

Research Article

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Early Outpatient Tele-rehabilitation Improves Functional Outcomes in Patients Following Hospitalization for COVID-19: A Case Series

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ABSTRACT

Introduction: This study assesses the impact of early outpatient telerehabilitation on patients following hospitalization for COVID-19. To date, there have not been studies assessing this type of program, despite significant documentation of functional deficits that would benefit from outpatient rehabilitation services.

Objective: To determine whether outcomes support the utilization of an early outpatient telerehabilitation based protocol.

Design: Retrospective analysis, nonrandomized controlled trial.

Setting: Academic healthcare center, secondary care.

Patients: All patients discharged following hospitalization with COVID-19 between April and September of 2020 (n=50) were contacted to participate; 26 accepted, 19 completed the rehabilitation protocol. Inclusion criteria were: patient diagnosed with and hospitalized for COVID-19, patient willing to participate in study.

Interventions: Patients were seen for 2-4 visits of physical therapy where they were assessed, screened to assess need for mental health, occupational therapy, and speech therapy services and placed into predetermined activity tolerance categories with corresponding exercises given.

Main Outcome Measures: Outcome measures assessed were Borg Rating of Perceived Exertion (RPE) on selected tasks, 30 Second Sit to Stand Test, Daily Fatigue Impact Scale score, Resting Respiratory Rate, activity tolerance (based on averaging severity levels of previously identified functional scale scores), and patient-rated feelings of dyspnea on exertion.

Results: Statistically significant improvements were found in resting respiratory rate ($p < 0.05$), 30 Second Sit to Stand score ($p < 0.001$), Daily Fatigue Impact Scale score ($p < 0.05$), Borg RPE ($p < 0.05$), and overall severity rating ($p < 0.01$). Patient-rated dyspnea was not significantly different from first to last visit.

Conclusions: 2-4 visits of telerehabilitation provided soon after hospital discharge resulted in significant improvements in functional outcome measures. This supports the utilization of outpatient rehabilitation following hospitalization for COVID-19 as well as the use of telerehabilitation to provide these services.

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The novel coronavirus causing a global pandemic made an appearance in the United States in January 2020. COVID-19 is known to be a highly contagious disease which predominantly impacts the respiratory system; however, it is a multisystem disease which is frequently severe and can result in death or long-term sequelae. Studies have shown that 31% of diagnosed patients are hospitalized, 10% are admitted to ICU, and 3.4% are fatal [1,2].

Statements about 7 and 30 day readmission rates of patients with COVID-19 are preliminary, as only a few studies currently report on these rates, and the ones that exist are quite variable

(possibly because they utilizing groups of patients with varying characteristics, and most have a relatively small cohort of patients). An early study from Turkey found that the 30-day readmission rate for patients with mild and moderate levels of disease (non-critical disease) was 7.1%, and 18% of those readmitted died during the readmission [3]. A larger scale study of patients in New York found that of patients who were admitted, 2.2% were readmitted during the study period. However, a study in Michigan found that readmission rate was 11.2% with a 30 day post discharge mortality rate of 20% [5]. A study from Rhode Island found a readmission rate of 6.8% within the first 12 days; this study did not report on data between 12 and 30 days post discharge [6].

The most common comorbidities found in patients with COVID-19

include hypertension, obesity, chronic kidney disease, and diabetes [4,5]. These comorbidities are associated with severity of disease, increased length of hospital stay, and likelihood of readmission.

Current standard of care for patients with mild or moderate cases is to recover at home in isolation, while patients with severe or critical illness are admitted to the hospital for supportive care, potentially including mechanical ventilation. Due to the prolonged length of ventilation and hospital stays in patients with severe to critical illness, hospitals in areas with major outbreaks have become overloaded, quickly reaching ICU bed capacity, making discharge as soon as feasible/safe a desired goal in treatment of patients with COVID19.

It is well known that movement balanced with rest, position changes, and breathing exercises can help decrease the risk of development of pneumonia secondary to respiratory viruses [7-9]. Many patients with severe cases of COVID-19 experience prolonged hospitalization, ventilation, and proning which can cause post-ICU dysphagia, muscle weakness, myopathy, neuropathy, pain, difficulty standing, impaired balance, gait impairments, and significant limitations in activities of daily living.¹¹ Early data about COVID-19 indicates that sarcopenia and post-ICU debilitation are both common and significant causes of morbidity, and that scarring of the lungs can lead to significant future limitations in lung capacity and respiratory muscle strength [1,2]. Other documented impacts of COVID19 include anxiety, impaired pulmonary function, fatigue, PTSD symptoms, impaired concentration, difficulties with speech and swallowing, and memory problems [10].

To date, the role of rehabilitation services in the outpatient management of COVID-19 has not been significantly studied, though multiple early studies document impairments that would benefit from rehabilitative services. Most of the studies that currently exist focus on management of critically ill patients in acute care settings; however, there have been fewer opportunities to assess the post-acute management of patients who either have milder cases not requiring hospital admission or patients who have recovered from a more severe case. Many of the proposals, consensus statements and literature reviews that currently exist call for the use of skilled service to promote return to a high quality of life for patients; however, few studies have looked at options for implementation or outcomes of implementing an outpatient rehabilitation program for these patients [11-16].

One significant challenge that presents with treatment of this population is the highly contagious nature of the illness, coupled with worldwide shortages of personal protective equipment (PPE). This makes conventional rehabilitation (especially pulmonary rehabilitation, which often involves procedures that lead to aerosolization of lung contents) highly risky and challenging to implement. Additionally, patients with this illness who live in more rural areas may not be easily able to travel distances for appointments. Telemedicine allows for social distancing between provider and patient as well as the convenience of care while the patient is in their home environment and as such may be an ideal option for rehabilitation and wellness coaching for this patient population.

The purpose of this paper is to assess the impact of a multidisciplinary telerehabilitation program provided to patients following hospitalization for COVID-19 for efficacy of services.

Methods

All individuals who were discharged following a hospitalization for COVID-19 between the dates of 4/5/2020 and 9/22/2020 were contacted with an offer to schedule an outpatient physical therapy (PT) telehealth consultation. All patients who accepted were scheduled for an evaluation visit within 72 hours of hospital discharge. All telehealth sessions were completed using the ZOOM (San Jose, California) secure platform, and participants were given instructions on how to set up ZOOM on their home devices as well as detailed instructions on how to attend a telehealth visit using the platform. A test visit was scheduled and completed prior to the first session to ensure that technical issues were solved prior to the evaluation session.

All physical therapists providing care to these patients went through the same training process, which included training in delivery of teletherapy services, COVID-19 patient experience as known at the time, proposed best practices based on the data available at the time, and training on the protocol used in this study. The protocol was developed by a multidisciplinary team that included physical, occupational, speech, and respiratory therapists as well as exercise professionals and PM&R physicians.

Subjective and objective measures were taken by the subject's assigned physical therapist at each visit and recorded for initial and final visits for analysis. Subjective measures included medication compliance, pain rating, Borg scale of perceived exertion while performing various activities of daily living (ADLs), fatigue, shortness of breath, and presence of sleep disturbances. Objective measures included respiration rate and a 30 second sit to stand test. Subjects were also evaluated for Occupational Therapy, Speech Therapy, and Psychiatric needs and referred out appropriately. Demographic and historical data collected included age, gender, comorbidities, and cognitive/physical status prior to COVID-19 diagnosis. There were 9 patients who spoke Spanish only, and for these patients, the hospital system's Language Services team was on the ZOOM call with the therapist and patient, interpreting throughout the conversation. The Language Services team also translated the patient educational materials into Spanish and Spanish language versions of outcome measures were utilized.

During the first session, physical function testing, cognitive screening, and screening for medication compliance were performed. Participants were placed into activity tolerance categories based on their scores on physical outcome measures, and were given education in addition to strengthening and respiratory exercise activities appropriate for their level of physical functioning. (Table 5) If the cognitive screening showed impairment, the patient was referred to occupational therapy (OT) for cognitive rehabilitation; if OT discovered speech and memory deficits, the patient was also referred to speech therapy (ST). If patients reported lack of compliance with medication, they were referred either back to their primary care physician or to a Patient Medication Liaison as appropriate.

Patients then received at least 1 but as many as 3 additional sessions during which they were screened for depression with appropriate referral if needed and all measures were repeated with exercise program progression or regression according to the patient's activity tolerance. The decision to provide 2 vs 3 vs 4 visits of physical therapy was a collaborative decision between the clinician and the patient based on the patient's presentation and therapist's best clinical judgment. The data gathered during the final session was utilized as the patient's discharge status regardless of whether that was session 2 or 4. (Table 1)

Table 1: Severity Score

Severity Score	Excellent	Good	Fair	Poor
Respiratory Rate Score	10-14	14-20	20-24	>24
Borg Score:	6-7	7-11	11-16	>16
30" Chair to Stand Score:	>14	9-14	7-9	<7
Daily Fatigue Impact Scale Score:	<12	12-21	21-30	>30
Shortness of Breath Score:	0	1	2-4	4

A retrospective chart review was conducted at completion of the study to gather additional demographic data including level of hospitalization required, need for a ventilator, number of days on a ventilator, hospital length of stay, discharge disposition, and number of days receiving supplemental oxygen at home. Readmission data was also gathered to see how many subjects had a 7 or 30 day readmission. New medical diagnoses acquired while participating in the study as well as number of outpatient visits the subjects had during the study (excluding teletherapy visits) were also collected to determine health status after COVID-19 diagnosis and study participation.

Data was deidentified and statistical analysis done using SPSS (IBM Corporation, Chicago IL). Tests utilized included Fischer’s Exact, t-test, and Wilcoxon signed-rank test.

Results

Of the 50 patients who were contacted during the study period, 25 scheduled an initial physical therapy appointment. Statistical analysis showed no variance in patients who accepted or declined therapy in terms of age, sex, length of hospital stay, number of comorbidities, or number of days ventilated. (Figure 1)

Six subjects (24% of those scheduled) didn’t follow-up after their evaluation. Four of these six subjects no showed or canceled their follow-up appointments. One patient declined to schedule a follow-up. One subject needed OT and ST more than PT and did not complete the PT protocol due to cost. These patients were placed in their own group for analysis due to having received a single session of the protocol but not having completed it.

Twenty-six individuals declined to schedule a therapy visit (Table 2).

Table 2: Timing, Screenings, and Education for Physical Therapy Sessions

Session	Time From Hospital Discharge	Screenings Performed	Education Provided	Exercise Program	Required?
1	2-3 days	Cognitive, medication compliance, activity tolerance	Exercise & healing, reasons to seek return care	Physical and respiratory, based on level of activity tolerance	Yes
2	4-6 days	Depression (PHQ-9), activity tolerance	Depression & anxiety resources	Updated based on activity tolerance	Yes
3	9-13 days	Activity tolerance	Patient question specific	Updated based on activity tolerance	No
4	16-20 days	Activity tolerance	Patient question specific	Updated based on activity tolerance	No

Table 3: Reasons to Decline Physical Therapy Consultation

Total Number of Patients	Reason for Declining Therapy
6	Not interested in therapy
5	Cost
4	Unable to contact
3	Didn't feel therapy was necessary
3	Not interested in telehealth
3	Preferred in-person therapy closer to home
2	Passed away prior to contact
26	

Table 4: Readmissions Following Hospitalization for COVID-19

Group	7 day readmission	30 day readmission	Total readmissions in 30 days
Declined PT	1	8	9
PT Evaluation, No Follow Up	0	0	0
Completed PT Program	0	1	1

Table 5: Age Groups of Subjects

Age Group	Number of Subjects
0-19	0
20-29	4
30-39	1
40-49	9
50-59	12
60-69	14
70-79	8
80-89	1
90-100	1

In patients (n=19) who completed at least 2 visits of physical therapy, statistically significant improvements were found in resting respiratory rate, 30 second sit to stand test, Daily Fatigue Impact scale score, Borg rating of perceived exertion with specified ADLs, and activity tolerance level between first and last visit. There were no significant differences found in pain or shortness of breath between evaluation and final visit. A one-way ANOVA revealed no significant difference in score change between those that received 2, 3, or 4 visits. There also was no significant difference in change in functional outcome measure scores between patients who only spoke Spanish and patients who were native English speakers.

11 (65%) of the patients who received physical therapy reported sleep disturbances, typically described as waking up at night gasping for air. 9 patients (47%) needed occupational therapy and 7 (37%) needed speech therapy.

In this study, there were a total of 10 readmissions experienced by 7 patients (13% of patients were readmitted at least once). One of these patients died during a readmission. The difference in readmissions between groups did not reach statistical significance. A logistic regression showed that level of hospitalization and length

of hospital stay were both independent of need for occupational or speech therapy. (Figure 2) (Figure 3)

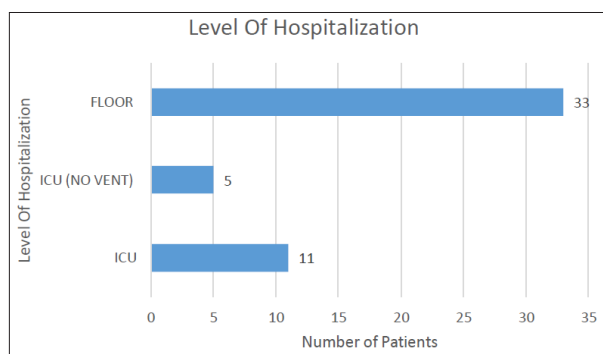


Figure 1

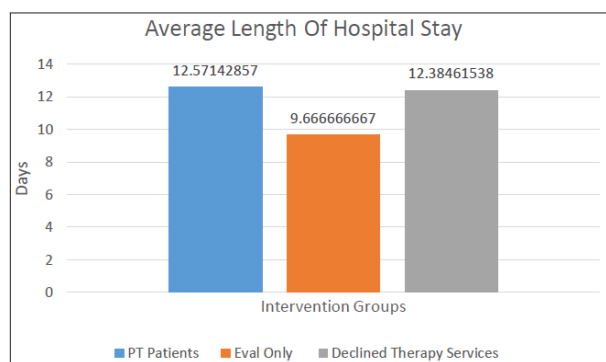


Figure 2

Discussion

The results of this study show that telerehabilitation provided shortly following discharge post hospitalization of COVID-19 resulted in significant improvements in multiple functional outcomes. Participants in our rehabilitation protocol demonstrated a significant improvement in multiple functional outcome measures when seen for 2-4 visits over a 1-3 week period following hospitalization for COVID-19. The improvement in functional outcome measures was comparable in patients whose therapists decided they were ready for discharge after 2, 3, or 4 visits. These findings support that the judgment utilized by therapists in a shared decision with the patient was appropriate with regard to discontinuation of therapy. Outcomes in the participants who spoke Spanish and subsequently had a translator participating in their telehealth sessions had similar results. These positive outcomes support the use of telehealth even when language interpreters are required. Degree of improvement was not found to be significantly related to degree of hospitalization or initial baseline for any test; however, it is possible that with a larger cohort, an association would become apparent.

An unexpected finding in this study was the frequently identified need for occupational and speech therapy services in patients. This need was not restricted to patients who had been in the hospital for extended periods or those who had required mechanical ventilation. This important finding points to the likelihood that even those patients hospitalized with COVID-19 who are not in the most significantly ill category may experience significant cognitive and/or language deficits and should be screened for need for these services. Because the high utilization of these services was not anticipated prior to implementation, a homogeneous protocol for occupational therapy rehabilitation and speech therapy screening was not created; future researchers should consider implementing such a protocol and gathering more specific data on cognitive

impairments and outcomes.

Hospital readmissions seen in this group of patients was slightly lower (4%) than that seen in some other similar studies, as 30 day all reason readmission numbers in the United States seem to hover around 11% in most studies.^{4,5,6} While the rate of readmission appeared substantially lower in individuals who had at least an initial session of physical therapy, it is not possible with this data to state this was due to receiving physical therapy due to study design which allowed patients to self-select whether they participated in the recovery program. Further study with a larger cohort of patients may better define any differences in rehospitalization rate based on rehabilitation status.

The investigators elected to screen for mental health needs during the second visit as it was believed that the length of the first visit was already potentially challenging for both therapists and patients who were still relatively unwell. However, given the relatively high number of dropouts and prevalence of mental health needs, it would likely make sense to prioritize mental health screening during the first visit, potentially in lieu of issuing a complete exercise program.

The data reported here represents the results of the first large-scale attempt to provide rehabilitation purely via telemedicine. While there were some challenges consistent with a learning curve for both therapists and patients with teletherapy, overall, the consensus was that this is an excellent option for specialty services to be delivered for patients who either don't live close enough to access in-person services or who are in quarantine. Additionally, telerehabilitation represents an attractive option for caring for these patients while eliminating risk to both healthcare providers and other patients. The statistically significant and clinically meaningful improvements in activity tolerance, fatigue impact, and functional mobility suggest that care delivered by this method was also highly effective even with a relatively low number of visits.

There are several areas for improvement and further investigation based on our results. Selection bias likely played a role in this study due to patients being allowed to elect whether to participate. This choice resulted in groups of approximately equal size that did and did not receive therapy services, however the groups were not randomly allocated and the design of the study did not allow pre- and post-testing of outcome measures on the individuals who declined therapy services. It would be useful in future studies to do a more detailed analysis of why patients might not be interested in participating in therapy; that analysis was not done during the gathering of this data and thus is not reported here. Additionally, it would be interesting to see whether more data points would result in a significant difference in rehospitalizations between groups.

In our initial program, we screened for depression but did not screen for anxiety. Based on the new literature available since the program was initiated, this has since been added to more fully address mental health needs.

Neither the patients nor the therapists were blinded. Our protocol was based upon best available evidence in March 2020 for treatment for patients with COVID-19, and it is possible that subsequently published evidence might provide basis for improvements upon our treatment protocol.

Future studies should consider utilizing a similar protocol in a randomized controlled study format with post-hospitalization

outcome measures taken in both the treatment and control groups to enable more accurate determination of impact of rehabilitation. It would also be beneficial to follow participants at 6 month intervals for at least 12-18 months in order to determine whether long-term health is improved in individuals who receive post-Covid rehabilitation. It would potentially be interesting to attempt to determine whether outcomes achieved by telehealth are equal to those that could be achieved in person; however, the highly contagious nature of COVID-19 suggests that the risk associated with such a study may not provide adequate benefit to justify such a study.

Conclusions

The results of this retrospective analysis show that a short course of telerehabilitation after discharge following hospitalization for COVID-19 was correlated with significant improvements in multiple functional outcomes. While it would be beneficial for further studies to investigate these findings with more scientific rigor, these initial results support the early utilization of rehabilitative services post-hospitalization for COVID-19 and indicate that telehealth is a viable option to deliver these services.

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