients with MS stated that the biggest advantage of TR for this group was flexibility and accessibility.

Declaration of competing interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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