Physiotherapy Management for COVID-19 in the Acute Hospital Setting:

Recommendations to guide clinical practice

Version 1.0
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TITLE:	**Physiotherapy management for COVID-19 in the acute hospital setting: Recommendations to guide clinical practice**
DESCRIPTION AND OBJECTIVES:	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 of physiotherapy, recommendations for the selection of physiotherapy treatments and personal protective equipment.
TARGET AUDIENCE:	Physiotherapists and other relevant stakeholders in the acute care setting caring for adult patients with suspected and/or confirmed COVID-19
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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 the information contained with the recommendation is accurate at time of publication. Further iterations of these guidelines 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 guideline group will review and update this guidance within 6-months, or if important new evidence emerges that changes the recommendations herein.

Citation of this work

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Management of Conflict of Interests

All guideline panel members completed a World Health Organisation (WHO) conflict of interest (COI) form. Direct financial and industry related COIs were not permitted and were considered disqualifying. The development of this guideline did not include any industry input, funding, or financial or non-financial contribution. No member of the guideline panel received honoraria or renumeration for any role in the guideline development process. We explicitly discussed conflicts of interest, including those who held grants related to ICU rehabilitation (CH, MK, SMP) or received industry funding for HFNC research (IB); because none of these projects specifically involved COVID-19, the group agreed there were no relevant conflicts of interest.

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- Association of Chartered Society of Physiotherapist in Respiratory Care UK (ACPRC)
- World Confederation for Physical Therapy (WCPT)
- International Confederation of Cardiorespiratory Physical Therapists (ICCrPT)

KEY INTERNATIONAL DOCUMENTS RELATED TO THIS GUIDELINE:

The following guidelines within the field directly informed the design of this publication:

- **World Health Organisation (WHO):** Clinical Management of severe acute respiratory infection when novel coronavirus (2019-nCoV) infection is suspected Interim Guidance V1.2. 13 Mar 2020. https://www.who.int/publications-detail/clinical-management-of-severe-acute-respiratory-infection-when-novel-coronavirus-(ncov)-infection-is-suspected. WHO Reference number WHO/2019-nCoV/clinical/2020.4

- **Society of Critical Care Medicine (SCCM) and European Society of Intensive Care Medicine (ESICM):** Alhazzani, et al (2020): Surviving sepsis campaign: Guidelines of the Management of Critically Ill Adults with Coronavirus Disease 2019 (COVID-19). Critical Care Medicine, EPub Ahead of Print March 20, 2020. https://www.sccm.org/disaster

- **Australian and New Zealand Intensive Care Society (ANZICS)** (2020): ANZICS COVID-19 Guidelines. Melbourne: ANZICS V1 16.3.2020 https://www.anzics.com.au/coronavirus/

- **National institute for Health and Care Excellence (NICE) Guidelines** COVID-19 rapid guideline: critical care. Published: 20 March 2020 www.nice.org.uk/guidance/ng159

- **French Guidelines: Conseil Scientifique de la Société de Kinésithérapie de Réanimation.** Reffienna et al. Recommandations sur la prise en charge kinésithérapique des patients COVID-19 en réanimation. Version 1 du 19/03/2020

BACKGROUND:

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 varies 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 a runny nose land on surfaces within two meters of the infected person. SARS-CoV-2 remains viable for at least 24 hours on hard surfaces and up to eight hours on soft surfaces [5]. The virus is transferred to another person through hand contact on a contaminated surface then touching the mouth, nose, or eyes. Aerosol airborne infected particles created during a sneeze or cough remain viable in the air for at least three 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 an asymptomatic infection, mild upper respiratory tract illness, 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 of lung CT scan findings that often include multiple mottling and ground-glass opacity [7]. Lung ultrasound is also being utilised at the bedside with findings of multi-lobar distribution of B-lines and diffuse lung consolidation [8]

At present, the mortality rate is 3 to 5%, with new reports of up to 9%, in contrast to influenza, which is around 0.1% [2].The rates of admission to an intensive care unit (ICU) are approximately 5% [4]. Half of patients admitted to hospital (42%) 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 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 and/or suspected COVID-19. COVID-19 is a disease caused by a new coronavirus, primarily impacting the respiratory system. Symptoms of COVID-19 can range from mild illness to pneumonia. Some people will have mild symptoms and recover easily, while others may develop respiratory failure and/or become critically ill and require admission to ICU.

Physiotherapists who work in primary healthcare facilities are likely to have a role in the management of patients admitted to hospital with confirmed and/or suspected COVID-19.

Physiotherapy is an established profession throughout the world. In Australia and overseas, physiotherapists often work in acute hospital wards and the ICU. In particular, cardiorespiratory physiotherapy is focussed 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 independently clear. 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 (e.g. neuromuscular disease, respiratory disease, cystic fibrosis etc). Physiotherapists who practice in the ICU environment may also provide airway clearance techniques for ventilated patients 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, patients with COVID-19 who are admitted to ICU may be at high risk of developing ICU acquired weakness (ICU-AW) [13]. This may worsen their morbidity and mortality [14]. It is therefore essential to anticipate early rehabilitation after the acute phase of ARDS in order to limit the severity of ICU-AW 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 is focused on the adult acute hospital setting.

The recommendations for physiotherapists are outlined below and focus on the specific health questions of this guideline:

- SECTION 1: Workforce planning and preparation including screening to determine indications for physiotherapy.
- SECTION 2: Delivery of physiotherapy interventions including both respiratory and mobilisation / rehabilitation as well as PPE requirements.

It is recognised that physiotherapy practices vary across the world. When utilising this guideline, the scope of practice within the local context should be considered.

GUIDELINE METHODOLOGY AND CONSENSUS APPROACH:

A group of international experts in cardiorespiratory physiotherapy came together to rapidly prepare a clinical practice guideline for physiotherapy management of COVID-19. Our guideline group initially convened on Friday March 20, 2020 at 10:00am (Australian Eastern Standard Time) to discuss the urgent need for acute care physiotherapy guidance world-wide in relation to COVID-19. We quickly prioritised our efforts to develop specific guidance for physiotherapists in the acute care settings.

The AGREE II framework [15] was used to guide our development, recognising the expediency of our work required pragmatic, yet transparent reporting. We modelled our conduct after the GRADE Adolopment Process [16] and Evidence to Decision framework [17] for recommendations and decision-making. Our expertise includes ICU and acute inpatient physiotherapy (all), rehabilitation interventions in the intensive care unit (all), physiotherapy administration (PT, IB, RG, AJ, RM, ShP), systematic reviews (CB, CG, RG, CH, MK, SP, ShP, LV), guideline methodology (PT, IB, RG, CH, MK, RM, ShP, LV), and epidemiology (CH, MK). We documented all conflicts of interest a priori using the World Health Organisation (WHO) form.

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

A priori we decided to develop a consensus guideline, given the time sensitive nature of our guidance. We agreed that we required ≥ 70% agreement for a recommendation. On Friday March 20, 2020 the lead author (PT) circulated draft recommendations to all guideline panel members. All guideline panel members returned comments to the lead author independently. The lead author (PT) collated all comments for further discussion. We discussed all guideline recommendations in a teleconference on Sunday, March 22, 2020 at 10:00am (Australian Eastern Standard Time).

14 people participated in the guideline process. We developed 67 recommendations. 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.

We sought endorsement for our guideline from physiotherapy societies, physiotherapy professional groups and the World Confederation for Physical Therapy. We circulated our guideline to these groups on March 23, 2020 at 12:00pm (Australia Eastern Standard Time) requesting endorsement within 24 hours.

STRENGTHS OF THIS GUIDELINE:

Our guideline has several strengths. We respond to an urgent need for clinical guidance for acute care physiotherapists worldwide. We base our guidance on the most recent, relevant COVID-19 clinical practice guidelines from highly respected organizations, national physiotherapy organizations, and from peer-reviewed studies and transparently report our evidence sources. We represent an international group of physiotherapists, with extensive clinical experience in the ICU and on the wards. We 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. We sought endorsement from international physiotherapy organizations.

LIMITATIONS OF THIS GUIDELINE:

Our guideline also has limitations. Given the recency in presentation of COVID-19, clinical guidance may change as we learn more about the natural history of this disease. We extrapolated our recommendations based on best evidence for current management of critically ill patients and long-term outcomes in critical illness survivors. We did not include a patient in our guideline development group. While our guideline applies to physiotherapy interventions in the acute care setting, longer-term follow-up of survivors is needed.

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SECTION 1: PHYSIOTHERAPY WORKFORCE PLANNING AND PREPARATION RECOMMENDATIONS

COVID-19 is placing significant demands on healthcare resources throughout the world. Table 1 outlines recommendations to assist the physiotherapy workforce to plan and respond to this demand. Tables 2 and 3 provide recommendations for determining whom physiotherapists should treat when patients have presumed or suspected COVID-19. Table 4 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.

Table 1. Physiotherapy workforce planning and preparation recommendations:

	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 who are currently working in non-clinical roles • work different shift patterns e.g. 12 hours shifts, extended evening shifts.
1.2	Identify potential additional staff who could be deployed to areas of higher activity associated with COVID-19 admissions. For example, the deployment to infectious disease ward, intensive care unit (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 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 to access. For example: • eLearning package via Clinical Skills Development Service for Physiotherapy and Critical Care Management [18] • Local physiotherapy staff ICU orientation • Personal protective equipment (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 of 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 e.g. >60 years of age • 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].
1.9	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. Presently there is not enough information available about the impacts of COVID-19 on the pregnant mother or their baby.
1.10	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].
1.11	Consider organisation of 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.
1.12	Be aware of and comply to relevant international, national, state and/or hospital guidelines for infection control in health care facilities. For example, World Health Organisation (WHO) “Guidelines for Infection prevention and control during health care when novel coronavirus infection is suspected” [19].

1.13	Senior physiotherapists should be involved in determining the appropriateness of physiotherapy interventions for patients with suspected and/or proven COVID-19 in consultation with senior medical staff and according to a referral guideline.
1.14	Identify hospital-wide plans for allocation / cohorting of patients with COVID-19. Utilise these plans to prepare resource plans that may be required. For example, **Table 4 below** is an example of a resource plan for ICU physiotherapy.
1.15	Identify additional physical resources that may be required for physiotherapy interventions and how the risk of cross-infection can be minimised (e.g. respiratory equipment; mobilisation, exercise and rehabilitation equipment, equipment storage).
1.16	Identify and develop a facility inventory of respiratory, mobilisation, exercise and rehabilitation equipment and determine process of equipment allocation as pandemic levels increase (i.e. to prevent movement of equipment between infectious and non-infectious areas).
1.17	It should be recognised that staff will likely have an increased workload with a heightened risk of anxiety both at work and at home [12]. Staff should be supported during and beyond the active treatment phases (e.g. via access to employee assistance programs, counselling, facilitated debriefing sessions).
1.18	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].

Table 2. Who should physiotherapists treat?

	Recommendations
2.1	The respiratory infection associated with COVID-19 is mostly associated with dry, non-productive cough and 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 if patients who have suspected or confirmed 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 e.g. in patients with comorbidities creating significant functional decline and/or (at risk) for 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 3** 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 of patients via subjective review and basic assessment whilst not being in direct contact with the patient should be trialled first whenever possible e.g. calling the patients' isolation room telephone and conducting a subjective assessment for mobility information and/or providing education on airway clearance techniques.

Table 3. Screening guidelines for physiotherapy involvement with COVID-19

	COVID-19 patient presentation (confirmed or suspected)	Physiotherapy referral?
RESPIRATORY	**Mild symptoms without significant respiratory compromise** e.g. fevers, 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 (e.g. oxygen flow ≤5L/min for SpO_2 ≥ 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 e.g. Cystic Fibrosis, neuromuscular disease, spinal cord injury, bronchiectasis, COPD) **AND current or anticipated difficulties with secretion clearance**	Physiotherapy referral for airway clearance. Staff use airborne precautions. Where possible, patients 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 e.g. weak, ineffective and moist sounding cough, tactile fremitus on chest wall, moist/wet sounding voice, audible transmitted sounds.	Physiotherapy referral for airway clearance. Staff use airborne precautions. Where possible, patients should wear a surgical mask during any physiotherapy.

	Severe symptoms suggestive of pneumonia / lower respiratory tract infection e.g. increasing oxygen requirements, fever, difficulty breathing, frequent, severe or productive coughing episodes, chest x-ray / CT / lung ultrasound changes consistent with consolidation.	Consider physiotherapy referral for airway clearance. Physiotherapy may be indicated, particularly if weak cough, productive and/or evidence of pneumonia on imaging and/or secretion retention. Staff use airborne precautions. Where possible, patients should wear a surgical mask during any physiotherapy. Early optimisation of care and involvement of ICU is recommended.
MOBILISATION, EXERCISE, & REHAB	Any patient at significant risk of developing or with evidence of significant functional limitations • e.g. patients who are frail or have multiple comorbidities impacting on their independence • e.g. mobilisation, exercise and rehabilitation in ICU patients with significant functional decline and/or (at risk for) ICU-acquired weakness	Physiotherapy referral. Use droplet precautions Use airborne precautions if close contact required or possible AGPs. If not ventilated, patients should wear a surgical mask during any physiotherapy whenever possible.

Table 4. Example ICU physiotherapy resource plan

Phase	Bed Capacity	Description & Location of patients	Physiotherapy Staffing	Equipment related to physiotherapy respiratory care, mobilisation, exercise and rehabilitation
Business as usual	e.g. 22 ICU Beds 6 HDU	All patients within existing ICU and HDU physical resources.	e.g. 4 FTE	e.g. • 6 Transmotion/oxford chairs • 10 high back sitting chairs • 3 Rollators • 1 Tilt Table • 2 Cycle ergometers • Steps/blocks • Bariatric equipment
Tier 1	e.g. expansion with additional number of ICU beds provided (e.g. opening previously non-commissioned beds)	Less than 4 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.	e.g. additional 1 FTE per 4 ICU beds[21]. 1 Senior PT will screen patients with COVID-19 in consultation with an ICU medical Consultant. Patients will be provided treatment in isolation rooms.	If needed, 1 Transmotion chair allocated and quarantined for use. 1 Tilt table quarantined for use with COVID patients. Quarantined in room, or cleaned and located for storage in isolation. Additional respiratory equipment.
Tier 2	e.g. 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	e.g. calculation for additional FTE as above.	Additional chair resources may be required. Quarantine fleet of chairs / tilt tables etc for infectious and non-infectious patients.

		confines of a negative pressure rooms. 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.	Infections ICU Pod PTs allocated, including 1 Senior PT Non-infections ICU Pod PTs allocated, including 1 Senior PT Infectious and non-infectious staff allocated, including on weekends.	
Tier 3	Additional ICU beds created outside of ICU (e.g 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.	e.g. calculation for additional FTE	**As above.**
Tier 4	Additional beds created across clinical areas in other parts of the hospital e.g. Cardiology; operating theatres	Large scale emergency	e.g. calculation for additional FTE	**As above.**

Medical management of COVID-19:

It is important for physiotherapists to be aware of the medical management for patients with COVID-19. For the purposes of this guideline we have summarised some of the recommendations available from medical guidelines developed by professional societies as listed on page 6.

Aerosol generating procedures (AGPs) create an airborne risk of transmission of COVID-19. AGPs include:

- Intubation
- Extubation
- Bronchoscopy
- High flow nasal oxygen use
- Non-invasive ventilation
- Tracheostomy
- CPR prior to intubation[12, 22]

Additional AGPs related to physiotherapy techniques will be outlined below.

High flow nasal oxygen (HFNO): HFNO is a recommended therapy for hypoxia associated with COVID-19, as long as staff are wearing optimal airborne PPE[12].

HFNO (e.g. at flow rates 40-60L/min) 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 HFNO therapy [12].

Respiratory support via HFNO should be restricted to patients in airborne isolation rooms only. Limiting the flow rate to not greater than 30L/min might reduce potential viral transmission.

Non-invasive ventilation (NIV): Routine use of NIV is not recommended [12]. as current experience with COVID-19 hypoxic respiratory failure reflects a high associate failure rate. If utilised e.g. with a patient with COPD or post-extubation it must be provided with strict airborne PPE [12].

Oxygen therapy: Oxygen therapy targets may vary depending on the presentation of the patient.

- For patients with presenting with severe respiratory distress, hypoxaemia or shock, SpO_2 >94% is targeted [23]
- Once a patient is stable, the target is >90% [24] in non-pregnant adults and 92-95% in pregnant patients [23].
- In adults with COVID-19 and acute hypoxaemic respiratory failure, the SpO2 target should not be maintained higher than 96% [22]

Nebulisation: The use of nebulised agents (e.g. salbutamol, saline) for the treatment of non-intubated patients with COVID-19 is not recommended as it increases the risk of aerosolization and transmission of infection to health care workers in the immediate vicinity.

Use of metered dose inhalers / spacers are preferred where possible [12]. If a nebulizer is required, liaise with local guidelines for directions to minimise aerosolization e.g. use of a Pari sprint with inline viral filter.

Use of nebulisers, NIV, HFNO and spirometry should be avoided and agreement to their use sought from senior medical staff [20] If deemed essential, airborne precautions should be used.

For patients admitted to ICU, additional strategies may be utilised which are summarised below. 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 AGPs. It is recommended that airborne PPE precautions should be used to care for all patients with COVID-19 in ICU [12].

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 12–16 hours per day is recommended [22, 23]. It requires sufficient human resources and expertise to be performed safely 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 BAL is not usually necessary [12].

Any disconnection of the patient from the ventilator should be avoided to prevent lung decruitment and aerosolization. If necessary, the endotracheal tube should be clamped and the ventilator disabled (to prevent aerosolization) [12].

Tracheostomy: Early tracheostomy could be considered in suitable patients to facilitate nursing care and expedite ventilator weaning. Reports indicate that some patients have a prolonged course and recovery following ARDS. However, the performance of

percutaneous tracheostomy with bronchoscopic guidance carries significant occupational risk of disease transmission due to generation of aerosols. Surgical tracheostomy may be a safer alternative, although the infectious risk is not eliminated. The merits of tracheostomy in patients with evolving multiple organ failure and / or sepsis would need to be weighed against the high reported mortality from COVID-19 in this group [12].

SECTION 2: RECOMMENDATIONS FOR THE DELIVERY OF PHYSIOTHERAPY INTERVENTIONS INCLUDING PPE REQUIREMENTS

Physiotherapy management principles – respiratory care:
Examples of physiotherapy led respiratory interventions (or chest physiotherapy) include:

- Airway clearance techniques. For example, positioning, active cycle of breathing, manual and/or ventilator hyperinflation, percussion and vibrations, positive expiratory pressure therapy (PEP), mechanical insufflation-exsufflation (MI-E).
- Non-invasive ventilation (NIV) and inspiratory positive pressure breathing (IPPB). For example, IPPB for patients with rib fractures, NIV application as part of airway clearance strategies, or in the management of respiratory failure, or during exercise.
- Techniques to facilitate secretion clearance. For example, assisted or stimulated cough manoeuvres, and airway suctioning.
- Exercise prescription and mobilisation.

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 AGP. Table 5 outlines recommendations for providing respiratory care to patients with COVID-19.

Table 5. Recommendation for physiotherapy respiratory interventions:

	Recommendations
5.1	***PPE:*** It is strongly recommended that airborne precautions are utilised during respiratory physiotherapy interventions.
5.2	**Cough etiquette:** Both patients and staff should practice cough etiquette and hygiene. During techniques which may provoke a cough, education should be provided to enhance cough etiquette and hygiene. • Ask patient to turn head away during cough and expectoration • Patients who are able should “catch their cough” with a tissue, dispose of tissue and perform hand hygiene. If patients are unable to do this independently then staff should assist. • In addition, if possible, Physiotherapist should position themselves ≥ 2m from the patient and out of the “blast zone” or line of cough.
5.3	Many respiratory physiotherapy interventions are potentially AGPs. While there are insufficient investigations confirming the AGPs of various physiotherapy

	interventions [25], the combination with cough for airway clearance makes all techniques potentially AGPs. These include: • Cough generating procedures e.g. cough during treatment, huff. • Positioning / gravity assisted drainage techniques and manual techniques (e.g. expiratory vibrations, percussion, manual assisted cough) that may trigger a cough and the expectoration of sputum • Use of positive pressure breathing devices (e.g. IPPB), mechanical insufflation-exsufflation (MI-E) devices, intra/extra pulmonary high frequency oscillation devices (e.g. The Vest, MetaNeb, Percussionaire) • PEP and oscillating PEP devices • BubblePEP • Nasopharyngeal or oropharyngeal suctioning etc. • Manual hyperinflation (MHI) • Open suction. • Saline instillation via and 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 to completing these interventions and use airborne precautions.
5.4	Where AGPs 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 due to the volume of patients presenting with COVID-19.
5.5	BubblePEP is not recommended for patients with COVID-19 because of uncertainty around the potential for aerosolization, similar to the caution the WHO places on bubble CPAP [23].
5.6	There is no evidence for incentive spirometry in patients with COVID-19.

5.7	Avoid the use of MI-E, NIV, IPPB devices or HFO devices. However, if clinically indicated and alternative options have not been effective, consult with both senior medical staff and Infection Prevention and Monitoring Services within local facilities prior to use. If used, ensure machines can be decontaminated after use and e.g. protect machines with viral filters over machine and patient ends of circuits. • Use disposable circuits for these devices. • Maintain a log for devices that includes patient details for tracking and infection monitoring (if required). • Use airborne precautions.
5.8	Where respiratory equipment is used, whenever possible use single patient use, disposable options e.g. single patient use PEP devices.
	Re-usable respiratory equipment should be avoided if possible.
5.9	Physiotherapists should not implement humidification or NIV or other AGPs without consultation and agreement with a senior doctor (e.g. medical Consultant).
5.10	**Sputum inductions** should not be performed.
5.11	**Requests for sputum samples.** 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 then 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.
5.12	**Saline nebulisation.** 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.
5.13	**Manual hyperinflation:** As it involves disconnection / opening of a ventilator circuit, avoid MHI and utilise ventilator hyperinflation (VHI) if indicated e.g. for suppurative presentations in ICU and if local procedures are in place.
5.14	**Positioning including gravity assisted drainage:** Physiotherapists can continue to advise on positioning requirements for patients.

5.15	**Prone positioning:** Physiotherapists may have a role in the implementation of prone positioning in ICU. This may include leadership within ICU "prone teams", providing staff education on prone positioning (e.g. simulation-based education sessions), or assisting in turns as part of the ICU team.
5.16	**Tracheostomy management:** 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. • The use of inspiratory muscle training, speaking valves and leak speech should not be attempted until patients are over acute infection and the risk of transmission is reduced. • Airborne precautions are recommended with infectious patients with COVID-19 with a tracheostomy.

Physiotherapy management principles – mobilisation, exercise and rehabilitation interventions:

Physiotherapists are responsible for the provision of musculoskeletal / neurological / cardiopulmonary rehabilitation tasks including:

- Passive, active assisted, active, or resisted joint range of motion exercises to maintain or improve joint integrity and range of motion and muscle strength
- Mobilisation and rehabilitation (e.g. bed mobility, sitting out of bed, sitting balance, sit to stand, walking, tilt table, standing hoists, upper limb or lower limb ergometry, exercise programs).

Table 6 outlines recommendations for the implementation of these activities in patients with COVID-19.

Table 6. Recommendations for physiotherapy mobilisation, exercise and rehabilitation interventions:

	Recommendation
6.1	***PPE:*** 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 e.g. for mobilisation, exercise or rehabilitation interventions that require assistance. In these cases, consider use of a high filtration mask (e.g. P2/N95). Mobilisation and exercise may also result in the patient coughing or expectorating mucous. Refer to local guidelines regarding ability to mobilise patients outside of their isolation room. If mobilising outside of the isolation room, ensure the patient is wearing a surgical mask.
6.2	**Screening:** Physiotherapists will actively screen and/or accept referrals for mobilisation, exercise and rehabilitation. When screening, discussion with nursing staff, the patient (e.g. 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.
6.3	Only where there are significant functional limitations (e.g. (risk for) ICU-acquired weakness, frailty, multiple comorbidities, advanced age) should the requirement for direct physiotherapy interventions be considered.
6.4	**Early mobilisation** is encouraged. Actively mobilize the patient early in the course of illness when safe to do so [23].
6.5	Patients should be encouraged to maintain function as able within their rooms • Sit out of bed • Perform simple exercises and activities of daily living
6.6	**Mobilisation and exercise prescription** should involve careful consideration of the patients' state (e.g. stable clinical presentation with stable respiratory and haemodynamic function) [26, 27].
6.7	**Mobility and exercise equipment:** The use of equipment should be carefully considered and discussed with local infection monitoring and prevention service staff before used with patients with COVID-19 to ensure it can be properly decontaminated.
6.8	Use equipment that can be single patient use. For example, use Theraband rather than distributing hand weights.
6.9	Larger equipment (e.g. mobility aids, ergometers, chairs, tilt tables) must be easily decontaminated. Avoid use of specialised equipment unless necessary for basic functional tasks. For example, Transmotion chairs or tilt tables may be deemed appropriate if they can be decontaminated with appropriate cleaning and are indicated for progression of sitting / standing.

6.10	When mobilisation, exercise or rehabilitation interventions are indicated:
	• Plan well
	  ○ identifying / use the minimum number of staff required to safely perform the activity [26]
	  ○ ensure all equipment is available and working before entering rooms
	• Ensure all equipment is cleaned appropriately / 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.

6.11	• When performing activities with ventilated patients or patients with a tracheostomy, ensure airway security is considered and maintained e.g. dedicated airway person to prevent inadvertent disconnection of ventilator connections/tubing.

PPE considerations

Patients with presumed or confirmed COVID-19 will be managed with either droplet or airborne precautions. They will also 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 due to the large volume of patient admissions.

Class N rooms are negative pressure isolation rooms used to isolate patients capable of transmitting airborne infection. A negative pressure room has a functional anteroom for donning and doffing PPE. Airborne PPE precautions are still required. Doffing is performed in the anteroom. However, there may be local variations in this e.g. some institutions may recommend removal of PPE gown and gloves with the patient's room, then removal of face shield/goggles and mask outside the patient's room.

Class S rooms are standard rooms which can be used for isolating patients capable of transmitting infection by droplet or contact routes. Class S rooms have no negative pressure capability and therefore no engineering controls.

It is recommended COVID-19 patient's, ideally, be treated in a Class N negative pressure single room. If Class N rooms are not available then the preference should be Class S single rooms with clear areas demarcated for donning and doffing of PPE. Once all Class N and Class S single rooms are exhausted, patients will need to be cohorted in areas that are physically separate to areas containing patients without COVID-19. In an open ICU or ward cohorted areas with one or more patients with COVID-19, the whole area is recommended to require airborne PPE precautions. Table 4 describes how the movement from dedicated isolation rooms to open cohorting might evolve within an ICU.

It is imperative that physiotherapists understand the measures in place to prevent transmission of COVID-19. Table 7 provides recommendations for this.

Table 7. PPE Recommendations for physiotherapists

	Recommendation
7.1	All Staff will 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.
7.2	"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].
7.3	Staff with beards should be encouraged to remove facial hair to ensure good mask fit [24].

7.4	For all suspected and confirmed cases, at a minimum **droplet precautions** are implemented. Staff will wear the following items: • Surgical mask • Fluid resistant long-sleeved gown • Goggles/face shield • Gloves [22]
7.5	Recommended PPE for staff caring for COVID-19 infected patients includes added precautions for patients with significant respiratory illness, when AGPs 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/face shield • Gloves [24]
7.6	In addition, the following can be considered: - Hair cover for AGPs. - 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].
7.7	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].
7.8	Use a step-by-step process for don/doff PPE as per local guidelines [24].
7.9	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.
7.10	Minimise personal effects in 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].
7.11	Staff caring for infectious patients must apply correct PPE irrespective of physical isolation. For example, 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. Similarly, once infectious patients are nursed on an open ward.

7.12	When a unit is caring for a confirmed or suspected COVID-19 patient it is recommended that all donning and doffing are supervised by an additional appropriately trained staff member [12].
7.13	Avoid sharing equipment. Preferentially use only single use equipment.
7.14	Wear an additional apron if high volumes of fluid exposure is expected [24].
7.15	If reusable PPE items are used, e.g. goggles – these must be cleaned and disinfected prior to re-use [24].

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