Journal of Physiotherapy ■ (2020) ■–■

AUSTRALIAN PHYSIOTHERAPY ASSOCIATION

Journal of PHYSIOTHERAPY

journal homepage: www.elsevier.com/locate/jphys

Invited Topical Review

Physiotherapy management for COVID-19 in the acute hospital setting: clinical practice recommendations

Peter Thomas [a], Claire Baldwin [b], Bernie Bissett [c,d], Ianthe Boden [e], Rik Gosselink [f,g], Catherine L Granger [h], Carol Hodgson [i], Alice YM Jones [j,k], Michelle E Kho [l,m,n], Rachael Moses [o], George Ntoumenopoulos [p], Selina M Parry [q], Shane Patman [r], Lisa van der Lee [s]

[a] *Department of Physiotherapy, Royal Brisbane and Women's Hospital, Brisbane, Australia;* [b] *Caring Futures Institute, College of Nursing and Health Sciences, Flinders University, Adelaide, Australia;* [c] *Physiotherapy, University of Canberra, Australia;* [d] *Physiotherapy Department, Canberra Hospital, Canberra, Australia;* [e] *Physiotherapy Department, Launceston General Hospital, Launceston, Australia;* [f] *Department of Rehabilitation Sciences, KU Leuven, Belgium;* [g] *Department of Critical Care, University Hospitals Leuven, Leuven, Belgium;* [h] *Department of Physiotherapy, The University of Melbourne, Australia;* [i] *Australian and New Zealand Intensive Care Research Centre, Monash University, Melbourne, Australia;* [j] *School of Health and Rehabilitation Sciences, The University of Queensland, Brisbane, Australia;* [k] *Discipline of Physiotherapy, Faculty of Health Sciences, The University of Sydney, Sydney, Australia;* [l] *School of Rehabilitation Science, McMaster University, Hamilton, Canada;* [m] *St Joseph's Healthcare, Hamilton, Canada;* [n] *The Research Institute of St Joe's, Hamilton, Canada;* [o] *Physiotherapy, Lancashire Teaching Hospitals, Preston, United Kingdom;* [p] *Physiotherapy, St Vincent's Hospital, Sydney, Australia;* [q] *Department of Physiotherapy, The University of Melbourne, Melbourne, Australia;* [r] *School of Physiotherapy, The University of Notre Dame Australia, Perth, Australia;* [s] *Physiotherapy Department, Fiona Stanley Hospital, Perth, Australia*

KEY WORDS

Physical therapy
Coronavirus
COVID-19

ABSTRACT

This document outlines recommendations for physiotherapy management for COVID-19 in the acute hospital setting. It includes: recommendations for physiotherapy workforce planning and preparation; a screening tool for determining requirement for physiotherapy; and recommendations for the selection of physiotherapy treatments and personal protective equipment. It is intended for use by physiotherapists and other relevant stakeholders in the acute care setting caring for adult patients with confirmed or suspected COVID-19. **[Thomas P, Baldwin C, Bissett B, Boden I, Gosselink R, Granger CL, Hodgson C, Jones AYM, Kho ME, Moses R, Ntoumenopoulos G, Parry SM, Patman S, van der Lee L (2020) Physiotherapy management for COVID-19 in the acute hospital setting: clinical practice recommendations. *Journal of Physiotherapy* ■:■–■]**

© 2020 Australian Physiotherapy Association. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a new coronavirus that emerged in 2019 and causes coronavirus disease 2019 (COVID-19).[1,2] SARS-CoV-2 is highly contagious. It differs from other respiratory viruses in that it appears that human-to-human transmission occurs approximately 2 to 10 days prior to the individual becoming symptomatic.[2–4] The virus is transmitted from person to person through respiratory secretions. Large droplets from coughing, sneezing or rhinorrhoea land on surfaces within 2 m of the infected person. SARS-CoV-2 remains viable for at least 24 hours on hard surfaces and up to 8 hours on soft surfaces.[5] The virus is transferred to another person through hand contact on a contaminated surface followed by touching the mouth, nose or eyes. Aerosol airborne infected particles created during a sneeze or cough remain viable in the air for $\leq$ 3 hours.[5] These airborne particles of SARS-CoV-2 can then be inhaled by another person or land on the mucosal membranes of the eyes.

Individuals with COVID-19 can present with an influenza-like illness and respiratory tract infection demonstrating fever (89%), cough (68%), fatigue (38%), sputum production (34%) and/or shortness of breath (19%).[4] The spectrum of disease severity ranges from asymptomatic infection or mild upper respiratory tract illness through to severe viral pneumonia with respiratory failure and/or death. Current reports estimate that 80% of cases are asymptomatic or mild; 15% of cases are severe (infection requiring oxygen); and 5% are critical requiring ventilation and life support.[2]

Preliminary reports indicate that chest radiographs may have diagnostic limitations in COVID-19.[6] Clinicians need to be aware that lung computed tomography (CT) scan findings often include multiple mottling and ground-glass opacity.[7] Lung ultrasound is also being used at the bedside with findings of multi-lobar distribution of B-lines and diffuse lung consolidation.[8]

The current mortality rate is 3 to 5%, with new reports of up to 9%, which is in contrast to influenza at around 0.1%.[2] The rates of admission to an intensive care unit (ICU) are approximately 5%.[4] Around 42% of patients admitted to hospital will require oxygen therapy.[4] Based on emerging data, individuals at highest risk of developing severe COVID-19 disease requiring hospitalisation and/or ICU support are those who are older, male, have at least one

https://doi.org/10.1016/j.jphys.2020.03.011
1836-9553/© 2020 Australian Physiotherapy Association. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Box 1. Physiotherapy workforce planning and preparation recommendations.

1.1	Plan for an increase in the required physiotherapy workforce. For example: • allow additional shifts for part-time staff • offer staff the ability to electively cancel leave • recruit a pool of casual staff • recruit academic and research staff, staff who have recently retired or are currently working in non-clinical roles • work different shift patterns (eg, 12-hour shifts, extended evening shifts)
1.2	Identify potential additional staff who could be deployed to areas of higher activity associated with COVID-19 admissions (eg, infectious disease ward, ICU and/or high dependency unit and other acute areas). Prioritise staff for deployment who have previous cardiorespiratory and critical care experience.
1.3	Physiotherapists are required to have specialised knowledge, skills and decision-making to work within ICU. Physiotherapists with previous ICU experience should be identified by hospitals and facilitated to return to ICU.[12]
1.4	Physiotherapists who do not have recent cardiorespiratory physiotherapy experience should be identified by hospitals and facilitated to return to support additional hospital services. For example, staff without acute hospital or ICU training may facilitate rehabilitation, discharge pathways or hospital avoidance for patients without COVID-19.
1.5	Staff with advanced ICU physiotherapy skills should be supported to screen patients with COVID-19 assigned to physiotherapy caseloads and provide junior ICU staff with appropriate supervision and support, particularly with decision-making for complex patients with COVID-19. Hospitals should identify appropriate physiotherapy clinical leaders to implement this recommendation.
1.6	Identify existing learning resources for staff who could be deployed to ICU. For example: • eLearning packages (eg, Clinical Skills Development Service for Physiotherapy and Critical Care Management)[18] • local physiotherapy staff ICU orientation • PPE training
1.7	Keep staff informed of plans. Communication is crucial to the successful delivery of safe and effective clinical services.
1.8	Staff who are judged to be at high risk should not enter the COVID-19 isolation area. When planning staffing and rosters, the following people may be at higher risk of developing more serious illness from COVID-19 and should avoid exposure to patients with COVID-19. This includes staff who: • are pregnant • have significant chronic respiratory illnesses • are immunosuppressed • are older (eg, > 60 years) • have severe chronic health conditions such as heart disease, lung disease, diabetes • have immune deficiencies, such as neutropenia, disseminated malignancy and conditions or treatments that produce immunodeficiency[12] It is recommended that staff who are pregnant avoid exposure to COVID-19. It is known that pregnant women are potentially at increased risk of complications from any respiratory disease due to the physiological changes that occur in pregnancy. There is not enough currently available information on the impact of COVID-19 on a pregnant woman or her baby.
1.9	Workforce planning should include consideration for pandemic-specific requirements such as additional workload from donning and doffing PPE, and the need to allocate staff to key non-clinical duties such as enforcing infection control procedures.[12]
1.10	Consider organising the workforce into teams that will manage COVID-19 versus non-infectious patients. Minimise or prevent movement of staff between teams. Liaise with local infection control services for recommendations.
1.11	Be aware of and comply with relevant international, national, state and/or hospital guidelines for infection control in healthcare facilities. For example, World Health Organization 'Guidelines for infection prevention and control during health care when novel coronavirus infection is suspected'.[19]
1.12	Senior physiotherapists should be involved in determining the appropriateness of physiotherapy interventions for patients with confirmed or suspected COVID-19 in consultation with senior medical staff and according to a referral guideline.
1.13	Identify hospital-wide plans for allocation/cohorting patients with COVID-19. Utilise these plans to prepare resource plans that may be required. For example, Table 2 below is an example of a resource plan for ICU physiotherapy.
1.14	Identify additional physical resources that may be required for physiotherapy interventions and how the risk of cross-infection can be minimised (eg, respiratory equipment; mobilisation, exercise and rehabilitation equipment; and equipment storage).
1.15	Identify and develop a facility inventory of respiratory, mobilisation, exercise and rehabilitation equipment and determine the process of equipment allocation as pandemic levels increase (ie, to prevent movement of equipment between infectious and non-infectious areas).
1.16	It should be recognised that staff will likely have an increased workload with a heightened risk of anxiety both at work and home.[12] Staff should be supported during and beyond the active treatment phases (eg, via access to employee assistance programs, counselling and facilitated debriefing sessions).
1.17	Consider and/or promote debriefing and psychological support; staff morale may be adversely affected due to the increased workload, anxiety over personal safety and the health of family members.[12]

COVID-19 = coronavirus disease 2019, ICU = intensive care unit, PPE = personal protective equipment.

co-existing comorbidity, higher severity of illness scores (measured via SOFA scores), elevated D-dimer levels and/or lymphocytopenia.[2,4,9–11]

Purpose

This document has been prepared to provide information to physiotherapists and acute care healthcare facilities about the potential role of physiotherapy in the management of hospital-admitted patients with confirmed or suspected COVID-19.

Physiotherapists who work in primary healthcare facilities are likely to have a role in the management of patients admitted to hospital with confirmed or suspected COVID-19. Physiotherapy is an established profession throughout the world. Globally, physiotherapists often work in acute hospital wards and ICUs. In particular, cardiorespiratory physiotherapy focuses on the management of acute and chronic respiratory conditions and aims to improve physical recovery following an acute illness. Physiotherapy may be beneficial in the respiratory treatment and physical rehabilitation of patients with COVID-19. Although a productive cough is a less common symptom (34%),[4] physiotherapy may be indicated if patients with COVID-19 present with copious airway secretions that they are unable to clear independently. This may be evaluated on a case-by-case basis and interventions applied based on clinical indicators. High-risk patients may also benefit, for example: patients with existing comorbidities that may be associated with hypersecretion or ineffective cough (eg, neuromuscular disease, respiratory disease and cystic fibrosis). Physiotherapists who practise in the ICU environment may also provide airway clearance techniques for ventilated patients

Box 2. Whom should physiotherapists treat?

2.1	The respiratory infection associated with COVID-19 is mostly associated with a dry and non-productive cough; lower respiratory tract involvement usually involves pneumonitis rather than exudative consolidation.[20] In these cases, respiratory physiotherapy interventions are not indicated.
2.2	Respiratory physiotherapy interventions in hospital wards or ICU may be indicated for patients who have confirmed or suspected COVID-19 and concurrently or subsequently develop exudative consolidation, mucous hypersecretion and/or difficulty clearing secretions.
2.3	Physiotherapists will have an ongoing role in providing interventions for mobilisation, exercise and rehabilitation (eg, in patients with comorbidities creating significant functional decline and/or (at risk of) ICU-acquired weakness).
2.4	Physiotherapy interventions should only be provided when there are clinical indicators, so that staff exposure to patients with COVID-19 is minimised. Unnecessary review of patients with COVID-19 within their isolation room/areas will also have a negative impact on PPE supplies.
2.5	Physiotherapists should meet regularly with senior medical staff to determine indications for physiotherapy review in patients with confirmed or suspected COVID-19 and screen according to set/agreed guidelines (Table 1 provides a suggested framework).
2.6	Physiotherapy staff should not be routinely entering isolation rooms, where patients with confirmed or suspected COVID-19 are isolated or cohorted, just to screen for referrals.
2.7	Options for screening patients via subjective review and basic assessment whilst not being in direct contact with the patient should be trialled first whenever possible (eg, calling the patient's isolation room telephone and conducting a subjective assessment for mobility information and/or providing education on airway clearance techniques).

COVID-19 = coronavirus disease 2019, ICU = intensive care unit, PPE = personal protective equipment.

who show signs of inadequate airway clearance and they can assist in positioning patients with severe respiratory failure associated with COVID-19, including the use of prone position to optimise oxygenation.[12]

Given the intensive medical management for some COVID-19 patients – including prolonged protective lung ventilation, sedation and use of neuromuscular blocking agents – those who are admitted to ICU may be at high risk of developing ICU-acquired weakness;[13]

Table 1
Screening guidelines for physiotherapy involvement with COVID-19.

Physiotherapy intervention	COVID-19 patient presentation (confirmed or suspected)	Physiotherapy referral
Respiratory	Mild symptoms without significant respiratory compromise (eg, fever, dry cough, no chest x-ray changes)	Physiotherapy interventions are not indicated for airway clearance or sputum samples[20] No physiotherapy contact with patient
	Pneumonia presenting with features: • a low-level oxygen requirement (eg, oxygen flow $\leq$ 5 l/min for $SpO_2 \geq 90\%$) • non-productive cough • or patient coughing and able to clear secretions independently	Physiotherapy interventions are not indicated for airway clearance or sputum samples No physiotherapy contact with patient
	Mild symptoms and/or pneumonia AND co-existing respiratory or neuromuscular comorbidity (eg, cystic fibrosis, neuromuscular disease, spinal cord injury, bronchiectasis, chronic obstructive pulmonary disease) AND current or anticipated difficulties with secretion clearance	Physiotherapy referral for airway clearance Staff use airborne precautions If not ventilated, where possible, the patient should wear a surgical mask during any physiotherapy
	Mild symptoms and/or pneumonia AND evidence of exudative consolidation with difficulty clearing or inability to clear secretions independently (eg, weak, ineffective and moist sounding cough, tactile fremitus on chest wall, wet sounding voice, audible transmitted sounds)	Physiotherapy referral for airway clearance Staff use airborne precautions If not ventilated, where possible, the patient should wear a surgical mask during any physiotherapy
	Severe symptoms suggestive of pneumonia/lower respiratory tract infection (eg, increasing oxygen requirements; fever; difficulty breathing; frequent, severe or productive coughing episodes; chest x-ray, CT or lung ultrasound changes consistent with consolidation)	Consider physiotherapy referral for airway clearance Physiotherapy may be indicated, particularly if weak cough, productive, evidence of pneumonia on imaging and/or secretion retention Staff use airborne precautions If not ventilated, where possible, the patient should wear a surgical mask during any physiotherapy Early optimisation of care and involvement of ICU is recommended
Mobilisation, exercise and rehabilitation	Any patient at significant risk of developing or with evidence of significant functional limitations • eg, patients who are frail or have multiple comorbidities impacting their independence • eg, mobilisation, exercise and rehabilitation in ICU patients with significant functional decline and/or (at risk of) ICU-acquired weakness	Physiotherapy referral Use droplet precautions Use airborne precautions if close contact required or possible aerosol generating procedures If not ventilated, where possible, the patient should wear a surgical mask during any physiotherapy

COVID-19 = coronavirus disease 2019, CT = computed tomography, ICU = intensive care unit, SpO_2 = oxyhaemoglobin saturation.

ARTICLE IN PRESS

Table 2
Example of an ICU physiotherapy resource plan.

Phase	Bed capacity	Description and location of patients	Physiotherapy staffing	Equipment for respiratory care, mobilisation, exercise and rehabilitation
Business as usual	22 ICU beds and six HDU beds	All patients within existing ICU and HDU physical resources	Four FTE	• six stretcher chairs • 10 high-back sitting chairs • three rollators • one tilt table • two cycle ergometers • steps/blocks • bariatric equipment
Tier 1	Expansion with additional number of ICU beds provided (eg, opening previously non-commissioned beds)	Fewer than four patients with COVID-19 Patients with COVID-19 only allocated to beds with reverse flow isolation rooms There is limited availability of reverse flow rooms within most hospitals	Additional one FTE per four ICU beds[21] One senior physiotherapist will screen patients with COVID-19 in consultation with an ICU medical consultant Patients will be provided treatment in isolation rooms	If needed, one stretcher chair allocated and quarantined for use One tilt table quarantined for use with COVID patients. Quarantined in room, or cleaned and located for storage in isolation Additional respiratory equipment
Tier 2	Further expansion to maximum ICU capacity	The number of patients with COVID-19 exceeds the availability of isolation rooms, necessitating the care of infectious patients outside the confines of a negative pressure room Infectious patients will be cohorted on the open ward of the ICU Normal ICU admission/non-infectious patients located in a separate part of ICU	Calculation for additional FTE as above Infections ICU Pod physiotherapists allocated, including one senior physiotherapist Non-infections ICU Pod physiotherapists allocated, including one senior physiotherapist Infectious and non-infectious staff allocated, including weekends	Additional chair resources may be required Keep separate sets of chairs, tilt tables, etc, for infectious and non-infectious patients
Tier 3	Additional ICU beds created outside of ICU (eg, in anaesthetic areas)	Surge in patients with COVID-19 exceeds the capacity of the allocated infectious area Bed allocation for patients with COVID-19 allocated across the entire ICU Non-infectious satellite ICU will be established in a separate location	Calculation for additional FTE as above	Additional chair resources may be required Keep separate sets of chairs, tilt tables, etc, for infectious and non-infectious patients
Tier 4	Additional beds created across clinical areas in other parts of the hospital (eg, cardiology, operating theatres)	Large-scale emergency	Calculation for additional FTE as above	Additional chair resources may be required Keep separate sets of chairs, tilt tables, etc, for infectious and non-infectious patients

COVID-19 = coronavirus disease 2019, FTE = full-time equivalent, HDU = high dependency unit, ICU = intensive care unit.

ARTICLE IN PRESS

Table 3
Specific respiratory interventions.

Aerosol-generating procedures	The following procedures create an airborne risk of transmission of COVID-19: • intubation/extubation • bronchoscopy • high-flow nasal oxygen use • non-invasive ventilation • tracheostomy • cardiopulmonary resuscitation prior to intubation[12,22] Additional aerosol-generating procedures related to physiotherapy techniques are outlined in Box 3.
High-flow nasal oxygen	This is a recommended therapy for hypoxia associated with COVID-19, as long as staff are wearing optimal airborne PPE.[12] At flow rates 40 to 60 l/min, high-flow nasal oxygen does carry a small risk of aerosol generation. The risk of airborne transmission to staff is low when optimal PPE and other infection control precautions are being used.[23] Negative pressure rooms are preferable for patients receiving high-flow nasal oxygen.[12] Respiratory support via high-flow nasal oxygen should be restricted to patients in airborne isolation rooms only. Limiting the flow rate to no more than 30 l/min might reduce potential viral transmission.
Non-invasive ventilation	Routine use is not recommended[12] because current experience with COVID-19 hypoxic respiratory failure has a high associated failure rate. If used (eg, with a patient with chronic obstructive pulmonary disease or post-extubation), it must be provided with strict airborne PPE.[12]
Oxygen therapy	Treatment targets may vary depending on the presentation of the patient. • For patients presenting with severe respiratory distress, hypoxaemia or shock, $SpO_2 > 94\%$ is targeted.[23] • Once a patient is stable, the SpO_2 target is $> 90\%$ in non-pregnant adults[24] and 92 to 95% in pregnant patients.[23] • In adults with COVID-19 and acute hypoxaemic respiratory failure, the SpO_2 target should not be maintained $> 96\%$.[22]
Nebulisation	The use of nebulised agents (eg, salbutamol, saline) for the treatment of non-intubated patients with COVID-19 is not recommended because it increases the risk of aerosolisation and transmission of infection to healthcare workers in the immediate vicinity. Use of metered-dose inhalers or spacers is preferred where possible.[12] If a nebuliser is required, liaise with local guidelines for directions to minimise aerosolisation (eg, use of a Pari Sprint with inline viral filter). Use of nebulisers, non-invasive ventilation, high-flow nasal oxygen and spirometry should be avoided and agreement to their use sought from senior medical staff.[20] If deemed essential, airborne precautions should be used.

COVID-19 = coronavirus disease 2019, FTE = full-time equivalent, HDU = high dependency unit, ICU = intensive care unit, PPE = personal protective equipment, SpO_2 = oxyhaemoglobin saturation.

this may worsen their morbidity and mortality.[14] It is therefore essential to initiate early rehabilitation after the acute phase of respiratory distress in order to limit the severity of ICU-acquired weakness and promote rapid functional recovery. Physiotherapy will have a role in providing exercise, mobilisation and rehabilitation interventions to survivors of critical illness associated with COVID-19 in order to enable a functional return to home.

Scope

This document focuses on the adult acute hospital setting. The recommendations for physiotherapists are outlined below in two sections: workforce planning and preparation, including screening to determine indications for physiotherapy; and delivery of physiotherapy interventions, including both respiratory and mobilisation/rehabilitation as well as personal protective equipment (PPE) requirements.

It is recognised that physiotherapy practices vary across the world. When using these recommendations, the scope of practice within the local context should be considered.[a]

Methods

Consensus approach

A group of international experts in cardiorespiratory physiotherapy came together to rapidly prepare clinical recommendations for physiotherapy management of COVID-19. The author group initially convened on 20 March 2020 to discuss the urgent need for worldwide acute care physiotherapy guidance in relation to COVID-19. Efforts were quickly prioritised to develop specific guidance for physiotherapists in the acute care settings.

The AGREE II framework[15] was used to guide development, and recognising the expediency of this work required pragmatic and transparent reporting. Conduct was modelled after the GRADE Adolopment Process[16] and Evidence to Decision framework[17] for recommendations and decision-making. Expertise includes ICU and acute inpatient physiotherapy (all), rehabilitation interventions in the ICU (all), physiotherapy administration (PT, IB, RG, AJ, RM, ShP), systematic reviews (PT, CB, CG, RG, CH, MK, SP, ShP, LV), guideline methodology (PT, IB, RG, CH, MK, RM, ShP, LV), and epidemiology (CH, MK).

Through a web search and personal files, recently developed guidelines for COVID-19 management of critically ill patients were identified from international agencies (eg, World Health Organization), critical care professional societies or groups (eg, Australia and New Zealand Intensive Care Society, Society of Critical Care Medicine/European Society of Intensive Care Medicine), or physiotherapy professional societies up to 21 March 2020. These guidelines were used to inform the consensus recommendations developed in conjunction with expert opinion of the authorship group.

A priori it was decided to develop consensus recommendations, given the time-sensitive nature of the guidance. It was agreed that a $\geq$ 70% agreement was required for a recommendation. On Friday 20 March 2020 the lead author (PT) circulated draft recommendations to all authors. All authors independently returned comments to the lead author. The lead author (PT) collated all comments for further discussion. All recommendations were discussed in a teleconference on 22 March 2020. Fourteen people participated in the development process and 66 recommendations were developed. A consensus of $> 70\%$ was achieved for all items. Further discussion was focused on greater clarity in wording and/or reduction of items where overlap occurred.

Endorsement for the recommendations was sought from physiotherapy societies, physiotherapy professional groups and the World Confederation for Physical Therapy. The recommendations were circulated to these groups on 23 March 2020, requesting endorsement; endorsements will be updated as they are confirmed.

Strengths and limitations

This document has several strengths. It responds to an urgent need for clinical guidance for acute care physiotherapists worldwide.

Table 4
Additional respiratory interventions in the ICU.

Intubation and mechanical ventilation	Patients with worsening hypoxia, hypercapnia, acidaemia, respiratory fatigue, haemodynamic instability or those with altered mental status should be considered for early invasive mechanical ventilation if appropriate.[12] The risk of aerosol transmission is reduced once a patient is intubated with a closed ventilator circuit.[12]
Recruitment manoeuvres	Although current evidence does not support the routine use of recruitment manoeuvres in non-COVID-19 ARDS, they could be considered in patients with COVID-19 on a case-by-case basis.[12]
Prone positioning	Anecdotal reports from international centres dealing with large numbers of critically ill patients with COVID-19-related ARDS suggest that prone ventilation is an effective strategy in mechanically ventilated patients.[12] In adult patients with COVID-19 and severe ARDS, prone ventilation for 12 to 16 hours per day is recommended.[22,23] It requires sufficient human resources and expertise to be safely performed, to prevent known complications including pressure areas and airway complications.
Bronchoscopy	Bronchoscopy carries a significant risk of aerosol generation and transmission of infection. The clinical yield is thought to be low in COVID-19 and unless there are other indications (such as suspected atypical/opportunistic superinfection or immunosuppression) it is strongly advised to avoid the procedure.[12]
Suctioning	Closed inline suction catheters are recommended.[12]
Sputum samples	In a ventilated patient, tracheal aspirate samples for diagnosis of COVID-19 are sufficient and bronchoalveolar lavage is not usually necessary.[12] Any disconnection of the patient from the ventilator should be avoided to prevent lung decruitment and aerosolisation. If necessary, the endotracheal tube should be clamped and the ventilator disabled (to prevent aerosolisation).[12]
Tracheostomy	Tracheostomy could be considered in suitable patients to facilitate nursing care and expedite ventilator weaning, but is an aerosolising procedure and this must be considered in clinical decision making.[12]

ARDS = acute respiratory distress syndrome, COVID-19 = coronavirus disease 2019, ICU = intensive care unit.

Guidance was based on the most recent and relevant COVID-19 clinical practice guidelines from highly-respected organisations, national physiotherapy organisations and peer-reviewed studies; these sources were transparently reported. The authors represent an international group of physiotherapists, with extensive clinical experience in the ICU and on the wards. They are also academic physiotherapists with experience in the leadership, conduct and execution of rigorous systematic reviews, clinical studies (including prospective cohort studies and international multi-centre trials), and clinical practice guidelines. The recommendations have been endorsed by international physiotherapy organisations.[b] Translations of the recommendations are available in Appendix 1 on the eAddenda.

There are also some limitations. Given the recent presentation of COVID-19, clinical guidance may change as more is learnt about the natural history of this disease. Recommendations were extrapolated based on best evidence for current management of critically ill patients and long-term outcomes in critical illness survivors. No patient was included in the author group. While the recommendations apply to physiotherapy interventions in the acute-care setting, longer-term follow-up of survivors is needed.

Recommendations for physiotherapy workforce planning and preparation

COVID-19 is placing significant demands on healthcare resources throughout the world. Box 1 outlines recommendations to assist the physiotherapy workforce to plan and respond to this demand. Box 2 and Table 1 provide recommendations for determining whom physiotherapists should treat when patients have confirmed or suspected COVID-19. Table 2 provides an example of a resource plan for ICU physiotherapy from Tier 0 (business as usual) through to Tier 4 (large-scale emergency). Local context, resources and expertise should be considered when utilising this example resource plan.

Medical management of COVID-19

It is important for physiotherapists to be aware of the medical management for patients with COVID-19. Table 3 summarises some of the recommendations available from medical guidelines developed by professional societies (as listed in Appendix 2 on the eAddenda).

For patients admitted to ICU, additional strategies may be used; these are summarised in Table 4. With increasing acuity, there is an increased risk of dispersion of aerosolised virus into the healthcare environment due to the nature of critical illness, higher viral load and the performance of aerosol-generating procedures. It is recommended that airborne PPE precautions should be used to care for all patients with COVID-19 in ICU.[12]

Recommendations for the delivery of physiotherapy interventions, including personal protective equipment requirements

Physiotherapy management principles – respiratory care

Examples of physiotherapy-led respiratory interventions (or chest physiotherapy) are provided below.

Airway clearance techniques

Airway clearance techniques include positioning, active cycle of breathing, manual and/or ventilator hyperinflation, percussion and vibrations, positive expiratory pressure therapy (PEP) and mechanical insufflation-exsufflation.

Non-invasive ventilation and inspiratory positive pressure breathing

Physiotherapists may use inspiratory positive pressure breathing (eg, for patients with rib fractures). Non-invasive ventilation may be applied as part of airway clearance strategies in the management of respiratory failure or during exercise.

Techniques to facilitate secretion clearance

Techniques to facilitate secretion clearance include assisted or stimulated cough manoeuvres and airway suctioning.

Other

Physiotherapists prescribe exercise and assist patients to mobilise. Physiotherapists also play an integral role in the management of patients with a tracheostomy.

COVID-19 poses significant considerations for respiratory physiotherapy interventions due to their aerosol-generating procedures. Box 3 outlines recommendations for providing respiratory care to patients with COVID-19.

Box 3. Recommendations for physiotherapy respiratory interventions.

Personal protective equipment	
3.1	It is strongly recommended that airborne precautions are utilised during respiratory physiotherapy interventions.
Cough etiquette	
3.2	Both patients and staff should practise cough etiquette and hygiene. During techniques that may provoke a cough, education should be provided to enhance cough etiquette and hygiene: • Ask the patient to cover their cough by coughing into their elbow or sleeve or into a tissue. Tissues should then be disposed and hand hygiene performed. • In addition, if possible, physiotherapists should position themselves $\geq$ 2 m from the patient and out of the likely path of dispersion.
Aerosol-generating procedures	
3.3	Many respiratory physiotherapy interventions are potentially aerosol-generating procedures. While there are insufficient investigations confirming the aerosol-generating potential of various physiotherapy interventions,[25] the combination with cough for airway clearance makes all techniques potentially aerosol-generating procedures. These include: • cough-generating procedures (eg, cough or huff during treatment) • positioning or gravity-assisted drainage techniques and manual techniques (eg, expiratory vibrations, percussion and manually assisted cough) that may trigger a cough and sputum expectoration • use of positive pressure breathing devices (eg, inspiratory positive pressure breathing), mechanical insufflation-exsufflation devices, intra/extra pulmonary high-frequency oscillation devices (eg, The Vest, MetaNeb, Percussionaire) • PEP and oscillating PEP devices • bubble PEP • nasopharyngeal or oropharyngeal suctioning • manual hyperinflation • open suction • saline instillation via an open-circuit endotracheal tube • inspiratory muscle training, particularly if used with patients who are ventilated and disconnection from a breathing circuit is required • sputum inductions • any mobilisation or therapy that may result in coughing and expectoration of mucus Therefore, there is a risk of creating an airborne transmission of COVID-19 during treatments. Physiotherapists should weigh up the risk versus benefit in completing these interventions and use airborne precautions.
3.4	Where aerosol-generating procedures are indicated and considered essential they should be undertaken in a negative-pressure room, if available, or in a single room with the door closed. Only the minimum number of required staff should be present and they must all wear PPE, as described. Entry and exit from the room should be minimised during the procedure.[12] This may not be able to be maintained when cohorting is required because of the volume of patients presenting with COVID-19.
3.5	BubblePEP is not recommended for patients with COVID-19 because of uncertainty around the potential for aerosolisation, which is similar to the caution the WHO places on bubble CPAP.[23]
3.6	There is no evidence for incentive spirometry in patients with COVID-19.
3.7	Avoid the use of mechanical insufflation/exsufflation, non-invasive ventilation, inspiratory positive pressure breathing devices or high-flow nasal oxygen devices. However, if clinically indicated and alternative options have been ineffective, consult with both senior medical staff and infection prevention and monitoring services within local facilities prior to use. If used, ensure that machines can be decontaminated after use and protect machine with viral filters over machine and patient ends of circuits: • Use disposable circuits for these devices. • Maintain a log of devices that includes patient details for tracking and infection monitoring (if required). • Use airborne precautions.
3.8	Where respiratory equipment is used, whenever possible, use single-patient-use disposable options (eg, single-patient-use PEP devices). Re-usable respiratory equipment should be avoided where possible.
3.9	Physiotherapists should not implement humidification, non-invasive ventilation or other aerosol-generating procedures without consultation and agreement with a senior doctor (eg, medical consultant).
Sputum inductions	
3.10	Sputum inductions should not be performed.
Requests for sputum samples	
3.11	In the first instance, ascertain whether the patient is productive of sputum and able to clear sputum independently. If so, physiotherapy is not required for a sputum sample. If physiotherapy interventions are required to facilitate a sputum sample, full airborne PPE should be worn. The handling of sputum samples should adhere to local policies. Generally, once a sputum sample has been obtained the following points should be followed: • All sputum specimens and request forms should be marked with a biohazard label. • The specimen should be double-bagged. The specimen should be placed in the first bag in the isolation room by a staff member wearing recommended PPE. • Specimens should be hand-delivered to the laboratory by someone who understands the nature of the specimens. Pneumatic tube systems must not be used to transport specimens.
Saline nebulisation	
3.12	Do not use saline nebulisation. It should be noted that some UK guidelines allow use of nebulisers, but this is currently not recommended in Australia.
Manual hyperinflation	
3.13	As it involves disconnection/opening of a ventilator circuit, avoid manual hyperinflation and utilise ventilator hyperinflation if indicated (eg, for suppurative presentations in ICU and if local procedures are in place).

(*Continued on next page*)

Box 3. Continued

Positioning, including gravity-assisted drainage	
3.14	Physiotherapists can continue to advise on positioning requirements for patients.
Prone positioning	
3.15	Physiotherapists may have a role in the implementation of prone positioning in the ICU. This may include leadership within ICU 'prone teams', providing staff education on prone positioning (eg, simulation-based education sessions) or assisting in turns as part of the ICU team.
Tracheostomy management	
3.16	The presence of a tracheostomy and related procedures are potentially aerosol generating: • Cuff deflation trials and inner tube changes/cleaning can be aerosol generating. • Closed, in-line suction is recommended. • Inspiratory muscle training, speaking valves and leak speech should not be attempted until patients are over the acute infection and the risk of transmission is reduced. • Airborne precautions are recommended with infectious patients with COVID-19 with a tracheostomy.

COVID-19 = coronavirus disease 2019, CPAP = continuous positive airway pressure, ICU = intensive care unit, PEP = positive expiratory pressure, PPE = personal protective equipment, WHO = World Health Organization.

Box 4. Recommendations for physiotherapy mobilisation, exercise and rehabilitation interventions.

Personal protective equipment	
4.1	Droplet precautions should be appropriate for the provision of mobilisation, exercise and rehabilitation in most circumstances. However, physiotherapists are likely to be in close contact with the patient (eg, for mobilisation, exercise or rehabilitation interventions that require assistance). In these cases, consider use of a high filtration mask (eg, P2/N95). Mobilisation and exercise may also result in the patient coughing or expectorating mucus, and there may be circuit disconnections with ventilated patients. Refer to local guidelines regarding ability to mobilise patients outside of their isolation room. If mobilising outside of the isolation room, ensure that the patient is wearing a surgical mask.
Screening	
4.2	Physiotherapists will actively screen and/or accept referrals for mobilisation, exercise and rehabilitation. When screening, discussion with nursing staff, the patient (eg, via phone) or family is recommended before deciding to enter the patient's isolation room. For example, to try to minimise staff who come in to contact with patients with COVID-19, physiotherapists may screen to determine an appropriate aid to trial. A trial of the aid may then be performed by the nursing staff already in an isolation room, with guidance provided, if needed, by the physiotherapist who is outside the room.
4.3	Direct physiotherapy interventions should only be considered when there are significant functional limitations, such as (risk of) ICU-acquired weakness, frailty, multiple comorbidities and advanced age.
Early mobilisation	
4.4	Early mobilisation is encouraged. Actively mobilise the patient early in the course of illness when safe to do so.[23]
4.5	Patients should be encouraged to maintain function as able within their rooms: • Sit out of bed. • Perform simple exercises and activities of daily living.
Mobilisation and exercise prescription	
4.6	Mobilisation and exercise prescription should involve careful consideration of the patient's state (eg, stable clinical presentation with stable respiratory and haemodynamic function).[26,27]
Mobility and exercise equipment	
4.7	The use of equipment should be carefully considered and discussed with local infection monitoring and prevention service staff before being used with patients with COVID-19 to ensure that it can be properly decontaminated.
4.8	Use equipment that can be single patient use. For example, use elastic resistance bands rather than distributing hand weights.
4.9	Larger equipment (eg, mobility aids, ergometers, chairs and tilt tables) must be easily decontaminated. Avoid use of specialised equipment, unless necessary, for basic functional tasks. For example, stretcher chairs or tilt tables may be deemed appropriate if they can be decontaminated with appropriate cleaning and are indicated for progression of sitting/standing.
4.10	When mobilisation, exercise or rehabilitation interventions are indicated: • Plan well. • Identify/use the minimum number of staff required to safely perform the activity.[26] • Ensure that all equipment is available and working before entering rooms. • Ensure that all equipment is appropriately cleaned or decontaminated. • If equipment needs to be shared among patients, clean and disinfect between each patient use.[23] • Specific staff training for cleaning of equipment within isolation rooms may be required. • Whenever possible, prevent the movement of equipment between infectious and non-infectious areas. • Whenever possible, keep dedicated equipment within the isolation zones, but avoid storing extraneous equipment within the patient's room.
4.11	When performing activities with ventilated patients or patients with a tracheostomy, ensure that airway security is considered and maintained (eg, a dedicated airway person to prevent inadvertent disconnection of ventilator connections/tubing).

COVID-19 = coronavirus disease 2019, ICU = intensive care unit.

Box 5. Recommendations regarding personal protective equipment for physiotherapists.

5.1	All staff must be trained in correct donning and doffing of PPE, including N95 'fit-checking'. A registry of staff who have completed PPE education and fit checking should be maintained.
5.2	'Fit testing' is recommended when available, but the evidence for fit testing effectiveness is limited and the variation in supply of N95 mask types may make any recommendation on fit testing difficult to implement from a practical perspective.[12]
5.3	Staff with beards should be encouraged to remove facial hair to ensure good mask fit.[24]
5.4	For all confirmed or suspected cases, **droplet precautions** should be implemented, at a minimum. Staff must wear the following items: • surgical mask • fluid-resistant long-sleeved gown • goggles or face shield • gloves[22]
5.5	Recommended PPE for staff caring for COVID-19-infected patients includes added precautions for patients with significant respiratory illness, when aerosol-generating procedures are likely and/or prolonged or very close contact with the patient is likely. In these cases, **airborne precautions** are followed, including: • an N95/P2 mask • fluid-resistant long-sleeved gown • goggles or face shield • gloves[24]
5.6	In addition, the following can be considered: • hair cover for aerosol-generating procedures • shoes that are impermeable to liquids and can be wiped down Recurrent use of shoe covers is not recommended, as repeated removal is likely to increase the risk of staff contamination.[12]
5.7	PPE must remain in place and be worn correctly for the duration of exposure to potentially contaminated areas. PPE (particularly masks) should not be adjusted during patient care.[24]
5.8	Use a step-by-step process for donning and doffing PPE as per local guidelines.[24]
5.9	Check local guidelines for information on laundering uniforms and/or wearing uniforms outside of work if exposed to COVID-19. For example, changing into scrubs may be recommended in local guidelines[12] and/or staff may be encouraged to get changed out of their uniform before leaving work and to transport worn uniforms home in a plastic bag for washing at home.
5.10	Minimise personal effects in the workplace. All personal items should be removed before entering clinical areas and donning PPE. This includes earrings, watches, lanyards, mobile phones, pagers, pens, etc. Stethoscope use should be minimised.[12] If required, use dedicated stethoscopes within isolation areas.[19,23] Hair should be tied back out of the face and eyes.[24]
5.11	Staff caring for infectious patients must apply correct PPE, irrespective of physical isolation. For example, in ICU, if patients are cohorted into a Pod with open rooms, staff working within the confines of the ICU Pod but not directly involved in patient care should also wear PPE. The same applies once infectious patients are nursed on an open ward. Staff then use plastic aprons, a change of gloves and hand hygiene when moving between patients in open areas.
5.12	When a unit is caring for a patient with confirmed or suspected COVID-19, it is recommended that all donning and doffing are supervised by an additional appropriately trained staff member.[12]
5.13	Avoid sharing equipment. Preferably only use single-use equipment.
5.14	Wear an additional plastic apron if a large volume of fluid exposure is expected.[24]
5.15	If reusable PPE items are used (eg, goggles), these must be cleaned and disinfected prior to re-use.[24]

COVID-19 = coronavirus disease 2019, ICU = intensive care unit, PPE = personal protective equipment.

Physiotherapy management principles – mobilisation, exercise and rehabilitation interventions

Physiotherapists are responsible for providing musculoskeletal, neurological and cardiopulmonary rehabilitation tasks, as outlined below.

Range of motion exercises

Passive, active-assisted, active or resisted joint range of motion exercises may be performed to maintain or improve joint integrity, range of motion and muscle strength.

Mobilisation and rehabilitation

Examples of mobilisation and rehabilitation include bed mobility, sitting out of bed, sitting balance, sit to stand, walking, tilt table, standing hoists, upper/lower limb ergometry and exercise programs.

Box 4 outlines recommendations for implementing these activities in patients with COVID-19.

Personal protective equipment considerations

It is imperative that physiotherapists understand the measures in place to prevent transmission of COVID-19. Box 5 provides recommendations for this. Patients with confirmed or suspected COVID-19 will be managed with either droplet or airborne precautions.[12] Additionally, they will be placed in isolation. Hospitals are often able to contain patients with droplet or airborne spread within dedicated isolation rooms. However, there are a limited number of negative pressure bays and pods and/or rooms across Australia and New Zealand,[12] so isolation within dedicated rooms may not be possible with COVID-19 because of the large volume of patient admissions.

It is important for physiotherapists to understand the different types of isolation rooms that exist in hospitals. Class S rooms (standard single rooms, no negative pressure capability), which can be used for isolating patients capable of transmitting infection by droplet or contact routes[12] and Class N rooms (single negative pressure isolation rooms), which are beneficial in isolating patients with transmissible airborne infections.[12] The preference would be for patients with confirmed or suspected COVID-19 to be isolated in Class N rooms.[12] If this is not possible, Class S single rooms with clearly designated areas for donning and doffing PPE are recommended.[12] In the event of all single Class N and S rooms being fully occupied, the recommendation is for patients with COVID-19 to be separately

cohorted to patients without COVID-19 within the hospital.[12] In an open ICU or ward-cohorted areas with one or more patients with COVID-19, it is recommended that staff members in the whole area are required to use airborne PPE precautions.[12] Box 5 describes how the movement from dedicated isolation rooms to open cohorting might evolve within an ICU.

Footnotes: [a] An international team of expert researchers and clinicians within the intensive care and acute cardiorespiratory fields have developed these recommendations. The recommendations are intended for use in adults only. This document has been constructed using existing medical guidelines, relevant literature and expert opinion. The authors have made considerable effort to ensure that the information contained with the recommendation is accurate at time of publication. Further iterations of these recommendations will be published as new information arises. The information provided in this document is not designed to replace local institutional policies and should not replace clinical reasoning for individual patient management. The authors are not liable for the accuracy, information that may be perceived as misleading, or completeness of information in this document. The author group will review and update this guidance within 6 months, or if important new evidence emerges that changes the recommendations herein. [b] These recommendations have been endorsed by: Australian Physiotherapy Association, Canadian Physiotherapy Association, Association of Chartered Society of Physiotherapists in Respiratory Care UK, Associazione Riabilitatori dell' Insufficienza Respiratoria, Koninklijk Nederlands Genootschap voor Fysiotherapie, International Confederation of Cardiorespiratory Physical Therapists, World Confederation for Physical Therapy, AXXON Physical Therapy in Belgium, and Société de Kinésithérapie de Réanimation.

eAddenda: Appendices 1 and 2 can be found online at https://doi.org/10.1016/j.jphys.2020.03.011.

Ethics approval: Not applicable.

Competing interest: All authors completed a World Health Organization conflict of interest form. Direct financial and industry-related conflicts of interest were not permitted and were considered to be disqualifying. The development of these recommendations did not include any industry input, funding, or financial or non-financial contribution. No author received honoraria or remuneration for any role in the development process. We explicitly discussed conflicts of interest, including those who held grants related to intensive care unit rehabilitation (CH, MK, SMP) or received industry funding for high-flow nasal cannula research (IB); because none of these projects specifically involved COVID-19, the group agreed that there were no relevant conflicts of interest.

Sources of support: Nil.

Acknowledgements: This work was adapted from a guideline originally prepared by Dr Peter Thomas and endorsed by the Queensland Cardiorespiratory Physiotherapy Network (QCRPN). The QCRPN was involved in the design of the work and development of statements. Representatives included: Alison Blunt, Princess Alexandra Hospital, Australia; Jemima Boyd, Cairns Base Hospital, Australia; Tony Cassar, Princess Alexandra Hospital, Australia; Claire Hackett, Princess Alexandra Hospital, Australia; Kate McCleary, Sunshine Coast University Hospital, Australia; Lauren O'Connor, Gold Coast University Hospital, Australia; Helen Seale, Prince Charles Hospital, Australia; Peter Thomas, Royal Brisbane and Women's Hospital, Australia; Oystein Tronstad, Prince Charles Hospital, Australia; and Sarah Wright, Queensland Children's Hospital, Australia.

Provenance: Invited. Peer reviewed.

Correspondence: Peter Thomas, Department of Physiotherapy, Royal Brisbane and Women's Hospital, Australia. Email: PeterJ.Thomas@health.qld.gov.au

References

1. del Rio C, Malani PN. 2019 Novel Coronavirus—Important Information for Clinicians. *JAMA*. 2020;323:1039–1040.
2. World Health Organization, Coronavirus disease 2019 (COVID-19) Situation Report 46, 2020.
3. Sohrabi C, Alsafi Z, O'Neill N, Khan M, Kerwan A, Al-Jabir A, et al. World Health Organization declares global emergency: a review of the 2019 novel coronavirus (COVID-19). *Int J Surg*. 2020;76:71–76.
4. Guan WJ, Ni ZY, Hu Y, Liang WH, Ou CQ, He JX, et al. Clinical Characteristics of Coronavirus Disease 2019 in China. *N Engl J Med*. 2020. Early online: 29 February, 2020.
5. van Doremalen N, Bushmaker T, Morris DH, Holbrook MG, Gamble A, Williamson BN, et al. Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. *N Engl J Med*. 2020. Early online: 17 March, 2020.
6. Yoon SH, Lee KH, Kim JY, Lee YK, Ko H, Kim KH, et al. Chest radiographic and CT findings of the 2019 Novel Coronavirus Disease (COVID-19): analysis of nine patients treated in Korea. *Korean J Radiol*. 2020;21:494–500.
7. Zhao D, Yao F, Wang L, Zheng L, Gao Y, Ye J, et al. A comparative study on the clinical features of COVID-19 pneumonia to other pneumonias. *Clin Infect Dis*. 2020. Early online: 12 March, 2020.
8. Peng QY, Wang XT, Zhang LN. Findings of lung ultrasonography of novel corona virus pneumonia during the 2019-2020 epidemic. *Intensive Care Med*. 2020:1–2.
9. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet*. 2020;395:507–513.
10. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet*. 2020. Early online: 11 March, 2020.
11. Xie J, Tong Z, Guan X, Du B, Qiu H, Slutsky AS. Critical care crisis and some recommendations during the COVID-19 epidemic in China. *Intensive Care Med*. 2020. Early online: 2 March, 2020.
12. Australian and New Zealand Intensive Care Society. ANZICS COVID-19 Guidelines, 2020. Melbourne: ANZICS; 2020.
13. Kress JP, Hall JB. ICU-acquired weakness and recovery from critical illness. *N Engl J Med*. 2014;370:1626–1635.
14. Herridge MS, Tansey CM, Matté A, Tomlinson G, Diaz-Granados N, Cooper A, et al. Functional disability 5 years after acute respiratory distress syndrome. *N Engl J Med*. 2011;364:1293–1304.
15. Brouwers MC, Kho ME, Browman GP, Burgers JS, Cluzeau F, Feder G, et al. Development of the AGREE II, part 1: performance, usefulness and areas for improvement. *CMAJ*. 2010;182:1045–1052.
16. Schünemann HJ, Wiercioch W, Brozek J, Etxeandia-Ikobaltzeta I, Mustafa RA, Manja V, et al. GRADE Evidence to Decision (EtD) frameworks for adoption, adaptation, and de novo development of trustworthy recommendations: GRADE-ADOLOPMENT. *J Clin Epidemiol*. 2017;81:101–110.
17. Moberg J, Oxman AD, Rosenbaum S, Schünemann HJ, Guyatt G, Flottorp S, et al. The GRADE Evidence to Decision (EtD) framework for health system and public health decisions. *Health Res Policy Syst*. 2018;16:45.
18. Clinical Skills Development Service, Q.H. Physiotherapy and Critical Care Management eLearning Course. https://central.csds.qld.edu.au/central/courses/108. Accessed 21 March, 2020.
19. World Health Organization. Infection prevention and control during health care when COVID-19 is suspected: Interim Guidance. 2020. https://www.who.int/publications-detail/infection-prevention-and-control-during-health-care-when-novel-coronavirus-(ncov)-infection-is-suspected-20200125. Accessed 21 March, 2020.
20. Queensland Health. Clinical Excellence Division COVID-19 Action Plan. Statewide General Medicine Clinical Network, 2020.
21. The Faculty of Intensive Care Medicine. Guidelines for the provision of the intensive care services. 2019. https://www.ficm.ac.uk/news-events-education/news/guidelines-provision-intensive-care-services-gpics-%E2%80%93-second-edition. Accessed 21 March, 2020.
22. Alhazzani W, Moller M, Arabi Y, Loeb M, Gong M, Fan E, et al. Surviving sepsis campaign: Guidelines of the Management of Critically Ill Adults with Coronavirus Disease 2019 (COVID-19). *Crit Care Med*. 2020. EPub Ahead of Print.
23. World Health Organization. Clinical Management of severe acute respiratory infection when novel coronavirus (2019-nCoV) infection is suspected: Interim Guidance, 2020. p. WHO Reference number WHO/2019-nCoV/clinical/2020.4.
24. Metro North. Interim infection prevention and control guidelines for the management of COVID-19 in healthcare settings, 2020. https://www.health.qld.gov.au/__data/assets/pdf_file/0038/939656/qh-covid-19-Infection-control-guidelines.pdf. Accessed 21 March, 2020.
25. Stiller K. Physiotherapy in intensive care: an updated systematic review. *Chest*. 2013;144:825–847.
26. Green M, Marzano V, Leditschke IA, Mitchell I, Bissett B. Mobilization of intensive care patients: a multidisciplinary practical guide for clinicians. *J Multidiscip Healthc*. 2016;9:247–256.
27. Hodgson CL, Stiller K, Needham DM, Tipping CJ, Harrold M, Baldwin CE, et al. Expert consensus and recommendations on safety criteria for active mobilization of mechanically ventilated critically ill adults. *Crit Care*. 2014;18:658.