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Does the Addition of Tele Health to In-Person Physical Therapy Treatment Have an Effect on Adherence to a Home Exercise Program and Perception of Progress/Recovery?

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Telehealth, Addition, COVID-19, Healthcare, Physical therapy.

Introduction

With the aging population in the United States, there is an increase in healthcare needs per capita... In the year 2000, about 12% of the country's population consisted of individuals 64 years and older, and this is projected to increase to 19% by the year 2030 [1]. An aging population will require increased availability and accessibility of healthcare services. Over the years, there has been an interest to develop more innovative ways to provide and increase the accessibility of healthcare services. Our recent COVID-19 pandemic experience resulted in an immediate need to resolve healthcare access issues in the short term. Within a couple of months, telehealth became the substitute for the more traditional in-person provider-patient healthcare model. Even today, many individuals chose to continue this electronic way of connecting with health care providers. Besides the immediate need for telehealth services, it also benefits those not living in close proximity to the point of care [2].

Traditionally, telehealth delivery methods were used for primary care purposes, medical specialties, the management and monitoring of chronic diseases, and rehabilitation services [1]. Tele health allows for easier collaboration between multiple providers when developing treatment plans for a patient. As mentioned, telehealth's major benefit is (instant) accessibility and thus a reduction in patient travel time and expenses. This increased access results in a decreased isolated feeling for those living in more rural areas [3]. Tele health is not a new phenomenon; it actually dates back to early in the 1990's [4]. In March 2010 as part of the Patient Protection and Affordable Care Act, telehealth was identified and considered an effective and efficient method to deliver healthcare [3].

With the introduction of various telehealth technology platforms physical therapists can provide direct patient care or supplement in-person treatments with supervised telerehabilitation [5-7]. In 2011, Cranen et al. [5]. Reported that a small subject population (N=25) with chronic pain perceived physical therapy telehealth services as beneficial when combined with in-person treatment or as a stand-alone follow-up intervention [5]. More recently, an embedded qualitative case study with subjects following a total knee arthroplasty receiving telerehabilitation services revealed six major themes [6]. These themes were improved access with reduced transportation needs, the ability to develop a stronger therapeutic relationship with their therapist while maintaining a sense of personal space, an ability to complement telerehabilitation with in-person visits, provide standardized yet tailored and challenging exercise programs, the perceived ease-of-use of telerehabilitation equipment, and the sense of feeling supported [6]. With the proper use of advanced technology, telehealth seems to work well for patients and practitioners to harmonize with today's fast-changing societal needs. Another benefit of telerehabilitation is a reduction in the physical effort to attend in-person visits, and this has a reported increase in tolerance and greater treatment frequency [7].

One of the significant barriers physical therapists face when treating patients is their adherence to prescribed Home Exercise Programs (HEP). Research has shown that patient adherence to home exercise programs can range from 19% to 72% [8,9]. Noncompliance poses a significant threat to the successful outcome of therapeutical interventions and may contribute to poor clinical outcomes [10]. Many factors such as self-perceived barriers, personal beliefs and intention to comply, self-motivation, self-efficacy level with a particular exercise, and social support influence adherence to HEP [10,11]. It has been demonstrated that self-efficacy is positively correlated with adherence in individuals

with musculoskeletal injuries, and it is a strong psychological factor that affects adherence [10]. Additional factors that can influence a patient's adherence include their mental constructs, prior experience with physical therapy, accurate knowledge of possible outcomes, and an available support system [10,11]. A person's mental constructs affect how decisions are made based on how the world is viewed, past experiences, and thoughts about the future [8].

There still remain unanswered questions regarding the benefit of telehealth in physical therapy, since this phenomenon is still in its early stages of development. It is not clear what the effect is of the concurrent use of telehealth with in-person therapy sessions on patient adherence to home exercise programs. Therefore, the purpose of this study was to explore the benefit of combining in-person physical therapy with concurrent use of the telehealth In-Hand Health application program on patient adherence to a home exercise programs as well as the patients' self-perception of their progress and recovery.

Methods

This study was a mixed-method, quasi-experimental pilot study. Eligible participants were recruited randomly into two groups; a telehealth group and a traditional outpatient physical therapy group (referred to as non-telehealth). Both groups received traditional, face-to-face outpatient physical therapy, including a prescribed daily home exercise program. The telehealth group was provided access to a telehealth application program in addition to traditional, face-to-face outpatient physical therapy. The "In Hand Health®" application was used in this study. This telehealth application can provide both asynchronous and synchronous communication using an encrypted chat between patients and providers [12].

This In Hand Health® application is used by physical therapists throughout the United States [12]. The application is HIPAA compliant and can be utilized in conjunction with patients' electronic medical records. Patients can utilize the application on their mobile device to receive information from their physical therapist regarding their prescribed exercises, including both pictures and videos with audio explanation.

To evaluate adherence to the home exercise program, both groups logged their participation in their HEP. The subjects in the telehealth group used the app to log their exercises daily and the non-telehealth group subjects self-reported by paper and pencil on a provided exercise log. The In Hand Health® application monitors not only the frequency but also the extent to which the patient is completing their exercises. The application indicates if a patient completes an exercise if the entire video is watched fully. After completing the prescribed exercises, the application prompts patients to record their level of pain on a sliding scale and how they rate their progress/recovery. These values (compliance, progress/recovery, and pain) are documented daily in the application as percentages and are depicted in a bar graph for both patients and clinicians to track [12]. The level of pain and progress/recovery was documented by the non-tele health group using a paper and pencil form. The participant's self-perception of their progress/recovery was defined as the value a participant chooses on a sliding scale of 0-10. These values were converted to percentages (in the decimal form) for analysis.

Subjects

After receiving IRB approval, participants were recruited from two private practice clinics over five months using a convenience sampling method. Participants received an informed consent which they signed before being enrolled in the study. This pilot study's target population included adults (at least 18 years of age) of any gender or diagnosis, who were beginning to receive outpatient physical therapy with a prescribed home exercise program. Additional inclusion criteria were the ability to speak and write English and who could access the In Hand Health® application via a smartphone or tablet. Exclusion criteria included participants under the age of 18, participants who were not prescribed a HEP, or participants who felt as though they could not handle the application's technological use.

As participants were recruited, they were randomly assigned to either the telehealth group (utilizing the In-Hand Health application) or the non-telehealth group (utilizing paper documentation) using a randomization table in each clinic. Physical therapists working at the two clinic locations were provided with a brief training session on how to utilize In-Hand Health application, including instruction setting up a patient profile, prescribing/change home exercises, and communicating with their patients via the encrypted chat and video conferencing features. Participants were instructed to complete their prescribed HEP daily, whether they were in the telehealth or non-telehealth group. Attendance for each outpatient visit was recorded for both groups. The participants joined the study at the point of intake and remained in the study until their point of discharge. They were instructed to continue their HEPs until discharge.

Participants in the telehealth group were provided access to the telehealth application and given a brief overview by their physical therapist on how to utilize and navigate throughout the application. Participants were instructed to click on each exercise video when performing their HEP. After completing their exercises each session, the application prompted the participants to answer three questions. They rated their level of pain and their level of progress/recovery on a sliding scale, and answered whether or not they were satisfied with their progress. The non-telehealth group used a form that was created to replicate the questions on the application identically (Figure 1).

Additionally, the participants in the telehealth group were told they would have correspondence with their physical therapist through the encrypted chat on the application at least one time per week. They were able to contact their physical therapist at any time through this chat and even request a virtual video correspondence if necessary. However, the physical therapists only had an obligation to contact the participants once a week.

Date	What percentage of your home exercise program did you complete today?	How is your progress/recovery? (mark an "X" on one of the lines)	Are you satisfied with your progress?
(Sample) Month/date/year	100%		Yes or No (circle one)
			Yes or No (circle one)
			Yes or No (circle one)
			Yes or No (circle one)
			Yes or No (circle one)
			Yes or No (circle one)
			Yes or No (circle one)

Figure 1: Home exercise log for the non-telehealth log.

Home Exercise Log

Please fill out this form daily as you complete your home exercise program and bring it with you to every physical therapy appointment at Integrated Therapy Practice.

Data for each subject were collected for seven weeks. Paper forms were collected weekly from the non-telehealth group, and data from the telehealth group was monitored weekly. The variables of interest were age, sex, diagnosis, number of visits attended, cancellation rate, the weekly number of logs, percentage of weekly logs of the prescribed frequency (adherence to HEP), and average self-reported progress/recovery weekly.

Results

For the statistical analysis, SPSS v26.0 (IBM) was used. Forty-seven subjects participated in this study. However, since two of the recruited participants were under the age of 18, their data were excluded from the analysis, leaving a total of 45. Ages ranged between 24 to 87 with a mean of 58.6. There were 23 individuals in the non-telehealth group (51.1%) and 22 individuals in the telehealth group (48.9%). Two of the non-telehealth group participants had turned in paper forms without their names on them, and therefore their data on sex and age were not included in the analysis. Of the 43 participants with their sex provided, 30 (69.8%) participants were female.

The study population had various primary diagnoses for which they sought physical therapy (Table 1). The frequency of logs, mean, and standard deviation for the telehealth group and the

non-telehealth group demonstrate that the non-telehealth group recorded their exercise activities more often than the telehealth group for each week of the first seven weeks (Table 2).

Table 1: Frequency of Diagnosis per Group (N = 43).

	Telehealth	Traditional
Back Pain/Dysfunction (includes stenosis, LBP, scoliosis)	10	2
Cervical Pain/Dysfunction/Headache	2	2
UE Pain/Dysfunction	2	1
LE Pain/Dysfunction	7	6
Fatigue	1	0
Balance/Dizziness/Vertigo	0	10

Table 2: Mean (SD) of Number of Logs per Week by Group.

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
Telehealth	N = 18	N = 19	N = 18	N = 17	N = 16	N = 10	N = 12
	3.94 (1.956)	3.05 (1.72)	3.67 (1.85)	2.94 (1.64)	3.06 (1.95)	3.90 (1.97)	3.42 (2.07)
Traditional	N = 23	N = 13	N = 9	N = 7	N = 3	N = 3	N = 2
	6.52 (.99)	6.08 (.95)	5.67 (1.12)	5.00 (2.38)	6.67 (0.58)	6.00 (0)	6.50 (.71)
P value	.264	.378	.971	.634	.649	.637	.955

Table 3: Mean (SD) Compliance per Week by Group.

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
Telehealth	N = 17	N = 19	N = 18	N = 17	N = 16	N = 10	N = 12
	.45 (.30)	.35 (.25)	.42 (.26)	.35 (.27)	.34 (.24)	.45 (.21)	.35 (.25)
Traditional	N = 23	N = 13	N = 9	N = 7	N = 3	N = 3	N = 2
	.77 (.23)	.70 (.29)	.66 (.20)	.53 (.31)	.94 (.07)	.83 (.06)	.93 (.10)
P value	**.001**	**.001**	**.022**	.174	**< .001**	**.010**	**.005**

A one-way analysis of variance (ANOVA) was conducted to compare the number of logs each week between the two groups. There was no statistically significant (p> 0.05) difference between groups for any of the seven weeks. The ratio of the number of logs versus the number of times per week that the participant completed their HEP was calculated for each participant (N=45). This ratio was considered as the measure of patient adherence for this study. The results demonstrate that the mean and standard deviation of the non-telehealth group were consistently higher than those of the telehealth group, indicating a higher adherence level (Table 3). However, there was a much greater attrition rate in the non-telehealth group than the telehealth group, ending with only 2-3 participants logging in weeks 5-7 (Table 3). A one-way analysis of variance (ANOVA) was conducted to compare the adherence each week between the two groups. Although the group sizes were unequal, the homogeneity of variance assumption was not violated. The adherence levels of the non-telehealth group were statistically significantly higher than those of the telehealth group in weeks 1-3,5,6 and 7 (with respective p values, p=0.01, p=0.01, p=0.22, p<0.01, p=0.010, p=0.005) except in week 4, with p=0.174 (Table 3).

In the In Hand Health® application, daily values of progress/recovery were self-reported by participants after completing their prescribed exercises. They were able to answer this question utilizing a visual sliding scale. These values were converted to a percentage within the application and displayed in a bar graph within the app. For participants in the non-telehealth group, a similar scale was presented on a paper form allowing for documenting daily progress recovery on a scale with increments from 0-10. The non-telehealth group reported higher progress/recovery levels on average per week than the telehealth group (Table 4). However, a greater number of participants in the telehealth group continued to report their progress/recovery each week for the seven weeks used in data analysis. The ratio of the number of logs versus the value each participant reported as their amount of progress/recovery per week was calculated for each participant. The non-telehealth group reported better progress/ recovery during each week based on the group mean and standard deviation. As with the comparison of means for HEP adherence, the homogeneity of variance assumption was not violated. The non-telehealth group reported statistically significantly higher levels of progress/recovery during weeks one, two, and five than the telehealth group (respective p-values, p<001, p=0,002, p= 0.026) (Table 4).

Table 4: Mean (SD) Progress/Recovery per Week by Group.

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
Telehealth	N = 18	N = 19	N = 17	N = 17	N = 16	N = 10	N = 12
	.27 (.15)	.25 (.17)	.35 (.18)	.28 (.16)	.28 (.19)	.38 (.22)	.33 (.25)
Traditional	N = 22	N = 12	N = 8	N = 6	N = 3	N = 3	N = 2
	.56 (.16)	.52 (.24)	.48 (.23)	.37 (.18)	.55 (.08)	.55 (.04)	.54 (.05)
P value	< .001	.002	.248	.374	.026	.220	.232

A Pearson product-moment correlation was conducted to examine the relationship between cancellation rate and the average number of logs for both the telehealth and non-telehealth group. For the telehealth group, there was a moderate, negative correlation r (20) = -.40 (p= 0.064). This correlation indicates that the higher the cancellation rate, the lower the number of logs. No statistically significant relationship was found between these two variables for the non-telehealth group (r (19) = -.02, p= 0.924). Also, an independent-samples t-test was conducted to compare the cancellation rate for the telehealth group and non-telehealth group. The non-telehealth group had a higher cancellation rate (μ = 0.10, SD= 0.10) than the telehealth group (μ= 0.08, SD= 0.09), however this was not a statistically significant difference (p=0.425).

The messages between provider and patient were analyzed in order to find trends in topics of conversation. Of the 22 participants in the telehealth group, 20 individuals utilized the chat for communication with their physical therapist between visits. The average percentage of messages (conversations) initiated by the physical therapist was 70.4%, with the average percentage of messages initiated by the patient was 29.6%. The transcripts were reviewed, and data were categorized. Seven main categories were identified, which are and can be found in Table 5. Nearly 62% of the messages related to checking in with each other and reinforcing

key treatment concepts, and 15.32% of the messages were related to pain reports.

Table 5: Frequency of Patient-Physical Therapist Messages per Topic.

Topic	Frequency (Percentage)
Checking in/Reinforcement of key concepts	76 (61.29%)
Pain	19 (15.32%)
Doctor Reports	7 (5.65%)
Technical Issues	8 (6.45)
Equipment	2 (1.61%)
Scheduling	9 (7.26%)
Change in Status	3 (2.42%)

Discussion

This study aimed to explore the effect of telehealth technology, In-Hand Health application program, in addition to in-person physical therapy sessions on patient adherence to home exercise programs as well as the patients' self-perception of their progress/recovery during therapy. This study demonstrates that the use of a telehealth application program with weekly consultation by a physical therapist did not significantly increase patient adherence to their HEP. Many factors may have played a role in these findings. Further analysis of individual differences in the participants may uncover reasons for this difference in groups. Additionally, the human factors that contribute to non-adherence must be better understood. Our findings concur with Campbell et al. [13], who identified higher initial compliance to a HEP, and they feel this could have been because patients feel loyal to their therapist. Factors that play a role in continued adherence include the willingness and ability to add exercises into their daily routine, their perceived severity of symptoms, and their attitudes towards their diagnosis and associated comorbidities [13].

Participant adherence appeared to remain relatively steady within the groups over the first seven weeks, but the non-telehealth group remained at a higher level consistently. Our findings concur with the findings of Guzman-Clark et al. [14]. They reported that adherence with the use of a telehealth device decreased over time within 90-days. This high initial compliance trend that tapers off with time was present in both the non-telehealth and telehealth group in this study. When looking at data from both the telehealth and non-telehealth group over the entire seven weeks of data collection, a higher initial adherence can be seen in the first two weeks. After that, there is a slow tapering down of adherence until week seven. Additionally, there were more reported instances of completing 100% of the prescribed HEP with participants in the non-telehealth group compared to the telehealth group. It is unclear exactly why this occurred; however, adherence levels were self-reported by participants in the non-telehealth group, which may not be completely accurate.

There were several instances where the participants in the telehealth group reported to the physical therapist that they were completing their prescribed HEP, however, they forgot to log the exercises on the application. The following are quotes from participants were taken from the message portion of the application: "Hi PT. I want to let you know I have been doing my exercises daily. I haven't been logging in because I know how to do them." Another participant stated, "I have been doing many exercises, but I may do some at a stop light, others while walking etc. I will try to record them." A third participant states, "Yes. I'm exercising, just not logging. Have a great day." Lastly, a fourth participant stated, "Yes, I have stopped logging. Life got in the way. I will start again!" These messages were in response to their therapist checking in on them and reminding them to complete their exercises using the application.

Another factor that may have played a role in the findings includes technical issues that participants in the telehealth group experienced. There were two participants who stated they were experiencing technical difficulties when attempting to log exercises. One stated, "Good Afternoon! I went to complete the exercises, but the second one seems stuck. It won't progress with the timer." At a later date, the same participant stated, "None of the workouts allow me to click complete on them now." Another participant stated, "Been doing them, the program keeps crashing when I try to log them." One therapist also experienced a technical issue when using the application. When attempting to add additional exercises to a patient's HEP, he stated the following "I will not be there, but we need to add these to your online program. The issue we are having is that the system is not allowing me to add anything."

Several limitations were identified in this study. Data collection was limited to only two outpatient physical therapy locations, and convenience sampling was used to recruit subjects. A relatively small sample size was recruited. These limitations might have resulted in type II error and limit the generalizability of the results. Additionally, there were several difficulties encountered throughout this pilot study that was unique to either group. In the non-telehealth group, participants did not always log each week of data correctly on a separate sheet of paper, making data collection difficult. Some paper logs were turned in by participants without a name and the researchers were unable to identify who they belonged to.

There were multiple shortcomings in the software, including a rare inaccurate depiction of data values, technical difficulties including video freezing, and the application crashing. Researchers also identified some challenges in data analysis that was unique to the application used in this study. The In Hand Health® application was created as a tool to help physical therapists. However, there was no export function built into the software for data analysis. Additionally, the application documented a "CaRe Index" value for every participant, which is defined by the software developer as a 7-day moving average weighted 40% Pain, 40% Recovery and 20% Compliance. However, there is no evidence that this CaRe Index has any clinical meaning.

Despite the limitations, this pilot study can serve as a building block for further research to expand upon regarding the effect of telehealth in conjunction with in-person therapy on patient adherence to home exercise programs.

Conclusion

This study measured differences in subject adherence to a home exercise program when a telehealth method was added to in-person physical therapy treatments. The results indicate that the In Hand telehealth application program's use did not have a significant effect on subject adherence. Neither was there a significant difference in the subject's perception of progress or recovery when using the telehealth app. Future research should further explore the patient-perceived benefit of using telehealth applications to complement in-person physical therapy care.

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