

Rehabilitation Medicine Response to the COVID-19 Pandemic

Joel Stein, MD¹ Christopher J. Visco, MD² and Scott Barbuto, MD, PhD²

¹Simon Baruch Professor and Chair Department of Rehabilitation and Regenerative Medicine, Columbia University College of Physicians and Surgeons, Chair, Department of Rehabilitation Medicine, Weill Cornell Medical College, Psychiatrist-in-Chief, New York Presbyterian Hospital, New York, NY, USA

²Department of Physical Medicine and Rehabilitation, College of Physicians and Surgeons, Columbia University Medical Center, New York, NY, USA

Corresponding Author

Joel Stein, MD

Simon Baruch Professor and Chair Department of Rehabilitation and Regenerative Medicine
College of Physicians and Surgeons, Columbia University Medical Center

Address: Harkness Pavilion, 180 Fort Washington, New York, NY 10032

Email: js1165@cumc.columbia.edu

Phone: 212-305-4818

Fax: 212-342-3138

Declaration of Conflicting Interests

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

No funding was received for this research.

ACCEPTED

Abstract:

The COVID-19 pandemic has spread across the globe at a rapid rate, affecting large numbers of individuals in different countries with varying health care systems and infrastructure. In the US, New York City has been the epicenter of the COVID-19 outbreak, and the peak impact in this region has come earlier in this location than most other parts of the country. We report our experience preparing for this pandemic in a New York City academic medical center and its regional health care system, the issues confronted during the rise and peak of the number of cases, and the plans for the post-peak recovery and adjustment to the new reality of providing rehabilitation in an environment where COVID-19 remains prevalent.

Keywords: COVID-19, Rehabilitation

Introduction

Background on COVID-19

In early December 2019, cases of pneumonia of unknown origin began to surface in Wuhan, the capital city of Hubei province China.¹ The city's South China Seafood Market was noted to be a link between these index cases, and the possibility of a new severe acute respiratory syndrome of zoonotic spread was speculated.² Subsequent research led to the discovery of a novel coronavirus, SARS-CoV-2, as the causative agent which shares 88-96% sequence identity to bat coronaviruses.³ The definitive identification of the animal hosts involved in the origin of the virus, however, remain yet to be elucidated.¹

The most common symptoms reported as a result of SAR-COV-2 infection include fever, cough, chest tightness, dyspnea, myalgias, and fatigue.⁴ Other less common symptoms include headache, dizziness, nausea, diarrhea, and taste or smell impairment.⁵ Most cases are reported to be mild in nature with an estimated 15-20% of cases being severe.⁴ However, with testing shortages and undiagnosed mild cases, the number of severe cases is likely overestimated due to detection bias.² The symptoms of infection appear after an incubation period that averages approximately 5.2 days.⁶ The case fatality rate has been estimated to be 2 to 3% with the period from symptom onset to death ranging from 6 to 41 days in most cases.⁷

The first case in the United States was confirmed on Jan 20, 2020 in Washington State.⁸ Soon after, on January 30th, the first case of suspected community viral spread was reported on US soil. The novel coronavirus, now named COVID-19 by the World Health Organization on February 11th, was first confirmed in New York City on March 1st. After about 2 weeks, the city started to see an exponential growth of cases and now is the epicenter of the world-wide pandemic. As of April 13th, New York City has 110,465 confirmed cases with 27,457

individuals hospitalized and 7,690 deaths.⁹ Of those, 2,554 cases were in the New York-Presbyterian hospital system with 766 individuals in intensive care. One week later on April 20th, these numbers started to drop with 2,131 hospitalized cases and 707 in intensive care. In this manuscript, we highlight our experiences as a rehabilitation department in a New York City academic medical center and its associated system in its efforts to prepare for, manage, and provide post-illness rehabilitation for the rapidly increasing population of individuals with COVID-19 disease.

Phase 0: Initial Response to the Pandemic

The response at the medical center ramped up quickly after the first case hospitalized in our system at the beginning of March. The response initially focused on reducing travel to limit exposure and contagion, prohibiting international travel, and work-related travel domestically. Over the next 10 days, the volume of patients within the institution steadily grew, and the decision was made to suspend all clinical rotations for medical students and other health science students, including physical and occupational therapy. All student classes, hospital grand rounds, and resident didactics were converted to virtual formats, and all meetings were similarly converted to on-line meetings. Most administrative staff were shifted to working from home, and the research enterprise was dramatically scaled back to selected high need clinical trials, and COVID-19 related research.

Two weeks after the first local case, clinical activities were reduced throughout the medical center to urgent care, eliminating elective surgery and procedures, and non-urgent ambulatory care. Visitors were generally prohibited from the hospital premises in most

circumstances. Figure 1 shows the rapid rise in the number of hospitalized patients, and Figure 2 provides a timeline of key milestones in the local manifestation of the pandemic.

Phase 1: Rising numbers of COVID-19 cases

Inpatient rehabilitation bed management

We experienced a transient reduction in the census for our inpatient rehabilitation units as elective surgery was suspended, as a significant portion of the admissions to our programs had come from this population prior to the pandemic. We established criteria for identifying patients who were COVID-19 survivors, and who were no longer deemed contagious, in order to provide access to rehabilitation for these patients. Based on CDC recommendations, our infection prevention and control team determined that two negative PCR tests were required to confirm that the risk of contagion had passed for these patients. At the same time, access to rehabilitation facilities outside of our hospital system constricted, as each hospital system in the region began “clearing the decks” in anticipation of growing numbers of COVID-19 patients, and some converted inpatient rehabilitation beds into acute care beds on a temporary basis. Due to the long lengths of stay for many of the most seriously ill COVID-19 patients, and the challenges in obtaining PCR testing on a timely basis, our strategy to admit COVID-19 patients who were no longer contagious did not result in a meaningful number of admissions to our rehabilitation units. Rather, we found increasing numbers of patients who were admitted to our rehabilitation units for other diagnoses (e.g. stroke), but who were subsequently found to be COVID-19+, prompting transfer back to acute care. Based on this, we changed our policy and practices to include COVID-19+ patients on our rehabilitation units with appropriate infection control precautions, while continuing to serve as a rehabilitation unit for other diagnoses.

The prohibition on visitors to the hospital precluded any in-person family teaching, and telephonic and videoconferencing were substituted, with some challenges and occasional delays in discharge home resulting. Acute hospital consults, and inpatient rehabilitation clinical rounds by physicians continued unchanged for patients who did not require PPE use (COVID-19 negative), but for COVID-19+ patients, typically only one member of the physician team (resident or attending physician) would perform the daily in-person assessment and physical exam to conserve PPE. As PPE supplies became more available, co-rounding in person by attending physicians and residents resumed. Multidisciplinary team rounds were converted to telephone or videoconferencing to avoid group meetings of staff.

Ambulatory Care

Telemedicine visits for physicians

Our physician practices had been in the early phases of implementing video visits prior to the outbreak of COVID-19, and thus the technology infrastructure was essentially in place to accommodate this form of practice. A new electronic medical record (EMR) for the enterprise went live on February 1st. This EMR has built-in video visit capability but a gradual implementation was anticipated. Prior to pandemic, less than 1% of our visits were performed as video visits, and these were limited to follow-up visits, rather than new patients. The rollout of video visits was accelerated to allow all physicians access, and no major technology hurdles were encountered on the provider side. From a patient perspective, however, a substantial degree of technological skill was required to successfully use this system, limiting adoption. Patients with limited English skills, lower socioeconomic status, as well as older patients and those with neurological disorders have had limited use of this option. Even among younger patients with

musculoskeletal disorders, the volume of video visits has been substantially below usual in-person visit volumes. During the suspension of our non-urgent ambulatory visits, our overall volume of ambulatory visits fell by approximately 84%. Of the remaining visits, approximately 80% were performed via video visits, 10% telephonically, and the remainder (largely urgent procedures) in person. Many of the video visits were for initial patient evaluations, with physicians providing favorable feedback regarding the utility of using video visits for both new and follow-up evaluations. Continued use of video visits is anticipated during the recovery period (phase 2) and beyond.

Telemedicine visits for PT/OT/SLP

Physical, Occupational and Speech therapies have all been found feasible via telemedicine systems, but our medical center was not actively preparing for this prior to the COVID-19 crisis. We have been able to establish some physical therapy video visits for ambulatory patients to a limited extent, but the hospital-based therapy services (even for ambulatory patients) have proven more complex to establish, and are not yet widely used.

Defining urgent care

The decision to limit ambulatory care to urgent visits was made over the course of a weekend as the volume of hospitalized patients rose exponentially. As a result, non-urgent ambulatory visits were rapidly tapered off over several days. The definition of “urgent” proved complex, as urgency varies based on different perspectives, and many patients felt their acute pain issues merited consideration as “urgent”. As the scope of the local epidemic became known to the public, however, a large number of patients elected to defer care on their own volition,

fearing possible contagion in a medical setting. Video visits have provided a partial substitution, although patients requiring injections or other procedures were generally managed with medications or home exercise programs, with varying degrees of success. A few specific scenarios were identified as clearly meeting the definition of urgent, including suspected fractures, and refills of intrathecal baclofen pumps. Patients with intrathecal baclofen pump refills have been continuing to come in for regularly scheduled refills throughout the pandemic. Visits have been consolidated to all occur on a single day of the week, and patients have been instructed to wear a surgical mask to all visits. Before arrival, patients were asked if they had any signs or symptoms suggestive of COVID-19. Temperature checks were not routinely performed on patient arrival, but plans are in place to adopt this approach in preparation for resuming non-urgent visits. We have not had any intrathecal baclofen pump patients with known active COVID-19 disease requiring refills, but have developed contingency plans to bring such patients directly into an exam room on arrival, and to decontaminate the room post-discharge, as well as use appropriate PPE for the refill.

Personnel management & Re-deployment

Communication

With the rapid changes occurring throughout the hospital during the pandemic, biweekly meetings with all physician and leadership staff were conducted via Zoom. During these briefings, data on the volume of patients, changes to hospital practices and policies were explained, and updates from key personnel were given to keep staff as informed as possible. These meetings were supplemented with weekly town hall meetings for the clinical therapy (PT,

OT, SLP) staff, with similar content, but focusing on the specific issues confronted by these disciplines, and allowing for question and answer sessions.

Attending Physicians

In the first two weeks after cases were identified in the New York area, restrictions on travel were implemented, along with cancelling internal conferences and larger meetings. With the rapid progression of the local epidemic, the medical center progressed to cancelling elective surgeries and procedures, and non-urgent office visits starting on March 16th. For attending physicians primarily engaged in ambulatory care, the first week after cancellation of ambulatory visits included considerable unscheduled time. As the pandemic progressed, however, calls were quickly made the following week for physician re-deployment to areas that were experiencing a large increase in demand. Our attending physicians stepped into roles working with employee health, fielding a large number of calls from staff with respiratory symptoms, and providing guidance regarding return to work, as well as serving as providers for a video visit urgent care service that experienced a large growth in demand, and freeing up Emergency Department physicians from their usual role staffing that service to permit them to serve in the ED itself providing care to more severely ill patients. Two attending physicians were converted to hospitalists on COVID-19 units, with a plan to provide intensive care to COVID-19 patients under supervision if needed, and one attending physician was re-deployed to the Emergency Department to provide direct care. Inpatient and consult attending physicians continued in their usual duties, although with schedule changes to limit contact among them, and to have a smaller contingent of physicians present on any given day.

Residents and fellows

An institutional travel ban came into place two days before the start of the AAP/ISPRM conference. This affected trainees in a number of ways as many missed career networking opportunities and in-person interviews which were scheduled to occur at the conference. One resident, on site in Mwanza, Tanzania had just begun a global health rotation and was recalled (along with all the NYP residents at that location) due to serious concern over ability to travel in the coming weeks and ability to obtain appropriate quarantine and medical care on-site if needed. Medical school leadership made the decision to recall all students on rotation and cancel medical student rotations.

Residents and fellows (in pediatric rehabilitation and in sports medicine) were initially unscheduled for significant amounts of time as ambulatory rotations were suspended. As the volume of COVID-19 patients in the hospital system increased, many were redeployed to roles in the ICU's, Emergency Departments, and providing video urgent care visits. The resident on-call system was converted to a night-float system, providing better flexibility for redeployment of residents to other roles.

This 2-person night float system had 3-4 consecutive days "on" each week allowing for decreased movement of trainees across various sites in the training program, limiting the exposure of staff/patients/trainees to each other. It also decreased the post-call days placing more trainees in a potential pool for redeployment. This was implemented on both NYP campuses where residents take call.

The consult resident on each campus was assigned a "remote consult" resident to assist with reviewing charts, team notes and orders, communications, pre-charting, and discussing the case with the team. Similar remote residents were assigned to inpatient and ambulatory care

including resident clinics. This was also done to assist with the anticipated increase in consults for clearing hospital beds and moving patients affected by COVID-19 through the system. Additional factors for this redistribution included limiting PPE use, and keeping a “reserve” of healthy trainees should several go out sick simultaneously with COVID-19 symptoms.

Those residents assigned remote work were given topical didactic assignments pertaining to the current educational module. The ACGME accelerated the telemedicine requirements, allowing an earlier implementation of video visits and providing some guidance on supervision. 3-way-telemedicine guidelines were distributed to allow key ambulatory faculty to work with remote residents and included supervision expectations.

Due to the rapid nature of schedule changes, the hospital and GME office gave additional flexibility to program directors to make direct accommodations for those with underlying medical conditions, immunocompromised, or pregnancy to ensure each individual’s safety as they endeavor to provide a high level of care for patients. As trainees began to be redeployed, there was a centralization of the redeployment process through NYP/GME. PDs with needed service coverage for the next day(s) would submit their requests by noon, and PDs from programs with available trainees would submit their availability. The GME endeavored to make the matches and suggested best-practice guidance to how orientation and communication should occur between programs.

Wellness/Mental health offerings were added to the weekly didactic schedule, led by one of the staff psychologists. Along with other staff at the medical center, residents and fellows were offered free short-term 1:1 telemedicine therapy when desired. Regular town hall meetings were held by the residency director to monitor resident wellness, supplemented by individual communications with redeployed residents in high acuity areas.

The ACGME granted NYP institutional Pandemic Emergency Status. This suspends most core and specialty-specific program requirements for 30 days with the exception of appropriate resources, training, supervision, and work hours. NYP subsequently granted fellows who have a medical license attending-level privileges in the hospital.

Physical, Occupational, and Speech/Language Therapy

Ambulatory therapy volume declined markedly with the limitation of treatment to patients with urgent needs. Some telemedicine encounters were established, but with limited volume. Therapy staff created videos for specific patient populations to assist with home exercise programs, and posted these on YouTube to provide wide access. Staff were redeployed in a variety of roles, including to assist with positioning COVID-19 patients in the prone position (“proning teams”), assisting other departments, such as radiology, with properly positioning patients for imaging (esp. Portable chest x-rays), and other clinical and non-clinical duties.

Nursing

Rehabilitation unit nurses received inservices in the appropriate use of PPE to care for COVID-19 patients, and other issues specific to this population. Nurses and Nurse practitioners in our ambulatory practice were redeployed to acute care roles to assist with the surge in patients, including serving on the internal medicine acute wards, ICU’s, and Emergency Department.

Protecting Staff from Infection

Personal Protective Equipment (PPE) shortages

The initial shortages of protective equipment significantly impacted the institutional response to the pandemic. These shortages contributed to the decisions to aggressively limit non-urgent care, as well as severely restrict visitors to the hospital, and discontinue student clinical experiences. Based on published guidelines, staff were instructed to use a surgical mask rather than N95 masks when treating COVID-19 patients, except when performing procedures known to cause aerosolization, when N95 masks were to be used. CDC recommendations, however, indicated that N95 masks remained preferable when treating COVID-19 positive patients (when available), causing concern among clinical staff that they were suboptimally protected when rendering direct care to these patients. Subsequent improvements in N95 supplies resulted in use of an N95 underneath a surgical mask, permitting reuse of the N95 mask, which reduced clinical staff concerns.

The definition of aerosol-generating procedures was a substantial concern, particularly for SLP staff, recognizing that coughing can generate aerosols, and that their treatment may trigger coughing.

Other strategies for conservation of PPE included eliminating almost all visitors and students from the hospital setting, and the elimination of non-urgent surgery, procedures or office visits. PT, OT and SLP ambulatory visits were similarly curtailed. Limiting in-person contact with patients was employed as another method of reducing PPE consumption, including placing IV poles and infusion devices outside of patient rooms to allow nurses to adjust them without entering the patient's room, and limiting in-person physical examination of many patients to a single member of the physician team (e.g. resident or attending physician, but not

both). PT/OT/SLP similarly consolidated treatment when feasible, so that a PT might address certain OT aspects of treatment and vice-versa.

Supporting clinical staff

Housing

The medical center provided free temporary housing to physicians and other staff who requested it for any reason, most commonly to reduce contact of staff members with their own vulnerable family members, and to avoid the need for lengthy commutes. Free meals and assistance with parking and other forms of transportation were also provided by the medical center to staff involved in the emergency response.

Psychological Health and Wellbeing

The department instituted “Support and Wellness” groups on a weekly basis for all staff, led by psychologists affiliated with our rehabilitation programs. An additional group focused on the residents and fellows was also implemented on a weekly basis. In addition to these group activities, the medical center provided access to short courses of individual counseling with mental health providers via telemedicine without charge to all staff.

Regulatory

On March 29th, the federal government issued temporary regulatory waivers and new rules to ensure local hospitals and healthcare systems have the capacity to handle a potential surge of COVID-19 patients. There was also a temporary relief in paperwork, reporting, and audit requirements to ensure a “Patients Over Paperwork” initiative. These new rules for

inpatient rehabilitation facilities include: 1) Ability to use telehealth to fulfill the requirement for physicians to conduct the required face-to-face visits at least 3 days a week. 2) No post-admission evaluations required. 3) Waiver of the 60 Percent Rule, which states that 60% of patients discharged need one of the 13 qualifying rehab conditions. 4) Freestanding inpatient rehab units can work with acute hospitals to provide surge capacity for the community. 5) Flexibility in the amount of therapy patients receive. 5) Extension of cost report due dates.

Our IRF units were scheduled for their triennial CARF survey during the height of the pandemic, which was postponed with extension of CARF accreditation for an additional six months.

Phase 2: Recovery

Access to rehabilitation beds

As the surge in COVID-19 patients within the hospital reached its apex, concern about the ability to discharge recovering COVID-19 patients from the hospital rose within the hospital. Many acute rehabilitation facilities in the region remained closed to external referrals due to internal capacity demands and conversion of some rehabilitation beds to acute care. The number of beds on the inpatient rehabilitation units within our hospital system were temporarily expanded by approximately 50% to accommodate the surge in patients requiring intensive rehabilitation, with these expanded units expected to operate for approximately 4-6 weeks before returning to their usual bed capacity. At the same time, specialized medical units within the acute care hospital were created to cohort patients in the early stages of COVID recovery to provide enhanced rehabilitation services while these patients continued to require active acute hospital medical management. As rehabilitation and recovery units were established, resident and faculty

deployment were shifted away from ICU and ED areas to these new units accommodating the growing rehabilitation workload. Expanded relationships with subacute facilities in the community have helped expedite discharge of less acutely ill patients for post-acute care.

Refining telemedicine

Overcoming the hurdles of telemedicine at an academic center required continued troubleshooting. Staff efforts at expanding the acceptance and adoption by patients often required a one to one interaction to help answer questions and assist with the patient interface. The challenge of appropriate trainee supervision in a HIPPA compliant manner also arose. Fortunately, this could be accomplished with the current version of the utilized EMR. However, some consideration had to be given to utilizing alternative third-party applications in the event the connection was poor or a three-way video could not be performed. The three-way telemedicine visit is accomplished by having the trainee initiate the electronic charting and the visit with or without the faculty at the start. The faculty then joins the telemedicine virtual room and patient encounter. Supervision, education and feedback all can occur in this environment. Treatment of non-English speaking patients remains a challenge, and translation services have proven challenging, though not impossible, to incorporate into these visits.

Telemedicine for COVID-19 rehabilitation

There is a wide range of clinical symptoms associated with COVID-19 infection, ranging from asymptomatic infection to multi-organ failure. For those with more serious manifestations of this disease, there may be a prolonged recovery phase with a need for active rehabilitation. Patients with prolonged mechanical ventilation may benefit from acute inpatient rehabilitation.

For those returning home, we established a home telemedicine program of rehabilitation, with a physiatrist providing an initial assessment via video visit, followed by video visit based physical therapy. We anticipate incorporating occupational and speech therapy into this post-COVID-19 rehabilitation program as well.

Phase 3: The New Normal

It is clear that the COVID-19 pandemic may be passing its peak in the New York City region, but will remain prevalent for a prolonged period of time, until a vaccine is developed and deployed, or until herd immunity is achieved. Despite the large number of cases in this region, the vast majority of the population remains vulnerable to infection, and no major advances in treatment have yet been reported as of this writing. For these reasons, adaptations to this disease are needed in the community at large, and in rehabilitation medicine, in order to provide needed treatment without undue risk.

Ambulatory care:

We anticipate the continued emphasis on telemedicine visits, which provide patients with greater convenience, and reduce the risk of COVID-19 transmission in the healthcare setting. We also recognize, however, that the use of telemedicine is likely to be greater in certain populations than others, and may vary substantially based on diagnosis. Patients with neurological disorders may find this more difficult to manage, such as patients with stroke or brain injury, and there are elements of the exam that are difficult or impossible to replicate remotely. In our urban location where there is a substantial population who are not fluent in English, language barriers, while not insurmountable, make the use of telemedicine more challenging. Finally, many rehabilitation

patients are of lower socioeconomic status, and lack the resources, such as broadband internet, and may lack the technical expertise to manage telemedicine.

For patients who receive care in-person in our practices, we have developed plans to reduce the risk of contagion to both patients and staff. These include mandated telephone screening of patients for any symptoms suggestive of possible COVID-19 infection at the time of initial appointment scheduling, and then repeated telephone screening shortly prior to the date of the appointment, as well as temperature checks on arrival, the mandated use of masks at all times for both patients and staff, prohibiting individuals from accompanying patients to their appointments unless essential (e.g. pediatric patients, cognitively impaired patients), and maintaining social distancing within this environment, such as signage and reorganizing our use of space. Exam room cleaning protocols have been established to avoid cross contamination between patients. A key element will be decompressing our patient schedule to reduce close physical proximity to other patients. In particular, we plan to eliminate our waiting rooms and bring patients into their examination room immediately upon arrival, which will require reducing the number of physicians practicing at any given time. While telemedicine will support this effort, expanding hours and weekend hours to spread our practice will be essential. Some suburban locations may be able to have patients wait for their exam room availability in their cars in the parking lot, although this is not feasible in most of our primarily urban practice environment where few patients arrive by car. Also, efforts to avoid the use of the “check-in” and “check-out” desks through the use of pre-registration, online scheduling and payment of copays, and obtaining vital signs in the exam room are planned. We are installing “sneeze guards” at check-in desks to as another physical barrier to contagion for circumstances when the use of these front desk areas is

unavoidable. An ongoing negative impact of practice productivity is anticipated, which will also result in continued fiscal challenges.

Inpatient Rehabilitation

We anticipate continued care of patients recovering from COVID-19 and prolonged mechanical ventilation on our inpatient rehabilitation units. While a large number of patients are on ventilators during the pandemic peak in New York City, these numbers are expected to gradually subside over a period of weeks. Future numbers of patients in this category are difficult to anticipate at present, due to the substantial and unpredictable impact of government policies and public behavior. While the numbers of patients requiring Long Term Acute Care Hospital care from this pandemic remain unclear, it seems likely that increased capacity in these facilities may be needed.

There are reports of an association of COVID-19 with certain neurological conditions, including stroke [6]. We may therefore see an increased number of patients with comorbid stroke and other neurological diseases along with COVID-19 even as the acute surge subsides.

Discussion:

There have been many important lessons learned through our experiences thus far, and more that will undoubtedly follow as we move into the future. A few key points are worth emphasizing:

The importance of supporting our staff

There have been many missed opportunities in this pandemic on a national and international level, including the flawed initial responses that might have contained the pandemic, to the lack of testing capacity that continues to be a challenge in the US. From a rehabilitation medicine perspective, the lack of optimal PPE has been a persistent issue that has made physicians, therapists, and nurses reluctant to spend time treating patients, and fearful when they do so. While optimal PPE would not eliminate these concerns, it would provide staff with reassurance that every possible precaution is in place to protect their health.

On a positive note, the availability of support groups and mental health services, along with housing and other supports, have helped the clinical team members manage their stress better. These are important lessons that pertain to any future pandemic or other emergency situation.

Adapting to new clinical needs

A novel disease results in novel rehabilitation needs, and the need to adapt to provide this care in real time. In our case, our initial plan to maintain our rehabilitation units as COVID-19-free floors was rapidly found to be unfeasible. Ramping up our ability to treat these patients in the inpatient rehabilitation facility has been followed by concerns about inadequate inpatient rehabilitation capacity. The need to establish rehabilitation programs for outpatients, along with maintaining social distancing, has resulted in rapid changes in patient type and flow for our department.

Creating a built environment to support future care needs

Rehabilitation units are often built to meet current, rather than future needs. The risk of future pandemics with patients requiring intensive rehabilitation suggests that rehabilitation facilities should be constructed in ways that allow appropriate infection control while permitting active rehabilitation. Single rooms with negative pressure ventilation, avoiding establishing large open gyms for therapy services in favor of multiple smaller therapy treatment spaces, and other strategies to facilitate patient isolation should be considered when planning or renovating these facilities.

Using technology

Technology has played a key role in society broadly in adapting to this pandemic. Video conferencing has become the norm in the workplace, and various video and other technologies have allowed physically isolated individuals in the community to remain socially connected. The use of video visits for PM&R physicians as well as for PT/OT/SLP visits has blossomed quickly, and will remain an important tool for the foreseeable future, even once the pandemic has completely resolved. Future technologies might include remote presence robots to allow treatment of patients by clinical staff without being in physical proximity and thus minimizing the risk of contagion.

Regulatory and reimbursement changes

A number of changes were introduced on an urgent basis to cope with the pandemic, including relaxing a number of rules that did not contribute to patient care, but were designed to limit access to rehabilitation care, such as the 60% and the 3-hour rules. Similarly telemedicine

rules for physician visits were liberalized as well. All of these changes have been helpful, and raise questions about the utility of the rules in the first place. It is hoped that this experience may inform updating and modernization of these rules. Reimbursement issues for therapy services via telemedicine remain problematic, and arguably in need of revision to maximize flexibility in this area of care as well.

Conclusion:

Rehabilitation is a critical aspect of our health care system, but is particularly vulnerable during a pandemic response, where the focus of the healthcare system shifts to acute management of a surge of acutely ill patients. The challenges of adjusting the role of rehabilitation providers and systems during the rapid progression of the COVID-19 pandemic provide insights that may help systems manage their response as they contend with these issues. The impacts of the pandemic will last long beyond the immediate emergency responses. Preparation for future pandemics is an essential long-term response to maximize our ability to respond to future challenges to provision of rehabilitation services in our health care system.

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.
2. Lake M. "What we know so far: COVID-19 current clinical knowledge and research." *Clin Med* 2020; 20:124-127.
3. Lu R, Zhao X, Li J, et al. "Genomic characterization and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding. *Lancet* 2020; [Epub ahead of print].
4. Guan W, Ni Z, Hu Y, et al. "Clinical characteristics of coronavirus disease 2019 in China." *New Eng J Med* 2020; [Epub ahead of print].
5. Mao L, Jin J, Wang M, et al. "Neurological manifestations of hospitalized patients with coronavirus disease 2019 in Wuhan, China." *JAMA Neurol* 2020; [Epub ahead of print].
6. Li Q, Guan X, Wu P, et al. "Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia." *N. Engl. J. Med.* 2020; [Epub ahead of print].
7. Singhai T. "A review of the coronavirus disease-2019." *Indian J Pediatr* 2020; 87:281-286.
8. Holshue ML, DeBolt C, Lindquist S, et al. "First case of 2019 novel coronavirus in the United States." *N Engl J Med* 2020; [Epub ahead of print].
9. <https://www1.nyc.gov/assets/doh/downloads/pdf/imm/covid-19-daily-data-summary-04132020-1.pdf>

Figure 1. Hospital and ICU census of COVID-19 patients in the New York-Presbyterian Hospital System.

Figure 2. Timeline of COVID-19 local outbreak and response at New York-Presbyterian (NYP) Hospital System.

ACCEPTED

Figure 1

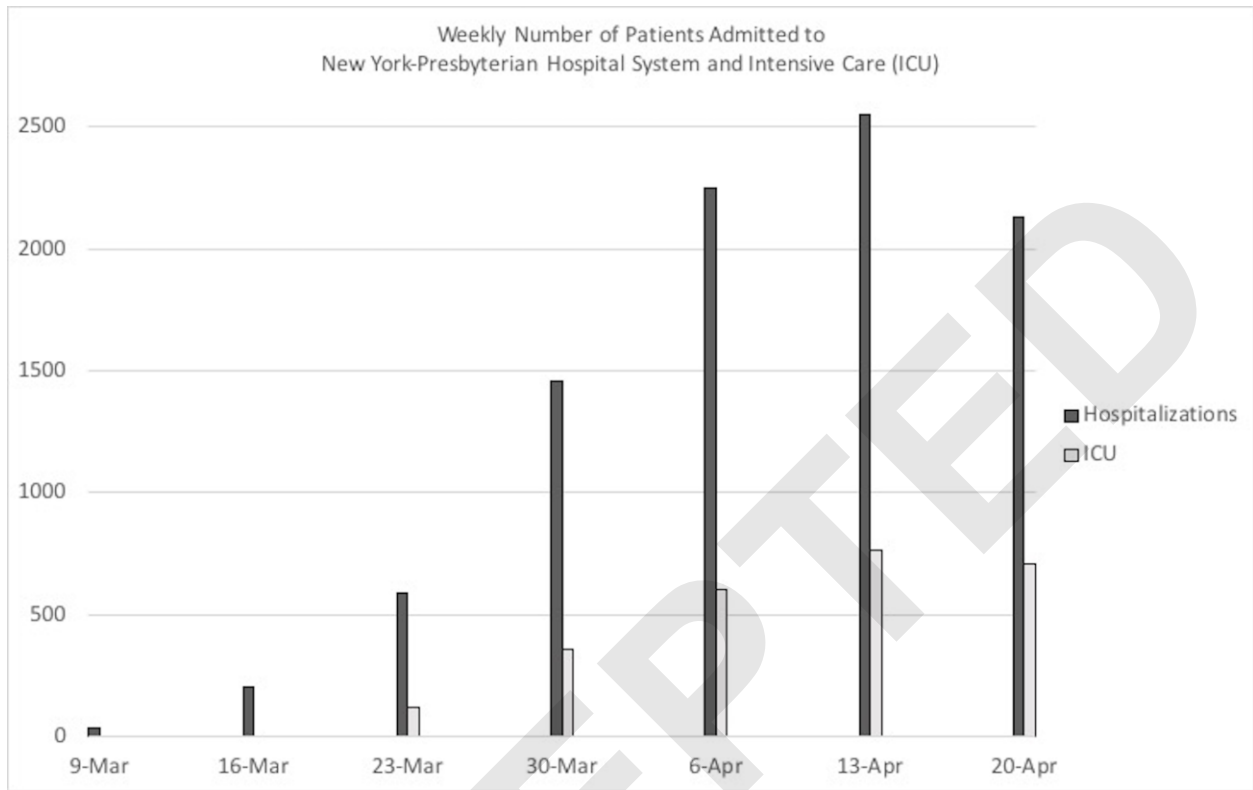


Figure 2

