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Recovery from Coronavirus Disease 2019 among Older Adults in Post-Acute Skilled Nursing Facilities



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A B S T R A C T

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Objectives: To examine functional outcomes of post-acute care for coronavirus disease 2019 (COVID-19) in skilled nursing facilities (SNFs).

Design: Retrospective cohort.

Setting and Participants: Seventy-three community-dwelling adults ≥ 65 years of age admitted for post-acute care from 2 SNFs from March 15, 2020, to May 30, 2020.

Measure(s): COVID-19 status was determined from chart review. Frailty was measured with a deficit accumulation frailty index (FI), categorized into nonfrail, mild frailty, and moderate-to-severe frailty. The primary outcome was community discharge. Secondary outcomes included change in functional status from SNF admission to discharge, based on modified Barthel index (mBI) and continuous functional scale scored by physical (PT) and occupational therapists (OT).

Results: Among 73 admissions (31 COVID-19 negative, 42 COVID-19 positive), mean [standard deviation (SD)] age was 83.5 (8.8) and 42 (57.5%) were female, with mean FI of 0.31 (0.01) with no differences by COVID-19 status. The mean length of SNF stay for rehabilitation was 21.2 days (SD 11.1) for COVID-19 negative with 20 (64.5%) patients discharged to community, compared to 23.0 (SD 12.2) and 31 (73.8%) among patients who tested positive for COVID-19. Among those discharged to the community, all groups improved in mBI, PT, and OT score. Those with moderate-to-severe frailty (FI >0.35) had lower mBI scores on discharge [92.0 (6.7) not frail, 81.0 (15.4) mild frailty, 48.6 (20.4) moderate-to-severe frailty; $P = .002$], lower PT scores on discharge [54.2 (3.9) nonfrail, 51.5 (8.0) mild frailty, 37.1 (9.7) moderate-to-severe frailty; $P = .002$], and lower OT score on discharge [52.9 (3.2) nonfrail, 45.8 (9.4) mild frailty, 32.4 (7.4) moderate or worse frailty; $P = .001$].

Conclusions and Implications: Older adults admitted to a SNF for post-acute care with COVID-19 had community discharge rates and functional improvement comparable to a COVID-19 negative group. However, those who are frailer at admission tended to have lower function at discharge.

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Older adults account for almost one-half of hospitalizations due to coronavirus disease 2019 (COVID-19).¹ Providing post-acute rehabilitation for frail older adults recovering from COVID-19 remains a significant challenge as nursing facilities,² one of the most common settings for post-acute care, have become overwhelmed by the COVID-19 pandemic.³ As the post-acute period is an essential window of opportunity for recovery,

having timely information to guide care decisions is critical to tailoring care. Older adults with frailty are at exceptionally high risk for complications including delirium and hospital-acquired disability.^{4–6}

We conducted a retrospective cohort study of older adults admitted after hospitalization in 2 SNFs. The purpose of the study was to compare (1) functional recovery between older adults presenting with and without COVID-19 and (2) post-acute recovery by baseline frailty in older adults presenting with COVID-19. We hypothesized that older adults would have good functional recovery after COVID-19 and that older adults with more frailty at baseline would have slower recovery during the post-acute care, compared with those with less frailty.

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Methods

This study was conducted in 2 long-term care facilities in Boston, MA. Both facilities had designated COVID-19 units that were separated from the rest of the facility and continued to accept patients for skilled nursing care after post-acute hospitalizations during this timeframe. These units were geographically cohorted with full multidisciplinary rehabilitation support for post-acute care during this period of time, including physical therapy (PT), occupational therapy (OT), and standard nursing/staff ratios. All care including rehabilitation as delivered in individual patient rooms. We included patient admissions from March 15, 2020, to May 30, 2020, when these facilities stopped accepting new patients to the designated COVID-19 units. Patients were excluded if they (1) were not discharged from a hospital inpatient admission; (2) age <65 years; or (3) lived in a nursing home or long-term care before acute hospital admission.

We reviewed electronic health records for COVID-19 status on admission. Demographics, comorbidities, and hospital admission details, including length of stay and illness severity, were obtained from admission notes. Discharge dates and destination were obtained from discharge summaries. We extracted details of functional baseline (activities of daily living and instrumental activities of daily living) and therapy progress from PT and OT notes, including modified Barthel index (mBI) (range 0–100, higher scores indicate better function),⁷ admission, and discharge function status (described in detail below). Study data were collected and managed using REDCap electronic data capture tools hosted at Hebrew SeniorLife. The Hebrew SeniorLife Institutional Review Board exempted this study from review.

A frailty index (FI) was calculated using a standard deficit accumulation method from 43 variables based on comorbidities on admission and reported baseline functional status.^{8,9} We categorized this into nonfrail (FI ≤0.25), mild frailty (FI 0.26–0.35), and moderate-to-severe frailty (FI >0.35). We created a functional scale based on 8 standardized tasks for PT (roll left and right, sit to lying, lying to sit, sit to stand, chair to bed, walking 10 feet, walking 50 feet, walking 150 feet), and OT (eating, oral hygiene, toileting, bathing, upper body dressing, lower body dressing, footwear, picking up objects off the floor). Each task was scored based on a continuous scale (1–7; dependent to independent), scored by physical and occupational therapists on admission and discharge. Thus, the range for PT score and OT score is 8 (complete dependence in all 8 tasks) to 56

(complete independence in all 8 tasks), with higher scores indicating better function.

We described the characteristics of the population using means and standard deviations (SD), and proportions. We used Fisher exact test to compare community discharge rates between frailty groups and Kruskal Wallis test to compare length of stay. We also calculated the mean change in the mBI,⁷ PT functional scale, and OT functional scale from SNF admission to discharge among those discharged to the community, compared the mean changes by baseline frailty category using analysis of variance or Kruskal Wallis test as appropriate based on whether or not the outcome measures were normally distributed. Tukey post hoc testing was used to confirm where the differences occurred between frailty groups after a statistically significant main effect. All analyses were done in Stata v 16.0 (StataCorp LLC, College Station, TX).

Results

Out of 98 admissions screened, 73 patients were included (Supplementary Table 1) mean (SD) age was 83.5 (8.8) and 42 (57.5%) were female, with mean FI of 0.31 (0.01). The most common reason for exclusion was that the patient was not presenting posthospitalization (n = 15). A total of 42 (57.5%) were COVID-19 positive. The mean age was 83.7 (9.8) years old for COVID-19 negative and 83.5 (8.1) for COVID-19 positive, with similar proportions of female patients [(16 (51.6%) COVID-19 negative vs 26 (61.9%) COVID-19 positive] and comorbidities apart from diabetes [6 (19.4%) vs 18 (42.9%), *P* = .045] (Table 1). The groups had similar mean hospital length of stay [10.4 days (11.9) vs 11.6 days (8.8), *P* = .62]. Only 5 (18.5%) of patients negative for COVID-19 required supplemental oxygen during their hospital admission vs 29 (69.1%) of patients positive for COVID-19 (*P* < .001). Distribution of frailty was comparable by mean FI (SD) (COVID-19 negative 0.32 (0.11) vs COVID-19 positive 0.30 (0.13), *P* = .83).

Length of stay at SNF was comparable between the 2 groups 21.2 days (11.1) vs 23.0 (12.2) for COVID-19 negative vs positive, respectively. Overall, 51 (69.9%) were discharged to the community, while 11 (15.1%) were discharged to long-term care, and 7 (9.6%) were hospitalized. By COVID-19 status, 20 (64.5%) of patients negative for COVID-19 were discharged to the community, compared with 33 (75.0%) of patients positive for COVID-19 (*P* = .46, Table 2). Among patients discharged to the community, although total PT and OT

Table 1
Characteristics of the Overall Cohort by COVID-19 Admission Status

Characteristics	COVID-19 Negative, n = 31	COVID-19 Positive, n = 42	<i>P</i> Value
Age in y (mean, SD)	83.7 (9.8)	83.5 (8.1)	.92
Female (n, %)	16 (51.6)	26 (61.9)	.47
White race (n, %)	25 (80.7)	31 (73.8)	.58
Comorbidities (n, %)			
Hypertension	26 (83.9)	33 (78.6)	.77
Chronic pulmonary disease	6 (19.4)	10 (23.8)	.78
Diabetes	6 (19.4)	18 (42.9)	.045
Heart failure	10 (32.3)	9 (21.4)	.42
Depression	14 (45.2)	13 (33.3)	.34
Dementia	6 (19.4)	4 (9.5)	.31
ADL dependency (mean, SD; range 0–7)	1.6 (1.8)	1.4 (2.1)	.65
IADL dependency (mean, SD; range 0–7)	3.8 (2.3)	3.9 (2.6)	.91
FI, mean (SD)	0.32 (0.11)	0.30 (0.13)	.46
Nonfrail (FI ≤0.25)	9 (29.0)	15 (35.7)	.83
Mild frailty (0.26–0.35)	13 (41.9)	17 (40.5)	
Moderate or worse (FI >0.35)	9 (29.0)	10 (23.8)	
Hospital length of stay, mean (SD)	10.4 (11.9)	11.6 (8.8)	.62
ICU admission, n (%)	3 (15.0)	6 (14.3)	1.0
Required supplemental oxygen in hospital	5 (18.5)	29 (69.1)	<.001

ADLs, activities of daily living; IADLs, instrumental activities of daily living; ICU, intensive care unit.

Table 2
Clinical Outcomes and Functional Status Changes by COVID-19 Status

Characteristics	COVID-19 Negative, Mean (SD) n = 31	COVID-19 Positive, Mean (SD) n = 42	P Value
Length of stay in d	21.2 (11.1)	23.0 (12.2)	.61
Discharged to community, n (%)	20 (64.5)	31 (73.8)	.46
Discharged to long-term care	6 (19.4)	5 (11.9)	
Discharged to hospital	3 (9.7)	4 (9.5)	
Discharged to hospice	1 (3.2)	0 (0.0)	
Discharged deceased	1 (3.2)	0 (0.0)	
Other discharge	0 (0.0)	2 (4.8)	
mBI score on admission (0–100; higher is better)*	39.6 (20.5)	38.5 (21.8)	.80
PT score on admit, (8–56; higher is better)	24.5 (11.9)	22.9 (10.8)	.46
OT score on admit, (8–56; higher is better)	27.5 (9.0)	25.8 (8.2)	.35
Functional Changes among those Discharged to Community			
Total PT min	594.9 (324.3)	451.9 (252.8)	.05
Average PT min per session	40.0 (8.2)	35.6 (5.6)	.04
Total OT min	547.0 (316.4)	410.9 (260.1)	.06
Average OT min per session	36.4 (5.4)	33.0 (5.1)	.04
Change in mBI	19.3 (16.0)	35.7 (15.9)	.01
mBI score on discharge	69.7 (15.7)	78.7 (21.4)	.05
Change in PT score	17.8 (12.1)	24.0 (9.3)	.06
PT score on discharge	42.6 (17.3)	49.3 (9.7)	.39
Change in OT score	12.4 (6.3)	17.8 (8.9)	.07
OT score on discharge	41.0 (11.9)	45.3 (10.5)	.19

*Mean mBI on admission n = 23 and 32 for non-COVID/COVID group because of missing data.

minutes were not significantly different between the 2 groups, average minutes per session were significantly longer in patients negative for COVID-19; PT [40.0 (8.2) vs 35.6 (5.6); $P = .04$] and OT scores [36.4 (5.4) vs 33.0 (5.1); $P = .04$]. Patients who tested negative for COVID-19 had significantly less improvement in mBI scores [19.3 (16.0) vs 35.7 (15.9), $P = .01$], however, differences were not statistically different in PT [17.8 (12.1) vs 24.0 (9.3); $P = .06$] and OT scores [12.4 (6.3) vs 17.8 (8.9); $P = .07$], between the groups.

Among those who were COVID-19 positive and were discharged to the community, the mean length of stay at SNF for post-acute care was 23.0 days (SD 12.2; range: 3–63 days) and was not significantly different across frailty groups [19.8 (SD 11.5) nonfrail vs. 24.8 (9.1) mild frailty vs 24.8 (17.2) moderate or worse frailty; $P = .26$, Table 3]. Total OT minutes were significantly different across frailty groups ($P = .03$) but total PT minutes were not ($P = .05$). Among those with discharge data, all groups had improved functional scores (ie, mBI, PT, and OT scores) by the time of discharge. However, those with moderate-to-severe frailty had lower mBI scores on discharge [92.0 (6.7) nonfrail,

81.0 (15.4) mild frailty, 48.6 (20.4) moderate-to-severe frailty; $P = .002$], lower PT scores on discharge [54.2 (3.9) nonfrail, 51.5 (8.0) mild frailty, 37.1 (9.7) moderate-to-severe frailty; $P = .002$], and lower OT score on discharge [52.9 (3.2) nonfrail, 45.8 (9.4) mild frailty, 32.4 (7.4) moderate or worse frailty; $P = .001$]. The mean change was also significantly different among the frailty groups for the OT score ($P = .04$) but not for the mBI ($P = .59$) and PT ($P = .49$) scores. In Tukey post hoc testing, the significant differences were between the nonfrail and moderate-to-severe frailty groups.

Discussion

Nursing homes have been a focus during this current COVID-19 pandemic. However, few studies have addressed the crucial role that skilled nursing facilities play in providing post-acute care and functional recovery for older adults.¹⁰ Understanding functional recovery and identifying potential risk factors for prolonged or persistent functional limitations are vital to providing appropriate resources

Table 3
Functional Recovery and Rehabilitation by Frailty for COVID-19 Patients

Characteristics	COVID-19 Positive n = 42 Mean (SD)	Nonfrail n = 14 Mean (SD)	Mild Frailty n = 17 Mean (SD)	Moderate-to-Severe Frailty n = 10 Mean (SD)	P Value
Length of stay in d	23.0 (12.2)	19.8 (11.5)	24.8 (9.1)	24.8 (17.2)	.26
Discharged to community n (%)	31 (73.8)	12 (80.0)	12 (70.6)	7 (70.0)	.82
mBI score on admission* (0–100; higher is better)	38.5 (21.9)	52.0 (18.5)	34.3 (19.9)	24.5 (19.6)	.01
Mean PT score on admit (8–56; higher is better)	22.9 (10.8)	26.9 (11.2)	22.8 (9.3)	16.9 (10.5)	.10
Mean OT score on admit (8–56; higher is better)	25.8 (8.1)	28.3 (7.7)	26.2 (8.1)	21.6 (8.1)	.16
Functional Changes among those Discharged to Community (n = 31)					
Total PT min	451.9 (252.8)	377.3 (291.0)	535.7 (196.6)	436.1 (260.8)	.05
Average PT min per session	35.6 (5.6)	35.5 (6.0)	36.7 (6.0)	33.9 (4.6)	.50
Total OT min	410.9 (260.1)	316.3 (306.4)	509.1 (214.9)	404.7 (210.4)	.03
Average OT min per session	33.0 (5.1)	32.9 (6.1)	33.1 (5.0)	33.1 (4.5)	.93
Change in mBI	35.7 (15.9)	34.9 (16.1)	40.4 (16.7)	29.6 (14.8)	.59
mBI score on discharge	78.7 (21.4)	92.0 (6.7)	81.0 (15.4)	48.6 (20.4)	.002
Change in PT Score	24.0 (9.3)	25.0 (12.5)	25.0 (6.4)	20.4 (7.2)	.49
PT score on discharge	49.3 (9.7)	54.2 (3.9)	51.5 (8.0)	37.1 (9.7)	.002
Change in OT score	17.8 (8.9)	22.6 (8.6)	17.2 (7.5)	11.3 (7.3)	.04
OT score on discharge	45.3 (10.5)	52.9 (3.2)	45.8 (9.4)	32.4 (7.4)	.001

Frailty defined by a deficit accumulation FI with the following cut-offs: nonfrail (FI ≤ 0.25), mild frailty (FI 0.26–0.35), and moderate or severe frailty (FI > 0.35).

*n = 31 for modified mBI data because of missing data.

during this unprecedented time. In our study of older adults with receiving post-acute care at a SNF, 64.5% of patients without COVID-19 and 73.8% of patients with COVID-19 recovered and were discharged to the community. Length of stay and function on discharge did not differ by COVID-19 status. In fact, participants that were discharged to the community significantly improved functional status after receiving similar PT and OT treatments in the SNF. However, the degree of improvement may vary by frailty level, as those with moderate to severe frailty improve less. Despite challenges in SNF based post-acute rehabilitation in the COVID-19 era, recovery among older adults is not only possible but quite common.

Overall functional status significantly improved over the course of SNF admission, supporting that SNF-based rehabilitation is effective at restoring function after COVID-19 hospitalizations. Previous work has stressed the importance of leveraging the post-acute care provided by nursing homes to relieve acute hospitals. However, rehabilitation in the SNF setting is challenging in the era of COVID-19. Many facilities faced shortages in personal protective equipment.¹¹ Despite geographic cohorting because of infection precautions and quarantine, patients and therapists were unable to fully use all typical rehabilitation resources. Rehabilitation for patients with COVID-19 was limited to individual patient rooms, and therapists had minimal to no ability to bring in large or shared equipment (eg, exercise bike). Furthermore, many patients continued wearing masks, which may have limited endurance. These challenges may explain our findings that mean minutes per session were shorter among patients with COVID-19. Despite these barriers, our data suggest that (1) rehabilitation and therapy can still be successfully delivered (mean total 451.9 minutes PT and 410.9 minutes of OT); and (2) the majority of patients have the capacity to recover function after COVID infection, as demonstrated by an average improvement of 35.7 points on mBI, 24.0 on PT score, and 17.8 on OT score, which is commensurate or even superior to those who were COVID-19 negative during this period of time. Of note, this finding may reflect a greater severity of illness among older adults who were admitted for post-acute care during the pandemic yet were COVID-19 negative.

Although previous literature has consistently demonstrated that frailty is a risk factor for poor outcomes in patients with COVID-19,^{12,13} ours is among the first to examine post-acute functional recovery by frailty in this unique population. Those with moderate-to-severe frailty at baseline had lower functional scores at both admission and discharge, with lower improvement overall. Interestingly, the change of the functional recovery may be different by frailty status. Those with frailty had lower functional scores at baseline and discharge. However, our results suggested that those with moderate or worse frailty at baseline improved significantly less on their OT functional score, compared with those with nonfrail and mild frailty at baseline. Other work among adults recovering from COVID also demonstrated severe disability and proposed specific COVID-19 rehabilitation protocols.¹⁴ It remains unclear if such protocols would be particularly effective or feasible in the SNF setting.

Because patients negative for COVID-19 presented with wide range of diagnoses, our study cannot adjust for COVID-19 illness specific complications or determine to what degree changes are uniquely secondary to COVID-19. Overall demographics, medical conditions, frailty, functional status, and hospital length of stay were, however, balanced between these observational groups. Our study was limited

to 2 SNFs. Because of limited sample size, we were likely underpowered to detect significant differences in some functional outcomes and length of stay. However, our use of detailed electronic medical record data, including PT and OT assessments, allows for critical insights into functional status. We could not capture discharge functional status for those who were acutely transferred back to the hospital. Similarly, because these patients never completed their therapy, we did not include them in analyses of rehabilitation provided. These missing data points are more likely among those with worse function or outcomes, thus, biasing our study to the null.

Conclusions and Implications

In our study, older adults admitted to a SNF for post-acute care with COVID-19 generally had good functional recovery and were discharged back to the community; however, those who are frailer tended to have a lower function at discharge. These findings provide key insight to discharge planning and shared decision making for older adults recovering from COVID-19 hospitalizations.

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Supplementary Table 1

Total Number of Participants Screened And Reasons For Study Exclusion

Exclusion Criteria	n
Total screened	98
Age <65 y	6
Not discharged from hospitalization	15
Lives in nursing home at baseline	11

Exclusion criteria are not mutually exclusive.