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Original Study - Brief Report

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

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Abstract

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

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.

Keywords: COVID-19, post-acute care, functional recovery, frailty

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

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) did not discharge 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), 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. 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, 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 | P 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) | |
| ICU admission, n ( %) | 10.4 (11.9) | 11.6 (8.8) | .62 |
| Required supplemental oxygen in hospital | 5 (18.5) | 6 (14.3) | 1.0 |

ADLs, activities of daily living; IADLs, instrumental activities of daily living; ICU, intensive care unit.
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. Understanding functional recovery and identifying potential risk factors for prolonged or persistent functional limitations are vital to providing appropriate resources.

### Table 2

| 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)                            | .56          |
| Discharged to hospital           | 3 (9.7)                             | 4 (9.5)                             | .56          |
| Discharged to hospice            | 1 (3.2)                             | 0 (0.0)                             | .00          |
| Discharged deceased              | 1 (3.2)                             | 0 (0.0)                             | .00          |
| Other discharge                  | 0 (0.0)                             | 2 (4.8)                             | .80          |
| mBI score on admission (0–100; higher is better)* | 39.8 (20.5) | 38.5 (21.8) | .001 |
| 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)                         | 40.3 (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.

### Table 3

| Characteristics                  | COVID-19 Positive n = 42 | Nonfrail n = 14 | Mild Frailty n = 17 | Moderate-to-Severe Frailty n = 10 | \( P \) 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 (30.0)      | 12 (20.6)          | 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) | 451.9 (252.8) | 377.3 (291.0) | 535.7 (196.6)      | 436.1 (260.8)                    | .05          |
| Total PT min                     | 410.9 (260.1)           | 316.3 (306.4)  | 509.1 (214.9)      | 404.7 (210.4)                    | .03          |
| Average PT 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 (9.7)              | 25.0 (12.5)    | 25.0 (8.4)         | 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).
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. 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 greater 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.

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.