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Review

Remote Delivery of Allied Health Therapies in Parkinson's Disease

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Abstract. Remote delivery of allied health therapies has long been possible, but adoption has been limited in some disciplines until relatively recently. The COVID-19 pandemic drove dramatic increases in use of remote delivery within allied health. This review summarizes the latest evidence on remotely-delivered physical therapy, occupational therapy, and speech therapy and discusses associated challenges and opportunities.

Keywords: Allied health, telemedicine, Parkinson's disease, physical therapy, occupational therapy, speech therapy

INTRODUCTION

Remote delivery of allied health therapies has become increasingly utilized and accepted as a result of the COVID-19 pandemic. A recent report from the American Physical Therapy Association indicates that nearly 33% of physical therapists report using telehealth as a means for providing care [1]. This represents a substantial increase in the use of remote delivery of allied health, in particular physical therapy, compared to pre-pandemic times, during which only 4% of physical therapists reported utilizing telehealth. The emergent nature of the pandemic and the shift from in-person to remote for many activities drove this trend out of necessity. But how much do we really know about remote delivery of allied health therapies? What gaps in our knowledge should we set out to fill as we move beyond the pandemic and remote delivery returns to being a choice rather than a requirement? This review summarizes current knowledge and knowledge gaps regarding remote delivery of three allied health disciplines, physical therapy, occupational therapy, and speech therapy. Challenges and opportunities as we move beyond the pandemic are also discussed.

PHYSICAL THERAPY

Use of physical therapy, provided through telehealth, accelerated due to the COVID-19 pandemic. During the pandemic, there were less in-person exercise offerings and a corresponding reduction in exercise participation among people with Parkinson's disease (PD) [2]. Physical therapists believe telehealth will remain part of their practice going forward and have identified benefits (e.g., convenience for the patient, increased patient retention) and limitations (lack of hands-on assessment) [3]. Remote delivery of physical therapy presents a unique opportunity for people with PD to engage in rehabilitation due to the reduced burden associated with getting in/out of the home, transportation, and travel.

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Evidence suggests that remote delivery of physical therapy and exercise is safe and feasible for people with PD [4–9]. Overall, studies evaluating physical therapy services using telerehabilitation generally include individuals with idiopathic PD aged 50–75, between Hoehn & Yahr stages I–III, within 2–10 years of diagnosis, and without evidence of dementia. The types of exercise with remote delivery or supervision varied significantly (e.g., dance [4], amplitude-based movement training [5, 10], postural stability training with virtual reality [6], aerobic exercise via cycling [7], mindfulness yoga [11], coordinated multidisciplinary care [12], Badajuajin Quiigong [13], generalized physiotherapy exercises [8, 9]). Safety was demonstrated in remote sessions delivered to either a group [4] or individually [5–7, 9]. Across all forms of remotely delivered exercise, there were no serious adverse events associated with the interventions. Individuals participating in remotely delivered rehabilitation participated in greater than 75% of scheduled sessions suggesting reasonable adherence and comparable to in-person sessions [4, 5, 8, 9, 11].

In addition to the demonstrated safety and feasibility of remotely delivered physical therapy interventions, several studies demonstrate efficacy for reducing motor sign severity and improving mobility in people with PD. In a large randomized controlled trial, van der Kolk [7] and colleagues studied high-intensity aerobic training completed within the home with remote supervision compared to an active control group performing stretching exercises. After six months, the intervention group had a small reduction (i.e., improvement) in the off-state MDS-UPDRS III score while there was a nearly 4-point worsening in the control group. These findings suggest that high-intensity aerobic exercise delivered within the home with remote supervision may reduce motor sign severity in people with PD [7]. Flynn and associates [8] compared remote delivery of an exercise intervention to center-based delivery. For the first 5 weeks of the intervention, both groups completed center-based exercises and an exercise self-management program. For the second 5 weeks of the intervention, participants were randomly assigned to complete a home program monitored via telehealth or continue the center-based exercises. Both groups demonstrated similar improvements in balance and gait speed suggesting no effect based on delivery type (remote vs. center-based). Pastana Ramos and colleagues noted improvements in TUG time following an individualized telerehabilitation program for people with PD in the Brazilian Amazon, though this was not superior to those who were provided an exercise booklet [9]. Seidler et al. [4] noted improvements in balance and motor sign severity when comparing a remotely-delivered, group-based dance intervention compared to in-person delivery. A cohort study of remotely-delivered amplitude-based movement training using the LSVT BIG paradigm demonstrated improvements in motor sign severity, subjective activities of daily living (ADL) performance, and quality of life [10]. A case study of the same remotely-delivered intervention reported improvements in gait, endurance, balance confidence, and quality of life in a 67-year-old woman with PD [5]. Finally, a remotely-delivered mindfulness yoga program resulted in improved motor sign severity and balance as well as reduced anxiety and depression [11].

OCCUPATIONAL THERAPY

As was the case for physical therapy, the use of telehealth to deliver occupational therapy rose substantially during the COVID-19 pandemic. Sixty percent of occupational therapists reporting use of telerehabilitation during the pandemic as compared to just 36% pre-pandemic [14]. There are just a few studies focusing on activities of daily living or upper extremity function addressed through remote delivery, while the majority of studies to date focus on remotely-delivered cognitive training. Studies evaluating remote delivery of occupational therapy services generally include people with PD who are on average 60–75 years of age, in Hoehn & Yahr stages 2 to 3 with disease duration averaging 5 to 10 years, and MMSE scores above 24.

ADLs and upper extremity function

The groundwork for use of telerehabilitation to address activities of daily living and upper extremity function in PD [15] started in the mid 2000 s with a study of a low-bandwidth system used to assess ADL status and hand function. Scoring via the telerehabilitation system was compared to traditional face-to-face scoring of assessments including the motor component of the Functional Independence Measure, selected items from the UPDRS, the Nine Hole Peg Test and other measures. The telerehabilitation system was noted to be valid and have a high level of reliability when assessing ADL status and hand function. Two more recent studies conducted within the past five years focused on use of telerehabilitation

to deliver exercises for enhancement of upper extremity function in PD. One study used an exergaming platform to deliver an adaptive "fruit picking" game to target reaching and grasping. Participating set up the exergaming system at their home and did 10 sessions of exercise (up to 30 minutes per session) over the course of three weeks [16]. Over 90% of participants were able to set up the system on their own. After 10 sessions, the group showed statistically significant and clinically meaningful improvements in Box and Blocks Test, UPDRS III, Jebsen test, writing a letter and moving light objects. The second study used a home-based virtual reality system to deliver unsupervised upper extremity exercise and compared this to use of the same virtual reality exercise program in a supervised clinical setting and to conventional rehabilitation [17]. All three groups demonstrated significant improvements in discriminative sensory function, wrist proprioception, gross manual dexterity bilaterally, and fine manual dexterity of the most affected hand.

Cognition

Cognitive changes can impact occupational performance, so timely monitoring of cognitive status is key to guiding occupational therapy interventions. One means of cognitive assessment is via videoconference, with an early study showing that about 3 out of every 4 patients evaluated receiving the same cognitive classification whether assessed remotely or in person using the Montreal Cognitive Assessment (MoCA) [18]. A more recent study showed good agreement for the MoCA and an abbreviated neurocognitive test battery when assessed in person as compared to when assessed remotely three months later [19]. Participants and providers in this study noted that the remote assessment eliminated costs related to time, travel, and caregiver burden, may allow inclusion of people who would be otherwise unable to attend, and provides a familiar testing environment while mitigating data loss. On the other hand, disadvantages noted by participants and investigators included difficult logistics for scheduling, lack of staff assistance with testing materials during evaluations, as well as possible distractions in the testing environment.

A few studies have examined the remote delivery of cognitive training in PD. Participants who took part in computerized cognitive training during at home transcranial direct current stimulation (t-DCS) supervised via videoconference showed improvements in UPDRS total and UPDRS-III scores as well as faster completion times on the Grooved Pegboard Test [20]. Good feasibility and usability were observed in a 6-week app-based cognitive rehabilitation program delivered remotely using participants' own smartphones [21]. Another study implemented a series of 14 twice-weekly sessions of cognitive rehabilitation, followed by one session per week for a duration of six months for maintenance therapy [22]. The treatment took place in groups of 4 patients in remote mode through use of an online meeting platform. Participants demonstrated improvements in cognition but not mood with this intervention. Just over half of the participants had limited digital literacy and needed assistance from another person to get connected, at least initially. Most participants indicate that they very or very much appreciate the online intervention with themes noting that it was a place for listening and welcoming, was stimulating and engendered feelings of calm and happiness. Only one participant was bothered by the online intervention due to unreliable internet connection.

SPEECH THERAPY

Speech language pathologists (SLPs) have been exploring remote delivery of home-based speech treatment for people with PD for more than a decade, though there are no studies to date of remote delivery of dysphagia therapy in PD [23]. Studies evaluating remote delivery of speech therapy services generally include people with PD who are on average about 70 years of age, in Hoehn & Yahr stages 1–4 with mild to moderate dysarthria. Early studies using video-based conferencing demonstrated the validity, feasibility and acceptability of online delivery of Lee Silverman Voice Treatment (LSVT) first in a case study [24]. This was followed by a randomized, controlled non-inferiority study comparing online vs. face-to-face LSVT, demonstrating high participant satisfaction and non-inferior improvements in sound pressure level with online therapy [25]. Later work confirmed that remotely delivered LSVT is non-inferior [26], that it is effective and has high patient satisfaction [27], and also showed that individuals with PD who had more years of education and higher cognitive performance scores are more likely to accept remote delivered LSVT [28]. More recent work demonstrates that readily available technologies and free apps can be used for voice telerehabilitation. One study utilized an iPad to deliver LSVT via Facetime

also showed non-inferiority compared to face-to-face treatment [29], and another uncontrolled pilot study used WhatsApp freeware to deliver sessions that were highly satisfying to participants and successful in increasing vocal loudness [30]. Another ongoing study is testing use of a dedicated speech training app to deliver personalized, home-based remote therapy for a total of 215 people with PD, which will be the largest ever study of voice telerehabilitation [31].

In additional to individual therapy as outlined above, group speech maintenance using telerehabilitation is also feasible and can improve and maintain vocal loudness in people with PD [32] And, the ongoing ParkinSong Online feasibility study is testing therapeutic group singing for people with PD to improve speech and wellbeing [33]. Another ongoing study is examining use of telehealth to deliver a program called Better Conversations, a communication partner training program that works with dyads comprised of a person with PD and their partner to build conversation skills [34].

Additional considerations for voice telerehabilitation include utilization rate and cost. A 2020 survey of SLPs revealed that only 23% engaged in telepractice, though 77% were interested in it [35] and we imagine that post-pandemic surveys would show that the numbers have shifted substantially. Only one study to date directly compared the cost of remote vs. in-person LSVT, revealing considerable cost savings from a patient perspective and slightly higher costs for remote delivery from the health system perspective [36].

MULTIDISCIPLINARY APPROACHES

Few studies to date have assessed remotely delivered, multidisciplinary care but examples are beginning to emerge in the literature. Two noteworthy studies in 2023 examined patient satisfaction with multidisciplinary telerehabilitation, including people with a variety of chronic conditions including PD. Roy et al. [37] noted high satisfaction for all participants in a four-week intervention intended to recreate at home what individuals would have experienced in a rehabilitation center. A physical therapist, and occupational therapist and a sports educator were part of the team delivering two to three sessions per day five days a week for patients with low back pain or neurological diseases including multiple sclerosis and PD. Interestingly, the reasons for satisfaction differed among the groups. Only the PD group cited an "interest in staying at home" as a determinant of satisfaction. In contrast, Goldman et al. noted no differences in telehealth experiences or satisfaction of people with musculoskeletal, pain, or PD who received multidisciplinary telerehabilitation [38]. The majority of participants were satisfied with their care and cited not needing to travel as a key determinant. Satisfaction among the PD group was 80% very satisfied and 15% somewhat satisfied.

CHALLENGES AND OPPORTUNITIES IN TELEREHABILITATION

There are many advantages inherent in the use of telerehabilitation. These include enhanced convenience for the patient related to the reduced need for travel as well as ability to communicate with providers easily and quickly when desired rather than having to wait until their next scheduled meeting. Telerehabilitation may also allow for more frequent assessment and progression of interventions as compared to in-person care. To capitalize fully on the promise of telerehabilitation, several challenges must be addressed.

Challenge: Access

One challenge with implementing telerehabilitation is the need for participants to have access to appropriate technology, and limitations in this area could limit uptake. This includes ownership of devices such as smartphones as well as having reliable internet access. A recent survey in the United States showed that ownership of smartphones among those who are 50+ years old has increased from 77% in 2019 to 86% in 2022, but is lower among those who are over 70 compared to those who are 50–69 years of age [39]. With regard to internet access, roughly one in five households in the United States lacks internet service and globally just under 2/3 of the world population is connected to the internet. Internet use varies widely by income level, with 26% of residents in low-income countries having internet access as compared to 92% of people in high-income countries [40]. As telerehabilitation advances, we must take care not to widen the gap in access as we move forward.

Challenge: Safety

A second challenge with implementation of telerehabilitation in PD is how to conduct assessments and deliver interventions safely given concerns about

motor impairments and fall risk in this population. This is particularly true for approaches that may be higher risk, such as balance testing and training. Telerehabilitation programs must be designed with safety as a top priority and take the insights and opinions of stakeholders into account [41]. Engaging stakeholders with PD in the design process can inform not just safety but also appropriateness of user interfaces to ensure that they are user friendly and accommodate people with different levels of motor and cognitive abilities.

Challenge: Patient satisfaction

A third challenge relates to level of satisfaction with remote delivery. For example, only 53% of participants in a home-exercise program monitored by telehealth found the exercise program satisfying [8]. The home-based group also had reduced adherence relative to an exercise group conducted in person. These findings are contrasted by those in a recent study of people with PD ($n = 44$) who received physical therapy via telehealth [42]. Ninety-three percent were satisfied or very satisfied with the technology and 100% were satisfied or very satisfied with the treatment received during the telehealth visits [42]. It may be that a combination of some in-person care with some remote care is ideal. Indeed, qualitative data from Colon-Semenza et al. [42] suggest a hybrid model of care is preferred by both patients with PD as well as physical therapists. Furthermore, patient satisfaction for multidisciplinary approaches and speech therapy seems to be higher among those with PD. Again, engaging stakeholders in the design to ensure that features determining satisfaction are addressed at the outset is key.

Opportunity: Reduced patient burden

Telerehabilitation in PD may reduce the burden associated with frequent in-person care. A number of barriers (e.g., travel time and costs, parking, caregiver burden) may be minimized through the use of telerehabilitation. This may be particularly important for patients who have less access to transportation or reduced social support or more mobility challenges that make travel burdensome. Colon-Semenza et al. noted that "convenience" was the most common response when a small sample of people with PD were asked what they liked most about receiving physical therapy via telehealth [42]. Additionally, a small study comparing the use of telerehabilitation and in-person care following total hip arthroplasty demonstrated a reduced time burden in favor of the telerehabilitation though healthcare costs remained similar between groups [43]. As previously mentioned, it is likely that the frequency with which telerehabilitation is utilized in PD will depend on patient preference as well as clinician judgment as to which mode of care is safest and likely to produce the best outcome. Studies are needed in people with PD to determine for whom and when telerehabilitation is most appropriate.

Opportunity: Facilitation of self-management strategies

In recent years, there has been an emphasis on shifting the model of care in PD rehabilitation from episodic to more continuous. An example of continuous care would be the dental care model in the United States in which preventive visits occur twice yearly. Adopting this model in PD rehabilitation may be facilitated through the use of telerehabilitation [44]. For example, patients may be assessed in-person twice yearly for purposes of preventing decline in motor function, but there may be touchpoints via telehealth between those assessments should a patient need a modification to an exercise program. A shift to this type of care model would promote self-management for people with PD while still ensuring they have access to the professional care needed to maximize function and quality of life. Preliminary evidence from Quinn and colleagues demonstrate it is feasible to deliver physical activity coaching via telerehabilitation, which suggests a shift to this type of care model can be facilitated through telehealth [45]. Additionally, a systematic review, though not specific to PD, suggests that self-management can be improved through the use of telehealth [46]. It will be important to conduct rigorous studies to determine whether and how the use of telehealth might facilitate self-management in PD and to take potential cognitive impairments into account when optimizing delivery for the broad population of people with PD.

Opportunity: Access revisited

Though access to telerehabilitation may be limited as previously suggested, there remains a tremendous opportunity to reach people with PD who have difficulty getting the care they need. As the population ages, smartphone and computer use will only

become more common. Recent legislation in the United States will allow for investment in enhancing access to high-speed internet for those in rural areas [47]. The increased access to technology provides a means for enhancing access to telerehabilitation for people with PD. Another potential benefit of telerehabilitation is the ability to access rehabilitation professionals with expertise in caring for people with PD. Previously, people with PD may have had to travel long distances to see these experts in person. The travel burden made regular follow-up with these experts impractical, which is an important consideration for rehabilitation services that often require multiple visits per week often over several months. Telerehabilitation provides an opportunity for those with PD to see a professional who understands their condition and can provide optimal management while simultaneously reducing the travel burden. There is a need to inform people with PD about the ability to use telerehabilitation services and that they may seek care from experts who do not necessarily reside near their residence.

CONCLUSIONS AND FUTURE DIRECTIONS

In summary, remote delivery of allied health therapy appears to be safe and feasible for people with PD. Despite potential challenges (e.g., access, safety, and patient satisfaction), telerehabilitation may facilitate improved outcomes for people with PD. Clinicians should determine the safety and appropriateness of using telerehabilitation in consultation with each patient.

More research has been done on remote delivery of physical therapy than on occupational therapy or speech therapy, and there is much work to be done in all fields. Extension of remote delivery to a broader swath of people with PD who have more substantial disability is warranted, and there is a clear need for further investigation into telerehabilitation for PD to determine optimal treatment parameters (e.g., frequency, session duration, ideal technologic platform) as well as for whom and when this mode of delivery may be best. More studies focusing on multidisciplinary telerehabilitation are also warranted and should include formal cost analyses. As we embark on these future questions, clinicians and administrators should not wait for all the answers but should instead work to prioritize and promote access to quality telerehabilitation services for people with PD, particularly for those with challenges to accessing in-person clinics.

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CONFLICT OF INTEREST

The authors have no conflict of interest to report.

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