

Patient Characteristics and Acute PT and OT Utilization During the Initial Surge of COVID-19

A Retrospective Observational Study

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ABSTRACT

Objective: To describe the characteristics of patients and investigate the utilization of physical (PT) and occupational therapy (OT) intervention for those with a positive coronavirus disease-2019 (COVID-19) diagnosis compared with other patient populations during the first 6 weeks of the novel coronavirus pandemic.

Methods: A retrospective, observational study of adult inpatients with a length of stay of 1 or more days at an urban hospital in Detroit, Michigan. Individuals with a COVID-19 diagnosis were compared with a cohort within similar diagnostic categories (respiratory, fever, and sepsis) but without COVID-19. Outcome measures included PT or OT intervention on 1 or more days, the timing of initial PT or OT visit, the average number of visits and units per patient, length of stay, discharge to home, and readmission within 30 days.

Results: Individuals with COVID-19 had lower rates of discharge to home ($P = .001$), higher rates of readmission within 30 days of hospital discharge ($P = .01$), increased hospital length of stay ($P = .001$), and waited an average of 3.1 days longer for therapy evaluations than subjects in the comparison group ($P = .001$). The percentage of subjects who had one or more PT or OT visits during their hospital stays was comparable between groups. Once therapy was initiated, the average number of visits per patient and dosing of units in 15-minute increments were similar between the 2 groups.

Conclusions: Patients acutely ill with COVID-19 hospitalized with the virus during the first 6 weeks of the pandemic remained in the intensive care unit and hospital longer than their counterparts without COVID-19 and had a delay in initiation of PT and OT intervention. PT and OT are important members of the care team for patients with the novel coronavirus. Understanding the descriptive characteristics of patients and therapy services during the initial surge could help improve utilization and patient outcomes.

Severe acute respiratory syndrome-coronavirus 2 (SARS-CoV-2) and, its resultant disease, coronavirus disease-2019 (COVID-19) have rapidly evolved into an international pandemic and impacted every

health care area, including physical therapy (PT). Initial studies reported 15% of patients were developing severe disease, and 5% of patients diagnosed with COVID-19 required critical care due to severe acute respiratory failure and multiorgan system dysfunction.¹⁻⁵ In the United States, New York City, New York, and Detroit, Michigan, were among the areas with the highest concentration of COVID-19 cases beginning in mid-March 2020. Early evidence reported a high percentage of patients requiring critical care due to COVID-19.⁶⁻⁸

Evidence supporting the role of PT in the care of critically ill patients is well-documented, and diagnosis-specific research continues to emerge.⁹⁻¹³ For example, patients admitted to an intensive care unit (ICU) with a diagnosis of acute respiratory distress syndrome (ARDS) and sepsis have been investigated and provide insight into the impairments and effect of early mobilization.¹⁴⁻¹⁷ The long-term physical function of patients surviving ARDS compared with those surviving other critical illness has also been described.¹⁸ To date, clinical practice recommendations for the management of patients with COVID-19 by acute care physical therapists

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have included physical mobility and respiratory interventions,¹⁹⁻²¹ but no descriptive or correlational studies have been reported at the time of article submission.

The aim of this study was to describe the specific characteristics of an initial cohort of patients and to investigate how PT and occupational therapy (OT) delivery of care in combination with other medical interventions impacted the outcomes for patients with a positive COVID-19 diagnosis as compared with other patient populations during the first 6 weeks of the novel coronavirus pandemic.

METHODS

Study Population, Data Sources, and Variables

A retrospective comparative study was designed to identify baseline clinical characteristics of adults 18 years and older admitted to Henry Ford Hospital (HFH), an 877-bed, academic, level I trauma center in the inner-city of Detroit, Michigan, on or after March 15, 2020, and discharged on or before April 30, 2020. The period was selected to investigate subjects from the date of the first known admission of a subject with a positive COVID-19 diagnosis to the date when the daily admission rate began to decline. Subjects with a hospital length of stay (LOS) 1 day or less were excluded to control for patients who may have died or been discharged home within 24 hours of admission. Subjects who died at any time during the study period were also excluded.

Data variables were collected from the EPIC electronic health record and included age, gender, race, Medicare Severity Diagnosis Related Group (MS-DRG), hospital LOS, ICU LOS, average days requiring mechanical ventilation (vent days), average days requiring sedation medication, discharge disposition, rate of readmission within 30 days, date of first PT and first OT visits (timing), the number of PT and/or OT visits (frequency), and the total units of service provided in 15-minute increments (dosing). PT and OT evaluations are non-time based and reflect 1 unit of service.

A novel variable for identifying the presence of COVID-19 was used to stratify subjects into 2 groups. This variable is based on a positive polymerase chain reaction test of the nasopharyngeal specimen or the diagnosis of COVID-19 actively listed on the subjects' EMR problem list.⁶ Group 1 included patients with a positive variable for COVID-19. Group 2 included patients with a negative variable for COVID-19.

Subjects were further stratified within each group to demonstrate a comparable patient population or diagnosis category between the 2 groups. At the time of this study, the Centers for Medicare & Medicaid Services had not identified MS-DRG (related to COVID-19). The investigators found that 89% of subjects in group 1 were assigned to one of the following MS-DRGs: Respiratory System (MS-DRG 166-208), Fever (864), or Sepsis (870-871) diagnostic groups.^{22,23} Subjects were excluded if they did not have

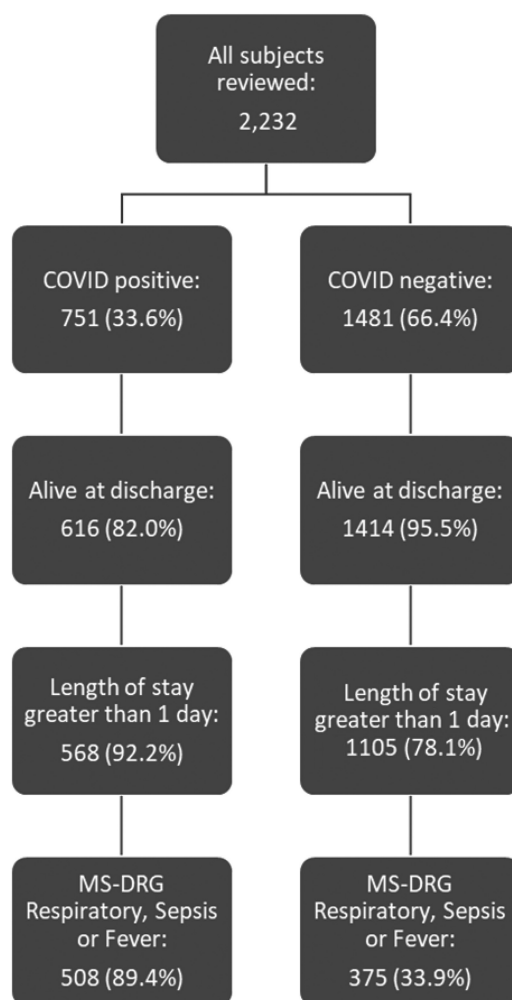


FIGURE. Subject Profile.

an MS-DRG within one of the identified groups (see the Figure).

The primary outcome variables compared were the percentage of subjects receiving 1 or more PT visits, 1 or more OT visits, discharged to home, and readmission within 30 days. Subjects requiring 2 or more days of ICU care and requiring mechanical ventilation were reported as well. For patients with 1 or more PT or OT visits, the primary variables were the number of days from hospital admission to the date of first PT and OT visit (timing; whether orders delayed or medically inappropriate), the average number of visits (frequency) and the number of units (duration of therapy) per subject.

Ethical Considerations and Consent

The hospital's Institutional Review Board approved the study design and data collection methods. Informed consent was waived due to the retrospective nature of the study.

Statistical Analysis

All continuous data were tested for normality and were described using means and standard deviations, while categorical data were described using counts and

TABLE 1. Subject Characteristics

Variable	Group 1: COVID Positive (n = 508)	Group 2: COVID Negative (n = 375)	P Value
	% (n)	% (n)	
Gender: male	53.2 (270)	49.9 (187)	.335
Age: >70 y	25.6 (130)	21.3 (80)	.142
Race: Black	87.6 (415)	78.2 (280)	<i>.001^a</i>
Discharged destination: home	78.2 (397)	89.6 (336)	<i>.001</i>
Intensive care unit length of stay, ≥2 d	20.3 (103)	17.3 (65)	.271
Mechanical ventilation required, ≥1 d	11.6 (59)	8.3 (31)	.104
Readmission within 30 d of discharge	11.0 (56)	17.1 (64)	<i>.01</i>
PT visits, ≥1	27.4 (139)	28.8 (108)	.638
OT visits, ≥1	26.0 (132)	26.9 (101)	.752

OT, occupational therapy; PT, physical therapy.
^a*Italicized value indicates statistical significance.*

column percentages. Univariate 2-group comparisons were performed using 2-group *t* tests with 80% power, with a 2-sided α level of 0.05, and were used to detect an effect size of 0.18, considered a small to medium effect. For categorical variables, a χ^2 test was performed with 80% power used to detect an effect size of 0.18, considered a small to medium effect size, and a 2-sided α level of 0.05. Statistical significance was set at $P < .05$. All analyses were performed using SAS 9.4 (SAS Institute, Cary, North Carolina).

RESULTS

A total of 2232 subjects were admitted to nonhospice or nonlabor and delivery units at HFH on or after March 15, 2020—the beginning of the surge of positive COVID-19 cases in Detroit, Michigan, and discharged on or before April 30, 2020, when admissions began to decline. The Figure describes subject selection into each cohort. Thirty-three percent, 751 subjects, met the criteria for a positive COVID-19 diagnosis, and of those, 568 subjects had

not died and had a LOS greater than 1 day. Eighty-nine percent, 508 subjects, were assigned to an MS-DRG category within the Respiratory System (MS-DRG 166-208), Fever (864), or Sepsis (870-871) diagnostic groups. Of the 1481 subjects without a positive COVID-19 diagnosis admitted during the period studied, 375 had comparable MS-DRGs and met inclusion criteria of alive at discharge and an LOS greater than 1 day.

Subjects in both groups were of similar age and gender. However, a greater percentage of subjects with COVID-19 were identified as African American ($P = .001$), had lower rates of discharge to home ($P = .001$), and had lower rates of readmission within 30 days of hospital discharge from any setting ($P = .01$), as shown in Table 1. Subjects with a COVID-19 diagnosis were also found to have statistically significant increases in LOS (see Table 2). While subjects in group 1 were also more likely to have ICU stays or require mechanical ventilation, the difference was not statistically significant (see Tables 1 and 2).

TABLE 2. Subject Characteristics and Hospital Outcome Variables

Variable	Group 1: COVID Positive (n = 508)				Group 2: COVID Negative (n = 375)				P Value
	Mean	SD	Median	IQR	Mean	SD	Median	IQR	
Age	60.4	14.7	61.0	52-71	58.5	15.1	60.0	49-70	.129
Length of stay, intensive care unit, d	1.6	4.4	0.0	0.0-0.0	0.9	3.0	0.0	0.0-0.0	.171
Length of stay, general practice unit, d	4.6	3.6	4.0	2.0-6.0	3.5	3.0	3.0	1.0-5.0	<i>.001^a</i>
Length of Stay, total hospital, d	7.3	6.2	5.0	3.0-9.0	5.4	4.4	4.0	3.0-7.0	<i>.006</i>
Duration of mechanical ventilation, d	1.1	3.7	0.0	0.0-0.0	0.4	2.0	0.0	0.0-0.0	.068
Duration of sedation medication, d	1.0	3.3	0.0	0.0-0.0	0.5	2.0	0.0	0.0-0.0	.232

IQR, interquartile range.
^a*Italicized value indicates statistical significance.*

TABLE 3. Characteristics of Physical Therapy Utilization

Variable	Group 1: COVID-Positive Subjects With PT Visit (n = 139)				Group 2: COVID-Negative Subjects With PT Visits (n = 108)				P Value
	Mean	SD	Median	IQR	Mean	SD	Median	IQR	
Admit to first PT visit, d	7.25	6.01	6.00	3.0-11.0	4.16	3.97	3.00	2.0-5.0	<i>.001^a</i>
PT visits per patient	2.92	2.64	2.00	1.0-4.0	2.83	2.21	2.00	1.0-4.0	.656
PT units of time per patient	9.45	9.88	5.00	3.0-14.0	8.56	7.93	6.00	3.0-12.0	.984
Average PT units per visit	3.95	0.89	3.00	2.0-3.5	2.80	0.07	3.00	2.2-3.2	.102

IQR, interquartile range; PT, physical therapy.
^a*Italicized value indicates statistical significance.*

The percentage of subjects who had 1 or more PT or OT visits during their hospital stays ranged from 26% to 28.8% (group 1: 108 patients; group 2: 139), and this was comparable between groups (see Table 2). The timing of initiation of therapy services was significantly different, however. Subjects in the COVID-19 group had a first PT or OT visit an average of 3.1 days later for therapy evaluations than subjects in the comparison group. The average number of days from admission to first PT and first OT visit for subjects in the COVID-19 cohort was 7.3 days (SD = 6; interquartile range [IQR], 3.0-11) compared with 4.2 days (SD = 4.0; IQR, 2.0-5.0) for those in the comparison group. Table 3 displays the characteristics of PT utilization, and Table 4 displays OT. Once therapy was initiated, the average number of visits per patient and the average dosing of units in 15-minute increments were similar between the 2 groups. Subjects received an average of 2.9 visits per subject in the COVID group compared with 2.8 visits per subject in the non-COVID group. On average, for both PT and OT, 2.8 units or 42 minutes per visit were spent for subjects with COVID and 3.0 units or 45 minutes for subjects without.

DISCUSSION

PT and OT provide an important role in the care of acutely ill patients, including during a global pandemic of the novel coronavirus, SARS-CoV-2, and its resultant disease, COVID-19.^{9,19,20,24} This study aimed to describe the characteristics of patients admitted to and discharged

from a single acute care hospital setting in the epicenter of the initial COVID-19 pandemic surge and describe the utilization of PT and OT during the first 6 weeks of the pandemic in the state of Michigan. This study is novel in its research design to compare subjects with the novel coronavirus with those with comparable diagnostic groups (Respiratory, Fever, or Sepsis MS-DRGs). Evidence in literature, particularly in the patient populations of respiratory disorders and sepsis, concludes early mobility and PT are feasible and effective in the care of critically ill patients.^{15,16,25,26} Tables 1 and 2 describe characteristics for all subjects within those MS-DRGs and found subjects with COVID-19 had significantly longer inpatient lengths of stay and were less likely to be discharged home than subjects without COVID-19. The demographic findings align with all patients' published clinical characteristics with COVID-19 at this hospital during the first 2 weeks of the surge and describe disproportionately higher rates of hospitalization of people of Black race due to COVID-19 in an urban academic hospital during the initial surge of coronavirus.⁶

The investigators found that PT and OT's utilization was similar for all subjects with an MS-DRG within the respiratory, fever, or sepsis diagnostic categories, with approximately one quarter of subjects receiving 1 or more PT or OT visits. Of those for whom PT and OT provided therapy, the average wait time for an evaluation for a patient with COVID-19 was 3.1 days longer. However, whether this was due to delays in order entry or due to

TABLE 4. Characteristics of Occupational Therapy Utilization

Variable	Group 1: COVID-Positive Subjects With OT Visit (n = 132)				Group 2: COVID-Negative Subjects With OT Visit (n = 101)				P Value
	Mean	SD	Median	IQR	Mean	SD	Median	IQR	
Admit to first OT visit, d	7.33	6.00	6.00	3.0-11.0	4.19	3.88	3.00	2.0-5.0	<i>.001^a</i>
Number of OT visits per patient	2.88	2.59	2.00	1.0-4.0	2.57	2.14	2.00	1.0-3.0	.725
Total OT units of time per patient	10.14	10.16	6.00	3.0-14.0	8.25	8.06	6.00	3.0-10.0	.323
Average OT units per visit	3.25	0.87	3.29	3.0-3.8	3.00	0.73	3.00	2.7-3.5	<i>.002</i>

IQR, interquartile range; OT, occupational therapy.
^a*Italicized indicates statistical significance.*

medical appropriateness is unknown. This finding was not unexpected due to reduced access to personal protective equipment and novel clinical guidelines, in which the delivery of care for patients with COVID-19 was initially limited to telehealth. However, by April 1, 2020 (3 weeks from the first admitted cases of patients with COVID-19), PT and OT delivery of care was at the bedside, in line with what is now described in recent publications.^{19,24,27-29} Additionally, the authors hypothesized that those patients diagnosed with COVID-19 would have less frequency of PT and OT visits due to isolation restrictions; however, the results show the average number of visits and units of time was comparable between those admitted with a COVID-19 diagnosis and those that were COVID-19 negative (see Tables 3 and 4). This finding suggests that skilled PT and OT are feasible in the care of patients with COVID-19.

Several limitations exist, including the short period of subject selection at a single hospital setting. Results may have been impacted by inconsistencies in personal protective equipment availability for therapists, causing delays in the provision of care and decreased availability of postacute rehabilitation facilities contributing to increased LOS. Additionally, the descriptors for utilizing therapy services are limited to assumptions of standard clinical practice guidelines, including mobilization, exercise training, and activities of daily living, rather than specific interventions. This study does not report functional mobility outcome scores or the presence of safety or physiologic events related to therapy. However, a follow-up study is under development that will include these variables with expanded periods and include patients from both urban and community hospitals.

To date, the clinical practice guidelines and roles of PT specific to COVID-19 are emerging. However, as of September 30, 2020, no published works exist that characterize or compare objective measures related to PT or OT. Descriptive and correlational studies are needed to understand and translate the effect and outcomes for patients with COVID-19. The authors wish to investigate novel questions that have arisen as a result of the pandemic. What effect will PT intervention have on those individuals who survive ARDS caused by COVID-19? Will differences in the functional outcomes of patients with ARDS and other pulmonary diagnoses in the presence of COVID-19 compared with those who did not have the virus be noted? Additionally, would the involvement of multiple organ system complications in patients with COVID-19 affect their long-term functional statuses?

CONCLUSIONS

This study shows that PT and OT care to patients acutely ill with COVID-19 is realistic. The findings suggest that patients hospitalized with COVID-19 have poorer outcomes than those hospitalized with acute illness in similar diagnostic categories. Further research is needed to investigate PT and OT intervention's long-term effects

on patients affected by COVID-19. The authors plan to focus future research on the effects of PT and OT on functional mobility scores or the presence of safety or physiologic events related to therapy.

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