Adapting Physical Therapy Management of Patients With COVID-19 in the Acute Care Setting: A Clinical Perspective

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Purpose: Using emerging evidence and information pertaining to the SARS-CoV-2 virus, a team of physical therapists (PTs) and occupational therapists (OTs) at the Duke University Hospital (DUH) created a screening algorithm to guide PT/OT evaluation readiness and treatment decisions. This article aims to discuss factors that were considered in the initial development of therapy guidelines and, in so doing, emphasizes the need for ongoing analysis of such screening algorithms and treatment guidelines as evidence continues to emerge. **Summary of Key Points:** The interdisciplinary team, leveraging their collective experience combined with the updated literature, changed the initial medical management for patients diagnosed with coronavirus disease 2019 (COVID-19). As a result, the screening algorithm was adapted to reflect evolving evidence-based practices. This facilitated earlier and more skillful PT intervention as well as continued PT involvement in the treatment process throughout the course of the patients' stay in the hospital. **Conclusions:** To guide clinical decisions regarding medical stability of patients and appropriate timing for PT intervention, the therapists at DUH considered factors including defining and identifying stages of disease severity, assessment of laboratory values, and monitoring oxygen stability. Beyond medical complexity, mobility was limited by several additional isolation barriers which presented challenges for PTs, nursing staff, and the patient. **(Cardiopulm Phys Ther J. 2021;32:140–146)** *Key Words: AGP, ARDS*

INTRODUCTION

With case numbers rising throughout the United States, hospitals across the country prepared themselves to isolate and treat patients with COVID-19, including physical therapists (PTs) and occupational therapists (OTs). In March 2020 at the Duke University Hospital (DUH) in Durham, North Carolina, a team of acute care PTs and OTs, with years of experience in cardiopulmonary and intensive care unit (ICU) patient care, volunteered to design a hospital-wide screening algorithm which aimed to guide therapy clinical decisions and treatment of patients who were positive for the SARS-CoV-2 virus. Therapists from a variety of backgrounds volunteered to be the primary rehabilitation providers for patients diagnosed with COVID-19. This team also included ICU-specific therapists who had considerable experience treating critically ill patients. Duke University Hospitals COVID-19 screening algorithm was initially used in early April 2020 (Fig. 1). The earliest version of the algorithm was based on recommendations from the Centers for Disease Control and Prevention,[1,2] World Health Organization,[3–6] webinar presentations by the Academy of Acute Care Physical Therapy,[7,8] and the *Recommendations to Guide Clinical Practice* by Thomas et al.[9]

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INITIAL SCREENING CONSIDERATIONS

Initially the screening algorithm was used primarily to assist PT in determining whether services were indicated

and, if so, appropriate at that point in the patients' hospitalization. Early reports suggested patients transitioning from moderate to severe disease presentation may have specific laboratory value and biomarker trends, including severe decrease in white blood cell count, increased C-reactive protein (CRP), decreased lymphocytes (lowest at day 14), decreased platelets, increased BUN/Cr, increased lactate dehydrogenase, increased liver function tests (such as alanine transaminase, aspartate transaminase, and total bilirubin), elevated D-dimer, elevated erythrocyte sedimentation rate, and elevated ferritin.[7,8,10] In addition to noting the listed biomarker trends, we also monitored for rises in troponins and B-type natriuretic peptide as potential markers of cardiac involvement.[7,10] Our review of additional literature suggested severe cases of COVID-19 may present as similar to acute respiratory distress syndrome (ARDS) as appreciated on both chest x-rays and chest computed tomography (CT).[7,11] Therefore, diagnostic imaging was used to supplement observations of laboratory values and biomarkers by the medical team and therapists to assess disease severity.

The therapy team used the patient's clinical features and symptoms to define the disease severity and categorize the patients into specific stages. The use of a staging system among therapists enabled quick categorization of the disease process, thereby helping to indicate the appropriate therapy treatment team (ICU vs stepdown). Shown in Table 1, the staging system was modified from Esbrook et al.[12] Throughout the screening process, we kept the fluid nature of the disease progression between stages in consideration, remaining mindful that those patients in stage 2 (moderate severity) were at risk of progression to stage 3 (severe/ICU). Treatment intensity and interventions were selected according to the stage. For example, resistance band exercises were added as a treatment considering the likelihood that a more taxing intervention would be better tolerated by patients in Stage 4 (post-ICU/"recovery").

After the chart review, communication commenced with the interdisciplinary team, including medical doctors, nursing staff, and respiratory therapists to further assess the patient's medical stability and readiness to participate. This process included discussions with the nurses about the cognitive status (i.e. Richmond Agitation–Sedation Scale), the Bedside Mobility Assessment Tool (BMAT) score, and the patient's response to bed-in-chair position.[13,14] These assessments helped the team determine if the patient had skilled PT needs and/or if the patient was hemodynamically stable for participation in therapy. If a patient decompensated with bed-in-chair position, PT was delayed until reassessment the following day. The BMAT is scored on a 4-point scale; a score of 1 indicates bedbound, 2 indicates moderately dependent, 3 indicates minimal assistance required, and a score of 4 indicates independence with gait.[14] As is hospital policy on all floors, nursing staff was asked to initiate mobility if a patient scored a 4 on the BMAT. This reduced the therapist's exposure risk and preserved personal protective equipment (PPE). Physical therapists initiated evaluation on patients who scored a 4 on the BMAT, if the patient required a formal oxygen assessment, or if the patient expressed concerns regarding activity and self-care.

When the algorithm was created, there was global concern for preserving PPE. Therapists were provided single use PPE per CDC[15] and hospital guidelines (Fig. 2). Subjective portions of the evaluation, including patient consent, occurred outside the room when possible to decrease risk of exposure to clinicians and to conserve PPE. Further exposure reduction efforts included limiting in room involvement to discrete disciplines when several were consulted (e.g. PTs and OTs entered separately).

Another consideration for the therapy team was potential exposure to airborne-generating procedures (AGPs), which create an increased risk of airborne transmission of the SARS-CoV-2 virus.[9] Examples of AGPs, which may be used during PT treatment, include the patient's use of high flow nasal cannula (HFNC), high flow high humidity (HFHH), and airway clearance techniques.[9,16,17] In addition, per the Academy of Acute Care Physical Therapy,[7] the use of AGPs may help to delay but does not prevent invasive mechanical ventilation for patients with rapid progression of the disease. To reduce AGPs, the initial medical approach at the DUH was structured in an effort to maintain oxygen requirement to a maximum flow of 6 liters/minute by a nasal cannula.[18] If a patient continued to decompensate, the medical team would transfer the patient to the ICU with a low threshold for escalation to mechanical ventilation. Thus, the initial screening algorithm called for therapists to maintain oxygen saturations >92% on ≤6 liters/minute through a nasal cannula. When treating this population, we took care to remain mindful of the hypoxic nature of the virus.[7,8] Therefore, in conjunction with the oxygen saturation, we used the rate of perceived exertion (RPE) and dyspnea on exertion (DOE) 0 to 10 scales to guide the intensity of activity.[19,20] With the goal of preventing respiratory decompensation, our patients were instructed to maintain ≤6/10 on either scale to minimize effort during functional tasks.[20–23]

With initial uncertainty of potential virus aerosolization while using HFNC and HFHH, the medical team's initial approach was to extubate patients directly to the nasal cannula.[18] As a result, ICU patients who were mechanically ventilated initially remained intubated and sedated for longer periods of time. If the trends in laboratory values did not suggest progression of the disease, PT initiated therapy after a detailed chart review and discussion with the medical team. With a mechanically ventilated patient, the initial algorithm required ventilator and hemodynamic stability for 12 hours to support physical activity.[24,25] Finally, the patient needed to be within a RASS score range that allowed for meaningful participation in PT.[24,25]

TREATMENT CONSIDERATIONS

Once the screening was completed and evaluations proceeded, PT considered particular treatments as they

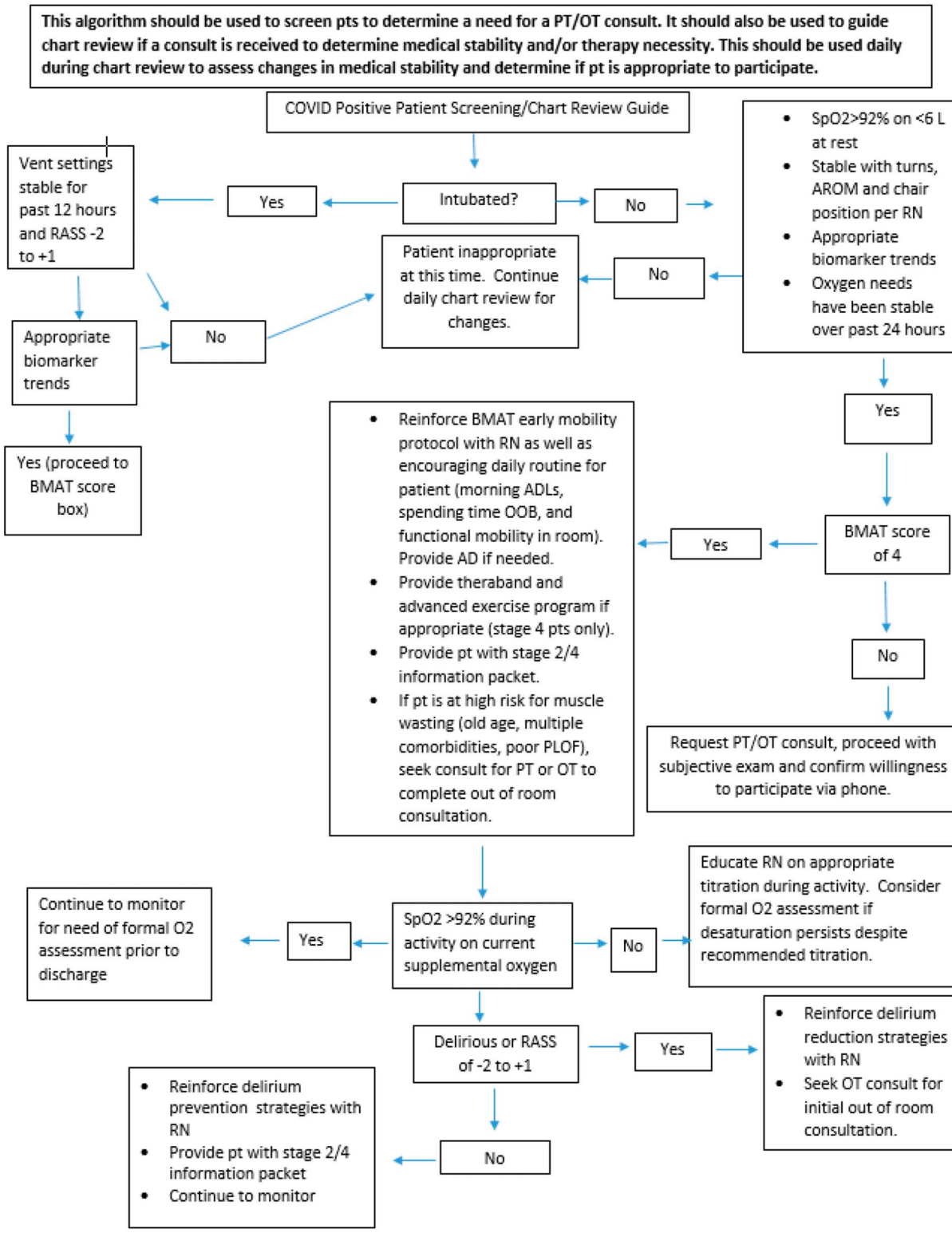

Fig. 1. Original COVID screening algorithm.

related to the clinical features of patients with COVID-19. Despite cough being one of the main symptoms of COVID-19, airway clearance techniques were less frequently considered because the virus was not expected to present with exudate/mucous production.[7,26] However, in cases where patients had an underlying pulmonary disease or could not independently clear their secretions, PT considered initiating airway clearance interventions.[9,27] It is important to note, PT is the discipline that performs most airway clearance treatments at DUH. To reduce exposure to an AGP, we initially prioritized the use of the bed percussion/vibration module, chest physical therapy vest, and positive expiratory pressure devices to help mobilize secretions for active expulsion of the mucus for patients

TABLE 1

Modified From Esbrook et al.[12]

Stage	Clinical Features
Stage 1/mild: early symptoms	Fatigue, shortness of breath, and fever
Stage 2/moderate: respiratory distress	Hypoxia requiring supplemental oxygen and supportive medical therapy
Stage 3/severe: respiratory failure	Mechanical ventilation, sedation/paralytics possible, and proning (ARDS-like presentation)
Stage 4/recovery	Physical, cognitive, and psychological dysfunction

ARDS, acute respiratory distress syndrome.

with airway involvement based on objective assessment. If the PT was required to be in the room for the airway clearance, we educated the patient on cough hygiene, had the patient wear a surgical mask, and maintained physical distancing of more than 6 feet. Further considerations for airway clearance included educating the patient on posture, cough technique, diaphragmatic breathing, huff coughing, and thoracic cage stretching.[27]

Another treatment goal was to optimize oxygenation and reduce the amount of effort required during functional tasks. We educated patients on energy conservation techniques and positioning throughout the day, encouraging the alert and stable patient to spend time in the prone position.[9,28,29] For those patients who were intubated, we emphasized early mobility and progression of activity.[24,28,30] Because of extended isolation and a lack of personal contact, patients who test positive for SARS-CoV-2 are at a higher risk of delirium, depression, and post-traumatic stress.[31] As a result, patients were encouraged to use technology to video conference with family and friends. Depending on the patient's stage of disease severity, as identified in Table 1, education packets were provided.

These educational packets were given to patients who were classified in Stage 2 (moderate disease, on the stepdown floor) and Stage 4 (post-ICU/"recovery"). Patients categorized in Stage 3 did not receive packets based on their ICU status and severe disease state. Each packet contained the following: a sheet outlining what to expect from therapy during/after hospitalization, tips for patients to ensure continued mobility/safety when mobilizing, handouts with illustrated exercises and activities of daily living, pursed lip and diaphragmatic breathing cues, energy conservation techniques, tips for maintaining/improving mental health, coping strategies, a blank page for journaling, and puzzles for cognitive stimulation. In addition, the Stage 4 packets included an illustrated handout of resistance band exercises for general upper extremity strengthening.

Fig. 2. Personal protective equipment.

CHANGES WITH EMERGING EVIDENCE

As with each institution caring for patients with COVID-19, DUH procedures and management strategies changed with the growing understanding of the disease process, treatment approaches, and resource availability. Likewise, our PT approach and screening algorithm was modified to accommodate these developments and to optimize patient-centered care (Fig. 3).

Although one of the initial goals in developing the COVID-19 therapy protocol was PPE conservation, over time, it became clear there would be adequate resources to support any needed services to these patients at DUH. Specifically, DUH used a sterilization technique for N95 masks, accepted donations, made their own "forever" face shields, and procured alternate reusable gowns. These resources allowed for an increased frequency of treatments when appropriate and enabled multiple disciplines to be present when deemed necessary for treatment efficacy, patient safety, and equipment management.

Following guidance from the American Physical Therapy Association,[16] other changes included the allowance of previously identified aerosol-generating oxygen delivery devices during therapy sessions such as HFNC and HFHH. Although use of high flow oxygen devices does cause aerosolization of the virus, proper PPE use and practicing airborne precautions does not significantly increase the exposure risk while caring for patients with COVID-19.[9,16] With emerging evidence and collaboration

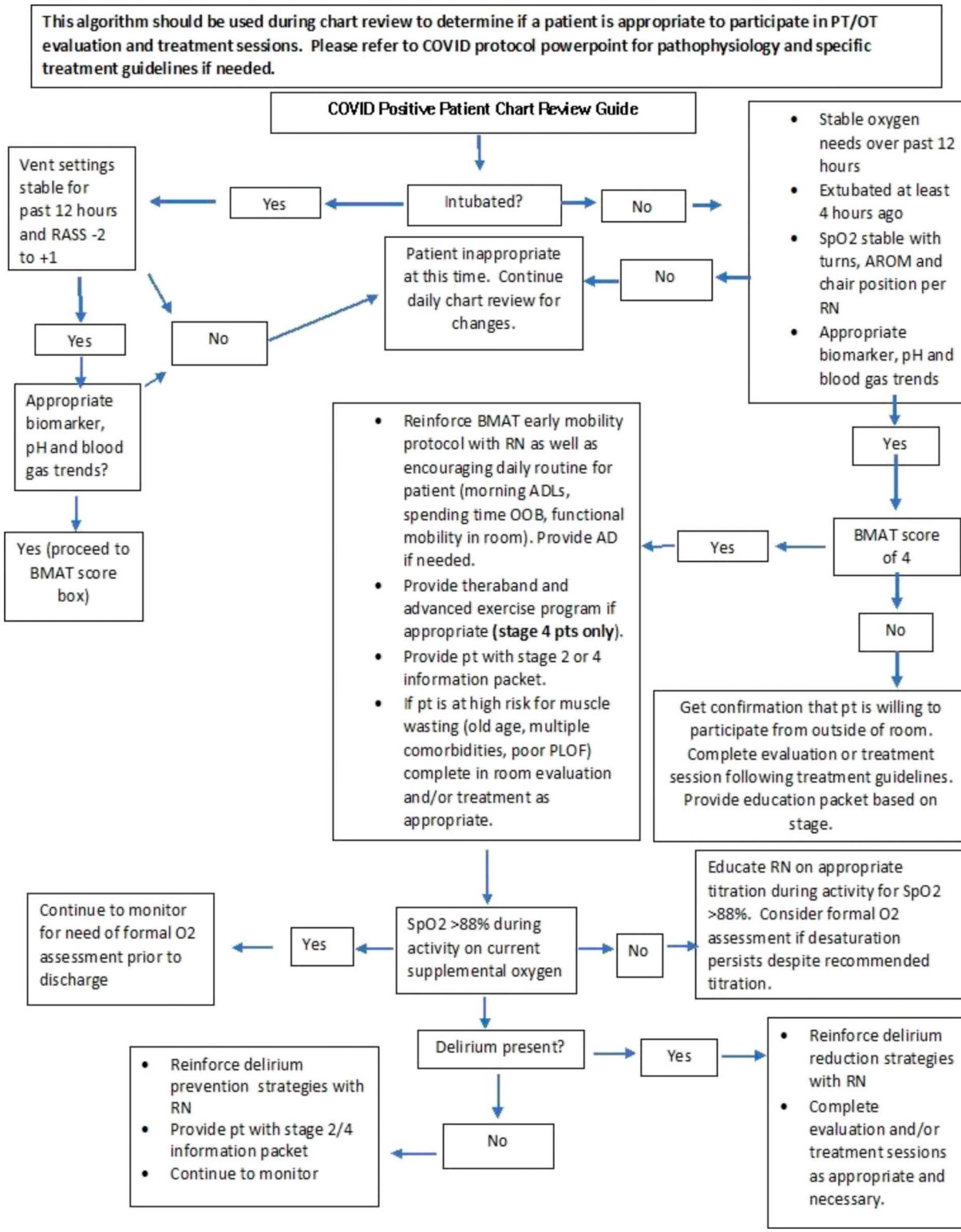

Fig. 3. Revised COVID screening algorithm.

with other large hospital systems, the therapy screening algorithm evolved to allow appropriate FiO2 titration to facilitate exercise, changing the goal of >92% to >88% SpO2 as long as RPE/DOE and other clinical signs indicated it is safe to progress mobility.[20,21,32]

Based on initial resources, we expected to identify a correlation between a patient's laboratory values and biomarkers and their disease severity.[7,10] As a result, some elements of the initial screening algorithm excluded patients from therapy. For instance, a patient would be excluded from therapy if their D-dimer, ferritin, and/or CRP was outside the normal limits. Although a patient might have elevated biomarkers, at DUH, these laboratory values were not routinely measured and primarily

reassessed if the patient had a significant change in medical status. Likewise, routine imaging (i.e., chest x-ray and chest CT) was used less frequently and seemed to be reassessed when there was an evolution in the clinical image which warranted further investigation. Rather, medical teams used the overall clinical image and trajectory of symptoms to guide treatments. Specific laboratory values alone proved less useful in context of critical illness or significant comorbidities. As experience grew, ICU care shifted toward a more traditional model for ARDS management including reducing sedation and allowing patients who are mechanically ventilated to mobilize earlier.[24,25,27,28] Thus, in collaboration with the medical team per their recommendation, we changed our focus of screening and PT intervention decisions to emphasize the patient's stability of oxygen requirement and arterial blood gas (ABG) results.[24,25,28]

Finally, with nursing staff clustering care and being delegated increasing daily tasks from multiple disciplines, some units were unable to prioritize mobility to the extent that was most beneficial for the patients. Overall, nursing staff was more consistent with initiating mobilization with patients who did not have perceived mobility barriers, were functionally stronger, and had lower oxygen requirements. Therefore, the populations most affected by immobility seemed to be those who were either critically ill, had high oxygen needs, were mechanically ventilated, non-English speaking, or from the department of corrections. As a result, we relied on communication with nursing and the medical team to identify these barriers so that PTs could provide care to those patients with such challenges. Our recommendations focused on removing these barriers, when able, by using methods such as keeping the interpreter tablets immediately available for all disciplines, allowing patients from the department of corrections time out of shackles to perform mobility, and relaying oxygen requirements during mobility.

Overall, DUH has not become an epicenter for the pandemic and has not experienced an overwhelming shortage of staff, PPE, ventilators, or ICU beds. These circumstances largely contributed to our ability to provide rehabilitation care. The institution has strived to maintain healthy multidisciplinary communication and continues to focus on patient-centered care, including efforts to ensure that patients are as strong as possible before discharge. Our policies and procedures are subjected to change as our knowledge of the disease process and the potential treatment options evolves.

SUMMARY

When receiving a consult for a PT evaluation for a patient with COVID-19, several factors should go into the chart review process. At the DUH, our initial screening process evolved with clinical experience, published data, and continued advisement from the medical team. The use of a *staging system* to designate disease severity allowed for quick communication between PTs/OTs to describe the patient's clinical features and symptoms. This was helpful when planning and prioritizing PT treatments as well as delegating to the appropriate team (ICU vs stepdown). The screening focus shifted from specific biomarkers toward interpretation of ABG results and the patient's oxygen stability. In addition, while using appropriate PPE and following appropriate airborne precautions, a PT is able to treat a patient with higher oxygen concentrations and flow rates. Keeping in mind that patients may report subjective shortness of breath, PT treatments should consider the patient's RPE and DOE in addition to their oxygen saturation. Helping the patient realize their functional capacity can reinforce mobilization outside of therapy sessions. However, in some patient cases, psychosocial and/or communication factors create a barrier to mobility. Thus, it is important to recognize these barriers and plan accordingly to accommodate them.

Of paramount importance is continued commitment to self-assessment, through evaluation of practices, frequent review of emerging literature, continuous discussions with medical teams to make appropriate adjustments to protocols, and daily analysis of session outcomes. Although this screening algorithm's intended purpose was to guide the appropriateness and timing of PT/OT intervention, we encourage other health care entities to use and adapt this tool to meet their needs. With continued collaboration, therapy teams can repeat this screening process and safely provide quality skilled PT intervention for patients with COVID-19.

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