

LITERATURE REVIEW**Rehabilitation Assessment of Post Intensive Care Syndrome**

Kevin Triangto¹, Peggy², Dian Marta Sari³, Nury Nusdwinuringtyas², Siti Chandra Widjanantie⁴

¹ Department of Prevention and Cardiovascular Rehabilitation, National Cardiovascular Center Harapan Kita Hospital Jakarta, Indonesia

² Department of Physical and Rehabilitation Medicine, Faculty of Medicine Universitas Indonesia, Cipto Mangunkusumo Hospital Jakarta, Indonesia

³ Department of Physical and Rehabilitation Medicine, Faculty of Medicine Universitas Padjadjaran, Dr. Hasan Sadikin General Hospital Bandung, Indonesia

⁴ Department of Physical and Rehabilitation Medicine, Faculty of Medicine Universitas Indonesia, Persahabatan Hospital Jakarta, Indonesia

ABSTRACT

The awareness of symptoms experienced after intensive care seems to have been extensively studied since the pandemic wave in 2019. The persistence or new occurrence of symptoms after intensive care is diagnosed as post-intensive care syndrome (PICS). The syndrome encloses multiple system disorders and therefore requires thorough utilization of assessment tools, which unfortunately have no standard clinical practice guidelines. Several subdomains that are crucial for assessment include physical, cognitive, and mental functions. Other aspects to be observed include quality of life, physical examination, and functional tests, particularly those related to reduced cardiorespiratory endurance. This review aimed to highlight the most notable list of tools to be used in the outpatient assessment setting of PICS. The feasibility was also tested in a recent workshop session for physical medicine and rehabilitation specialists, and it was possible to accomplish this in 30 min. Until a consensus is reached on the PICS assessment, it is strongly suggested that practitioners exercise these tools and use them in daily practice.

Keywords: Assessment tools, Post Intensive Care Syndrome, Quality of life, Rehabilitation

Correspondence Detail:**Kevin Triangto**

Department of Prevention and Cardiovascular Rehabilitation, National Cardiovascular Center Harapan Kita Hospital Jakarta, Indonesia
Email: kevintriangto14@gmail.com

INTRODUCTION

As we live through the pandemic, more patients seem to have experienced staying in the intensive care unit (ICU).^{1,2} With the recent medical advances, mortality of critical illness in the ICU has declined throughout the years, however this has brought another aspect to be overlooked, that is the wellbeing of ICU survivors.³ Many of the ICU survivors reported difficulty to return to normal daily activities due to physical and cognitive impairments, some of which also mentioned mental health problems after ICU discharge, and eventually affects their quality of life.^{3,4} All these impairments are collectively diagnosed as post-intensive care syndrome (PICS), whereas recent studies had shown how PICS could also affect caregiver and family members, this current study would focus the review specifically the PICS patients.⁵ The physical medicine and rehabilitation field have played important role in managing ICU patients and reducing the length of stay by preventing further deconditioning.^{5,6} In the case of PICS rehabilitation, up until today, it is still debatable whether a brief outpatient setting is sufficient to tackle the multitude of problems identified in PICS patients.⁷⁻⁹

Therefore this review is aimed to highlight suggestions towards establishing a PICS rehabilitation outpatient clinic which could be directly applicable to a daily practice setting.

PICS Rehabilitation

PICS is defined as a collective manifestation of several health domains, namely physical impairments, cognitive impairments, and mental health problems, that occur during or after ICU stay, and could possibly persists beyond discharge from the ICU.^{2,3} There are also a rising number of studies showing how quality of life (QoL) reduces in PICS subjects depending on their onset.^{4,10} Ultimately this would create a significant impact towards productivity, and studies had shown unemployment after PICS.^{9,10} Several etiologies have been identified, such as interventional, environmental, and psychological factors, owing to the treatments done inside ICU, such as mechanical ventilation, numerous intravenous lines, limited mobility, unfamiliar environment and sounds, also tremendous stressful situation.^{2,9,11} The challenge of rehabilitation would be how to achieve productivity in an allotted time after the patient has been discharged from ICU and are targeted to return to work.^{4,12-14} However, it should be well known that formulating rehabilitation goals for PICS patient would be challenging if these specific domains are not addressed initially.¹⁴

Physical impairments generally occur in 30% of PICS survivor and are identified 3-6 months after ICU admission.^{2,10} Studies had shown that 6-minute walk test outcomes are reduced below the normal level at a significant rate.^{3,15} On the other hand, 33% of patients experience

partial dependence for their activities of daily living (ADL) following their critical illness after 12 months.¹² Prolonged ICU stay is identical with prolonged immobilization, in which catabolism would dominate and finally resulting in ICU-acquired weakness (ICU-AW) occurring in approximately 30-50% of ICU patients.^{12,16} Generally, the weakness comprises of slower gait speed, and weaker handgrip strength, which in overall would affect their quality of life.⁴

Cognitive impairments were also often reported, accruing up to 40% of ICU survivors, and could persist until 1 year for some patients.^{3,12} Common cognitive sub-domains affected are the attention, concentration, memory, processing speed, and executive function.^{3,17} Surely each of the above problems should be addressed and intervened separately, however the real challenge is to identify each of these sub-domains, which could take longer time of assessment, and inaccurate assessment would lead to unachieved rehabilitation target.¹⁷ Cognitive impairment could usually be identified before and during critical illness, as risk factors towards cognitive decline includes delirium, and shock.^{3,17} Additionally, during ICU stay, invasive mechanical ventilation, sepsis, and acute respiratory distress syndrome would also lead to cognitive decline owing to prolonged hypoxia and inadequate brain perfusion.³

Psychological domain is also known to affect PICS patients.^{2,12} Despite the aforementioned stressful environment, PTSD still appear less common as compared to anxiety and depression in PICS patients.^{3,12} Studies had shown that at 12-14 months after intensive care, anxiety are

generally more prevalent, and even it could coexist with depression.^{3,12} Previous mental problems would also be a predisposing factor prior to ICU admission, on top of the stressful experience throughout the ICU stay.^{9,18}

Assessment Tests

Knowing the proportion of each domain would be essential in setting an accurate and achievable goal for each PICS patient.^{5,7} Prior studies have shown that using a PICS-specific questionnaire is an effective strategy for screening the affected domains in each patient.¹⁹ As of now, the PICS questionnaire is available only in English, while the Indonesian version is still in the process of translation.

i. PICS Questionnaire

The PICS questionnaire consisted of 18 statements regarding symptoms on a 4 point Likert scale, with 0 as never occurred, and 3 as always felt.¹⁹ Participants were expected to grade these symptoms whether it's a new appearance, or worsening of prior symptoms. More importantly, the PICS questionnaire can stratify the severity of PICS domains, namely physical, mental, and cognitive domains.¹⁹ The sensitivity of the PICS questionnaire in identifying these domains has greatly boosted its utilization in daily practice and made it possible to screen outpatients.

ii. Physical Function

The timed up and go test (TUG) is very popular in screening neurologic patients for both balance and coordination.^{20,21} This test only requires a standard chair, a cone, and a stopwatch, as the subject is requested to stand up, walk a forward stride of 3 m, and return to their seat with the whole timing measured in

seconds.²⁰ Recent studies also accommodate gait speed in TUG, which differs between the first stride and returning stride, owing to the fact that turning requires good overall brain-muscle coordination to succeed.²² Overall, the TUG may seem simple to perform, but in the light of PICS screening, the test boasts high functionality to screen physical and cognitive parameters. It is not surprising that TUG has often been studied, and obtained a cut-off value of 12.8 seconds to show low physical performance in PICS.⁵ Although the TUG also could screen executive functioning, there are no official reports of this utilization. Some studies modified the TUG to also require subjects hold a cup of water in both hands to assess decision making, executive function, balance, and coordination.²²

iii. Cognitive Function

It is a common practice to perform outpatient screening of cognitive function.^{9,18} Two of the most commonly utilized questionnaires are the Mini Mental State Examination (MMSE) and the Montreal Cognitive Assessment (MoCA), both of which could be used to stratify cognitive function in PICS.^{5,23} Between the two tests, a study by Ciesielka had shown that MMSE might have limitations between gender, ethnicity, and age, whereas MoCA does not. Their meta-analysis concluded that MoCA is more sensitive than MMSE to identify Mild Cognitive Impairment in geriatric subjects.²³ Among the subdomains that could be measured, executive functioning seemed to be most affected by cognitive interventions compared to language, orientation, memory, and visuospatial ability.^{17,24} Despite the obvious cognitive decline observed, studies on therapeutic cognitive intervention on

PICS are still scarce.^{3,17} For Indonesian daily practice, several publications have shown superiority in MoCA, accruing to the fact that the Indonesian version has already been released and utilized in prior studies.²⁵ Across the results, it was shown that global cognitive function had the most observable improvement after cognitive intervention in PICS subjects. Despite its inconclusive findings in providing improvement, the global cognitive function score could be assessed by both MoCA and MMSE despite slight variations.^{14,16}

iv. Mental Function

In the light of assessing mental function, addressing both anxiety and depression are the key requirement to be utilized in PICS assessment.^{2,6} Numerous studies had administered Hospital Anxiety and Depression Scale (HADS), Impact of Event Scale-Revised (IES-R), and Patient Health Questionnaire-9 (PHQ-9), all of which could be used in many instances of medical research.⁵ Among these commonly used scales, HADS seem to be superior and sensitive in assessing both anxiety and depression in PICS.^{3,5} This self-test questionnaire comprises of 14 questions alternating between anxiety and depression subdomain, and subjects are required to respond in a score on a scale of 3 to 0.⁹ Higher values warrant higher severity, therefore the maximum score for each subdomain is 21, with a cut-off of 0-7 being normal, 8-10 is mild, 11-15 considered as moderate, and finally 16-21 classified as severe.⁹ Additionally, the self-administered nature of this questionnaire makes it easy to administer during both inpatient and outpatient setting. Studies administering the HADS seem to be sensitive in screening mental health problems for PICS,

accounting up to 47% in a post burn, and 30% in prolonged ventilator, however only one study showed higher proportion of depression, whereas most studies only highlighted the presence of depression or anxiety combined.^{3,9}

v. Health Related Quality of Life

Although the subdomains of PICS do not include health related quality of life (HRQoL), prior meta-analysis had effectively displayed how early rehabilitation could provide better HRQoL in PICS.¹⁶ Despite the modest number of samples, the results are consistent that better HRQoL are seen with intervention, accruing the utilization of both EuroQoL-5 Dimension (EQ-5D), Short Form 36 (SF36), or other questionnaires used in each center.¹⁶ Although most questionnaires on HRQoL are self-administered, the EQ-5D has been famous for its simplicity and brief time required, thus it's more suitable to be utilized in PICS as the assessment involves numerous questionnaires.^{4,16} There are two versions of EQ-5D used, namely the 5 Level (EQ-5D-5L) and 3 Level (EQ-5D-3L), accruing for the number of statements that are placed in order of severity and could better illustrate the patients' current condition, higher statements have better health state as compared to the lowest one.²⁶ Five dimensions are described in each subdomain, in which the subject is required to tick one box that best describes their condition today for the appropriate subdomain, namely mobility, self-care, usual activities, pain/discomfort, and anxiety/depression.²⁶ After answering these, patient will be faced with EQ visual analogue scale (EQ VAS), where they should draw a cross through a linear vertical scale numbered 0-100, with 100 as the best health condition, and 0 being worst.²⁶

Although there is a method to combine all the values into a single index value, each of these data could be gathered and presented to show improvements for each patient, like what has been done by prior studies in PICS.^{5,6} Both EQ-5D-5L and EQ-5D-3L have both been translated to Bahasa Indonesia, thus could be seamlessly used during daily practice.²⁷

vi. Functional Testing

Due to the nature of rehabilitation medicine, functional testing is an integral part of a comprehensive physical and rehabilitation practice which is hard to be detached.^{5,6,15} Appropriate functional testing for PICS mostly revolves around the assessment of cardiorespiratory endurance, and musculoskeletal strength.^{5,15} In the above set of tests, TUG had been done and could give a gross impression on musculoskeletal strength, balance, and coordination, however the test is still unable to illustrate cardiorespiratory endurance.^{2,5} The gold standard of cardiorespiratory endurance functional testing remains to be cardiopulmonary exercise testing with gas exchange (CPET), however this could not be performed regularly, and field testing seemed to be more appropriate as it would better emphasize walking ability, as well as build patients' confidence.^{2,5,6} The six-minute walk test (6MWT) has been effectively used in the cardiovascular field, and it has good correlation with the CPET for heart failure patients with chief complaint of fatigue, thus are comparable to PICS subjects.^{15,28,29} This test requires patient to walk a linear distance of 30 meter before turning back and forth in a 6-minute duration, accounting the total distance travelled as the output.²⁹ Subsequently, at times when the

6MWT could not be performed due to patient's inability to walk 10 meters without stopping, then the Short Physical Performance Battery (SPPB) could still be administered.³⁰ The SPPB total score had shown good correlation to 6MWT and have been considered an effective adjunct to 6MWT in describing a patients' overall level of physical function.³⁰ The SPPB comprises of three physical tests representing distinct subdomains: the first being balance test using a tandem-gait stance; following it is the four-meter gait speed test that requires the patient to walk a 6-meter linear track and measure time required to travel the middle 4 meter; and finally for muscle strength is to measure the time required to perform five times sit-to-stand test.³⁰ During the pandemic era, sit to stand test has been a great tool to be performed in a teleconsultation setting, it is however, still unable to replace the vastly used 6MWT.³¹ All in all, performing both 6MWT and SPPB seem to be feasible when performed in a daily practice setting, thus should be exercised effectively in handling PICS.⁵

Outpatient Setting

Despite some studies had shown the presence of outpatient PICS clinic, there are still no clear guideline as to which tools that must be used in an outpatient PICS assessment.^{3,4,9} Some studies had shown the results of consensus between experts, revealing that many assessment instruments can be used if

it could cover the subdomains of physical, cognitive, mental, and quality of life.^{6,8} Recent findings revealed the importance of addressing the mental health problems of PICS patients' family members, enclosing the PICS continuum.^{6,32} All these studies then encourage the establishment of a concrete brief assessment in an outpatient clinic, with variations based on each center.⁸

During the recent annual scientific meeting of the Indonesian Physical Medicine and Rehabilitation Association, a cardiorespiratory workshop session attempted to construct a brief outpatient assessment of PICS in rehabilitation clinics. The assessment itself is expected to be done in 30 minutes, its components include two main parts: the first being self-assessment tools, namely the PICS questionnaire, HADS, EQ-5D-3L; followed by doctor's physical assessments such as MoCA Ina, TUG; and finally functional tests SPPB and 6 MWT, as illustrated in Table 1.^{5,8} Additional physical assessment based on the underlying disease should also be done, especially respiratory and musculoskeletal organs, and other organs based on current presenting symptoms. Indonesian version of the integrated tools is accessible in the supplementary material.⁸ More studies should be done to evaluate the integrated tools' efficacy, and accuracy to be used for evaluation during follow-up sessions.^{5,7}

Table 1. Outpatient Tools Illustration for PICS Assessment

No	Assessment	Domains Assessed	Target
1	History taking	Subjective on Physical / Cognitive / Mental	post intensive care complaints and focus
2	PICSQ	Physical / Cognitive / Mental	Obtain which domain is affected
3	Physical Examination	Physical	General assessment and focused exam on respi, or neuro and musculoskeletal
<i>Specific functional tests</i>			
4	Timed up and go (TUG) / Handgrip	Physical	Physical assessment of general coordination and handgrip strength
5	Montreal Cognitive Assessment Indonesian version (MoCA-INA)	Cognitive	Self-Assessment of cognitive function and classify subdomains affected
6	Hospital Anxiety and Depression Scale (HADS)	Mental	Self-Assessment of and grade severity of anxiety and depression
7	EQ-5D-5L	Quality of Life	Self-Assessment of quality of life after PICS
<i>Advanced Functional Test</i>			
8	Short Physical Performance Battery (SPPB)	Physical	Physical Assessment of balance, gait speed, and brief muscle endurance
9	Six Minute Walk Test (6MWT)	Physical	Physical assessment of cardiorespiratory endurance in six minute

CONCLUSION

PICS has been considered an important diagnosis in the continuum of intensive care rehabilitation.² More studies have shown the importance of assessing the subdomains of PICS, namely physical, cognitive, and mental disorders, all of which could be first identified by using a specific PICS questionnaire.¹⁹ Each of the subdomains should then be more thoroughly described by using assessment tools; recommended selections

include TUG for physical, MoCA for cognitive, HADS for mental health, and EQ-5D for quality of life. Additionally, functional tests such as the SPPB and 6 MWT could be performed to better illustrate the overall function in PICS subjects, signifying the role of both musculoskeletal and cardiorespiratory function.⁵ Through the nature of each PICS assessment tool, selecting appropriate instruments will make it possible to perform all these assessments in a single outpatient visit.^{8,9} Therefore, PICS assessment in an outpatient

setting is greatly encouraged for a comprehensive rehabilitation experience.

ACKNOWLEDGEMENTS

The authors would like to acknowledge all parties, including the Brawijaya University Physical Medicine and Rehabilitation lecturers and residents, who facilitated the success of our cardiorespiratory workshop session in the annual scientific meeting of the Indonesian Physical Medicine and Rehabilitation Association.

REFERENCE

1. Brown SM, Bose S, Banner-Goodspeed V, Beesley SJ, Dinglas VD, Hopkins RO, et al. Approaches to addressing post-intensive care syndrome among intensive care unit survivors A Narrative Review. *Ann Am Thorac Soc.* 2019 Aug 1;16(8):947–56.
2. Rawal G, Yadav S, Kumar R. Post-intensive care syndrome: An overview. *J Transl Int Med.* 2017 Jun 30;5(2):90–2.
3. Carel D, Pantet O, Ramelet AS, Berger MM. Post Intensive Care Syndrome (PICS) physical, cognitive, and mental health outcomes 6-months to 7 years after a major burn injury: A cross-sectional study. *Burns.* 2023 Feb 1;49(1):26–33.
4. Nakamura K, Kawasaki A, Suzuki N, Hosoi S, Fujita T, Hachisu S, et al. Grip strength correlates with mental health and quality of life after critical care: A retrospective study in a post-intensive care syndrome clinic. *J Clin Med.* 2021 Jul 2;10(14).
5. Nakanishi N, Liu K, Kawauchi A, Okamura M, Tanaka K, Katayama S, et al. Instruments to assess post-intensive care syndrome assessment: a scoping review and modified Delphi method study. *Crit Care.* 2023 Dec 1;27(1).
6. Nakanishi N, Liu K, Kawakami D, Kawai Y, Morisawa T, Nishida T, et al. Post-intensive care syndrome and its new challenges in coronavirus disease 2019 (Covid-19) pandemic: A review of recent advances and perspectives. Vol. 10, *Journal of Clinical Medicine.* MDPI; 2021.
7. He M, Wang Y, Zhang XY, Wang CQ, Zheng XT, Yang YH, et al. Developing strategy of clinical practice guidelines for post-intensive care syndrome: a systematic review of 14 practice guidelines and 10 consensus statements. Unpublished study. 2020.
8. Spies CD, Krampe H, Paul N, Denke C, Kiselev J, Piper SK, et al. Instruments to measure outcomes of post-intensive care syndrome in outpatient care settings – Results of an expert consensus and feasibility field test. *J Intensive Care Soc.* 2021 May 1;22(2):159–74.
9. Farley KJ, Eastwood GM, Bellomo R. Long-term follow-up after prolonged mechanical ventilation A feasibility study of functional status and follow-up clinic preferences of patients at high risk of post intensive care syndrome. Vol. 44, *Anaesth Intensive Care.* 2016.
10. Yakubi M, Devlin A, Venn R, Hodgson L. 1-year outcomes of patients admitted to critical care with treatment limitations: A dual-centre observational study. *J Intensive Care Soc.* 2023 Aug 1;24(3):338–40.
11. Ramnarain D, Pouwels S, Fernández-Gonzalo S, Navarra-Ventura G, Balanzá-

Martínez V. Delirium-related psychiatric and neurocognitive impairment and the association with post-intensive care syndrome—A narrative review. Vol. 147, *Acta Psychiatrica Scandinavica*. John Wiley and Sons Inc; 2023. p. 460–74.

12. Lee A, Zeleznik H, Coffey Scott J, Erie S, York Fatima NA, Needham D, et al. Perspective Home and Community-Based Physical Therapist Management of Adults With Post-Intensive Care Syndrome [Internet]. Vol. 100, *Physical Therapy* 1062 *Physical Therapy*. 2020.

13. Sayde GE, Stefanescu A, Hammer R. Interdisciplinary Treatment for Survivors of Critical Illness due to COVID-19: Expanding the Post-Intensive Care Recovery Model and Impact on Psychiatric Outcomes. *J Acad Consult Liaison Psychiatry*. 2023;64(3):226–35.

14. Mehlhorn J, Freytag A, Schmidt K, Brunkhorst FM, Graf J, Troitzsch U, et al. Rehabilitation interventions for postintensive care syndrome: A systematic review. Vol. 42, *Critical Care Medicine*. Lippincott Williams and Wilkins; 2014. p. 1263–71.

15. Parry SM, Nalamalapu SR, Nunna K, Rabiee A, Friedman LA, Colantuoni E, et al. Six-Minute Walk Distance After Critical Illness: A Systematic Review and Meta-Analysis. Vol. 36, *Journal of Intensive Care Medicine*. SAGE Publications Inc.; 2021. p. 343–51.

16. Fuke R, Hifumi T, Kondo Y, Hatakeyama J, Takei T, Yamakawa K, et al. Early rehabilitation to prevent postintensive care syndrome in patients with critical illness: A systematic review and meta-analysis. Vol. 8, *BMJ Open*. BMJ Publishing Group; 2018.

17. Muradov O, Petrovskaya O, Papathanassoglou E. Effectiveness of cognitive interventions on cognitive outcomes of adult intensive care unit survivors: A scoping review. Vol. 34, *Australian Critical Care*. Elsevier Ireland Ltd; 2021. p. 473–85.

18. Vlak JH, Van Genderen ME, Schut A, Verkade M, Wils EJ, Gommers D, et al. Patients suffering from psychological impairments following critical illness are in need of information. *J Intensive Care*. 2020 Jan 9;8(1).

19. Jeong YJ, Kang J. Development and validation of a questionnaire to measure post-intensive care syndrome. *Intensive Crit Care Nurs*. 2019 Dec 1;55.

20. Portnoy S, Reif S, Mendelboim T, Rand D. Postural control of individuals with chronic stroke compared to healthy participants: Timed-Up-and-Go, Functional Reach Test and center of pressure movement. *Eur J Phys Rehabil Med*. 2017;53(5):685–93.

21. Hafsteinsdóttir TB, Rensink M, Schuurmans M. Clinimetric Properties of the Timed Up and Go Test for Patients With Stroke: A Systematic Review. *Top Stroke Rehabil*. 2014;21(3):197–210.

22. Kusumaningsih W, Triangto K, Salim H, Benlidayi IC. Gait turning patterns in chronic ischemic stroke males and its relationship to recovery: A cross-sectional study. *Medicine (United States)*. 2019;98(38).

23. Ciesielska N, Sokołowski R, Mazur E, Podhorecka M, Polak-Szabela A, Kędziora-Kornatowska K. Is the Montreal Cognitive Assessment (MoCA) test better suited than the Mini-Mental State Examination (MMSE) in mild cognitive impairment (MCI) detection among people aged over 60? Meta-analysis. *Psychiatr Pol*. 2016;50(5):1039–52.

24. Statsenko Y, Habuza T, Gorkom KN Van, Zaki N, Almansoori TM, Al Zahmi F, et al. Proportional Changes in Cognitive Subdomains During Normal Brain Aging. *Front Aging Neurosci.* 2021 Nov 15;13.

25. Rambe AS, Fitri FI. Correlation between the Montreal cognitive assessment-Indonesian version (MoCA-Ina) and the Mini-mental state examination (MMSE) in elderly. *Open Access Maced J Med Sci.* 2017;5(7):915.

26. Thompson AJ, Turner AJ. A comparison of the EQ-5D-3L and EQ-5D-5L. *Pharmacoeconomics.* 2020;38:575–91.

27. Purba FD, Hunfeld JAM, Iskandarsyah A, Fitriana TS, Sadarjoen SS, Ramos-Goñi JM, et al. The Indonesian EQ-5D-5L value set. *Pharmacoeconomics.* 2017;35:1153–65.

28. Deka P, Pozehl BJ, Pathak D, Williams M, Norman JF, Alonso WW, et al. Predicting maximal oxygen uptake from the 6 min walk test in patients with heart failure. *ESC Heart Fail.* 2021 Feb 10;8(1):47–54.

29. Giannitsi S, Bougiakli M, Bechlioulis A, Kotsia A, Michalis LK, Naka KK. 6-minute walking test: a useful tool in the management of heart failure patients. *Ther Adv Cardiovasc Dis.* 2019;13:1753944719870084.

30. Kitai T, Shimogai T, Tang WHW, Iwata K, Xanthopoulos A, Otsuka S, et al. Short physical performance battery vs. 6-minute walking test in hospitalized elderly patients with heart failure. *European Heart Journal Open.* 2021;1(1):oeab006.

31. Nunez-Cortes R, Rivera-Lillo G, Arias-Campoverde M, Soto-Garcia D, Garcia-Palomera R, Torres-Castro R. Use of sit-to-stand test to assess the physical capacity and exertional desaturation in patients post COVID-19. *Chron Respir Dis.* 2021;18:1479973121999205.

32. Lobato CT, Camões J, Carvalho D, Vales C, Dias CC, Gomes E, et al. Risk factors associated with post-intensive care syndrome in family members (PICS-F): A prospective observational study. *J Intensive Care Soc.* 2023;24(3):247–57.