

# Functional decline in hospitalized patients with COVID-19 in the early months of the pandemic

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## Abstract

**Introduction:** Coronavirus disease 2019 (COVID-19) survivors are at risk of functional decline. To address the current gap in knowledge about post-acute needs of those infected by COVID-19, we examined discharge function data to better prepare patients, providers, and health systems to return patients to optimal levels of functioning.

**Objective:** To examine the prevalence of functional decline and related rehabilitation needs at hospital discharge.

**Design:** Prospective chart review.

**Setting:** Academic tertiary care hospital.

**Participants:** Hospitalized adults with a laboratory confirmed COVID-19 diagnosis, with admission dates between March 4, 2020 and May 1, 2020.

**Interventions:** Not applicable.

**Main Outcome Measures:** Discharge location; need for outpatient physical, occupational, or speech therapy; need for durable medical equipment at discharge; presence of dysphagia at discharge; functional decline.

**Results:** Three hundred eleven potential cases were reviewed. The final number of cases included in analysis was  $N = 288$ ; patient ages ranged from 20 to 95 years old (mean  $66.80 \pm 15.31$  years). Nearly 20 % of COVID-19 survivors were discharged to a location other than their home. Forty-five percent of survivors experienced functional decline impacting their discharge. Eighty-seven survivors (80.6%) who showed functional change during hospitalization were referred for additional therapy at discharge. At least 73 (67.6%) of these patients required durable medical equipment at discharge (in 12 cases this was not clearly documented). Twenty-nine (26.7%) of the survivors who showed functional changes had ongoing dysphagia at the time of hospital discharge. Ninety-seven of the survivors (40.6%) were never assessed by a PM&R physician, physical therapist, occupational therapist, or speech language pathologist during their hospitalization.

**Conclusions:** COVID-19 mortality rates are frequently reported in the media, whereas the effects on function are not as well described. The information provided here highlights the need for rehabilitative services during and after hospitalization for COVID-19.

## INTRODUCTION

The novel coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), and coronavirus disease 2019 (COVID-19) have led to a global pandemic, with millions of cases in the United States alone, resulting in the deaths of over 600,000 Americans at

the time of this writing.<sup>1</sup> The virus spreads via respiratory droplets, in some cases leading to acute respiratory distress syndrome requiring intensive care admission, with associated morbidity and mortality. It has been widely reported that critical illness due to any etiology can result in acute changes in functioning,<sup>2</sup> and it is known that the related viruses, severe acute respiratory system coronavirus (SARS-CoV) and Middle East Respiratory Syndrome (MERS), resulted in significant new impairments in functioning for many patients.<sup>3</sup>

There is a growing body of literature regarding the systemic effects of SARS-CoV-2 on various organ systems, frequently resulting in new neurological and musculoskeletal impairments.<sup>4,5</sup> However, the impact on daily functioning has not been described. This has important clinical and public health implications, as impairments in functioning will impact hospital discharge planning, distribution of post-acute resources, and accurate assessment of prognosis. This is particularly true given the magnitude of the public health crisis underway. For example, endotracheal intubation is known to be associated with dysphagia/aspiration,<sup>6</sup> and it is likely that many patients will require assessment for these impairments and appropriate treatment following infection with COVID-19.

Under typical circumstances, hospitals and rehabilitation teams may have protocols in place to assess and mitigate the deleterious effects of severe illness. However, given the limited resources and constantly evolving knowledge about COVID-19's spread and effects, typical hospital protocols may be adapted or abandoned to function properly during the pandemic. This observational study presents medical records discharge data from our institution in the Greater Detroit metro region during the early months of the pandemic. This information should prove useful to better prepare patients, providers, and health care systems for the post-acute needs of patients with COVID-19.

## METHODS

DataDirect software was used to identify people admitted to a single tertiary care hospital in the Detroit Metro Area, with a laboratory confirmed diagnosis of COVID-19. An internal institutional review board was consulted and the project was allowed under secondary research exemption. Individual medical records were reviewed by practicing physical medicine and rehabilitation (PM&R) physicians. Each case was confirmed to have a laboratory verified diagnosis of COVID-19 occurring during the time of a hospitalization. Patients who were not SARS-CoV-2 positive during an admission were excluded. Children younger than 18 years old were also excluded from analysis.

Individual hospital medical records were reviewed, including admission and discharge notes; physical, occupational, and speech language pathology records; case management notes; and relevant PM&R or neurology consultations. For patients who survived to hospital discharge, charts were further reviewed to identify and understand changes in physical functioning that were impacting the patient at the time of discharge. Changes from functional baseline were documented as those requiring additional physical, occupational, or speech therapy at discharge; additional caregiver assistance for mobility or activities of daily living; new durable medical equipment needs (excluding home oxygen alone); or diet modifications for dysphagia. When none of these characteristics was present, it was assumed that no functional decline was apparent. Data distribution analyses and non-parametric mean differences test (Mann-Whitney *U* test) were conducted to address study aims. Statistical analysis was performed using IBM SPSS Statistics for Windows (Version 25.0, released 2017) software.

## RESULTS

### Subject characteristics

Three hundred eleven potential cases were reviewed, with admission dates between March 4, 2020 and May 1, 2020. Six cases were excluded because of age younger than 18. Sixteen cases were excluded due to asynchronous COVID-19 diagnosis and hospitalization dates (i.e., the person was never SARS-CoV-2 positive during the time of the inpatient admission). One was excluded from analysis due to being currently admitted at the time of data analysis. The final number of cases included in analysis was  $N = 288$ ; patients ranged in age from 20 to 95 years old (mean  $66.80 \pm 15.31$  years). Additional subject characteristics are detailed in Table 1.

### Discharge location

Discharge location is summarized in Figure 1. Two hundred thirty-nine patients survived to discharge from our hospital. The mean age for the surviving group was  $60.38 \pm 15.15$  years of age (range 20-95), which was significantly younger than the mean age of the deceased  $68.67 \pm 14.32$  years (range 30-90,  $F [1287] = 12.40$   $P < .001$ ). Home was the most common discharge location ( $N = 183$ , 63.5%). Five people (1.7%) were transferred to another acute care hospital or field hospital, and five (1.7%) were transferred to a long-term acute care hospital (LTACH). In addition, four people (1.4%) transferred to an unaffiliated acute inpatient rehabilitation hospital; the inpatient rehabilitation unit

**TABLE 1** Study participant characteristics

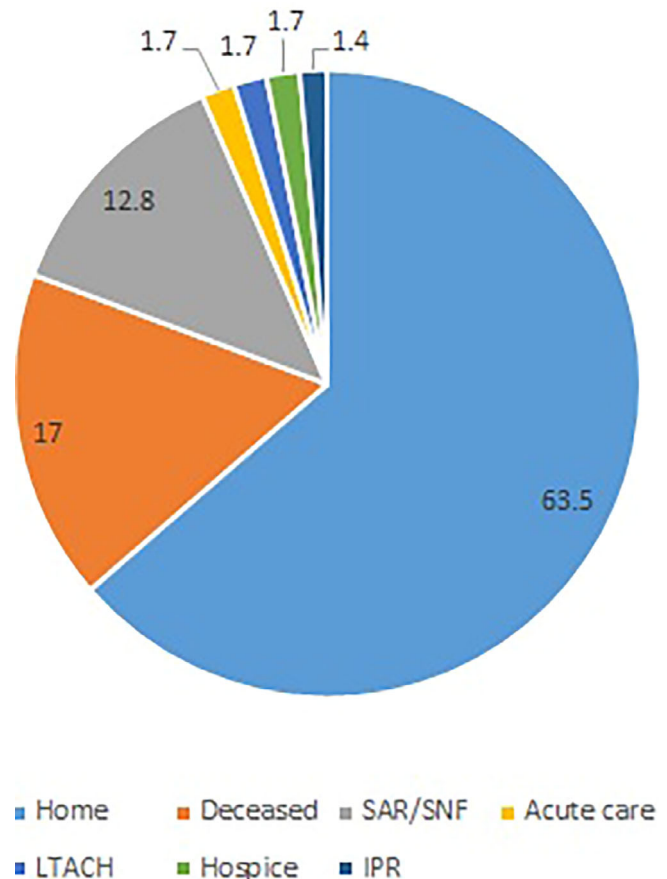
	N/%
<b>Sex</b>	
Female	122/42.4%
Male	166/57.6%
<b>Race</b>	
Caucasian	125/43.4%
African American	125/43.4%
Asian	10/3.5%
Hispanic	1/0.3%
Other	12/4.2%
Unknown	15/5.2%
Transfer from outside hospital	54/18.8%
Mean $\pm$ SD (min-max)	
Length of stay (all)	13.40 $\pm$ 12.84 (0–75) days
Length of stay (survivors) n = 239	13.21 $\pm$ 13.16 (0–75)days
Length of stay (deceased) n = 49	14.31 $\pm$ 11.24 (1–65) days

within the academic center was closed during this time period. Thirty-seven patients (12.8%) required subacute care (SAR) or a skilled nursing facility (SNF). Five (1.7%) transferred to hospice care. Forty-nine people (17%) were deceased at the time of discharge.

### Survivor functional decline

Of the 239 people who survived to discharge or transfer, 108 (45.2%) experienced a significant functional decline. Eighty (74.1%) of those experiencing functional decline had previously been independent or modified independent with mobility and activities of daily living; this information was unavailable in 13 cases. Eighty-seven survivors (80.6%) who showed functional change during hospitalization were referred for additional therapy at discharge. At least 73 (67.6%) of these patients required durable medical equipment at discharge (in 12 cases this was not clearly documented). Twenty-nine (26.7%) of the survivors who showed functional changes had ongoing dysphagia at the time of hospital discharge. Ninety-seven of the survivors (40.6%) were never assessed by a PM&R physician, physical therapist, occupational therapist, or speech language pathologist during their hospitalization. The mean length of stay for this group was  $4.51 \pm 3.55$  days, which is significantly lower than the mean length of stay for patients who did receive therapy referral (mean =  $19.16 \pm 14.00$  Mann-Whitney  $U Z = -10.65, P < .001$ ).

Length of stay as well as days on a ventilator differed significantly between those who did and did not show functional declines. Those who showed functional decline had significantly longer length of stay (mean =  $21.70 \pm 14.64$ ; median = 18, interquartile



**FIGURE 1** Percent of patients discharged by location type. IPR, inpatient rehabilitation; LTACH, long-term acute care hospital; SAR, subacute rehabilitation; SNF, skilled nursing facility

range [IQR] = 10.25, 18, 30.75) compared to those who did not show functional decline (mean =  $6.21 \pm 5.61$ ; median = 5 IQR = 3,5,7; Mann-Whitney  $U Z = -10.29, P < .001$ ). Similarly, those who showed functional change were mechanically ventilated longer (mean =  $6.96 \pm 9.69$ ; median = 0, IQR = 0,0,13) compared to those who did not show function change (mean =  $0.17 \pm 0.85$ ; median = 0, IQR = 0,0,0; Mann-Whitney  $U Z = -8.03, P < .001$ ).

### DISCUSSION

COVID-19 mortality rates are frequently reported in the media, while the effects of the infection on function are not as well described. The data reported here are likely an underrepresentation of the true rehabilitation needs of COVID-19 survivors. Baseline functional status was not always noted in the medical record, making changes from baseline more difficult to assess. Furthermore, it is possible that some patients had

unrecognized functional loss, as evidenced by the large proportion of patients who were never assessed by a PM&R physician or therapist. This may be secondary to efforts to minimize staff exposure to COVID-19 and preserve personal protective equipment, and the fact that the hospital's inpatient rehabilitation unit was closed temporarily due to increased demand for acute care beds.

## Study limitations


The data presented above have some limitations. The findings represent outcomes from a single center navigating the “first wave” of COVID-19 admissions, and include only a portion of all of the patients admitted at this institution. This information is only descriptive of rehabilitation needs at acute care discharge, and does not provide insight into the longer term functional trajectory. This recovery may be protracted, particularly for those who have rarer complications such as organ failure, stroke, or critical illness myopathy and neuropathy. This is especially true given the limited availability of inpatient rehabilitation beds at the time of the study. Survival rates and complication rates may change as therapeutics and interventions evolve throughout the pandemic, and it is yet unknown what implications this will have on morbidity. In addition, this study did not include data regarding functional decline due to psychological sequelae, which can be a prominent issue during and after critical illness.

## CONCLUSIONS

Further efforts are needed to meet the complex rehabilitation needs of COVID-19 survivors. Comprehensive and multidisciplinary follow-up programs, standardized outcomes assessments, and additional research regarding functional outcomes should be considered as

the pandemic continues. This information should prove useful to better prepare our health care systems to meet the needs of those who survive COVID-19. In addition, it may serve as a caution to citizens who may be unaware of the physical challenges associated with COVID-19 hospitalizations.

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## REFERENCES

1. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet*. 2020;395:497-506. [https://doi.org/10.1016/S0140-6736\(20\)30183-5](https://doi.org/10.1016/S0140-6736(20)30183-5).
2. Connolly B, Salisbury L, O'Neill B, et al. Exercise rehabilitation following intensive care unit discharge for recovery from critical illness. *Cochrane Database Syst Rev*. 2015;2015(6):CD008632. <https://doi.org/10.1002/14651858.CD008632.pub2>.
3. Ahmed H, Patel K, Greenwood DC, et al. Long-term clinical outcomes in survivors of severe acute respiratory syndrome and Middle East respiratory syndrome coronavirus outbreaks after hospitalisation or ICU admission: a systematic review and meta-analysis. *J Rehabil Med*. 2020;52(5):JRM00063. <https://doi.org/10.2340/16501977-2694>.
4. Abdullahi A, Candan SA, Abba MA, et al. Neurological and musculoskeletal features of COVID-19: a systematic review and meta-analysis. *Front Neurol*. 2020;11:687. <https://doi.org/10.3389/fneur.2020.00687>.
5. Ghannam M, Alshaer Q, Al-Chalabi M, Zakarna L, Robertson J, Manousakis G. Neurological involvement of coronavirus disease 2019: a systematic review. *J Neurol*. 2020;267:3135-3153. <https://doi.org/10.1007/s00415-020-09990-2>.
6. Skoretz SA, Flowers HL, Martino R. The incidence of dysphagia following endotracheal intubation: a systematic review. *Chest*. 2010;137(3):665-673. <https://doi.org/10.1378/chest.09-1823>.

**How to cite this article:** Daunter AK, Bowman A, Danko J, Claflin ES, Kratz AL. Functional decline in hospitalized patients with COVID-19 in the early months of the pandemic. *PM&R*. 2022;14(2):198–201. <https://doi.org/10.1002/pmrj.12624>