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Original Research

Baseline Characteristics and Outcomes for People With and Without COVID-19 Diagnoses Receiving Inpatient Rehabilitation Care Across the US in 2020-2021

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KEYWORDS
Rehabilitation;
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Abstract *Objective:* To assess sociodemographic, medical complexity, and outcomes of persons receiving care at inpatient rehabilitation facilities (IRFs) with and without a diagnosis of COVID-19.
Design: A retrospective cohort study using electronic medical record (EMR) data from 138 IRFs across 34 states and Puerto Rico.
Setting: N/A.
Participants: IRF EMR data for 212,663 patients discharged between 04/01/2020 and 05/31/2021 (N=212,663), of which 16,199 (COVID-19 group) had a primary or secondary COVID-19 diagnosis based upon ICD codes set (ICD-10 codes U07.1, B94.8, Z86.19, Z86.16).
Main Outcome Measures: Four categories: (a) sociodemographic, (b) medical complexity, (c) process, that is, standard IRF processes, and clinical outcomes (collected routinely as part of administrative reporting), and (d) functional outcomes. Patients with missing functional data associated with short/incomplete stays (n=623) were excluded from analysis of functional outcomes category only. Standard descriptive analysis techniques were employed for comparing categorical and continuous variables between groups.

List of abbreviations: BIMS, Brief Interview for Mental Status; CIM, critical illness myopathy; CIPN, critical illness polyneuropathy; CMI, Case Mix Index; CMS, Center for Medicare and Medicaid Services; EMR, electronic medical record; IRF, inpatient rehabilitation facility; LOS, length of stay; PHQ, Patient Health questionnaire; RIC, Rehabilitation Impairment Category; SNF, skilled nursing facility.

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Results: Statistically significant differences were noted between the COVID-19 group and non-COVID groups for race (26.0% vs 19.7% non-minority, $P<.001$), Case Mix Index (1.49 vs 1.46, $P<.001$), Center for Medicare and Medicaid Services 60% rule qualification (79.0% vs 73.4%, $P<.001$), time to onset (24.3 vs 18.0 days, $P<.001$), length of stay (14.2 vs 12.9 days, $P<.001$), and discharge disposition (to community: 75.3% vs 81%, $P<.001$; to acute care facility: 15.6% vs 10.8%, $P<.001$). The COVID-19 group had higher frequency of respiratory and cardiovascular disease, diabetes, encephalopathy, morbid obesity, and critical illness neuropathy and myopathy. Clinically insignificant differences were noted for age, sex, depression, and cognitive assessment. Ability to participate and functional outcomes were comparable between the groups.
Conclusion: There are significant differences between the COVID-19 and non-COVID group in some sociodemographic, medical complexity, process and clinical outcomes, but not in functional outcomes. The ability to participate in the IRF-required intensity of therapy services along with attainment of comparable levels of functional outcomes supports the benefit of IRFs for persons with COVID-19.

Although lessening now in frequency, the human coronavirus SARS-CoV-2,[1] with its clinical disease manifestations collectively known as COVID-19, has disrupted the health care system on a global scale since late 2019. This disruption by the pandemic has affected the entire continuum of care in the US, from acute to post-acute and community care settings. Several national public health emergency exemptions have helped to improve access to care for both COVID-19 and non-COVID populations.[2] From a functioning perspective, rehabilitation has been a major strategy for maximizing participation for people diagnosed with COVID-19.[3] This vital need for rehabilitation for COVID-19 patients has also been highlighted by agencies such as the World Health Organization.[4,5]

There is recognition that for the more severely (14%) and critically-ill patients with COVID-19 (5%), inpatient rehabilitation has played a vital role over the past 2 years.[6] Inpatient rehabilitation facilities (IRFs) aim to deliver coordinated rehabilitation care to address multisystem manifestations associated with COVID-19, with potential minimization of subsequent sequelae.[7] The benefit of inpatient rehabilitation for COVID-19 has been described by studies such as the New York and New Jersey Research Consortium study (n=320).[8] Another study[9] comparing 139 patients with COVID-19 with 196 patients without COVID-19 concluded that COVID-19 positive status is not a barrier to discharge or functional outcomes. Some European studies demonstrate the benefit of early rehabilitation as well.[10]

However, most of these studies are relatively small and describe a geographically limited sample. Additionally, access to inpatient rehabilitation needs to be fortified in the face of payment denials that might result from payer policy and review in order to make a stronger case for COVID-19 inpatient rehabilitation care at the national policy level. Country-level studies contrasting baseline characteristics and outcomes for people with and without COVID-19 simultaneously receiving care in IRFs across the nation are needed. This study aims to provide evidence supporting care in IRFs across the nation for people with COVID-19 by comparing sociodemographics, medical complexity, and outcomes between people with and without a COVID-19 diagnosis that received inpatient rehabilitation care from 04/01/2020 to 05/31/2021 at 1 of 138 IRFs that are part of a large IRF system across 34 states and Puerto Rico.

Methods

Study design

This was a country-level retrospective cohort study using a standard electronic medical record (EMR), ACE-IT, as the source dataset for IRF data. The study was designated as non-human subjects research by Washington University IRB, because study team members did not have access to any identifiable data, and all data retrieval was conducted by Encompass Health IT personnel, who de-identified it prior to sharing with the study team. Informed consent was, therefore, not applicable because of the nature of this study.

The study sample was composed of patients discharged from 138 Encompass Health IRFs during the time period 04/01/2020 to 05/31/2021. Fifty-three of the IRFs are joint venture hospitals co-owned by larger hospital systems and 5 are partnerships with academic centers. Patients with age less than 18 years (n=3) and cases with incomplete functional data (n=3484) were excluded. COVID-19 diagnoses were identified as by 1 of the following ICD-10 codes: U07.1 (COVID-19), B94.8 (Sequelae of other specified infectious and parasitic diseases), Z86.19 (Personal history of other infectious and parasitic diseases, effective until 12/31/2020), or Z86.16 (Personal history of COVID-19, effective starting 1/1/21). The total sample size was 212,663 with 16,199 identified with (COVID-19 group) and 196,464 without (non-COVID group) a COVID-19 diagnosis.

Four categories of variables were collected, namely, sociodemographic, medical complexity, process and clinical outcomes, and functioning outcomes. Functional data were found to be missing for short or incomplete stays (n=623) due to discharge to the acute care setting, discharge against medical advice, length of stay (LOS) less than 3 days, or inpatient mortality. These patients were excluded when analyzing functional outcomes only and were retained for data analysis of the other 3 variable categories.

Data collection

Sociodemographic variables including age, sex, and race/ethnicity were obtained at admission as coded by data entry into the EMR at registration.

Medical complexity variables at admission included Case Mix Index (CMI),[11] Center for Medicare and Medicaid Services (CMS) 60% rule qualification (60% of IRF cases must have 1 of CMS's 13 qualifying conditions so that facilities maintain exemption from the Medicare Hospital Prospective Payment System, "PPS", and are paid under the IRF PPS[12]), etiologic diagnoses specified by Rehabilitation Impairment Category (RIC),[13] and Case Mix Group[14] determined and tabulated according to CMS regulatory requirements. Comorbid conditions documented by physicians in the EMR during the course of the rehabilitation encounter were tabulated and categorized according to the convention of a report of the National Center for Health Statistics, National Vital Statistics System.[15] At admission, clinicians assessed depression using the Patient Health Questionnaire (PHQ2 and PHQ9)[16] and cognitive status using the Brief Interview for Mental Status (BIMS) Scale.[17,18]

Process and clinical outcome variables included metrics that were routinely collected outside of the EMR as part of clinical care quality. These included time to onset, defined as the time duration from acute care hospital admission date to IRF admission date[14]; LOS is defined as the time duration between the IRF admission and discharge date; inpatient mortality; discharge disposition with options including acute hospital readmission, discharge to home, or skilled nursing facility (SNF); and fall rate, measured as the number of falls per patient days. As entered into the EMR by clinicians, therapy intensity was measured as hours of therapy completed per day, averaged over a 7-day period, with the standard goal being 3 hours per day over 5 days or modified goal being 15 hours over 7 days. Functional outcome variables were measured at admission and discharge using Section GG of the IRF Patient Assessment Instrument,[14] as required by CMS. Section GG scores were recorded for mobility (bed mobility, sit to stand, transfer from toilet, chair, and car, walk, manage stairs) and self-care (eating, oral hygiene, toilet hygiene, shower/bathing, upper body dressing, lower body dressing, and putting on/taking off footwear) domains.[19] Functional gain for self-care and mobility was calculated as the difference between respective discharge and admission GG scores.

The Net Promotor score was collected by patient questionnaires after discharge in order to describe patient experience of IRF care.[20]

Data analysis

Categorical variables were described by frequencies and continuous variables by means and standard deviations. Difference in frequencies for categorical variables between the 2 groups were analyzed with the pairwise z-test and frequencies. Differences in mean for continuous variables were analyzed with a 2-tailed unpaired *t* test.

Results

Sociodemographics

Sociodemographics are presented in table 1.

Age

As shown in figure 1, the study cohort showed an average age of 70.3 years. The COVID-19 group was younger by 0.4 years than the non-COVID group (70.0 vs 70.4, $P<.001$).

Sex

As shown in figure 1, the study cohort showed an even distribution of male and female patients (50.5% female vs 49.5%

Table 1 COVID-19 and non-COVID groups—baseline characteristics

Admission Characteristics	Total Cohort (n=212,663)	COVID-19 (n=16,199)	Non-COVID (n=196,464)	*P* Value
Sociodemographics				
Age (years): **mean ± SD***	70.3 (14.3)	70.0 (13.6)	70.4 (14.4)	<.001
Sex: male**, n (%)**†	105,370 (49.5)	8715 (53.8)	96,660 (49.2)	<.001
Race/ethnicity: non-White **n (%)**†	42,973 (20.2)	4218 (26.0)	38,756 (19.7)	<.001
Baseline cognitive and psychological status, n (mean score)*				
Mood assessment: PHQ2	211,910 (0.37)	16,155 (0.33)	195,755 (0.37)	<.001
Mood assessment: PHQ9	35,462 (6.7)	2594 (6.14)	32,868 (6.74)	<.001
Mental status: BIMS	207,240 (16.58)	15,864 (16.64)	191,376 (16.58)	.677
Process indicators of medical complexity				
CMI mean score* (99% CI)	1.464 (1.462-1.466)	1.493 (1.485-1.501)	1.462 (1.460-1.465)	<.001
RIC distribution, **n (%)**†				
- Neurologic condition	45,942 (21.6)	7768 (48.0)	38175 (19.4)	<.001
- Stroke	40,296 (18.9)	1483 (9.2)	38,813 (19.8)	<.001
- Other disabling conditions	25,554 (12)	3354 (20.7)	22,200 (11.3)	<.001
Time to onset: days* (95% CI)	18.5 (17.3-18.9)	24.3 (19.6-26.1)	18 (16.8-18.5)	<.001
CMS 60% rule qualifying, **n (%)**†	157,052 (73.9)	127,325 (79.0)	144,264 (73.4)	<.001

Abbreviations: CI, confidence interval.

* Difference in mean for continuous variables were analyzed with 2-tailed unpaired *t* test.

† Difference in frequencies for categorical variables between the 2 groups were analyzed with the pairwise z-test and frequencies.

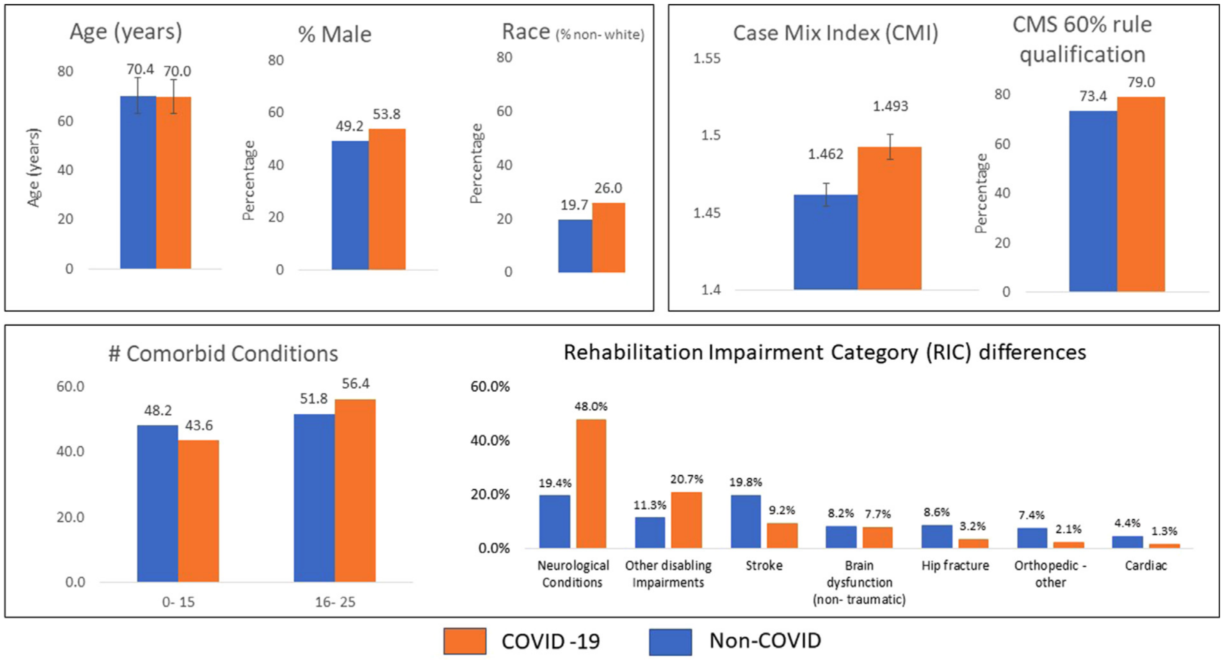

Fig 1 Major differences between COVID-19 and non-COVID groups: sociodemographics and medical complexity metrics.

male, $P<.01$). Males had a higher percentage of COVID-19 than females (53.8% vs 46.2%, $P<.001$) with an odds ratio of 1.2 for a male to have a COVID-19 diagnosis.

Race/ethnicity

As shown in figure 1, The percentage of minorities (non-white) was significantly higher in the COVID-19 group compared with non-minorities (26.0% vs 19.7%, $P<.001$) in descending order of frequency for the Hispanic, black, Asian, American Indian, and Islander groups.

Medical complexity

Medical complexity is shown in table 2.

CMI

Patients with COVID-19 had a higher CMI (1.493 vs 1.462; $P<.001$; fig 1).

CMS 60% rule qualifying

The COVID-19 group had 5.6% more CMS-qualified patients (79.0% vs 73.4%; $P<.001$; fig 1).

RIC-based diagnosis definitions

RIC-based diagnosis definitions are presented in fig 1. The COVID-19 group showed a significant shift in distribution within the IRF-specified RICs. There was a higher percentage of *Neurological conditions* and *other disabling impairments* (difference=31.4% and 1.5%, respectively, $P<.001$). Within the *Neurological conditions* RIC, there was a very high frequency of critical illness myopathy (CIM), and to a lesser extent, critical illness polyneuropathy (CIPN) in the COVID-19 group. 68.4% of patients with COVID-19 in the *Neurological conditions* RIC had CIM compared with 37.0% in the non-COVID group.

Depression assessment

Patients with COVID-19 showed a lower score on the admission PHQ2 (0.33 vs 0.37, difference=-0.04, $P<.001$) and the PHQ9 (6.14 vs 6.74, difference=-0.6, $P<.001$).

Cognitive assessment (BIMS)

Admission BIMS Scale showed no significant difference in the BIMS Score (16.64 vs 16.58, difference=0.06, $P>.5$).

Comorbid conditions

Comorbid conditions are presented in table 2 and figure 1. The COVID-19 group displayed a higher frequency of having 16-25 conditions (56.26% vs 51.76%, $P<.001$). Patients with COVID-19 have higher percentages of influenza and pneumonia (difference=25.1%, $P<.001$) as well as respiratory failure/arrest (difference=19.9%, $P<.001$). Adult respiratory distress syndrome was diagnosed in only 1.01% of patients with COVID-19, but with a significantly higher frequency than in patients without COVID-19 (difference=0.97%, $P<.001$). Patients with COVID-19 have slightly higher percentage of hypertensive disease (difference=0.7%, $P<.033$), higher percentage of diabetes (difference=8.6%, $P<.001$), and lower percentage of cerebrovascular disease (difference=-13.4%, $P<.001$). In addition, COVID-19 patients had a significantly higher percentage of morbid obesity (difference=1.7%, $P<.001$), encephalopathy (difference=4.8%, $P<.001$), and acute embolism and thrombosis of deep vein of lower extremity (difference=1.5%, $P<.001$).

Standard Inpatient Rehabilitation Process and Clinical outcomes

Standard Inpatient Rehabilitation Process and Clinical outcomes are presented in table 3.

Table 2 COVID-19 and non-COVID groups: medical comorbidities with high prevalence, listed in descending order of frequency in COVID-19 group

Comorbid Conditions (%)	Cohort (n=212,663)	COVID-19 (n=16,199)	Non-COVID (n=196,464)	*P* Value*
Hypertensive diseases	80.43	**81.07**	80.38	<.033
Diabetes	53.62	**61.63**	52.96	<.001
Influenza and pneumonia	7.44	**30.66**	5.52	<.001
Respiratory failure (includes arrest)	7.16	**25.5**	5.61	<.001
Heart failure	23.86	23.49	23.89	.246
COPD	17.84	17.91	17.83	.806
Cerebrovascular diseases	29.43	17.08	**30.45**	<.001
Morbid obesity (BMI 40 or greater)	13.14	**14.76**	13.01	<.001
Encephalopathy, unspecified	9.74	**14.21**	9.37	<.001
Acute embolism and thrombosis of other specified OR unspecified deep vein of lower extremity	2.87	**4.26**	2.75	<.001
Adult respiratory distress syndrome*	0.11	**1.01**	0.04	<.001

NOTE. Gray cells indicate significantly greater frequency in the COVID-19 group.
Abbreviations: BMI, body mass index; COPD, chronic obstructive pulmonary disease.
* Between-groups difference were calculated using the pair-wise z-test.

Time to onset

Time to onset is presented in figure 2. The average time to onset for the study cohort was 18.48 days (99% CI=[17.28, 18.94]). Patients with COVID-19 showed longer onset days compared with non-COVID by 6.3 days (24.3 vs 18 days, *P*<.001).

LOS

Patients with COVID-19 displayed a longer LOS by 1.3 days (14.2 days vs 12.9 days, *P*<.001; fig 2).

Discharge disposition

Discharge to the community was lower for the COVID-19 group compared with the non-COVID group (75.3% vs 81%, *P*<.001), and discharge to acute care facility was higher for the COVID-19 group (15.6% vs 10.8%, *P*<.001; fig 2). Discharge rate to SNF was similar for the COVID-19 group and non-COVID group (7.87% vs 7.34%, *P*<.013).

Mortality

Inpatient mortality was similar for both groups: 99.77% of the cohort was discharged alive, with 99.66% of the COVID-19 group and 99.78% of the non-COVID group discharged alive, *P*<.002.

Fall rate

There was no significant difference in the incidence of falls: the fall rate was 8.1 for the COVID-19 group and 7.7 for the non-COVID group, *P*<.083.

Therapy intensity

The average daily therapy intensity (averaged over 7 days) for the COVID-19 group was slightly less than the non-COVID group (2.27 hours vs 2.32 hours, *P*<.001), but this difference was not clinically meaningful (fig 2).

Table 3 COVID-19 and non-COVID groups—outcomes

Outcomes	Cohort (n=212,663)	COVID-19 (n=16,199)	Non-COVID (n=196,464)	*P* Value
Process outcomes				
Length of stay in days, **mean ± SD***	13.0 (6.7)	14.2 (8.6)	12.9 (6.5)	<.001
Falls **(%)**†	7.8	8.1	7.7	.083
Discharged alive, **n (%)**†	212,171 (99.77)	16,144 (99.66)	196,027 (99.78)	<.002
Discharge disposition, **n (%)**†				
- Community	171,341 (80.6)	12,203 (75.3)	159,138 (81.0)	<.001
- Acute care	23,709 (11.2)	2533 (15.6)	21,178 (10.8)	<.001
- SNF	15,696 (7.4)	1275 (7.9)	14,421 (7.3)	<.013
- All other (includes expired)	1917 (0.9)	188 (1.2)	1725 (0.9)	<.001
NPS (Promoter), **n (%)***	48,448 (76.24)	3859 (80.50)	44,590 (75.89)	<.001
Functional outcomes, mean ± SD*				
Therapy intensity in hours/day	2.32 (0.32)	2.27 (0.35)	2.32 (0.32)	<.001
GG Mobility admission	32.7 (12.4)	31.9 (12.1)	32.7 (12.4)	<.001
GG Mobility change	32.0 (16.0)	32.8 (16.8)	31.9 (16.0)	<.001
GG Self-care admission	21.5 (6.25)	21.5 (6.6)	21.5 (6.2)	.804
GG Self-care change	13.1 (6.4)	13.5 (6.7)	13.0 (6.4)	<.001

Abbreviation: NPS, Net Promotor score.
† Difference in frequencies for categorical variables between the 2 cohorts were analyzed with the pairwise z-test and frequencies.
* Difference in mean for continuous variables were analyzed with 2-tailed unpaired *t* test.

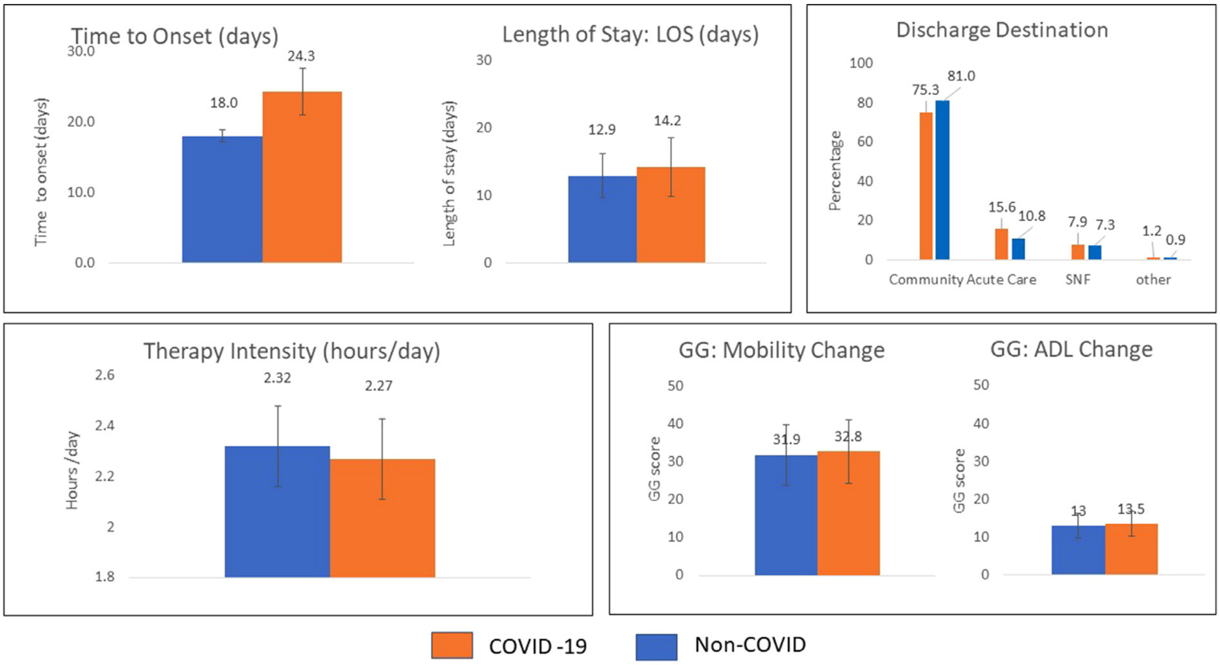

Fig 2 Major differences between COVID-19 and non-COVID groups: standard inpatient rehabilitation process outcome and functional outcome metrics.

Patient experience (Net Promotor score)

The COVID-19 group demonstrated a higher satisfaction score represented by a 4.6% higher "Promoter" score (80.5% vs 75.9%, $P<.001$).

Functional outcomes

Functional outcomes are presented in table 3 and figure 2.

Mobility

Admission mobility scores were lower for the COVID-19 group compared with non-COVID group (31.9 vs 32.7, difference=-0.8, $P<.001$). Discharge mobility scores were similar for both groups with slightly greater gain in the COVID-19 group (32.8 vs 31.9, difference=0.9, $P<.0001$).

Self-care

There was no difference in the average self-care score on admission between COVID-19 and patients without COVID-19 (21.5, $P>.05$). However, patients with COVID-19 showed a greater change (13.5 vs 13.0, difference=0.5, $P<.001$).

Discussion

As far as we know, this is the first study to report country-level (USA) baseline characteristics and outcomes for persons with COVID-19 completing inpatient rehabilitation. The large sample size and geographic reach support generalizability of the study findings. This analysis is intended as a first pass at understanding characteristics and outcomes of a sizeable COVID-19 IRF population. We expect that these data will be useful in future analyses for exploring the association of rehabilitation outcomes for patients with COVID-19 with baseline characteristics such as race, insurance coverage, and other social determinants of health along with specific primary rehabilitation diagnoses such as brain injury, spinal cord injury, and limb loss.

With regard to the sociodemographic findings, it is noteworthy that this study's mean age of 70.3 years is approximately 10 years higher than reported comparisons in the literature on IRF cohorts, most of which are single center studies.[21,22] Although the COVID-19 group demonstrates a slightly lower mean age (70.0) than the non-COVID group (70.4), this difference is not felt by the authors to be clinically meaningful in this cohort. The male sex predominance and higher odds of being a male with COVID-19 agree with the other studies.[8] The recognized racial imbalance of COVID-19 in the community[23] continues to the IRF setting with 6.31% higher frequency in the non-white group with 1.43 times higher likelihood of being a minority. This finding agrees with other studies documenting increased likelihood of COVID-19 positivity in African- American group receiving care in the IRF setting.[21]

These data show higher medical complexity for the COVID-19 group, as shown by the higher CMI and RIC distribution (table 1). The COVID-19 group comorbidities with high frequency include diseases of the respiratory system, hypertension, and diabetes- these conditions are associated with severe and fatal cases of COVID-19 in the literature.[24,25] The COVID-19 group also shows a higher incidence of thrombotic complications, consistent with the known thrombogenicity of this disease.[26] This complexity is also reflected by longer time to onset days (table 1), longer LOS (table 3), and higher discharge to acute care facility and SNF rate (table 3). Overall, COVID-19 is a multisystem disease affecting neurologic,[27] psychiatric, musculoskeletal, pulmonary, and cardiovascular systems.[28-30] Given the level of physician supervision required in an IRF setting, medical attention to associated comorbidities in the immediate post-acute period allows these to be identified and addressed.

The IRF setting is also conducive to diagnosing underrecognized conditions such as ICU-acquired weakness and related causes.[31] Timely diagnosis of rehabilitation conditions associated with critical illness[32,33] such as pain, motor weakness, pulmonary insufficiency, and psychological stress, along with appropriate management using a combination of medical and rehabilitation strategies has been shown to lessen morbidity, reduce LOS, and mitigate chronic disability for several conditions. Weakness is a major manifestation seen with COVID-19. Literature supports the occurrence of peripheral muscle dysfunction secondary to a myopathic etiology for many diseases such as chronic obstructive pulmonary disease and acute respiratory distress syndrome,[34] congestive heart failure,[35] and uremia,[36] with relative disuse being only 1 of many contributors.[37] Because skeletal muscle dysfunction as a result of systemic inflammation has been well documented, and inflammation is a key feature of COVID-19,[38] it is conceivable that myopathic processes play a major role in explaining the weakness associated with COVID-19 as well. The high frequency of CIM and CIPN found in this study supports the occurrence of comorbid neuropathic and myopathic processes[39] in the COVID-19 population, and consideration of these entities contributes to the design and implementation of rehabilitation programs. Future studies could look at how IRF care can be helpful in modification of the disease course to positively affect wide-ranging and variable manifestations of SARS-CoV-2 infection beyond the initial phase, referred to as post-COVID syndrome.[40]

It is important to consider that, in order for IRFs to qualify for CMS's payment methodology for IRFs, they must demonstrate that at least 60% of patients (known as the "60% rule"[12]) are admitted because of a condition that is included within 13 discreet diagnostic categories specified by CMS as CMS 60% rule qualifying conditions. Therefore, accurate identification and documentation of a CMS 60% rule qualifying condition is critical. The COVID-19 group exhibited greater than 5% higher rate of qualification with the 60% rule (table 1), partly due to the shift toward higher frequency of the RIC *neurologic conditions*. CIM and CIPN fall within this category (table 1),[12] and the higher incidence of CIM in the COVID-19 group could account for the shift toward the N*eurological conditions* RIC. The COVID-19 group's high frequency of compliance with the 60% rule also reflects better alignment with medical conditions that, according to CMS, require IRF-level medical and rehabilitation management.[12]

As demonstrated via therapy intensity data (table 3), the COVID-19 group was able to participate in the intensity of therapy services specified per current CMS guidelines as a minimum 3 hours per day 5 days per week or 15 hours spread over 7 days. The study COVID-19 group did not fall at a rate significantly different from the non-COVID group.

The effectiveness of IRF rehabilitation care delivery is supported by the improvement in mobility as well as self-care GG scores (table 3). Unlike other published studies,[21] self-care admission score was not significantly different between COVID-19 and non-COVID groups, but the lower admission mobility score was similar to previous studies. The average change in self-care and mobility scores was higher in the COVID-19 group than has been previously described.[8] Overall, the IRF care experience based on Net Promoter Scores[18] was significantly more positive for patients with COVID-19.

Limitations and future work

Limitations of this study are similar to those typically found with the use of hospital medical record datasets for research purposes. This study did not differentiate between COVID-19 as a primary vs comorbid diagnosis. This is in accordance with the intent of the study to understand the overall effect of COVID-19 on IRF admissions, and the value of IRF for improving clinical and functional outcomes for persons with an acute or subacute diagnosis of COVID-19. There exists a selection bias that favors selection of the most severely ill patients that survived the acute course of illness and require the intensity of rehabilitative services of an IRF setting. Because severity is a major factor determining appropriateness and insurance approval for inpatient rehabilitative care at an IRF setting, the authors suggest cautious application of these data to other post-acute less intense levels of rehabilitative care where similar levels of disease severity might obviate admissibility and levels of service and outcomes are measured differently.[41] While this study primarily presents the United States IRF perspective for COVID-19 care, the provision of effective rehabilitative services is needed even after discharge from IRF.[42] Hence, understanding how post-acute care modifies the functional trajectory to affect post-COVID syndrome would be a natural subsequent area of study. Other future work includes understanding regional variations in baseline and outcomes for COVID-19, as well the association of outcomes for COVID-19 with baseline characteristics such as race, insurance, and other social determinants of health.

Conclusions

This country-level study provides insight into the rehabilitation of COVID-19 in the inpatient rehabilitation setting in the USA, with recognition of the high medical acuity in this population. Racial disparities do exist in the IRF setting across the nation and requires closer attention through policy and system development. From a programmatic perspective, this study demonstrates that COVID-19 IRF care is successful across the nation, as demonstrated by non-inferior functional outcomes across 138 IRFs in 34 states and Puerto Rico. From a rehabilitation research perspective, these data could aid in our understanding of functional progression during the course of recovery. Taken together, these baseline and outcomes data can serve as descriptive benchmarks to support and guide policy for IRF services for patients affected by COVID-19.

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