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Original Research

Examining the Relationship Between Individual Patient Factors and Substantial Clinical Benefit From Telerehabilitation Among Patients With Chronic Low Back Pain

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Abstract

Objective. The coronavirus disease-2019 pandemic has facilitated the emergence of telerehabilitation, but it is unclear which patients are most likely to respond to physical therapy provided this way. The purpose of this study was to examine the relationship between individual patient factors and substantial clinical benefit from telerehabilitation among a cohort of patients with chronic low back pain (LBP).

Methods. This is a secondary analysis of data collected during a prospective longitudinal cohort study. Patients with chronic LBP ($N = 98$) were provided with a standardized physical therapy protocol adapted for telerehabilitation. We examined the relationship between patient factors and substantial clinical benefit with telerehabilitation, defined as a $\geq$50% improvement in disability at 10 weeks, measured using the Oswestry Disability Index.

Results. Sixteen (16.3%) patients reported a substantial clinical benefit from telerehabilitation. Patients reporting substantial clinical benefit from telerehabilitation had lower initial pain intensity, lower psychosocial risk per the STarT Back Screening Tool, higher levels of pain self-efficacy, and reported higher therapeutic alliance with their physical therapist compared to other patients.

Conclusion. Patients with lower psychosocial risk and higher pain-self efficacy experienced substantial clinical benefit from telerehabilitation for chronic LBP more often than other patients in our cohort. Therapeutic alliance was higher among patients who experienced a substantial clinical benefit compared to those who did not.

Impact. This study indicates that psychosocial factors play an important role in the outcomes of patients receiving telerehabilitation for chronic LBP. Baseline psychosocial screening may serve as a method for identifying patients likely to benefit from this approach.

Keywords: Patient-Centered Care, Precision Medicine, Risk Factors, Telemedicine

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Introduction

During the early phases of the coronavirus disease-2019 (COVID-19) pandemic, state and federal policies were modified, allowing many physical therapists in the United States to begin providing care through televisits (ie, telerehabilitation) for the first time.[1] Initially intended to slow the spread of infection among patients attending outpatient physical therapy, telerehabilitation has been widely accepted by patients and early evidence suggests that telerehabilitation may produce similar results to traditional in-person physical therapy for patients with musculoskeletal conditions, including those with low back pain (LBP).[2–6] While telerehabilitation is currently being reimbursed on a temporary basis by the Centers for Medicare and Medicaid Services, legislation has also been introduced that would make telerehabilitation a permanently reimbursable service.[7]

Should telerehabilitation be made a permanently reimbursable service in the coming year(s), physical therapists will be left with questions surrounding how best to incorporate this approach into clinical practice, alongside in-person physical therapy services. For example, it is unclear if telerehabilitation should only be provided to those who cannot attend in-person physical therapy or if there are subgroups of patients more likely than others to respond positively to telerehabilitation. Identifying patients likely to respond to telerehabilitation will allow for tailoring of physical therapy services to maximize clinical effectiveness and outcomes. However, little research has been conducted to identify patients likely to respond positively to telerehabilitation.

The purpose of this study was to examine the relationship among individual patient factors and changes in patient-reported disability among a cohort of patients who received telerehabilitation for chronic LBP during the COVID-19 pandemic. It is our intent that the results of this study be used to help identify patients with chronic LBP most likely to respond favorably to telerehabilitation.

Methods

At the onset of the pandemic, our study team was conducting the OPTIMIZE trial, a pragmatic, sequential multiple assessment randomized trial of nonpharmacologic treatments for chronic, nonspecific LBP (NCT05103462).[8] Physical therapy is included as a treatment arm of this study. When in-person physical therapy visits were restricted at each of our study sites (University of Utah, Johns Hopkins University, Intermountain Healthcare) during the early phases of the pandemic, our study team pivoted to examine the effects of telerehabilitation for patients with chronic LBP. To do so, we adapted our in-clinic physical therapy protocol to be delivered via synchronous televisits and enrolled patients in a single-arm interventional cohort study to examine the effects of this intervention.[5] The current study is a secondary analysis of the data collected among patients with chronic LBP who enrolled in the original telerehabilitation study. Additional details of that study have been previously published.[5]

Patients

This study included patients aged 18 to 64 years who had sought care from primary care in the preceding 90 days for LBP, from August to December 2020. To be included in the study, patients also needed to report a pain score of ≥4 on the numeric pain rating scale (NPRS) and LBP-related disability ≥ 24% on the Oswestry Disability Index (ODI). Lastly, they needed to satisfy the National Institutes of Health criteria for chronic LBP that requires that LBP has been a problem for at least 3 months and has been an ongoing problem almost every day or every day for the past 6 months.[9] Patients were excluded if they reported red flag symptoms indicative of serious pathology (eg, fracture, cauda equina syndrome), were non-English speaking, were unable to participate in telerehabilitation (eg, no internet access), had received physical therapy in the past 90 days, were pregnant, had spine surgery in the past 12 months, or were currently being treated for substance use disorder. Patients meeting eligibility criteria and interested in participating in the study were consented over the phone by a research coordinator.

Interventions

For enrolled patients, our treatment protocol included 8 physical therapy sessions delivered by a licensed physical therapist via real-time video conferencing technology. Physical therapists were trained to provide evidence-based physical therapy interventions, including education and exercise, adapted for telerehabilitation delivery. Educational interventions focused on reassurance, positive recovery expectations, behavioral change communication, and the importance of physical activity.[10,11] Exercise interventions included general strength and conditioning, direction-specific exercises, flexibility, and motor control training based on the treatment-based classification decision making algorithm.[10,11] A more detailed description of the adaptations made to the OPTIMIZE physical therapy protocol for delivery via telerehabilitation have been previously published.[5]

Data Collection

Our primary outcome for this study was change in LBP-related disability from baseline to 10-week follow up, measured by the ODI.[12] The ODI is a valid and reliable questionnaire that asks patients to rate the difficulty they experience during 10 functional activities. The ODI is scored on a scale of 0 to 100, with higher scores indicating higher levels of LBP-related disability.[12]

To characterize patients who did and did not experience a substantial clinical benefit from telerehabilitation, we also collected data on a number of individual patient factors. These patient factors included demographics, medical history, previous care utilization, baseline function and disability, psychosocial factors, therapeutic alliance, and visit utilization. Our intent was to examine patient factors that could be used to inform clinical decisions on the use of telerehabilitation, rather than to identify novel connections that would have limited clinical utility.

Demographics included patient age, race, ethnicity, marital status, and current work status. Medical history included body mass index and whether patients had a history of spine surgery (prior to preceding 12 months). Previous care utilization included whether patients had previously attended in-person physical therapy (prior to the preceding 90-days) or a telehealth visit with any provider type prior to the study.

The Patient-Reported Outcomes Measurement Information System-29 v2.0 was completed to assess function, pain interference, depression, and anxiety.[13] Each domain was assessed using 4 items and expressed as *t* scores with a mean of 50 ± 10

and higher scores indicating a greater presence of the characteristic assessed.[14] Additional measurements of baseline function and disability included LBP-related disability, measured by the ODI[12]; pain severity, measured by the NPRS on a scale of 0 to 10[15]; and symptom duration, reported in months. Additional psychosocial factors included pain self-efficacy, measured using the Pain Self Efficacy Questionnaire with a score of 0 to 60 (higher scores equal greater self-efficacy)[16]; and the STarT Back Screening Tool (SBST), which categorizes patients as low, moderate, or high risk for persistent disability based on a combination of 9 physical and psychosocial risk factors.[17]

We also collected the 12-item Work Alliance Inventory Short-Revised (WAI-SR). The WAI-SR has been shown to be a valid measurement of therapeutic alliance between the patient and physical therapist from the patient's perspective.[18] The WAI-SR includes 4-item subscale scores for Goals, Tasks, and Bond components (ranging from 4 to 20) and a total score (ranging from 12 to 60). Higher scores indicate greater alliance between therapist and patient, a known predictor of clinical outcomes for patients with chronic LBP.[19]

Statistical Analysis

To explore the relationship between baseline patient factors and substantial clinical benefit from telerehabilitation, we summarized each of the included patient factors overall and stratified by response to telerehabilitation. We defined substantial clinical benefit with telerehabilitation as a 10-week change in LBP-related disability $\geq$ 50% compared to baseline (measured by the ODI), based on previous research indicating this cutoff as a reliable method for identifying a successful outcome for patients with LBP attending physical therapy.[20] Summary statistics were used to describe our patient factors overall and for each group. Differences between groups were examined using Wilcoxon rank sum tests for continuous data and Fisher exact tests for categorical data.

As it is possible that the baseline factors we included in our analysis could be related to the number of visits patient attended, which might have influenced clinical outcomes, we performed a sensitivity analysis examining the relationship between the number of visits patient attended and changes in ODI scores from baseline to 10 weeks.

Ethical Review

This study was approved by the University of Utah Institutional Review Board (IRB) acting as the single IRB.

Role of the Funding Source

The funders played no role in the design, conduct, or reporting of this study.

Results

Our original sample consisted of 126 enrolled patients. Once patients with missing ODI scores at baseline ($N = 1$) and 10 weeks ($N = 27$) we excluded, we were left with a final cohort of 98 patients for our analysis (Table). Our sample had an average age of 45.6 years (SD = 12.6), was predominantly White (68.4%) or Black (26.5%) and were mostly non-Hispanic (87.5%). Nearly half (45%) of our cohort reported being employed full-time, with 38% reporting they were unemployed, 8% reporting part-time employment, and 8% reporting they were retired. About two-thirds of patients had previous experience with physical therapy (67.4%), and nearly three quarters (73.5%) of our sample had previous experience with telehealth (any provider type). Most patients reported having LBP symptoms for >5 years (65.3%).

Overall, 16 (16.3%) patients in our cohort experienced substantial clinical benefit with telerehabilitation (Table). There were significant differences in demographics, medical history, and baseline symptoms between those who did and did not experience a substantial clinical benefit. For example, we observed a higher proportion of Hispanic patients ($P = .02$) among those reporting a substantial clinical benefit, as well as a higher proportion of those reporting full- or part-time employment ($P = .001$). Those experiencing a substantial clinical benefit also had decreased rates of previous spine surgery ($P = .03$). In addition, we observed that baseline pain intensity, per the NPRS, was significantly lower among patients reporting a substantial clinical benefit compared to those who did not (4.5 [SD = 1.8] versus 5.6 [SD = 1.8]; $P = .01$).

We observed that psychosocial factors and therapeutic alliance were associated with substantial clinical benefit (Table). For example, we observed that a higher proportion of patients reporting a substantial clinical benefit were identified as low or moderate risk by the SBST, with a higher proportion of high-risk patients among those not reporting substantial clinical benefit ($P = .03$). We also observed higher pain self-efficacy among patients reporting substantial clinical benefit (38.4 [SD = 10.5] versus 31.6 [SD = 12.3]; $P = .04$). Additionally, we observed higher scores on all 3 subsections of the WAI, as well as higher total WAI scores, among those reporting substantial clinical benefit compared to those not reporting this level of clinical benefit ($P = .03$, .03, .02, and .04, respectively).

In our sensitivity analysis, we did not observe an association between the number of visits attended and substantial clinical benefit ($P = .15$). However, we did observe that the majority (75%) of patients who reported a substantial clinical benefit did attend at least 4 visits.

Discussion

This study is one of the first studies to examine the relationship between individual patient characteristics and substantial clinical benefit with telerehabilitation among patients with chronic LBP. We observed a number of significant differences between patient factors for those reporting substantial clinical benefit and those not reporting substantial clinical benefit with telerehabilitation. Notably, those experiencing substantial clinical benefit reported lower pain intensity, higher pain self-efficacy, and higher therapeutic alliance with their physical therapist compared to other patients. We also observed a higher proportion of patients with low-moderate psychosocial risk and a lower proportion of patients with high psychosocial risk (per the SBST) among those experiencing substantial clinical benefit compared to other patients.

The results of this study align with the results of previous studies that have identified relationships between psychosocial factors and patient response to physical therapy among those with chronic LBP. For example, previous studies have found that self-efficacy, anxiety and overall psychosocial risk as determined by the SBST are strongly associated with clinical outcomes for patients receiving rehabilitation interventions for chronic LBP.[21–23] While the relationships between

Table. Patient Characteristics Stratified by Substantial Clinical Benefit[a]

Characteristic	Overall	≥50% Improvement	<50% Improvement	*P*
Demographics				
Age (y), mean (SD)	45.6 (12.6)	41.9 (12.9)	46.3 (12.5)	.20
Female, *N* (%)	63 (64.3)	11 (68.8)	52 (63.4)	.78
Race, *N* (%)				
White	67 (68.4)	13 (81.2)	54 (65.8)	0.32
Black	26 (26.5)	2 (12.5)	24 (29.3)	
Multiracial	2 (2.0)	0	2 (2.4)	
Other	3 (3.1)	1 (6.23)	2 (2.4)	
Ethnicity, *N* (%)				
Non-Hispanic	84 (87.5)	10 (66.7)	74 (91.4)	**.02**
Hispanic	12 (12.5)	5 (33.3)	7 (8.6)	
Marital status, *N* (%)				
Single/widowed/divorced	42 (42.9)	3 (18.8)	39 (47.6)	.05
Married/living with other	56 (57.1)	13 (81.3)	43 (52.4)	
Work status, *N* (%)				
Not employed	24 (24.5)	2 (12.5)	22 (26.8)	**.001**
Part-time employment	8 (8.2)	5 (31.2)	3 (3.7)	
Full-time employment	44 (44.9)	9 (56.2)	35 (42.7)	
Not employed due to LBP	14 (14.3)	0 (0)	14 (17.1)	
Retired	8 (8.2)	0 (0)	8 (9.8)	
Medical history				
BMI category, *N* (%)				
Underweight/normal (<24.9)	13 (13.3)	4 (25.0)	9 (11.0)	.18
Overweight (25–29.9)	24 (24.5)	5 (31.3)	19 (23.2)	
Obese (≥30)	61 (62.2)	7 (43.8)	54 (65.9)	
Spine surgery, *N* (%)				
History of surgery	18 (18.4)	0	18 (22.0)	**.03**
No prior spine surgery	80 (81.6)	16 (100)	64 (78.1)	
Previous care utilization				
Previous physical therapy, *N* (%)	66 (67.4)	8 (50.0)	58 (70.7)	.14
Previously used telehealth (any provider), *N* (%)	72 (73.5)	10 (62.5)	62 (75.6)	.35
Baseline function and disability				
ODI, mean (SD)	40.5 (12.4)	35.8 (10.38)	41.4 (12.4)	.11
PROMIS PF, mean (SD)	38.6 (5.5)	41.0 (6.3)	38.2 (5.2)	.09
PROMIS PI, mean (SD)	63.4 (4.6)	62.2 (5.5)	63.7 (4.4)	.06
NPRS, mean (SD)	5.6 (1.8)	4.5 (1.6)	5.8 (1.8)	**.01**
Symptom duration, *N* (%)				
≤1 y	9 (9.2)	2 (12.5)	7 (8.5)	.62
1–5 y	25 (25.5)	5 (31.3)	20 (24.4)	
>5 y	64 (65.3)	9 (56.3)	55 (67.1)	
Baseline psychosocial factors				
SBST category, *N* (%)				
Low	16 (16.3)	5 (31.2)	11 (13.4)	**.03**
Moderate	53 (54.1)	10 (62.5)	43 (52.4)	
High	29 (29.6)	1 (6.3)	28 (34.2)	
Pain self-efficacy, mean (SD)	32.9 (12.3)	38.4 (10.5)	31.8 (12.3)	**.04**
Depression (PROMIS), mean (SD)	51.6 (9.6)	48.6 (9.9)	52.1 (9.4)	.17
Anxiety (PROMIS), mean (SD)	54.3 (10.5)	49.2 (10.9)	55.2 (10.2)	.07
Therapeutic alliance				
WAI subscale scores, mean (SD)				
Task	14.9 (4.5)	17.1 (3.5)	14.4 (4.6)	**.03**
Bond	16.2 (4.6)	18.1 (16.3)	15.8 (4.7)	**.03**
Goal	15.8 (4.7)	17.9 (3.5)	15.3 (4.8)	**.02**
WAI total score	46.8 (13.2)	53.1 (9.8)	45.5 (13.5)	**.02**
Total, *N* (%)	**98 (100)**	**16 (16.3)**	**82 (83.7)**	

[a]Substantial clinical benefit defined as >50% improvement on the Oswestry Disability Index between baseline and 10-week follow-up. BMI = body mass index; LBP = low back pain; N = number; NPRS = numerical pain rating scale; ODI = Oswestry Disability Index; PROMIS = Patient-Reported Outcomes Measurement Information System; PROMIS PF = Patient-Reported Outcomes Measurement Information System – Physical Function; PROMIS PI = Patient-Reported Outcomes Measurement Information System – Pain Interference; SBST = STarT Back Screening Tool; WAI = Working Alliance Inventory.

psychosocial factors and patient response to treatment identified in this study are not entirely novel, our results do indicate that these relationships are maintained when physical therapy is provided via telerehabilitation. Applied clinically, it is possible that our results may inform the development of screening tools that can be used to identify patients appropriate for telerehabilitation. It is also possible that these psychosocial factors can be used to help identify patients more or less likely to respond to telerehabilitation compared to in-person physical therapy, as it is possible some patients will respond more readily to either treatment approach. However, additional studies are needed with larger samples to determine if these relationships are useful for matching patients with specific treatment approaches (ie, in-person physical therapy versus telerehabilitation).

Importantly, we observed strong associations between therapeutic alliance and clinical outcomes. A previous study completed among this patient cohort demonstrated that physical therapists and patients were able to develop high levels of therapeutic alliance using a telehealth approach to physical therapy.[5] The current study indicates that higher levels of therapeutic alliance are associated with superior clinical outcomes. While previous studies have shown that therapeutic alliance also impacts the clinical outcomes of patients attending in-person physical therapy, it is possible that therapeutic alliance takes on an even bigger role in telehealth given that many physical therapy interventions cannot be delivered virtually (ie, manual therapy, modalities).[24] This also points to the need for research on the role of therapeutic alliance among patients receiving physical therapy using mHealth (ie, delivered through mobile application), where direct communication between patients and physical therapists is more limited.

We should consider the circumstances in which this study was conducted and how these differ from most real-world clinical scenarios. For example, this study was conducted at a time when outpatient physical therapy services were unavailable or limited at our study sites due to COVID-19 infection concerns. As such, patients enrolling this study did not have the usual option of attending in-person physical therapy. This is important given the role of patient preference and its potential to influence clinical outcomes.[25,26] It is possible that some patients enrolled in this study may have preferred in-person care and this influenced their experiences with telerehabilitation. It is also possible that our results would have been different if our study was conducted among individuals electing to utilize telerehabilitation instead of in-person care. This scenario may be more reflective of real-world clinical scenarios and should be considered in future studies.

The proportion of patients reporting a substantial clinical benefit in our cohort (16.3%) was lower than those reported by previous studies that have used the same criteria (reduction in ODI scores $\geq$ 50%) to identify patients experiencing substantial clinical benefit from physical therapy interventions for LBP.[20,27] For example, previous studies have reported that as high as 40% to 45% of patients who received physical therapy interventions for LBP experienced substantial clinical benefit.[20,27] However, these studies were focused on patients with acute and subacute LBP, whereas our study only included patients meeting the National Institutes of Health definition of chronic LBP. Moreover, the majority of patients in our study reported LBP of over 5 years in duration. As such, direct comparisons between these previous studies and the current study are not appropriate and may lead to erroneous conclusions regarding the effectiveness of telerehabilitation for LBP. Very few studies of patient with chronic LBP have reported on the number of patients experiencing substantial clinical benefit from physical therapy. Those that do have used different criteria than those used in the current study, not allowing for meaningful comparison between studies.[28,29] Further research, ideally in the form of randomized clinical trials, is needed to examine the effectiveness of telerehabilitation for patients with chronic LBP.

In conclusion, we observed the highest rates of substantial clinical benefit from telerehabilitation for chronic LBP among patients with lower baseline pain, fewer psychosocial risk factors and high pain self-efficacy. We also observed higher levels of therapeutic alliance between patients and physical therapists among those reporting substantial clinical benefit from telerehabilitation. These findings may be helpful in identifying patients most likely to respond favorably to telerehabilitation for chronic LBP. Larger studies are needed to further examine these subgroups and to compare outcomes among patients receiving telerehabilitation versus in-person physical therapy.

Limitations

This study has limitations that may impact our observations and conclusions. Because our study did not include a comparison group, we are unable to say with certainty whether the clinical outcomes reported by patients in our cohort are related to the physical therapy they received or due to spontaneous improvement. However, given that the patients in this cohort all reported LBP for a minimum of 3 months and most spontaneous LBP improvement occurs during the acute phase of LBP, we think it is unlikely that the results we observed were due to spontaneous healing.[30,31] Our sample size for this study was also relatively small, which limited the statistical techniques (ie, regression) that could be used in our analysis. As such, our results are primarily descriptive, and we are unable to comment on the amount of variance in patient outcomes for which the individual factors measured in this study accounted.

Author Contributions

Kevin H. McLaughlin (Conceptualization [Lead], Formal analysis [Lead], Writing—original draft [Lead], Julie M. Fritz (Funding acquisition [Equal], Writing—review & editing [Equal]); Kate I. Minick (Writing—review & editing [Equal]); Gerard Brennan (Writing—review & editing [Equal]); Terrence McGee (Writing—review & editing [Equal]); Elizabeth Lane (Writing—review & editing [Equal]); Anne Thackeray (Writing—review & editing [Equal]); Tyler Bardsley (Formal analysis [Supporting], Writing—review & editing [Equal]); Stephen Wegener (Writing—review & editing [Equal]); Stephen J. Hunter (Writing—review & editing [Equal]); Richard Skolasky (Conceptualization [Equal], Writing—original draft [Equal], Writing—review & editing [Equal])

Ethics Approval

This study was approved by the University of Utah IRB acting as the single IRB.

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Clinical Trial Registration

This study was registered in ClinicalTrials.gov (NCT05103462).

Disclosures

The authors completed the ICMJE Form for Disclosure of Potential Conflicts of Interest and reported no conflicts of interest.

The statements in this publication are solely the responsibility of the authors and do not necessarily represent the views of the Patient-Centered Outcomes Research Institute (PCORI), its Board of Governors, or Methodology Committee.

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