

**TITLE:** Translating COVID-19 Evidence to Maximize Physical Therapists' Impact and Public Health Response

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**AUTHOR BYLINE:** Elizabeth Dean, Alice Jones, Homer Peng-Ming Yu, Rik Gosselink, Margot Skinner

**AUTHOR INFORMATION:**

E. Dean, PT, PhD, Department of Physical Therapy, Faculty of Medicine, University of British Columbia, 212 Friedman Bldg, 2177 Wesbrook Mall, Vancouver, British Columbia, Canada V6T 1Z3. Address all correspondence to Dr. Dean at: [elizabeth.dean@ubc.ca](mailto:elizabeth.dean@ubc.ca).

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A.Y.M Jones, PT, PhD, FACP, School of Health and Rehabilitation Sciences, The University of Queensland, Brisbane, Australia.

H.P.M. Yu, PT, PhD, Rehabilitation Medical Center, West China Hospital, Sichuan University, Sichuan, China; and Faculty of Physical Therapy, Rehabilitation Medicine College, Sichuan University.

R. Gosselink, PT, PhD, FERS, Department Rehabilitation Sciences, Faculty Movement and Rehabilitation Sciences, Katholieke Universiteit Leuven, Leuven, Belgium.

M. Skinner, PT, PhD, School of Physiotherapy, Division of Health Sciences, University of Otago, Dunedin, New Zealand.

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Coronavirus disease 2019 (COVID-19) has sounded alarm bells throughout global health systems. Late May, 2020, over 100,000 COVID-19 related deaths were reported in the United State, the highest number of any country. This article describes COVID-19 as the next historical turning point in the physical therapy profession's growth and development. The profession has had over a 100-year tradition of responding to epidemics including poliomyelitis; two world wars and geographical regions experiencing conflicts and natural disasters; and the epidemic of noncommunicable diseases (NCDs). The evidence-based role of non-invasive interventions (non-pharmacologic/non-surgical) that hallmark physical therapist practice has emerged as being highly relevant today in addressing COVID-19 in two primary ways. First, despite some unique features, COVID-19 presents as acute respiratory distress syndrome (ARDS) in its severe acute stage. ARDS is well familiar to physical therapists in intensive care units. Body positioning and mobilization, prescribed based on comprehensive assessments/examinations, counter the negative sequelae of recumbency and bedrest; augment gas exchange and reduce airway closure, deconditioning and critical illness complications; and maximize long-term functional outcomes. Physical therapists have an indisputable role across the COVID-19 care continuum. Second, over 90% of individuals who contract and die from COVID-19 have co-morbidities, most notably cardiovascular disease, hypertension, chronic lung disease, type 2 diabetes mellitus, and obesity. Physical therapists need to redouble their efforts to address NCDs by assessing patients for risk factors and manifestations and institute evidence-based health education (smoking cessation, whole-food plant-based nutrition, weight control, physical activity/exercise), and/or support patients' efforts when these are managed by other professionals. Effective health education is a core competency for addressing risk of COVID-19 as well as NCDs. COVID-19 is a wake-up call to the profession, an opportunity to assert its role throughout the COVID-19 care continuum and augment public health initiatives by reducing the impact of the current pandemic.

Coronavirus disease 2019 (COVID-19) caused by the virus SARS-CoV-2 has sounded alarm bells throughout health systems around the world. Late May, 2020, a milestone was reached in the United States when COVID-19 related deaths surpassed 100,000, the highest number of deaths of any country.<sup>1</sup> The pandemic has created unprecedented socioeconomic uncertainty and strain. The race to develop a test for the virus and a vaccine redoubled as the public continued to be urged to handwash regularly, wear face masks and physically distance themselves from others.<sup>2</sup> In the meantime, how the pandemic will play out over the months, if not years, ahead, is a question of considerable debate. While physical therapist services other than in acute care settings have been limited over the past 12 weeks, the pandemic has served as an opportunity to reflect on the profession and how COVID-19 could serve as a catalyst to the profession's further evolution and growth historically, in the interest of those we serve.

In this article, we first describe the development of the profession of physical therapy over more than 100 years, in relation to global crises and indicators. Over the past 70 years, the leading health priority in high-income countries and increasingly in low- and middle-income countries, has been noncommunicable diseases (NCDs) which constitute leading causes of disability and premature death.<sup>3</sup> The NCDs include cardiovascular disease, hypertension, cancer, stroke, chronic lung disease, type 2 diabetes mellitus, and obesity. Commensurate with this escalation, the physical therapy profession has incorporated health promotion and the prevention and management of NCDs into its practices.<sup>4-6</sup> Second, we describe how COVID-19 could similarly shift the trajectory of the profession's growth and development by drawing attention to physical therapists' role across the continuum of care of patients with COVID-19. The care continuum extends from the intensive care unit (ICU) to long after hospital discharge, and to reducing people's susceptibility to COVID-19 which is highly

associated with NCDs risk factors and manifestations,<sup>7,8</sup> by addressing risk factors and manifestations of NCDs in our patients. Patients with underlying co-morbidity have been consistently reported to be more vulnerable to COVID-19 with increased risk of not surviving.<sup>7,8</sup> We conclude that the emergence of COVID-19 could augment the profile of the profession of physical therapy within the health professions and within public health, given physical therapists' role in reducing COVID-19 susceptibility as well as its management from its most severe expression, acute respiratory distress syndrome (ARDS),<sup>9</sup> to long-term functional return long after hospital or ICU stays. Prevention and outcome of COVID-19 could be substantially impacted with exploitation of non-invasive strategies including patient health education, that are subsumed within contemporary physical therapist practice.

### **[H1] Alignment of the Profession's History and Management of COVID-19**

For over 100 years in industrialized countries, physical therapists have specialized in human movement and functioning irrespective of disease and its severity (from the community to the ICU) and chronic disability. It has become the third largest established health profession in the world, excepting dentists and pharmacists who have distinct practice patterns.<sup>10</sup> Physical therapy has been largely hallmarked by its non-invasive approaches, ie, non-pharmacological and non-surgical approaches, and competencies, and has applied this perspective through a history of responding to epidemics including poliomyelitis, two world wars and geographical regions experiencing conflicts, wars and natural disasters, and most recently NCDs.<sup>11</sup> The profession has emerged from a tradition of applying passive interventions to maximize movement and function, to a more holistic comprehensive tradition of exploiting means of maximizing overall health and wellbeing to augment movement and function.<sup>5</sup> Throughout its history, the physical therapist profession has correspondingly responded in terms of maximizing people's health and function by exploiting non-invasive interventions to the

highest degree possible, be it in the ICU, at work, at home, and generally in the community.<sup>11,12</sup> The World Health Organization has long warned that most cases of chronic NCDs managed by health systems today are largely preventable,<sup>13,14</sup> thus aggressive approaches are needed by global health systems and those health professionals practicing within them, to achieve this.

Since the profession's inception, patient education has been a core component of practice as a means of empowering patients to promote their function, health and wellbeing. Lifestyle counselling has warranted being an even greater physical therapist priority during the current global epidemic of NCDs.<sup>15-17</sup> Given physical therapists' goals include maximizing a patient's overall health as well as functional capacity by maximizing immune and circulatory factors to promote healing and repair, these can be maximized by not smoking, plant-based nutrition, moderate alcohol consumption (if any), reduced sedentary behavior, and increased regular physical activity and exercise.<sup>17,18</sup>

Contemporary definitions of physical therapy or physical therapist refer to a health profession and health professional committed to a patient's overall health-related of life and wellbeing and as a means of augmenting functional capacity.<sup>19-21</sup> Correspondingly, physical therapists' scope of practice has become far reaching, eg, outpatients, ambulatory care, medicine and surgical care in acute care hospitals, rehabilitation facilities, private practice, home care, homes for the elderly, centers for children and adults with special needs, schools, and workplaces, as well as on the sports playing field.

The definition of the profession and its values were reflected in the World Health Organization's International Classification of Functioning, Disability and Health (ICF),<sup>22</sup>

Because of this, the ICF has been supported by the World Confederation for Physical Therapy (WCPT)<sup>23</sup> and its member organizations. This was another turning point that advanced patient assessment, evaluation and examination to include broad dimensions beyond limitations of structure and function, to activity and participation, and assessment of contextual factors such as the patient's environment and personal factors including lifestyle behaviors. All the while, the research intensity of the profession has been unprecedented and has grown exponential over the past 40 years in terms of securing competitive grant monies and publishing in high-ranking peer-reviewed journals.

### **[H1] COVID-19 Evidence and Physical Therapist Practice**

About 85% of COVID-19 cases are mild and may even be undetected.<sup>24</sup> Ten percent of those infected will have symptoms requiring medical attention and hospitalization, and about 5% will be admitted to the ICU and require mechanical ventilation. Based on postmortem studies of COVID-19 patients, acute and organizing diffuse alveolar damage and viral persistence in the respiratory tract are predominant histopathologic findings. Such damage constituted the leading cause of death in both ventilated and non-ventilated patients.<sup>25</sup> Over the long-term, such pulmonary insult could contribute to restrictive lung pathology, ie, interstitial pulmonary fibrosis. Given that the majority of patients with COVID-19 who die or have poor outcomes, have one or more NCDs including chronic obstructive lung disease, patients may then present with restrictive lung pathology superimposed on obstructive lung disease. Myocardial alterations are considered reflective of low-grade systemic inflammation with endothelial cell infection and endotheliitis being implicated.<sup>26</sup> Further, microvascular coagulopathy and thrombosis been observed.<sup>27</sup> Cardiac involvement of COVID-19 has highlighted the need for post discharge cardiac care for some patients as well as vigilance regarding cardiovascular status in severe stage of disease.<sup>27</sup> Despite this potential added demand for cardiac

rehabilitation however, the World Health Organization has raised concern about attention to NCDs including rehabilitation having become less of a priority since the onset of the pandemic.<sup>28</sup>

In industrialized countries, the general presentation of COVID-19 in the ICU is not unfamiliar to physical therapists, despite it's having some unique features. Its associated ARDS is being addressed daily by ICU physical therapists worldwide with goals of minimizing the marked hemodynamic and ventilatory consequences of bedrest, maximizing gas exchange with prescriptive body positioning and movement, with the long-term view of minimizing post-discharge disability, and reducing critical illness complications such as myopathies and neuropathies.<sup>29</sup> By maximizing gas exchange and reducing the rate of deconditioning and maximizing conditioning, physical therapy may reduce need for invasive measures such as supplemental oxygen, mode and level of mechanical ventilation, and for vasoactive and other medications. Critically important for ICU physical therapists is the need to monitor cardiovascular as well as pulmonary signs and symptoms, in addition to neurological and level of arousal, musculoskeletal, integumentary, and renal.

Over the past decade, a primary focus of physical therapy-related research has been on 'thriving' long after ICU admission, not simply surviving, given that patients followed for a year or two post discharge frequently have not returned to work or resumed activities of daily living.<sup>30-34</sup> ICU care is among the most expensive in health systems, thus it is tragic for patients and healthcare funders, when this investment has not yielded quality of life dividends beyond survival.



## **[H1] Physical Therapists' Role: Management from the ICU to Community**

The physical therapy community has responded expediently with the publication of practice guidelines for the acute management of patients with COVID-19.<sup>35-37</sup> These guidelines and recommendations largely build on the position statement for physical therapy for adults with critical illness published in 2008.<sup>38</sup> However, that patients in the ICU generally do not do well months, often years, after post-ICU discharge has reinforced the notion that the continuum of care including physical therapy needs to extend for months afterwards.<sup>39-41</sup>

With respect to the continuum of care for patients with COVID-19, physical therapists need to monitor both cardiovascular and pulmonary status and responses to interventions, whether changing body position in the ICU or prescribing a structured exercise program when the patient has returned to the community. In addition, NCD risk factors warrant being systematically assessed and lifestyle education initiated as indicated and supported well beyond hospital stay. The principles and practices of pulmonary rehabilitation, cardiac rehabilitation, or both, need to be applied as indicated based on initial assessment and evaluation of the patient with COVID-19 and responses to exercise.

Lifestyle education is fundamental to the care continuum of the patient with or having recovered from COVID-19. As described in the following section, the systemic anti-inflammatory effects of not smoking, plant-based nutrition, physical activity, reduced unmanageable stress, and optimal sleep may in turn help to boost a patient's immune status and immune response, thereby reduce low grade systemic inflammation.<sup>41,42</sup> Dietary assessment has been specifically advocated for patients to help establish their susceptibility to COVID-19.<sup>43</sup>

## **[H1] Physical Therapists' Role: Reducing Patient COVID-19 Susceptibility**

The association of comorbidities, ie, NCDs, with increased susceptibility to COVID-19 and poorer outcomes including survival, has been well documented.<sup>44,45</sup> Given the prevalence of NCDs in the United States and increasingly around the world, most people have one or more risk factors or manifestations, which makes them vulnerable to COVID-19 infection. This being the era of NCDs,<sup>46</sup> physical therapists have long been urged to exploit lifestyle and behavioral medicine competencies,<sup>47</sup> to reverse NCDs and their risk factors, eg, atherosclerosis, smoking, hypertension, type 2 diabetes mellitus and obesity, often within days or weeks, and atherosclerosis within one year or more.<sup>48,49</sup>

In the United States, 94% of those who have succumbed to COVID-19 have at least one comorbidity, primarily related to lifestyle-related NCDs; in Italy this figure is 99%.<sup>50</sup> Only 1 in 5 Americans engage in 4 or more healthy behaviors, whereas almost half of them participate in fewer than 3 healthy behaviors.<sup>51</sup> Increased participation in numerous healthy behaviors can decrease premature mortality, decrease the burden of chronic diseases, improve life quality, and provide substantial economic benefits.<sup>51</sup> Thus, reducing such susceptibility is critical. Improving lifestyle behaviors has been well documented to prevent, reverse, as well as manage NCDs. A public health practice of targeting a constellation of behaviors as opposed to individual behaviors is needed.<sup>52,53</sup>

Smoking, sedentary behavior, physical inactivity, and obesity are an independent risk factors for metabolic syndrome,<sup>54-56</sup> as well as cardiovascular disease, and all associated with elevated markers of low grade systematic inflammation.

Consistent with the recent report of the Lancet EAT Commission,<sup>57</sup> the American College of Lifestyle Medicine advocates a whole-food plant-based nutrition to maximize health, prevent disease particularly NCDs, reverse these conditions, and reduce disability, premature death and socioeconomic burdens associated with them. Such a dietary regimen has been well established to reduce risk of heart disease, cancer, high blood pressure, type 2 diabetes, and obesity, and their relative, metabolic syndrome,<sup>48</sup> conditions unequivocally linked to more severe COVID infections and poorer outcomes including death. In some instances, such as hypertension and elevated blood glucose, these can be reduced within days or weeks.<sup>58</sup> Atherosclerosis can also be reduced or resolved with dietary changes and exercise, however these effects can take many months.<sup>59,60</sup> Overweight can be addressed with a healthy plant-based nutrient-dense diet and exercise.<sup>61</sup>

Variations in host immune responses might be explained in large part by the healthfulness of the host's lifestyle and behavioral factors including nutritional choices.<sup>41</sup> Thus, immune responses to COVID-19 and mechanisms of hyperinflammation-driven pathology warrant elucidation to best define therapeutic strategies for COVID-19,<sup>62</sup> including non-pharmacologic strategies such as healthy nutrition and exercise. A secondary gain of healthy nutrition could be lower incidence of physical impairment,<sup>63</sup> irrespective of body mass.

## **[H1] The Way Forward**

Physical therapy is no elixir. However, based on its values and commitment to exploiting non-invasive interventions and high-level evidence, it promises to better target the World Health Organization's leading health priorities, including COVID-19 from its first being contracted to beyond hospital stay. Physical therapists can achieve this by addressing COVID-19 in its acute stages, in addition to addressing burgeoning NCDs, primary risk

factors for poor outcome and death, in patients after acute illness. Furthermore, effectively addressing NCD risk factors in all patients, systematically and vigorously, will substantially reduce COVID-19 susceptibility. Thus, non-pharmacological interventions such as those embodied in lifestyle medicine and behavioral medicine warrant being exploited.<sup>64</sup> This includes smoking cessation, whole food plant-based nutrition, weight loss, and exercise which can have superior outcomes to drugs and surgery in addressing NCDs, by addressing their underlying contributing causes, rather than simply reducing signs and symptoms. Healthcare providers have a primary commitment to ‘first doing no harm’ and reducing the need for biomedical intervention as much as possible. Left unbridled, they themselves can become a leading cause of premature death such as in the United States.<sup>65</sup>

Effective health and lifestyle education are unique physical therapist competencies.<sup>47</sup> As the leading established non-invasive health profession in the world, the profession needs to assume a leadership role with respect to including in their practices and entry-level education curricula, health and risk factor assessment and prescribing health promoting interventions or indications for referral to others. Effective health and lifestyle education, ie, lifestyle knowledge translation, warrants being ever more so at the forefront of every physical therapist-patient interaction.<sup>66</sup>

At a broad level, the physical therapy profession needs to ensure that health providers and stakeholders continue to be updated about the profession and practitioners’ competencies as the professions continues to evolve and serve global societies. This will ensure that stakeholders such as legislators, ministries of health and higher education, hospital managers, university administrators, and other health professions, continue to support the physical

therapy profession in its practicing at its highest evidence-informed level, in the interest of health and participation for all.

## **[H1] Conclusion**

The unprecedented global crisis of COVID-19 has become an unprecedented opportunity for the physical therapist profession to continue to advance along its evolving historic trajectory, commensurate with societal and global needs. The profession has an opportunity to respond impactfully. We conclude that the COVID-19 pandemic could well augment the profile of the profession of physical therapy within the health professions and within public health, given its potential role in reducing COVID-19 susceptibility, and its management from its most severe expression, ARDS, to maximizing functional return long after hospital or ICU stays. Prevention and outcome of COVID-19 could be substantially impacted with exploitation of non-invasive strategies including health and lifestyle education and exercise, that are subsumed within contemporary physical therapist practice. This is an unparalleled opportunity for the physical therapist profession to step up to the plate, and to further establish itself among the health professions and demonstrate its worth.

### **Author Contributions**

Concept/idea/research design: E. Dean, A.Y.M Jones, H.P.M. Yu, R. Gosselink

Writing: E. Dean, A.Y.M Jones, R. Gosselink, M. Skinner

Clerical/secretarial support: E. Dean

Consultation: E. Dean, M. Skinner

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UNCORRECTED MANUSCRIPT