

INCREASING BED CAPACITY FOR COVID-19 PATIENTS

Health Technical Advice HTA-2020-003



Contents

Introduction	2
Identify areas to provide additional capacity	2
Overview	2
Infection control.....	3
Heating, ventilation and air conditioning	3
Fire risk assessment.....	4
Electrical supply	4
Waste management	5
Allow for appropriate bed-side clinical services	5
Medical service panels	5
Maintaining an adequate oxygen supply.....	5
Deliver the works.....	6
Procurement and delivery of works.....	6
Procurement of equipment and supplies.....	6
Exit strategy.....	6
References and Bibliography	7
Attachment 1: COVID-19 medical services panel layout	8
Intensive care unit bed medical services panel.....	8
COVID-19 patient bed medical services panel.....	9
Inpatient unit bed medical services panel	9
Sub-acute bed medical services panel	9

Introduction

The COVID-19 viral pandemic represents an unprecedented challenge across intensive care services throughout Victorian health providers. This document provides advice on mechanisms to increase bed capacity for treating COVID-19 infected patients.

The major challenge centres on preparing appropriate critical care beds for the expected surge in caseload presentations. The robust public health measures are aiming to reduce community transmission, hence 'flattening the pandemic curve' to prevent intensive care services becoming overwhelmed. This is essential to minimise load on existing intensive care unit (ICU) capacity for all patients, not just those with COVID-19, as well as to maintain the health, wellbeing, and sustainability of the intensive care workforce.

This health technical advice (HTA) is to be read in conjunction with local ICU pandemic plans as developed by all healthcare organisations.

The purpose of this HTA is to provide guidance to health agencies on infrastructure works and equipment provision that may be required to expand critical care capacity within existing hospital facilities to treat COVID-19 patients.

This HTA does not take the place of any applicable regulatory requirements such as building codes or Australian Standards and is intended to inform preparation and planning activities in response to increasing bed capacity for COVID-19.

Identify areas to provide additional capacity

Overview

Health agencies should assess current facilities' capabilities for creation of adequate isolation rooms or areas, identifying potential areas that could be converted effectively with minimum modifications. Where possible, a designated self-contained area or wing of the healthcare facility should be used for the treatment and care of patients with COVID-19. The Australian and New Zealand Intensive care Society (ANZICS) recommend that:

...patients who only require monitoring be managed in alternate locations. ICU admission should be prioritised to those who require specific ICU interventions such as mechanical ventilation.

Furthermore, the ANZICS recommends that all clinical areas with the physical infrastructure suitable to care for critically ill patients should be identified. These include (but are not limited to):

- complex care units or other high dependency units
- perioperative monitoring / recovery areas
- coronary care units
- uncommissioned or unstaffed ICU bays
- decommissioned critical care areas (for example 'old' ICUs).

Operating theatre spaces provide ideal clinical spaces to treat COVID-19 patients, as these areas are generally large and can serve multiple patients and have access to medical services outlets (oxygen). However, operating room spaces should be avoided for the use of COVID-19 patients because they are positive pressure, may be required for other patients and the HVAC systems may not be able to avoid cross-contamination of other adjacent areas.

Infection control

Special environmental controls, such as negative pressure isolation rooms, are not necessary to prevent the transmission of COVID-19. However, in the early stages and in high-risk settings, patients with suspected or confirmed COVID-19 should be isolated in negative-pressure rooms. This is of importance during aerosol-generating procedures, such as tracheal intubation, non-invasive ventilation, tracheotomy, cardiopulmonary resuscitation, manual ventilation before intubation, and bronchoscopy as these procedures have been associated with an increased risk of transmission of infectious diseases.

Ideally, areas converted for treating COVID-19 patients should:

- include a reception area that is separate from the rest of the facility and, if feasible, have a separate entrance/exit from that for the rest of the building
- not be used as a thoroughfare by other patients, visitors or staff, including patients being transferred, staff going for meal breaks, and staff and visitors entering and exiting the building
- be separated from non-segregated areas by closed doors
- have amenities (such as toilets, staff-kitchen, tea-room etc) that are separate from the public, other patients and staff
- have clean and dirty utility rooms separate to other parts of the hospital
- have signage displayed warning of the segregated area to control entry
- have 100 per cent outside air ventilation and exhaust to outside at high level.

Wherever possible, patients with suspected or confirmed COVID-19 should be placed in single rooms. Where a multiple bed space is used, a minimum space of 3.6 metres bed centre to bed centre is recommended. Rooms with ICU patients should aim to accommodate a one metre clearance at head of bed/s wherever possible to assist with patient treatment/intubation.

Hospitals should work with ICU staff to develop processes enabling the expeditious repurposing of these areas when needed and establish workforce models that allow critical care staffing of potentially physical disparate locations.

The ability to meet the above standards may be limited in the advanced phases of a pandemic, necessitating adjustments based on the clinical needs of the patients and available resources.

Housekeeping plans and procedures should consider that the virus may be aerosolized during toilet flushing.

Heating, ventilation and air conditioning

HVAC systems can protect healthcare workers and instil confidence by providing safe environments for their interactions with most contagious patients and reduce exposure when patients discharge contaminants during procedures. Hospital Engineers need to ensure the following principles are applied when reviewing alternative ward spaces for COVID patients:

- system arrangement should protect health workers
- system arrangement should protect other patients
- airflow should flow from clean to less clean.

Negative isolation rooms are the logical areas to preform aerosol generating procedures and could be used as patient rooms where infected patient numbers are low. Negative isolation room should have minimum air flow rates in accordance with the [DHHS guidelines for the classification and design of isolation rooms in health care facilities](http://docs2.health.vic.gov.au/docs/doc/4AAF777BF1B3C40BCA257D2400820414/$FILE/070303_DHS_ISO%20RoomGuide_web.pdf) <[http://docs2.health.vic.gov.au/docs/doc/4AAF777BF1B3C40BCA257D2400820414/\\$FILE/070303_DHS_ISO%20RoomGuide_web.pdf](http://docs2.health.vic.gov.au/docs/doc/4AAF777BF1B3C40BCA257D2400820414/$FILE/070303_DHS_ISO%20RoomGuide_web.pdf)> and all exhaust air should be discharged directly to atmosphere.

Solutions beyond negative isolation rooms may include:

- increasing air change dilution rates
- increasing exhaust air rates to remove contaminants
- additional filtration to remove contaminants

- creating negative relative pressure zones to help contain contaminants.

Dedicated ICU areas may be positive pressure relative to surrounding areas, and this will need to be verified, modified and balanced as required.

Areas served via room recirculating units such as fan coil units, heat pump systems and in room split systems should be avoided for treating COVID-19 patients, as these units typically have low air change rates and minimal filtration. If there is no other option, then the total room exhaust must be increased to create a relative pressure to the corridor and adjoining spaces. This may be achieved via adding supplemental local exhaust fans to the room, or via a system level approach by increasing general/toilet exhaust airflow systems.

Equally any systems with energy recovery devices such as heat wheels should be avoided to minimise any cross-contamination concerns.

The hospital engineer needs to recognise that changing the outdoor air amount might impact of internal thermal conditions, building pressure balances and create humidity issues if unmanaged.

Fire risk assessment

The Department of Health and Human Service's [Capital Development Guidelines – Series 7 Fire Risk Management](https://providers.dhhs.vic.gov.au/capital-development-guidelines-series-7) (the Guidelines) <<https://providers.dhhs.vic.gov.au/capital-development-guidelines-series-7>> details expectations for fire risk management in buildings subject to the Guidelines. Guideline 7.6 relates directly to hospitals.

Where an existing area of a hospital is proposed to be converted into a patient care area for COVID-19 patients, it is recommended that a fire risk assessment of this area be completed to ensure that effective fire prevention and protection systems are in place.

In addition to the typical fire hazards found in a hospital, the fire risk assessment for the area being converted should consider the following additional risks which are directly related to the area being used to care for COVID-19 patients:

- ability of patient cohort to self-evacuate (higher life safety sleeping risk)
- increase in oxygen utilisation
- evacuation for the COVID-19 patients should an evacuation be required, such as an alternate isolation area for temporary relocation
- staff response and protection.

With regards to the oxygen usage, as there is likely to be enriched oxygen in the treatment area, the level of air changes through natural and mechanical ventilation must be maximised to lower the oxygen level and the risk of combustion. Oxygen enrichment is to be maintained below 23.5 per cent.

Rooms that could be subject to oxygen enrichment are to be adequately ventilated by mechanical and/or natural means. Interim Life Safety Plans should be developed for the additional areas.

Electrical supply

Ensure there is sufficient power to site and emergency back-up for the electrical demand of the increased bed capacity. Power outlets do not need to be supplied through an uninterruptable power supply system (UPS) but are to be connected to essential power and backed up through an emergency generator.

Consideration needs to be given to whether the emergency generator can support the additional electrical load provided by the increased capacity. Where this is not the case, a temporary emergency generator will need to be installed and allowed for in the cost plan.

Waste management

In order to minimise risk of infection, all waste associated with a patient known to have, or suspected of having, COVID-19 must be disposed of as clinical waste through a licenced clinical waste contractor. It is recommended that waste is double bagged and if a ridged bin is being used the bin must be disinfected prior to leaving the ward.

Adequate space needs to be allowed for at the bed-side, in dirty utility rooms and in the loading dock to manage the additional clinical waste.

Allow for appropriate bed-side clinical services

Medical service panels

Engagement with clinicians has identified that the primary clinical demand for COVID-19 patients is ventilator use. Whereas, these are provided in ICU beds, the additional ICU services are not necessarily required for COVID-19 patients. The recommended bed-side clinical services for COVID-19 patient compared to other bed-types is provided in **Table 1**. Diagrams of each of the medical services panels are in **Appendix 1**.

Table 1: Services to be provided for COVID-19 patients compared to other bed-types

Services (pendant or medical services panel)	COVID -19 ICU	ICU - AHFG	IPU bed	Sub-acute bed
UPS GPO	0	4	0	0
Essential GPO	8	16	4	4
Non-essential GPO	2 (ideally)	0	4	2
Data	2	6	2	2
Oxygen	2	4	1	1
Suction	2	4	1	1
Medical air	1	3	1	1
Nurse call	1	1	1	1
Staff assist	1	1	1	1
Emergency call *	1	1	1	1

* Emergency call buttons to be installed separately on wall.

Maintaining an adequate oxygen supply

To establish if medical oxygen source supply and distribution systems can cope with increased demand the following should be considered:

- the flowrate capability of each evaporator
- the flowrate capability of each pressure regulator
- sizing of mains distribution pipe sizes
- sizing of departmental distribution pipe sizes
- plant alarms may alert due to pipeline pressure reductions.

A robust review of the medical oxygen source supply is critical to establish that the storage capacity of the liquid and/or the oxygen cylinder source supplies is adequate and that the medical oxygen supplier can replenish for extended periods of time.

Health services should consider the reduction of piped medical oxygen consumption for less critical departments, such as the outpatient department, radiology, and use portable cylinders or oxygen concentrators where practical.

Diversity factors for medical gas calculations as per the Australian Standard AS2896-2011 Table B1, should be used with caution due to the increased number of patients requiring ventilators. Oxygen is to be calculated at 40 litres/minute maximum draw, which would be decreased over time to around 10 to 15 litres/minute for a COVID-19 patient requiring assistance with ventilation.

The second oxygen outlet is provided for back up, if something happens to the ventilator, like a blockage and nursing staff need to manually ventilate the patient. The second oxygen outlet is to be considered at maximum flow (40 litres/minute) when designing infrastructure sizing such as pipework. It would be either the first or second outlet supplying oxygen to the patient not both.

Medical air and suction outlet capacity are to be sized in accordance with Australian Standard AS2896-2011.

An increase in oxygen use within the space due to the higher numbers of patients on ventilators will necessitate the HVAC systems to be checked to ensure oxygen saturation within the space is avoided. Oxygen enrichment is to be maintained below 23.5 per cent.

Medical suction systems, although not directly related to the use or consumption of medical oxygen, may pose a risk of cross contamination via an existing piped medical suction system. One recommendation is to use portable suction units which can be removed and sterilised where practical.

Deliver the works

Procurement and delivery of works

Health services will need to follow their usual process to comply with building regulatory requirements, such as building permits. If a health service is experiencing any significant difficulties with compliance in relation to COVID-19 related projects, please contact Isabel Cossio, Principal Solicitor at VHHSBA at isabel.cossio@dhhs.vic.gov.au.

Procurement of equipment and supplies

Health Purchasing Victoria, the Department and the Department of Jobs, Precincts and Regions is working to secure PPE, ICU equipment and additional beds and ensure appropriate care can be delivered.

The usual processes related to compliance for equipment standards, such as Australian Standards, Therapeutic Goods Administration, related legislations (eg. Radiology Safety Act, Workcover) and related guidelines apply.

Further advice will be provided on the mechanism for securing the appropriate equipment and supplies within the required timeframe.

The ownership of medical equipment provided by the State to operate the additional beds will revert to the State once it is no longer required for responding to the COVID-19 pandemic. Queries related to equipment should be directed to COVIDequipment@dhhs.vic.gov.au.

Exit strategy

An exit strategy will need to be agreed with the department. It cannot be assumed that the increased bed capacity, or reconfigured area, will continue beyond the COVID-19 pandemic. Consideration will need to be given to converting the space back to its original purpose to enable delivery of health services beyond the pandemic.

Upon cessation of the COVID-19 pandemic an established disinfection plan should be developed before returning HVAC systems (grilles, duct, air handler) and any hospital areas back to normal operation. This should include as a

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minimum, ventilation of the room/space and terminal clean before re-use. Table 3 in the [DHHS Guidelines for the classification and design of isolation rooms in health care facilities](http://docs2.health.vic.gov.au/docs/doc/4AAF777BF1B3C40BCA257D2400820414/$FILE/070303_DHS_ISO%20RoomGuide_web.pdf) <[http://docs2.health.vic.gov.au/docs/doc/4AAF777BF1B3C40BCA257D2400820414/\\$FILE/070303_DHS_ISO%20RoomGuide_web.pdf](http://docs2.health.vic.gov.au/docs/doc/4AAF777BF1B3C40BCA257D2400820414/$FILE/070303_DHS_ISO%20RoomGuide_web.pdf)> provide a guide to the minimum time required for airborne containment removal.

References and Bibliography

Australasian Health Facility Guidelines

Australian Standard AS2896-2011 – Medical Gas Systems – Installation and testing of non-flammable medical gas pipeline systems

DHHS Guidelines for the classification and design of isolation rooms in health care facilities, Victorian Advisory Committee on Infection Control, 2007

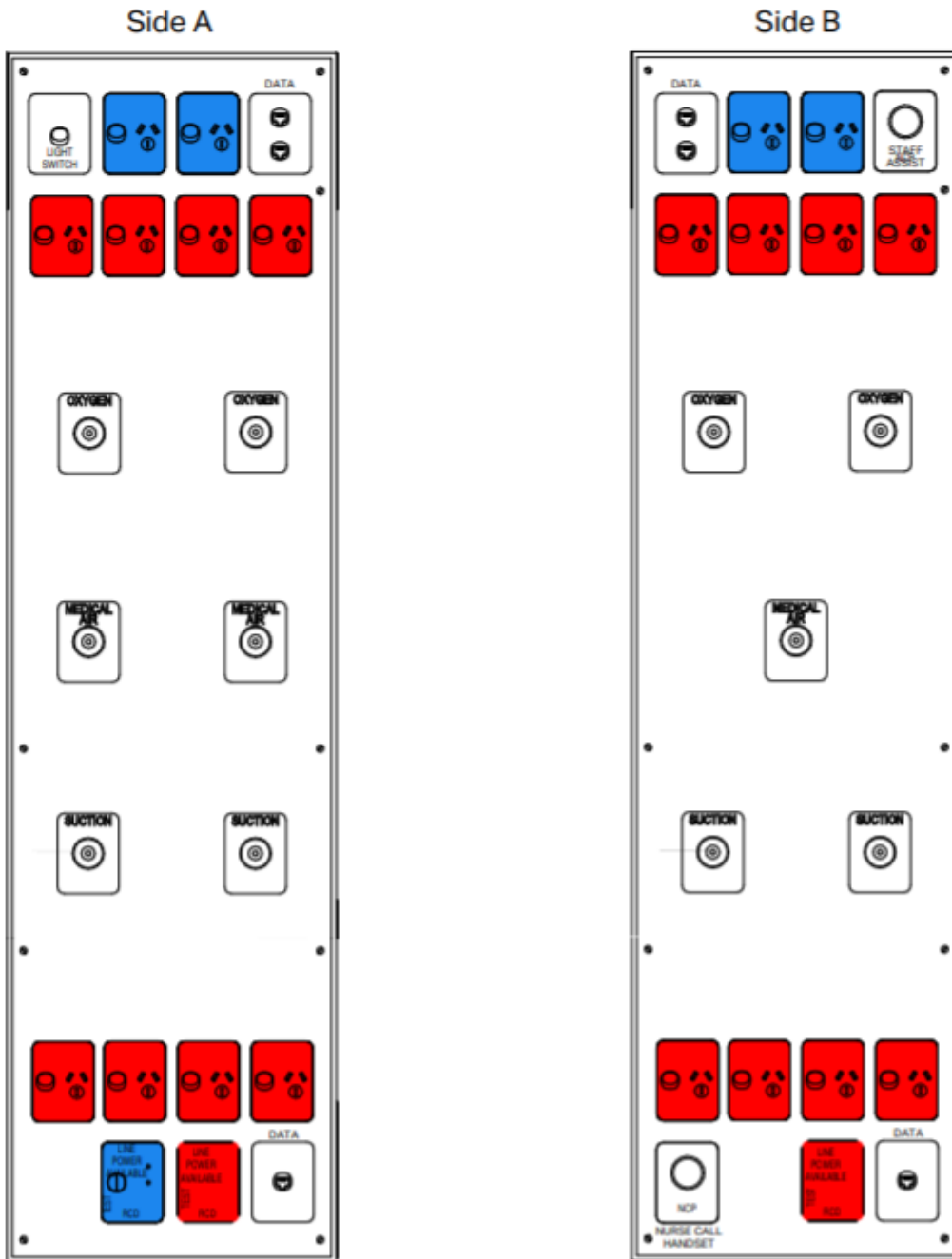
Novel coronavirus (COVID19) standard operating procedure design note: COVID-19 ward for intubated patients. NHS England and NHS Improvement. Publications approval reference: 001559. 22 March 2020

The Australian and New Zealand Intensive care Society (ANZICS) – COVID-19 Guidelines

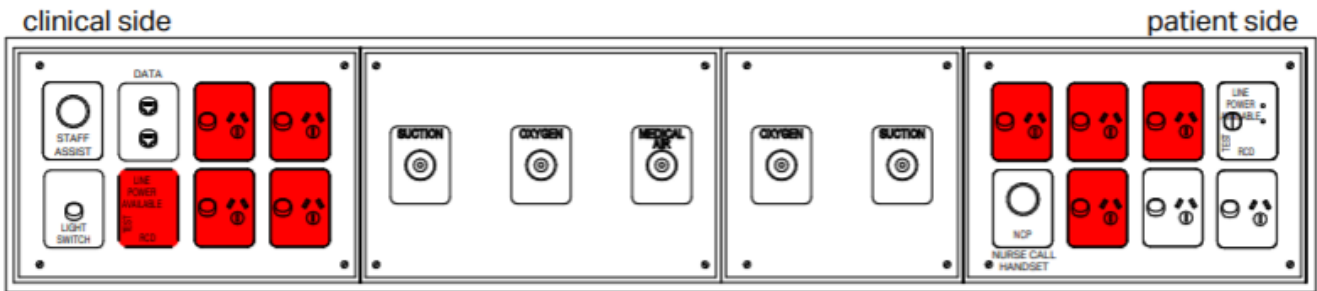
TLC Engineering Solutions COVID 19 Guidance

Attachment 1: COVID-19 medical services panel layout

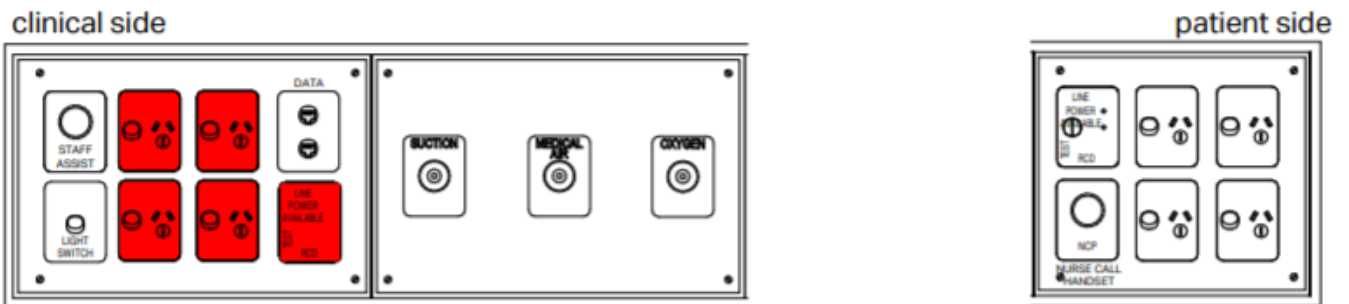
Intensive care unit bed medical services panel



COVID-19 patient bed medical services panel



Inpatient unit bed medical services panel



Sub-acute bed medical services panel

