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ORIGINAL RESEARCH

Identification of Functional Limitations and Discharge Destination in Patients With COVID-19

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Abstract

Objectives: The objectives of this study were to identify functional limitations in patients with coronavirus 2019 (COVID-19) admitted to acute care hospitals; to evaluate functional limitations by demographic, medical, and encounter characteristics; and to examine functional limitations in relation to discharge destination.

Design: and Setting:This is a cross-sectional, retrospective study of adult patients with COVID-19 who were discharged from 2 different types of hospitals (academic medical center and a community hospital) within 1 health care system from January 1 to April 30, 2020.

Participants: Patients were identified from the Cedars-Sinai COVID-19 data registry who had a new-onset positive test for severe acute respiratory syndrome coronavirus 2. A total of 273 patients were identified, which included 230 patients who were discharged alive and 43 patients who died and were excluded from the study sample.

Interventions: Not applicable.

Main Outcome Measures: Functional limitations in patients with COVID-19 in acute care hospitals and the predictors for discharge disposition.

Results: A total of 230 records were analyzed including demographic, encounter, medical, and functional variables. In a propensity score–matched cohort based on age and comorbidity, 88.2% had functional physical health deficits, 72.5% had functional mental health deficits, and 17.6% experienced sensory deficits. In the matched cohort, individuals discharged to an institution experienced greater physical (62.7% vs 25.5%, $P<.001$) and mental health (49.0% vs 23.5%, $P=.006$) deficits than patients discharged home. Marital status (odds ratio, 3.17; $P=.011$) and physical function deficits (odds ratio, 3.63; $P=.025$) were associated with an increase odds ratio of discharge to an institution.

Conclusions: This research highlights that functional status is a strong predictor for discharge destination to an institution for patients with COVID-19. Patients who were older, in the acute care hospital longer, and with comorbidities were more likely to be discharged to an institution. Rehabilitation is a significant aspect of the health care system for these vulnerable patients. The challenges of adjusting the role of rehabilitation providers and systems during the pandemic needs further exploration. Moreover, additional research is needed to look more closely at the many facets and timing of functional status needs, to shed light in use of interdisciplinary rehabilitation services, and to guide providers and health care systems in facilitating optimal recovery and patient outcomes.

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In a short span of time, a pandemic affected the world as we know it. The medical community characterized the face of the severe acute respiratory syndrome coronavirus 2 as ranging from asymptomatic and mild cases to severe symptoms resulting in high morbidity and mortality.[1] Initial studies on coronavirus disease 2019 (COVID-19) described typical clinical manifestations including fever, respiratory symptoms, diarrhea, myalgia, and fatigue.[2-5] In more severe cases, thrombocytopenia, acute kidney injury, acute myocardial injury, liver damage, gastrointestinal damage, and acute respiratory distress syndrome are often

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observed.[6,7] Further, as individuals in our global population present with diverse symptoms secondary to COVID-19, scientific endeavors have elucidated additional clinical manifestations of the illness, which include central nervous system dysfunction.[4,8,9] Mao et al[4] found that patients with more severe cases had increased risk for neurologic manifestations; almost 37% (78 of the 214 patients) with COVID-19 presented with neurologic symptoms, including impaired consciousness (14.8%), acute cerebrovascular diseases (5.7%), and skeletal muscle injury (19.3%). In a scoping review of the literature, COVID-19 has manifested in symptoms such as headache, dizziness, hypogeusia, anosmia, altered level of consciousness, acute cerebrovascular events, seizures, and ataxia.[9]

Clinical observations and pathologic studies have shown that COVID-19 can result in significant dysfunction both acutely and subacutely.[7] Jianan[10] referenced that mild cases in an acute setting were found to have sleep dysfunction (63.6%), poor exercise endurance (61.4%), mild dyspnea (57.9%), anxiety (62.1%), fear (50.0%), and poor motivation (41.8%). Kiekens et al[11] summarize reports of post−intensive care unit (ICU) functional difficulties, including severe muscle weakness and fatigue, joint stiffness, critical illness myopathy and neuropathy, dysphagia, (neuro)psychological problems, and impaired functioning including gait and mobility, activities of daily living, and work. Preliminary research has begun to conceptualize the long-term impairment and dysfunctions resulting from the multifaceted body structure damage and deconditioning.[10] Jianan[10] noted that weakness, motor dysfunction with reduced mobility, and comorbidities exacerbated by COVID-19 may result in significant and chronic functional deficits.

Ceravolo et al[12] conducted a systematic review on rehabilitation needs due to COVID-19 and found articles were based on previous literature and not on the current pandemic. They concluded further updates are warranted to characterize the emerging disability in survivors of COVID-19 and the adverse effects of chronic disability in this population.

It is plausible that residual organ dysfunction (ie, cardiopulmonary, neurologic symptoms), debilitating weakness, motor dysfunction with reduced mobility, and comorbidities exacerbated by COVID-19 will result in significant functional deficits. With the experience of improved and discharged patients, timely rehabilitation intervention may improve prognosis, maximize function, and improve quality of life. Given that different degrees of physical and psychological functional impairment are reported in patients,[4] clarity of the functional limitations ensuing from COVID-19 needs further exploration. The challenges involved in transferring patients with COVID-19 to inpatient rehabilitation facilities and getting access to outpatient rehabilitation clinics and rehabilitation in home health[13] demonstrates a critical need to identify functional limitations to show the need for rehabilitation intervention and related outcomes.[14] Rehabilitation efforts in this population are only in the early stages, and there remains a significant knowledge gap in understanding functional limitations in patients with COVID-19 and the role of rehabilitation for this diverse patient population.

The aims of this study were to identify functional limitations in patients with COVID-19 admitted to acute care hospitals; to evaluate functional limitations by demographic, medical, and encounter characteristics; and to examine functional limitations in relation to discharge destination. Using the demographic, medical, encounter, and functional limitation variables, we hypothesize that functional limitations will be significant in predicting discharge destination using bivariate and multivariate predictive modeling.

List of abbreviations:

COVID-19	**coronavirus disease 2019**
EHR	**electronic health record**
ICU	**intensive care unit**
LOS	**length of stay**

Methods

Design and cohort identification

This is a cross-sectional, retrospective study of adult patients with COVID-19 who were discharged alive from 2 hospitals within 1 health care system. One hospital is an academic medical center and the other hospital is a community hospital, both located in Los Angeles, California. Participants included patients discharged from January 1, 2020, to April 30, 2020. Patients were identified from the data registry using the *International Classification of Diseases, Tenth Revision* diagnosis and positive COVID-19 laboratory test. A total of 273 patients were identified, which included 230 patients who were discharged alive and 43 patients who died and were excluded from the study sample. Cases were included if they were age 18 or older and were confirmed as a patient with new-onset COVID-19 from January 1, 2020, through April 30, 2020. Most of the patients were from the academic medical center (85%) and were admitted from home through the emergency department (80.5%). The other 19.5% were admitted from an assisted living or skilled nursing facility. Ethical approval and oversight were granted by the Cedars-Sinai Institutional Review Board.

Data elements for the study were identified through the electronic health record (EHR), Epic,[15] and were extracted using the COVID-19 Population Discovery application. Population Discovery is an application that enables exploration and extraction of data. The EHR information in Population Discovery is based on the Caboodle database, which is one of Cedars-Sinai's Epic databases. This application is designed to help clinicians and operational leadership easily identify groups of patients based on selected demographic and clinical information.

Demographic, encounter, medical, and functional variables were tested against the dependent variable of discharge destination (discharge home vs discharge institution). Discharge to an institution included inpatient rehabilitation facility, skilled nursing facility, long-term care hospital, or discharge to another acute care facility. Demographic data included age at the time of admission, sex (male/female), ethnicity (Hispanic/non-Hispanic), race (white vs black vs all others), and marital status (married/domestic partner vs single/divorced/widowed). Encounter variables included hospital length of stay (defined as time from the acute hospital admission to the acute hospital discharge, admission to an intensive care unit, and ventilator use). Other variables included the presence or absence of rehabilitation therapy services. Therapy services were defined by participation in physical therapy, occupational therapy, or speech-language pathology. Medical variables included comorbidities. Comorbidity burden was quantified using the Elixhauser coding algorithms for Elixhauser index to aid in

Table 1 Demographic and clinical characteristics of the sample

Parameters	Discharge Home (n = 165)	Discharge Institution (n = 65)	*P* Value
Demographic variables % of the total cohort (n = 230)	71.7	28.3	<.001
Age (y), mean ± SD	56.75±61.2	75.77±14.65	<.001
Sex (%)	16.62	50.8	.098
Male	38.8	49.2	
Female	75.8	84.6	.097
Ethnicity (%)			
Non-Hispanic	24.4	15.4	.003
Hispanic	70.3	61.5	
Race and ethnicity (%)			
White	12.1	26.2	
Black	17.6	12.3	
Other Marriage status (%)	61.2	40.0	.003
Married/domestic partner			
Single/divorced/widowed	38.8	60.0	
Encounter variables			
Length of stay (d), mean ± SD	7.66±5.87	15.15±9.39	<.0001
Intensive Care Unit (%)			
ICU stay	23.0	38.5	.015
Non-ICU stay	77.0	‘61.5	
Ventilator (%)			
Yes	46.2	53.8	<.0001
No	77.0	23.0	
Therapy provided (%)			
Yes	18.2	47.7	<.0001
No	81.8	52.3	
Medical variables			
Elixhauser Index, mean ± SD	8.42±6.93	15.52±8.59	<.0001
No. of Elixhauser comorbidities (%)			
0	10	2	
1-2	41	17	
3	21	11	
≥4	27	71	

prediction[16] and number of Elixhauser comorbidities (0, 1-2, 3, ≥4). We selected the Elixhauser Comorbidity Index to adjust for comorbidities because it has been shown to be superior to other metrics.[17-20]

To examine functional status, functional variables retrieved from the EHR were categorized into Physical Health, Mental Health, and Sensory Function. Physical Health included the presence or absence of self-care deficits, motor deficits, dysphagia/eating deficits, and bladder management deficits. Mental Health included the presence or absence of cognitive deficits, depression, anxiety, or psychosis. Sensory Function included the presence or absence of sensation deficits, vision deficits, or hearing deficits. Whether a functional deficit was mentioned more than once, on different days, and within different assessments determined the threshold for whether a patient had a deficit in 1 of the domains and was included in the analyses. Hearing was the only variable that was mentioned only 1 time and was therefore excluded.

To control for confounding disparities of age and comorbidities within the sample (table 1), cohort matching was established to compare functional status between the discharge home vs discharge institution groups. To focus on functional status for the population with COVID-19 and its effect on discharge destination, age and Elixhauser Comorbidity Index were used to create a propensity score–matched comparison from the complete study sample of 230 patients. The matched cohort consisted of 102 patients, 51 in the discharge home group and 51 in the discharge institution group.

Statistical analysis

Continuous variables were compared with a 2-sample *t* test or with a Wilcoxon rank-sum test for nonnormally distributed data. Categorical variables were compared with a chi-square test. Because the cohorts of individuals discharged to an institution and home differed at baseline (see table 1), we conducted a propensity score–matched analysis to compare the outcomes between groups while accounting for imbalances in baseline risk. We developed a multivariable logistic regression model to estimate the propensity score for discharge location as the dependent variable. Age and comorbidity score were the independent variables in the model. Between-group imbalances were considered to be small if the absolute standardized difference for a given covariate was <10%. Analyses were performed using SAS statistical software version 9.4[a] and the SPSS version 25.0 for Windows.[b] Statistical significance was defined as $P < .05$.

Table 2 Elixhauser comorbidities and discharge destination

Elixhauser Comorbidity (%)	Discharge Home (n=165)	Discharge Institution (n=65)
Fluid and electrolyte disorders	52.7	73.8
Hypertension, uncomplicated	38.2	32.3
Obesity	20.0	18.5
Cardiac arrhythmias	15.8	41.5
Chronic pulmonary disease	15.8	23.1
Diabetes, uncomplicated	15.2	9.2
Hypothyroidism	12.1	16.9
Diabetes, complicated	11.5	41.5
Coagulopathy	11.5	15.4
Renal failure	9.7	35.4
Congestive heart failure	9.1	24.6
Depression	7.3	18.5
Liver disease	6.7	1.5
Weight loss	5.5	18.5
Other neurologic disorders	4.2	32.3
Hypertension, complicated	4.2	24.6
Drug abuse	4.2	3.1
Valvular disease	3.6	3.1
AIDS/HIV	3.6	1.5
Peripheral vascular disease	3.0	9.2
Solid tumor without metastasis	3.0	3.1
Rheumatoid arthritis/collagen vascular diseases	2.4	6.2
Deficiency anemia	1.8	9.2
Lymphoma	1.8	0.0
Metastatic cancer	0.6	3.1
Pulmonary circulation disorders	0.6	1.5
Alcohol abuse	0.6	0.0
Blood loss anemia	0.6	0.0
Peptic ulcer disease, excluding bleeding	0.6	0.0
Paralysis	0.0	4.6
Psychoses	0.0	3.1

Results

Baseline characteristics by discharge location

In analyzing the sample (n=230) by discharge destination of home vs discharge to an institution, the age in years was 56.75±16.62 years and 75.77±14.65 years ($P<.001$), respectively. As in the overall sample, the majority in the discharge home vs institution were male (61.2%). For ethnicity, non-Hispanic was greater in both the discharge home cohort (75.8%) and the discharge institution cohort (84.6%). In the discharge home and institution cohorts, race also showed a higher percentage of white, 70.3% and 61.5%, respectively ($P=.003$). More of the patients who were discharged home were married or had a domestic partner (61.2%) than those discharged to an institution (40.0%, $P=.003$) (see table 1).

Outcomes by discharge location

Length of stay (LOS) for the patients who were discharged home was shorter, 7.66±5.87 days than for those who were discharged to an institution, 15.15±9.39 days ($P<.0001$). For patients with an ICU stay, there was more variability in their discharge destination, with 38.5% discharged to an institution and 23.0% home ($P=.015$) (see table 1). Specifically, patients who had an ICU stay and who were discharged to an institution spent 10.71 days on average in the ICU compared with those who were discharged home, who spent 6.41 days on average in the ICU. Ventilator use was higher in the discharge to institution cohort (53.8%, $P<.0001$). Overall, rehabilitation therapy provision was 18.2% in the discharge to home cohort and 47.7% in the discharge to institution cohort (see table 1), despite significant risks for medical complications and functional impairments (because functional deficits are known to accompany high comorbidity rates).[21-23]

Comorbidities and risk factors by discharge location

The higher Elixhauser Index was seen in the discharge to institution cohort at 15.52±8.59 compared with the discharge home cohort at 8.42±6.93 ($P<.0001$). The percentage of Elixhauser comorbidities was higher in the discharged to institution cohort, with 71% having ≥4 compared with 27% of the discharged home cohort. Table 2 provides a breakdown of Elixhauser comorbidities in the discharge to home and discharge to institution cohorts.

Propensity score matching and discharge location

Emphasis in the COVID-19–matched control sample was on function and its effect on discharge destination. The cohort group

Table 3 Age- and comorbidity cohort–matched demographics and clinical characteristics

Parameters	Discharge Home (n=51)	Discharge Institution (n=51)	*P* Value
Demographic Variables			
Age (y), mean ± SD	73.41±10.67	74.22±15.22	.758
Sex (%)			.345
Male	58.8	52.9	
Female	41.2	47.1	
Ethnicity (%)			
Non-Hispanic	80.4	84.3	.796
Hispanic	19.6	15.7	
Race (%)			
White	78.4	60.8	.092
Black	9.8	25.5	
Other Marriage status (%)	11.8	13.7	
Married/domestic partner	66.6	41.2	.008
Single	17.6	23.5	
Divorced or widowed	15.7	35.3	
Encounter Variables			
Length of stay (d), mean ± SD	10.9±7.28	15.41±9.91	.01
Rehabilitation therapy received*	41.2	49.0	.275
Medical variables			
Elixhauser Index, mean ± SD	14.41±7.69	15.67±9.31	.460
Intensive care unit (%)			
ICU stay	33.3	41.2	.270
Non-ICU stay	66.7	58.8	
Ventilator (%)			
Yes	21.6	35.3	.094
No	78.4	64.7	

* Rehabilitation therapy includes physical therapy, occupational therapy, or speech language pathology.

who was discharged home consisted of 51 patients who had an average age of 73.71 years and Elixhauser Index of 14.41. The comparison group of participants who were discharged to an institution consisted of 51 patients with an average age of 74.32 years ($P=.77$) and Elixhauser Index of 15.67 ($P=.55$). Fourteen cases within the discharge to institution comparison group were not able to be matched to home discharge cases and were removed from the functional analysis. Demographics in the matched control population had no significant differences based on sex, and a trend was noted for race and ventilator as depicted in table 3.

A higher percentage of the married/domestic partner group (66.6%) were discharged home vs institution (41.2%, $P=.008$). Encounter variables noted a significant difference in LOS between those discharged home (10.9±7.28d) vs those discharged to an institution (15.41±7.28d, $P=.01$). Individuals being discharged to an institution had a higher percentage of physical health deficits (62.7%) than those being discharged home (25.5%, ($P<.001$). Mental health deficits yielded a significant difference between cohorts, with a higher percentage of mental health deficits for those being discharged to an institution (49.0%) vs home (23.5%, $P=.006$). Provision of rehabilitation therapy was generally not significant based on discharge destination; however, those patients who received occupational therapy were more likely to be discharged to an institution (27.5%) than those discharged home (7.8%, $P=.009$) (table 4).

The significant variables from the bivariate analysis were included in the logistic regression model including physical health, mental health, marital status, and LOS. Marital status of single/divorced/widowed was significant for discharge to an institution (odds ratio, 3.17; $P=.011$). Presence of physical health deficits was also significantly associated with discharge destination to an institution (odds ratio, 3.63; $P=.025$). Table 5 shows discharge disposition by type of therapy service both for patients in the ICU and those not in the ICU. Patients who were in the ICU and who received occupational or physical therapy were more likely to be discharged to an institution (80.0% and 59.2% for occupational therapy and physical therapy, respectively).

Discussion

Functional limitations in patients with COVID-19 in an acute care hospital and the predictors for discharge disposition have yet to be explored. Understanding functional limitations in patients with COVID-19, including patients in both ICU and non-ICU settings, is important in the treatment and recovery process for this vulnerable population. It is critical to determine limitations that predict discharge destination to understand and provide access to rehabilitation services.

Previous studies have examined many factors that predict discharge destination. Predictors of discharge destination in general medical and rehabilitation populations have included, but are not limited to, severity of illness,[24] functional status,[25-28] mobility,[28-30] cognitive status,[25] length of stay,[29] depression,[25] and sociodemographic factors such as age,[27,28] ethnicity,[25] number of coresident household numbers,[27] and marital status.[25,31]

In an age- and Elixhauser comorbidity–matched sample cohort with COVID-19, 88.2% had physical health deficits, 72.5%

Table 4 Age- and comorbidity cohort–matched functional deficit identified in electronic health record and provision of physical medicine and rehabilitation services

Parameters	Discharge Home (n = 51)	Discharge Institution (n = 51)	*P* Value
Functional deficit identified in electronic health record (%)*			
Physical health	25.5	62.7	<.001
Mental health	23.5	49.0	.006
Sensory function	3.9	13.7	.08
Physical medicine and rehabilitation services provided (%)			
Occupational therapy	7.8	27.5	.009
Physical therapy	41.2	45.1	.421
Speech-language pathology	0.0	5.9	.121
Physiatry consultation	2.0	9.8	.102

* Physical health: self-care deficit, motor deficit, dysphagia deficit, urinary deficit; Mental health: cognitive deficit, depression, psychosis; Sensory function: sensation deficit, vision deficit.

had mental health deficits, and 17.6% experienced sensory deficits. The discharge to institution cohort had a larger percentage of individuals with physical and mental health deficits than those who were discharged home. Consistent with previous research investigating predictors for discharge destination, marital status[25,31] and the presence of compromised physical health (eg, mobility[28-30]) were significant predictors of discharge destination within a logistic regression model. Individuals were more likely to be discharged home if they were married or without functional physical deficits.

Functional status was a strong predictor for discharge destination for patients with COVID-19, a finding consistent with other medical populations.[21-23,30] Consistent with previous reports,[32] the majority of patients in this study discharged to postacute inpatient rehabilitation were 65 years or older with multiple comorbidities. In the context of patients with COVID-19, one could deduce that older age and comorbidities increase the risk of developing medical complications,[4] which can negatively affect functional status, discharge destination, hospital readmission, and mortality.[21-23] Adding patient-level functional status in an algorithm looking at discharge destination and readmissions has proven to improve the discriminatory ability in prediction analyses in other patient populations,[33,34] and using functional status in prediction analyses for patients with COVID-19 is now confirmed. Given the lack of rehabilitation data on patients with COVID-19, our research adds necessary evidence to support rehabilitation candidates in acute care.

A small percentage of patients with COVID-19 received rehabilitation. Plausible explanations include the novelty of the pandemic, the attention to primary symptoms (eg, fever, cough, acute respiratory symptoms, gastrointestinal symptoms, fatigue) and staff/patient safety issues that detracted from considerations for rehabilitation services.

Implications for this study include understanding functional limitations for patients with COVID-19 and developing a thorough treatment plan during the hospitalization. Early intervention and discharge planning for older and acutely ill patients reduces duration of hospitalization, readmissions, and mortality and

Table 5 Age- and comorbidity cohort–matched discharge disposition and physical medicine and rehabilitation services for patients in ICU and not in ICU

Variables	Discharge Disposition			
PM&R Services Provided ICU (n = 38) vs Non-ICU (n = 64)	Home & Home With Home Health	IRF	SNF	Other*
Occupational therapy (%)				
ICU (n = 15)	20.0	66.7	13.3	0
Non-ICU (n = 3)	33.3	66.7	0	0
Physical therapy (%)				
ICU (n = 27)	40.7	44.4	14.8	0
Non-ICU (n = 17)	58.8	23.5	17.6	0
Speech-language pathology (%)				
ICU (n = 0)	NA	NA	NA	NA
Non-ICU (n = 3)	0	0	100	0
Physiatry (%)				
ICU (n = 6)	16.7	83.3	0	0
Non-ICU (n = 0)	NA	NA	NA	NA

Abbreviations: IRF, inpatient rehabilitation facility; NA, not applicable.

* Other, another acute hospital, long-term care hospital, hospice inpatient, other; PM&R, physical medicine and rehabilitation; SNF, skilled nursing facility.

improves quality of life.[30,35,36] Stucki et al[37] pointed out that prolonged hospital stays can result in debility, muscle weakness, contractures, and atrophy, which, without rehabilitation, can result in worse outcomes. Function is a modifiable risk factor that affects readmission outcomes if function-based interventions are instituted early.[33,34,37] Understanding functional status for patients with COVID-19 can aid in cost management.[37,38] Functional impairment is associated with greater Medicare costs for postacute care and may be an unmeasured but important marker of long-term costs.[39] A COVID-19 systematic review[40] highlighted the absence of studies addressing predictors for discharge destination, and another study[41] stated that there was a need to develop appropriateness and selection criteria for rehabilitation. Incorporating functional assessments for patients with COVID-19 may aid in the reduction of LOS and prevention of disability while improving operational efficiency and long-term costs.

Study limitations

All patients were from 1 health system, which affects generalizability. Sample size within the matched cohorts was small, which required grouping factors (ie, physical health, mental health, sensory function) rather than specific functional predictors. A comprehensive picture of the role of rehabilitation services for patients with COVID-19 was not obtained. The variability and inconsistency of documentation of the complication classification made the data unreliable and was not used. Given the limited involvement of rehabilitation specialists, it is likely that many functional deficits and psychophysiological factors were not systematically assessed or documented. Premorbid living setting included 19.5% from an assisted living or a skilled nursing facility in which physical health at the time of hospital admission was unknown. Physical health, mental health, and sensory variables were included in the analyses when the functional deficit was mentioned more than once, on different days, and within different assessments. Future studies should explore optimal thresholds and the related implications. Furthermore, replication of the current study within other geographic areas and with inclusion of additional medical, functional, and sociocultural variables will be important to further understand the role of rehabilitation medicine within the population with COVID-19. Moreover, looking more closely at the many facets and timing of functional status (ie, mobility, performance of activities of daily living, cognition, social functioning, psychological variables [ie, anxiety, depression, quality of life]) will further aid in predicting discharge destination after acute hospitalization, guiding rehabilitation services and recovery and facilitating improved patient outcomes.

Conclusions

COVID-19 is a global pandemic affecting individuals across the lifespan, with particularly heightened vulnerabilities to physical and mental health deficits in older adults with multiple comorbidities. As we take a look at the current picture of the medical community through the lenses of the International Classification of Functioning, Disability and Health framework, it is clear that patients with COVID-19 have a heterogeneous manifestation of symptoms pertaining to body structure and function, with significant functional deficits affecting activity and participation. Given the findings of this study, for individuals with confirmed COVID-19 who also have high comorbidity rates, it is prudent to integrate rehabilitation therapies earlier in the hospitalization to address physical, mental, and sensory deficits. The effects of the pandemic will continue, and it is essential for the rehabilitation community to optimize our ability to respond to the challenges and to determine the optimal timing and dosage of rehabilitation services in our health care system.

Suppliers

a. SAS/ACCESS 9.4 Interface to ADABAS: Reference; SAS Institute.
b. SPSS Statistics for Windows version 25.0; IBM.

Keywords

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