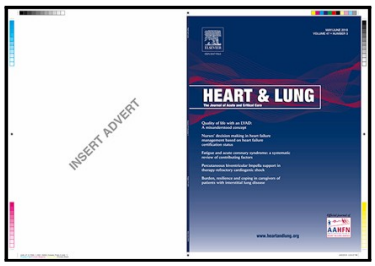

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Flattening the Disability Curve: Rehabilitation and Recovery after COVID-19 Infection

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The coronavirus-19 (COVID-19) pandemic has led to a surge of hospitalizations, many of which have required prolonged intensive care unit (ICU) stays and mechanical ventilation.[1,2] While considerable attention has been paid to survival rates among the rapidly increasing population of patients infected with COVID-19, a second crisis is emerging—the challenge of managing the high disability burden associated with ICU survivorship.[3] ICU survivors, especially those who are mechanically ventilated, often suffer from new or worsening impairments in physical function, cognitive function, and/or emotional health collectively known as post-intensive care syndrome (PICS).[4-6] These deficits may persist for months or years after a critical illness, and have substantial impact on outcomes important to patients such as quality of life, return to work[7], and disability in activities of daily living such as bathing or walking.[8,9] Patients infected with COVID-19 often require stays of 10 or more days in the intensive care unit[2], and many experience acute respiratory distress syndrome requiring mechanical ventilation, which usually requires sedation, and sometimes, neuromuscular blockade.[1,10] Taken together, these factors are likely to increase the burden of PICS among COVID-19 survivors; indeed, recent estimates indicate at least 40% of COVID-19 survivors have prolonged and significant neurological deficits such as fatigue or weakness after hospital discharge.[11]

The Awakening and Breathing Coordination, Delirium monitoring/management and Early exercise/mobility (ABCDE) bundle is critical to reducing the adverse consequences of critical illness.[12] The early exercise and mobility component of this bundle is especially important in ameliorating the negative impact of ICU stays on physical function. Yet, use of rehabilitation services within many ICUs has substantially decreased to preserve dwindling supplies of personal protective equipment (PPE) and protect rehabilitation staff from prolonged exposure in close proximity to infected patients. Movement is medicine for patients in the ICU, and being unable to provide this critical treatment for vulnerable patients is likely to negatively impact recovery.

Once patients are well enough to leave the hospital, rehabilitation evaluations and necessary treatment are recommended as part of the standard of care. Yet, surges in COVID-19 hospitalizations also substantially strain provision of rehabilitation in post-acute and outpatient settings as well. Post-acute care facilities, such as skilled nursing facilities or rehabilitation hospitals, often operate at close to maximal capacity with little ability to handle sharp increases in patient volume, especially medically complex patients discharging after COVID-19

infections.[3] Even if a patient can be admitted to a skilled nursing facility, shortages of personal protective equipment within nursing homes (which are often even more acute than hospital shortages) and rules in some nursing homes defining rehab staff as non-essential personnel may negatively impact the amount and intensity of physical and occupational therapy delivered.[13]

While discharge home is often an optimal outcome after hospitalization, and perhaps more preferential, current treatment paradigms in home health care settings may not provide optimal support for COVID-19 survivors. Intensity of rehabilitation varies within agencies, but recent research indicates that at least 1 in 3 patients do not receive any rehabilitation after an ICU stays and those who do receive a small number of visits.[14] Home health agencies are not currently staffed to handle a large increase in patient volume, especially patients who are using home health care as a substitute for more intensive rehabilitation settings. In addition, outpatient rehabilitation clinics have largely closed, further complicating rehabilitation access.

Faced with these challenges, how can we improve outcomes for COVID-19 survivors in the current healthcare environment? Beyond obvious solutions, such as increasing staffing and PPE availability within hospital and post-acute care settings, there are two additional strategies which could help improve disability outcomes for COVID-19 survivors.

1) Increase use of tele-rehabilitation during the hospital stay

Among the strategies with the largest potential for immediate benefit is increasing use of tele-rehabilitation interventions both within the ICU and following ICU discharge. Using available telehealth technology in patient rooms may allow physical therapists to participate in patient care without donning scarce PPE resources. For patients who are conscious and have volitional movement, therapists could teach a safe bed or chair-based exercise and mobility program to reduce deconditioning. For those who are sedated, therapists could virtually guide nursing staff on integrating early mobilization principles into tasks already taking place in the room. While an imperfect solution, it may help reduce hospital-acquired disability during an ICU stay.

Once patients discharge out of the ICU to the floor, telerehabilitation strategies could be continued. Virtual rehabilitation programs, which guide exercise and track movement with remote sensors, have been used for post-surgical recovery and could be re-purposed for in-room exercise progression for patients with COVID-19 to reduce the number of entries from rehabilitation staff during exercise sessions. These basic strategies could improve overall physical activity during hospitalization more than exercise handouts or other passive exercise strategies.

2) Consider developing rehabilitation at home models for COVID-19 survivors after discharge

Because of infection control concerns at nursing homes, there is growing interest in shifting rehabilitation into the home health setting.[3] These rehabilitation-at-home models, which could utilize increased availability from physical therapists in community clinics which have closed, may be a win-win—helping reduce disability burden while simultaneously limiting COVID-19 exposures to high risk older patients in rehabilitation facilities. Therapists can provide exercise

equipment to patients from clinics for use during the entirety of rehabilitation stays, which limits cross-contamination concerns from therapy gyms and allows therapy to be carried out with greater intensity. Because Medicare allows clinic-based physical therapists to bill for care provided at home to any patient, this is a solution which is quickly actionable and may preserve PPE to a greater extent than daily therapy in a rehabilitation facility.

Managing functional impairments associated with COVID-19 will require a concerted effort by clinicians across the continuum of care. We recommended making assessment and management of physical function an integral part of COVID-19 management, and integrating rehabilitation assessment and treatment care in innovative ways for all COVID-19 patients in the hospital and after discharge, virtually or face-to face as PPE supplies allow. It is important to remember that the needs of COVID-19 survivors do not end at the time of hospital discharge. By proactively planning for the rehabilitation needs of this population, we can all help flatten the disability curve for COVID-19 survivors.

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