

Home and Community-Based Physical Therapist Management of Adults With Post-Intensive Care Syndrome

Physical Therapist Management of Adults With PICS

Musculoskeletal

Perspective

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More than 4 million adults survive a stay in the intensive care unit each year, with many experiencing new or worsening physical disability, mental health problems, and/or cognitive impairments, known as the post-intensive care syndrome (PICS). Given the prevalence and magnitude of physical impairments after critical illness, many survivors, including those recovering from COVID-19, could benefit from physical therapist services after hospital discharge. However, due to the relatively recent recognition and characterization of PICS, there may be limited awareness and understanding of PICS among physical therapists practicing in home healthcare and community-based settings. This lack of awareness may lead to inappropriate and/or inadequate rehabilitation service provision. While this perspective article provides information relevant to all physical therapists, it is aimed toward those providing rehabilitation services outside of the acute and post-acute inpatient settings. This article reports the prevalence and clinical presentation of PICS and provides recommendations for physical examination and outcomes measures, plan of care, and intervention strategies.

The importance of providing patient and family education, coordinating community resources including referring to other healthcare team members, and community-based rehabilitation service options is emphasized. Finally, this perspective article discusses current challenges for optimizing outcomes for people with PICS and suggests future directions for research and practice.

Each year, more than 4 million adults survive a stay in the intensive care unit (ICU), with most experiencing aspects of post-intensive care syndrome (PICS).<sup>1</sup> Particularly relevant for physical therapists are the physical complications of PICS, along with associated delays in return to employment, and substantial caregiver burden. Following critical illness, the majority of adults with PICS, including those who are young to middle aged, return home and struggle with physical problems that are slow to resolve.

Physical therapists, as experts in optimizing movement, are ideally positioned to promote functioning and participation, foster improvements in quality of life, and reduce reliance on inpatient services among people with PICS. Providing physical therapy services for people with PICS is valuable and requires greater understanding of PICS, which is the focus of this article. We report the prevalence and clinical presentation of PICS and provide recommendations for physical examination and outcomes measures, plan of care, and intervention strategies. The importance of providing patient and family education, coordinating community resources including referring to other healthcare team members, and community-based rehabilitation service options is emphasized.

Finally, this perspective article discusses current challenges for optimizing outcomes for people with PICS and suggests future directions for research and practice.

## **Overview of Post-Intensive Care Syndrome**

The PICS term was introduced approximately one decade ago to raise awareness among ICU and post-ICU clinicians, patients, and families regarding problems that commonly occur in survivors of critical illness; in this context, “critical illness” is often used to indicate a patient who received care in an intensive care unit. PICS was defined as “new or worsening impairments in physical, cognitive, or mental health status arising after critical illness and persisting beyond acute care hospitalization.”<sup>2</sup> PICS is not a diagnosis, but rather this term was created to increase awareness of post-ICU impairments prompt screening for specific impairments, and stimulate research into specific morbidities following intensive care. PICS can also affect family members, known as PICS-F.<sup>2</sup> (Tab. 1) By raising awareness, the goal of creating the PICS term was to stimulate screening/diagnosis and treatment for specific impairments that were commonly occurring, but often unrecognized, after critical illness.

While studies of people with acute respiratory distress syndrome (ARDS) represent some of the most robust literature on this topic, the constellation of problems associated with PICS is known to occur in people who have previously experienced critical illness that required treatment in general,<sup>3</sup> medical,<sup>4</sup> surgical,<sup>5</sup> respiratory,<sup>6</sup> trauma,<sup>7</sup> and cardiac<sup>8</sup> ICUs and evidence is emerging that people requiring neurological ICU treatment also incur the problems associated with PICS in addition to those due to their primary neurological dysfunction.<sup>9</sup> While the literature has not revealed the effect on people surviving the COVID-19 pandemic, it is reasonable to expect that those experiencing critical illness will develop the problems associated with PICS.

## Incidence and Clinical Presentation of PICS

Physical complications after critical illness may occur in ~70% of people<sup>5</sup> and include impairments in skeletal muscle strength, pulmonary function, pain,<sup>10</sup> walking ability, activities of daily living (ADL), and instrumental activities of daily living (IADL). These complications can last for months or years after critical illness.<sup>11-14</sup> In a multi-site prospective study, one-third of survivors of acute respiratory distress syndrome (ARDS) had significant limb muscle weakness at hospital discharge, with most survivors demonstrating improvement over the first 12 months of follow-up.<sup>11</sup> This muscle weakness was associated with substantial impairments in survivors' physical functioning and quality of life, with the duration of bed rest in the ICU being independently associated with relative decreases in muscle strength throughout the 24-month follow-up period.<sup>11</sup> The presentation of weakness is variable, as is the effect on physical functioning. Some people with PICS may require total assistance for functioning while others may demonstrate grossly independent ADL but have limitations with stair climbing.

Cognitive impairment is also common and long lasting after critical illness. At one year after discharge, approximately half of survivors of ARDS experience cognitive impairment, including problems with attention, memory, and executive function, with persisting problems demonstrated at 2-year follow-up.<sup>15</sup> Cognitive deficits have also been reported following medical and surgical ICU care, with ~60% of survivors experiencing continued cognitive problems at 1-year follow-up,<sup>16</sup> suggesting impaired cognition following time in the ICU is not unique to ARDS survivors.

Mental health impairments, including depression, anxiety, and post-traumatic stress disorder (PTSD), are commonly reported by survivors of critical illness, with meta-analyses demonstrating pooled prevalences of approximately 30%,  $\geq 32\%$ , and 20%, respectively, over 1-year follow-up.<sup>17-19</sup> Notably, for depression and anxiety symptoms, longitudinal assessments over 1-year follow-up demonstrate little improvement in the prevalence and severity of symptoms in many people.<sup>17,19</sup>

Survivors of critical illness commonly require inpatient healthcare resources. For instance, in one multi-site study, among people surviving for at least two years after ARDS, 80% had at least one inpatient admission to a skilled nursing or rehabilitation facility, or re-admission to acute care hospital during the 2-year follow up.<sup>20</sup> Of those re-admitted to hospital, one-third of readmissions occurred within one month of hospital discharge.<sup>20</sup> Along with inpatient healthcare utilization, survivors of critical illness also frequently require on-going outpatient medical and rehabilitation healthcare services.<sup>21</sup>

The influence of PICS and ongoing healthcare utilization can impact joblessness and associated lost earnings. A recent meta-analysis demonstrated that jobless rates, among those previously employed before critical illness, are approximately 67%, 40%, and 33% at up to 3, 12, and 60 months after hospital discharge.<sup>22</sup> Those who do return to work often experience ongoing challenges, including subsequent job loss, change in occupation, or decreased work hours.<sup>23</sup> Notably, delayed return to work contributes to substantial lost earnings for critical illness survivors and their families. This period of

unemployment was also associated with a shift from private medical insurance to government-funded healthcare coverage.<sup>23</sup>

A New Yellow Flag?

With the increasing population of survivors of critical illness, physical therapists will likely encounter people who are referred for musculoskeletal and neurological impairments that may not be identified as being related to critical illness. We propose that physical therapists include a screening question about ICU care for all people who have had hospitalizations, both recent and remote, due to the long trajectory of recovery. A standard follow up question to “Have you ever been hospitalized?” should be “Did you require care in an ICU? If yes, how many days were you in the ICU and were you on a breathing machine (mechanical ventilator)?” This knowledge represents a “yellow flag,” cautioning the physical therapist that the person has the risk for additional physical limitations, cognitive deficits, and/or mental health symptoms. When such problems are recognized, the use of the screening questions, standardized outcome measures, and interventions presented here should improve the outcome from physical therapy services and the person’s overall health.<sup>24</sup>

### **Physical Examination of an Individual Following ICU Care**

Early referral for physical therapist screening for physical, cognitive, and mental health problems associated with critical illness provides opportunities for prompt identification and management of all aspects of PICS. Due to the long duration of physical impairments after ICU care,<sup>11,13,15,25</sup> early examination using reliable and valid outcome measures supports the timely development and monitoring of an individualized plan of

care. A systematic review, using the International Classification of Functioning, Disability, and Health (ICF) framework,<sup>26</sup> identified the physical impairments, activity limitations, and participation restrictions associated with PICS.<sup>14</sup> Using standardized outcome measures (see existing resources created for survivors of critical illness<sup>27</sup> and for the general population<sup>28</sup>) allows the physical therapist to establish a baseline level of function, ensures optimal documentation of an individual's progress, and may allow comparison to population norms.

Impairments in Body Structures and Functions: Examination and Outcome Measures

**Respiratory system.** Within the first year following critical illness, people surviving general, medical, and surgical ICU services, including people with ARDS, spirometry, maximum inspiratory pressure and diffusion capacity measures are reduced.<sup>12,14,25</sup>

These pulmonary impairments may manifest as clinical symptoms, such as increased work of breathing at rest and during exertion and ineffective cough due to decreases in respiratory muscle strength.<sup>11</sup>

Basic pulmonary function and respiratory muscle strength measures can be longitudinally screened using handheld spirometry and respiratory muscle strength devices (Tab. 2). If impairments in spirometry and/or respiratory muscle strength are present, more comprehensive measures can be accomplished through referral for more comprehensive pulmonary function testing, including diffusion capacity assessment.

Results of these assessments will inform the physical therapist regarding pulmonary function impairment and may inform regarding potential benefit of respiratory muscle training and other pulmonary rehabilitation interventions.



**Muscle strength.** Upper and lower extremity muscle strength is often reduced during the first year following ICU care.<sup>11,12,14</sup> A physical therapist can readily identify ICU-acquired limb muscle weakness.<sup>29</sup> Manual muscle testing is commonly used to assess the strength of six muscle groups bilaterally to determine the Medical Research Council (MRC) Sum Score.<sup>30</sup> A MRC Sum Score <48 is an important criterion for identifying ICU acquired weakness (ICUAW).<sup>31</sup> Muscle strength can be measured longitudinally using manual muscle testing with the MRC scale<sup>32</sup> or a handheld dynamometer (Tab. 2). While both provide reliable measures,<sup>33</sup> we propose the advantages of using dynamometry over the MRC scale is the opportunity to precisely and objectively determine strength, changes in strength longitudinally,<sup>34</sup> and the ability to compare findings with normative reference values.<sup>35-37</sup>

Activity Limitations: Examination and Outcome Measures

**Exercise Capacity.** Numerous studies have reported reduction in exercise capacity, as measured by the six-minute walk test (6MWT; Tab. 2),<sup>38</sup> in the first year following critical illness.<sup>14,39</sup> Factors associated with shorter 6MWT distances in survivors of critical illness are female sex, presence of preexisting comorbidity, and ARDS.<sup>39</sup> The 6MWT has been validated for survivors of critical illness<sup>40</sup> and is predictive of future mortality, hospitalization, and health-related quality of life.<sup>40</sup> The 6MWT minimal important difference (MID) for survivors of ARDS is estimated at 20 to 30 meters.<sup>40</sup> The 6MWT has been used extensively for evaluation of individuals with PICS due to the ability for comparison with reference data sets for the general population. In the outpatient setting, the 6MWT is a robust outcome measure that can be used to assess exercise capacity. Notably, administration of the 6MWT requires more than 30 minutes when following

guidelines that recommend performing two walks, with each preceded by a 15 minute rest break.<sup>38</sup>

Recently, the Academy of Neurological Physical Therapy (ANPT) endorsed the 6MWT as a core measure for the assessment of walking endurance and aerobic capacity and published guidelines for its administration.<sup>41,42</sup> In the ANPT guideline, a 12 meter pathway is used to address the frequent barrier of limited space in clinical settings. However, when using this path that is shorter than traditionally recommended,<sup>38</sup> caution should be taken in comparing walking distances to normative data, as the walking distance achieved will be shorter with a shorter lap length.<sup>38</sup> While therapists may be tempted to choose the 2 minute-walk test (2MWT) as an alternative to a 6MWT, the 2MWT has been shown to be of less value than the 6MWT.<sup>41,43</sup> Even when a person is only able to walk 10 meters, that score on the 6MWT is informative and presents the opportunity to reveal improvement, rather than waiting until later in the person's recovery to initiate use of the 6MWT.

**Gait Speed.** Gait speed, a performance-based measure of physical functioning, is reduced after critical illness and is associated with lean muscle mass in survivors of ARDS survivors.<sup>44</sup> Gait speed is a reliable and valid measure across many populations,<sup>45</sup> including survivors of critical illness.<sup>46</sup> While various methods exist to measure gait speed, the 4-meter walk test (Tab. 2), included in the NIH Toolbox for the Assessment of Neurological and Behavioral Function,<sup>47</sup> is recommended for the measurement of gait speed due to strong evidence for use with survivors of critical illness.<sup>46</sup> The 4-meter walk test has demonstrated predictive validity for outcomes,

including hospitalization and health-related quality of life, and responsiveness consistent with changes in patient-reported physical functioning following critical illness.<sup>46</sup>

**Balance.** There is emerging evidence that survivors of critical illness have an increased risk for injurious falls within the first year following ICU discharge.<sup>48</sup> Balance (Tab. 2) can be measured using one of three outcome measures - static and dynamic standing balance (Berg Balance Scale<sup>49,50</sup>), walking balance (Functional Gait Assessment<sup>51,52</sup>) and balance confidence (Activities-Specific Balance Confidence Scale<sup>53,54</sup>). The physical therapist patient history and discussion with their caregiver will identify the areas of balance are of the most concern and utilize the appropriate balance assessment outcome measure.

Participation Restriction Examination: Outcome Measures

**Activities of daily living.** The incidence of difficulties with ADL is increased during the first year after critical illness, with the most common challenges being with bathing, dressing, and continence.<sup>4,14,55</sup> To examine ADL proficiency, the Katz Index of Independence in ADL (Tab. 2) is a recommended outcome measure.<sup>56,57</sup> The Katz ADL Index can be determined by observation or self- or surrogate-report of an individual's ability to perform six ADL.

**Instrumental activities of daily living.** In the first year following ICU care, new or worsening dependency in IADL is present in many survivors.<sup>14,58</sup> To fully characterize the degree of IADL dependency, the Lawton IADL questionnaire<sup>59</sup> is commonly used.<sup>58</sup> (Tab. 2) The Lawton IADL is a self- or surrogate-report instrument designed to capture information about eight functional skills necessary to live in the community. These skills include ability to use the telephone, shopping, food preparation, housekeeping, laundry,

mode of transportation, and ability to handle finances.<sup>59</sup> Tracking IADL performance will inform ongoing physical therapy interventions and identify people who may benefit from referrals to occupational therapists.

**Return to driving.** During the first year following intensive care, approximately one-third of survivors were unable to return to driving.<sup>14,58</sup> An inability to drive will limit a person's participation in the community, including their ability to return to employment and attend outpatient appointments. Therefore, return to driving is important and can be assessed by simply asking the person if they have returned to driving. (Tab. 2) Referral to an occupational therapist or comprehensive driving evaluation center is appropriate for evaluating ability to return to driving and considering interventions to improve such ability if needed.

**Return to remunerative employment.** During the first year following critical illness, return to remunerative employment was not achieved for 44% - 70% of survivors employed prior to their ICU stay.<sup>14,23</sup> In a study of survivors of ARDS who returned to work, 43% never return to their previous hours worked, 31% experienced a major occupation change, 27% reported reduced effectiveness at work, and 24% subsequently lost their jobs.<sup>60</sup> Given the substantial impact of reduced or loss of remunerative employment, it is essential that skills required for employment be individually assessed and included as part of the rehabilitation program. Referral to occupational therapy<sup>61</sup> and/or occupational medicine<sup>62</sup> should be considered.

Furthermore, recognition that inability to return to work may result from cognitive or

mental health changes associated with critical illness is important and appropriate screening and referral is important.

The collective burden from the physical, mental health, and cognitive problems associated with PICS may influence quality of life. Reduced quality of life is greatest in the first year after the critical illness, and after several years it may trend towards ordinary levels.<sup>63</sup>

### **Screening for Cognitive and Mental Health Impairments**

Cognitive impairment, and depression, anxiety, and post-traumatic stress disorder symptoms are common among people with PICS (Tab. 3).<sup>64</sup> The Montreal Cognitive Assessment (MoCA) is effective for identifying mild cognitive impairments,<sup>65</sup> however, its validity for survivors of critical illness needs further examination.<sup>64,66</sup> To screen for depression and anxiety, the Hospital Anxiety and Depression Scale (HADS)<sup>67</sup> is recommended for survivors of critical illness.<sup>17,19,64</sup> Common symptoms of depression that may overlap with physical impairments (such as fatigue or difficulty sleeping) have been removed from this instrument. Physical therapists may be familiar with screening for depression with the questions “During the past month, have you often been bothered by feeling down, depressed, or hopeless?” and “During the past month, have you often been bothered by little interest or pleasure in doing things?”<sup>68</sup> However, those questions have not been validated for use for people experiencing PICS. To screen for PTSD in survivors of critical illness, the Impact of Events Scale-Revised (IES-R) is recommended,<sup>64,69</sup> A score  $\geq 1.6$  indicates positive screening for clinically important

PTSD symptoms.<sup>69</sup> Cognitive impairment, depression, anxiety, and PTSD negatively impact engagement in physical therapy and physical performance;<sup>70</sup> therefore, identification and referral to a mental health specialist is an important consideration.

## **Evaluation**

Examination data obtained using robust outcome measures is key to developing and monitoring the efficacy of a plan of care. Several strategies increase the utility of the examination. Comparing a person's score on the outcome measure with baseline scores allows for tracking over time to determine the progress (or lack of progress) as well as the impact of the physical therapist's intervention.

Normative values are available for some outcome measures. Comparison of the person's outcome data with norms for the general population allows the physical therapist to determine the person's relative performance for impairment and activity limitation outcome measures. The person's performance, as a percentage of normal values, also can be tracked over time to document response to interventions and may provide a metric that is easily understandable to a survivor of critical illness.

## **Prognosis**

Recovery of physical impairments for individuals with PICS can be slow, and may take months or years.<sup>11,13,25,71</sup> The presence of ICUAW at hospital discharge is associated with reduced physical function and health-related quality of life for up to 24 months

following critical illness.<sup>11,71</sup> Furthermore, muscle weakness at discharge is associated with mortality at one<sup>72</sup> and five year<sup>73</sup> follow up.

## **Plan of Care**

Using the evaluation, a comprehensive rehabilitation plan of care is developed.

Rehabilitation for the physical problems associated with PICS is safe and feasible for home healthcare and outpatient practices,<sup>74,75</sup> specialized PICS clinics,<sup>76</sup> or potentially through the use of telehealth<sup>77</sup> to deliver the rehabilitation program. When developing the plan of care, the physical therapist must also consider the impact of cognitive and/or mental health impairments. To optimize the rehabilitation plan, incorporation of strategies to compensate for problems with memory, problem solving, organization, anxiety, and/or depression are essential. Commonly employed strategies may include repetition of essential messages, establishing comprehension by having the person paraphrase or repeat back to the physical therapist, and providing handouts that communicate instructions in the manner optimal for the person. In some situations, it may be of value to combine the physical and cognitive rehabilitation as improved outcomes in both areas have been observed.<sup>78</sup>

Due to the complex presentation of an individual with PICS, the physical therapist must ensure there is care coordination with an interprofessional team, including integration with the primary care and other relevant physicians (eg, psychiatrist), occupational therapist, mental health counselor, and social worker.

## Interventions

In survivors of critical illness, improvements in quality of life and functioning generally have not been achieved with rehabilitation interventions initiated after ICU discharge.<sup>79</sup> Hence, early intervention may be best; for instance, starting during the ICU stay.<sup>80</sup> Following hospitalization, we recommend that early physical therapy interventions focus on providing compensatory strategies to address problems with performing ADL and functioning. In addition to interventions teaching the person new strategies, caregivers will benefit from learning techniques for assisting in the presence of new and evolving functional limitations. Compensatory interventions may include recommending and instructing in the use of assistive devices (eg, use of a cane or walker), adaptive devices that assist the performance of activities of daily living (eg, raised toilet seat), and instruction in strategies that promote participation in the community (eg, use of accessible parking spaces). Patient and family education should address the recovery process that accompanies PICS, the benefits from accessing physical and emotional support, coping strategies for the prolonged recovery, and strategies for prioritizing activity and participation in the presence of fatigue or reduced stamina.<sup>81</sup>

The elevated risk of hospital readmission associated with a decline in functional status<sup>82</sup> establishes the paramount challenge to the physical therapist managing the person with PICS. Therefore, exercises that promote functioning should predominate early in the course of recovery. Because the physical problems imposed by PICS respond poorly to restorative interventions,<sup>83</sup> we emphasize compensatory training, accompanied by exercises that are relevant (ie, task-specific) to foster improvement in performance and



motor learning. Referral to a dietician is recommended, as strengthening exercises may be more effective with nutritional supplementation.<sup>84</sup> Additionally, an exercise diary should be used.<sup>84</sup> A journal will assist the person with appraising functioning and the improvements achieved with rehabilitation interventions.<sup>81,84</sup>

Once functioning is addressed, the focus should progress to restorative strategies. Major et al (2016)<sup>43</sup> recommended the mode for restorative exercises should integrate exercises that foster strengthening and function, endurance training, circuit and high-intensity interval training, balance training, interventions to increase range of motion, and education of patients and caregivers on the recovery process, as outlined in Table 4. An optimal outcome will require customized exercise interventions with intensity titrated to achieve overload. Aerobic exercise intensity should be at 50 to 70% of heart rate reserve and a Borg Breathlessness score of 3 to 4.<sup>84</sup> Strength training should provide resistance at 70% to 80% of the person's 1 repetition maximum.<sup>85</sup> In addition to informing exercise intensity, routine measurement of cardiac and respiratory responses are necessary due to the risk for decompensation in response to exercise. In summary, anticipation of a dose-dependent response to exercise and titration of exercise interventions to achieve overload while balancing the physiological demand is essential.

#### Patient and Family Education

Patient education is an important component of care that has multiple challenges. Survivors of critical illness experience impairments in cognitive and mental health functioning subsequent to a period of critical illness.<sup>81,86</sup> Therefore particular care must be taken when approaching education with people who are experiencing PICS.

Understanding the nature of health literacy is essential to patient education regardless of the patient population. Health literacy is impacted by multiple factors including age, education level, income level, as well as whether the person is a member of a minority or immigrant population.<sup>87</sup>

Fundamental principles when providing patient education include that information shared be provided in multiple formats including visual (ex. pictures, diagrams), auditory (description using lay terms when possible), and written materials at a reading level of no higher than fifth grade. Many people require kinesthetic approaches as well, which is why writing down information for themselves is helpful. The practitioner should be prepared to review information more than once and consider using a teach back approach where the person “teaches” the physical therapist the information they have learned in order to demonstrate understanding.<sup>88</sup> Awareness of challenges relating to health literacy and other communication barriers is key to successful patient education.

Unique learning needs among people with PICS, and their family members, include identification, understanding, and validation of the problems associated with PICS; reassurance as they address the fears associated with the episode of critical illness and the sequelae of problems; confirmation about their recovery in response to interventions; and where appropriate, referral for social and/or spiritual support.<sup>81</sup>

Education about strategies for prevention and wellness are advantageous, because surviving critical illness is associated with elevated risk for developing new, chronic conditions (eg, heart disease, chronic obstructive pulmonary disease, diabetes).<sup>89</sup>

Beyond the individualized rehabilitation program, people with PICS should be coached to engage in lifestyle changes such as regular aerobic and resistance exercise, and increased physical activity.

Furthermore, critical illness is a family crisis that impacts the health of family members. Physical therapists should recognize that family members are at risk for the development of mental health problems such as anxiety and depression<sup>90</sup> as well as physical health problems related to decreased self-care while caring for a person with PICS.

#### Coordination of Resources

Due to the complex presentation of an individual with PICS, the physical therapist should coordinate services with an interprofessional team. This optimally includes integration with the primary care physician, occupational therapist, speech-language pathologist, pharmacist, mental health counselor, and social worker. Collaboration with additional professionals such as physiatrists, other specialist physicians, psychologists, cardiopulmonary physical therapists or palliative care teams may also be beneficial. This strategy of care coordination exemplifies the culture of team-based collaborative rehabilitation services that support people and families.<sup>76</sup> Additionally, referral to peer-support groups where survivors of critical illness are able to connect with one another to help improve recovery.<sup>76</sup>

## **Community-based Rehabilitation Options for Individuals with PICS**

ICU Follow Up Clinics

One model that can be used to identify people with PICS and coordinate the necessary services are post-ICU clinics. The goals of these clinics are to prospectively identify impairments and create individualized restorative plans for people. ICU follow-up clinic models are emerging in the United States and internationally. Ideally, during an ICU stay, people with factors associated with the development of PICS are identified.<sup>75,78,91</sup> Initiation of services early after hospital discharge is recommended, with planning for timed intervals for follow up from that point forward.<sup>92</sup> Identification of physical, cognitive, and mental health impairments in an interprofessional setting, with providers that include a physical therapist, assists in the establishment of a multifaceted care plan for the unique person.<sup>75</sup>

#### Community-based Services: Home Health and Outpatient Physical Therapy Clinics

Following services in an ICU, the majority (~85%) of people are discharged home from the acute care hospital.<sup>93</sup> While ICU follow up clinics are becoming available, the majority of people returning home will not have access to the specialized services offered by these clinics. We advocate that home healthcare and outpatient physical therapists are ideally positioned to provide and coordinate rehabilitation services for people with PICS. Home healthcare and outpatient practices are located in most communities, thereby providing convenient access to rehabilitation services for individuals experiencing the physical impairments associated with PICS.

Given the potential presentation of impairments in muscle strength, exercise capacity, gait speed, balance, ADL, and IADL that are frequently present in the first year following critical illness,<sup>14</sup> and commonly accompanied by cognitive and mental health problems,

a high level of coordination of services with other health care providers is necessary to achieve optimal outcomes. Due to the evolving understanding of PICS, coupled with limited education about PICS for primary providers,<sup>94</sup> it may be necessary for physical therapists to become the driver for informing the members of the healthcare team about PICS. The physical therapist may need to educate the person's primary care provider and others about the breadth of physical, cognitive, and mental health problems that the person may experience due to PICS. A goal of facilitating the coordination of services is to reduce the hospital readmission rates and greater resource utilization that has been associated with PICS.<sup>24</sup>

## **Future Directions**

With the aging population and improving ICU mortality, the number of survivors of critical illness is growing. The PICS term was introduced relatively recently and ongoing efforts are needed to continue to raise awareness among ICU and post-ICU clinicians, patients, and families regarding problems that commonly occur in survivors of critical illness. Importantly PICS emphasizes the coincident problems that may occur within physical, cognitive, and mental health status of survivors of critical illness. Greater research is needed to understand underlying mechanisms for these problems and to design and evaluate novel interventions to prevent or treat specific impairments commonly experienced by survivors of critical illness. Given the common occurrence of problems across these distinct domains, interventions may need to target any common underlying mechanisms and include multi-component interventions. Considerations for future research in this field includes: (1) focusing on patient-important outcomes, with

use of appropriate outcomes measures that are reliable and valid in this specific population, including conducting new psychometric evaluation of existing instruments and rigorously creating new instruments if needed,<sup>64,95</sup> (2) following survivors longitudinally, throughout the trajectory of recovery, with rigorous, evidence-based methods for retaining participants in these long-term studies,<sup>96</sup> and (3) use of appropriate statistical methods to appropriately address the impact of high mortality on outcome assessment and interpretation of the efficacy of interventions.<sup>97</sup> Through NIH-funded research infrastructure, free resources are available at [www.improveLTO.com](http://www.improveLTO.com) to address each of these three issues. Further research infrastructure and novel research studies are needed, including digital healthcare, and studies with a focus on interprofessional collaboration among physical therapists, other rehabilitation specialists, critical care physicians and nurses, and neuropsychological experts.

## Conclusions

The success of critical care services has resulted in increasing numbers of critical care survivors, with many experiencing PICS. Home healthcare and outpatient physical therapists are ideally positioned to address the reduced functioning and participation associated with PICS. Optimal management begins with the recognition of PICS. We propose that a history of critical illness is a “yellow flag” to recognize an elevated risk for associated physical, cognitive, or mental health impairments. Outcome measures that demonstrate the impact of impairments should be included in the initial examination and in longitudinal follow-up to help understand the pathway of recovery experienced by the person. In anticipation of a prolonged recovery period, early interventions based on

compensatory strategies may prove beneficial. The interconnected nature of the problems associated with PICS often requires collaboration within an interprofessional team to tailor the clinical services to the unique needs and abilities of each person and optimize patient and family outcomes.

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### **Disclosures**

The authors completed the ICMJE Form for Disclosure of Potential Conflicts of Interest and reported no conflicts of interest.

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**Table 1. Clinical Presentation of People and Families with PICS<sup>a</sup>**

PHYSICAL SYMPTOMS	COGNITIVE SYMPTOMS	MENTAL HEALTH SYMPTOMS	PICS-FAMILY SYMPTOMS
Respiratory problems and muscle weakness	Decreased concentration	Depression	Depression
Decreased exercise capacity	Impaired memory	Anxiety	Anxiety
Decreased ability to perform ADLs and IADLs	Difficulty organizing and completing tasks	PTSD	PTSD
Delayed return to driving and employment	Reduced mental processing	Sleep impairments	

<sup>a</sup>PICS = post-intensive care syndrome; PTSD = post-traumatic stress syndrome.

**Table 2. Outcomes Measures for Quantifying the Physical Impairments**

**Associated with PICS<sup>a</sup>**

ICF DOMAIN	PROBLEM	OUTCOME MEASURE
Impairments	Lung function	Spirometry
	Respiratory muscle strength	Pulmonary Function Testing
	Limb muscle strength	Manual Muscle Testing Handheld Dynamometry
Activity Limitations	Exercise capacity	6 Minute Walk Test



	Gait Speed	4-Meter Walk Test
	Balance	Berg Balance Scale Functional Gait Assessment Activities-Specific Balance Confidence Scale
Participation Restrictions	Activities of Daily Living	Katz Index of Independence in ADL
	Instrumental Activities of Daily Living	Lawton IADL
	Return to Driving	Ask "Have you returned to driving?"
	Return to Remunerative Employment	Ask "Have you returned to work?"

<sup>a</sup>ADL = Activities of Daily Living; IADL = Instrumental Activities of Daily Living; ICF = International Classification of Functioning, Disability, and Health; PICS = post-intensive care syndrome.

**Table 3. Cognitive and Mental Health Screening Tools Typically Applied to People with PICS<sup>a,b</sup>**

Domain	Prevalence in PICS	Recommended Tool	Interpretation
Cognition	Up to 81% 3 months after ICU discharge, 42% 1 year after discharge <sup>98</sup>	Montreal Cognitive Assessment (MoCA) <sup>64</sup>	26 – 30 = no impairment <sup>99</sup> 18 – 25 = mild impairment <sup>99</sup> 10 – 17 = cognitive impairment <sup>99</sup> <10 = severe impairment <sup>99</sup>
Depression	~30% <sup>19</sup>	Hospital Anxiety and Depression Scale (HADS) – Depression subscale <sup>19</sup> (7 items)	≤7 = normal <sup>19,67,100</sup> 8-10 = borderline <sup>19,67,100</sup> 11-21 = abnormal <sup>19,67,100</sup>
Anxiety	≥32% <sup>17</sup>	Hospital Anxiety and Depression Scale (HADS) – Anxiety subscale <sup>17</sup> (7 items)	≤7 = normal <sup>17,67,100</sup> 8-10 = borderline <sup>17,67,100</sup> 11-21 = abnormal <sup>17,67,100</sup>
Post Traumatic Stress Disorder (PTSD)	~20% <sup>101</sup>	Impact of Events – Revised (IES-R) <sup>69</sup> (22 items)	≥1.6 positive screening for PTSD <sup>69</sup>

<sup>a</sup>HADS = Hospital Anxiety and Depression Scale; IES-R = Impact of Events–Revised; MoCA = Montreal Cognitive Assessment; PTSD = Post Traumatic Stress Disorder

<sup>b</sup>Based on an international modified Delphi consensus process,<sup>64</sup> HADS and IES-R instruments are recommended for use in research studies evaluating survivors of acute respiratory failure (ARF). No consensus was reached, due to lack of adequate psychometric data in survivors of ARF, for a cognitive screening tool, but MoCA was the instrument with highest level of support by the consensus panel and is noted here. More information on these instruments and this consensus process is available at [www.improveLTO.com](http://www.improveLTO.com).

**Table 4. Physical Therapist Management for People with PICS<sup>a</sup>**

Goals	Screen / Examine for These Problems	Recommended Interventions
Locomotion in home or community	respiratory muscle strength skeletal muscle strength flexibility exercise or activity capacity gait speed balance	Resistance training with nutritional support Stretching Balance training Gait training Interval or endurance training Circuit training
Perform Activities of Daily Living	skeletal muscle strength exercise or activity capacity balance flexibility	Resistance training with nutritional support Stretching Balance training Interval or endurance training Circuit training Task-specific training
Perform Instrumental Activities of Daily Living	skeletal muscle strength exercise or activity capacity gait speed balance cognitive or mental health function	Resistance training with nutritional support Balance training Gait training Interval or endurance training Circuit training Consultation with mental health clinician
Driving or return to work	capacity for activity cognitive or mental health function	Interval or endurance training Consultation with driving specialist Consultation with vocational specialist Consultation with mental health clinician
Pain relief	skeletal muscle strength flexibility Postural changes	Pain management Resistance and postural training Stretching

Participation in community activities and recreation	respiratory muscle strength skeletal muscle strength exercise or activity capacity gait speed balance driving Pain	Resistance training with nutritional support Stretching Balance training Gait training Interval or endurance training Circuit training Task-specific training
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**Strategies for optimal outcome:**

- Routinely measure cardiac and respiratory responses for safety during all exercise and activities.
- Titrate exercise intensity to 50-70% of heart rate reserve and Borg Breathlessness score of 3-4 out of 10. Information about heart rate intensity and calculation of heart rate reserve is available from the Academy of Neurologic Physical Therapy at <http://www.neuropt.org/practice-resources/locomotor/resources>.
- Titrate resistance training intensity to resistance at 70% to 80% of the patient's 1 repetition maximum, or with form deterioration around 8 repetitions.
- Reinforce patient and family education on the process of recovery from PICS.
- Use a team-based approach, with collaboration with the primary care physician, and other clinicians, as needed, including: specialist physician(s), dietician, occupational therapist, speech-language pathologist, pharmacist, mental health counselor, social worker, and psychologist.

<sup>a</sup>PICS= post-intensive care syndrome.