australasian health infrastructure alliance

Australasian Health Facility Guidelines

Pandemic Preparedness –

Health Infrastructure Planning & Design Guidance

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Australasian Health Facility Guidelines

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Acronyms

ABHR	Alcohol Based Hand Rub
ACEM	Australasian College for Emergency Medicine
ACH	Air Changes per Hour
ACIPC	Australasian College for Infection Prevention and Control
ACSQHC	Australian Commission on Safety and Quality in Health Care
AGP	Aerosol Generating Procedures
AGB	Aerosol Generating Behaviours
AHIA	Australasian Health Infrastructure Alliance
ANZICS	Australian and New Zealand Intensive Care Society
ARI	Acute Respiratory Infection
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASID	Australasian Society for Infectious Diseases
AusHFG	Australasian Health Facility Guidelines
BMS	Building Management System
CDC	Centers for Disease Control and Prevention
ED	Emergency Department
ESD	Environmentally Sustainable Design
FFE	Furniture, Fittings and Equipment
HAI	Healthcare Associated Infection
HPU	AusHFG Health Planning Unit Guideline
HVAC	Heating, Ventilation & Air Conditioning
ICEG	Infection Control Expert Group (Australian Government Department of Health)
ICU	Intensive Care Unit
ICT	Information Communication & Technology
MERS–CoV	Middle East Respiratory Syndrome
PFR	Particulate Filter Respirator
PPE	Personal Protective Equipment
RANZCR	Royal Australia and New Zealand College of Radiologists
SARS-CoV-1	Severe Acute Respiratory Syndrome Coronavirus 1 (responsible for the 2003 SARS)
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2 (responsible for COVID-19)
VHBA	Victorian Health Building Authority
WHO	World Health Organization

01 INTRODUCTION

1.1 PREAMBLE

This AusHFG resource has been developed by the Australasian Health Infrastructure Alliance (AHIA) to provide health infrastructure planning and design guidance relating to pandemic preparedness. The aim of this guideline is to ensure that future hospital developments support increased resilience of health systems in response to pandemics, as well as prevention of transmission associated with acute respiratory infection (ARI) cases and surges outside of pandemics.

The document has been developed in consultation with infection control, health infrastructure and engineering specialists, as well as clinical and operational experts, from across Australia and New Zealand. This includes review and feedback by the Australian Commission on Safety and Quality in Health Care (ACSQHC), Australasian College for Infection Prevention and Control (ACIPC) and Australasian Society for Infectious Diseases (ASID). Although a number of key recommendations are made in relation to infrastructure strategies it must be acknowledged that approaches may vary between individual jurisdictions.

It is intended that this document will be regularly reviewed and updated to align with the evolving knowledge in this area, and relevant recommendations will be incorporated within other associated AusHFG resources as they are reviewed and updated.

1.2 PURPOSE AND SCOPE

The COVID-19 pandemic has required a rapidly evolving response by public health authorities to protect health workers, patients, carers and visitors within healthcare facilities. This response has involved a range of integrated strategies including considerations relating to the design of healthcare facilities.

The focus of this document is to draw on lessons learned during the COVID-19 pandemic to improve and inform health infrastructure planning and design approaches that will support resilience against future pandemics associated with infectious respiratory diseases. The recommendations reflect best practice based on the available evidence at the time of writing and acknowledgement of existing and well-established infrastructure controls that have proven successful in response to COVID-19.

The document provides guidance on the approach to health infrastructure planning and design as part of an integrated ‘hierarchy of control’ strategy to minimise the risk of infection transmission. The scope of this guidance includes:

- planning principles relating to pandemic preparedness that should be adopted for all new build and refurbishment works;
- risk minimisation strategies for infectious respiratory pathogen transmission based on the hierarchy of control model as an integrated approach to pandemic preparedness;
- key principles and references relating to engineering controls to minimise infection transmission;
- hospital unit / service specific considerations, including:
    - recommended changes to the planning and design of new build facilities to support increased resilience against future pandemics, as well as prevention of ARIs associated with cases and surges outside of pandemics,
    - suggested approach to refurbishment works, acknowledging each facility will need to be considered on a case-by-case basis through a multidisciplinary, consultative approach,

  - temporary solutions that may be implemented during pandemic periods that then allow the facility to easily return to non-pandemic periods; and
- recommendations relating to surge capacity management.

1.3 PANDEMIC PREPAREDNESS PLANNING PRINCIPLES

For routine management, surge periods and all pandemics associated with infectious respiratory diseases, the identification of health infrastructure related strategies to prevent the transmission of infectious respiratory diseases must:

- align with international, national and local jurisdictional policies
- consider the role of the health service in any local, regional or statewide or national disaster management plans
- be informed by the mechanism of disease transmission and associated level of risk to health workers, patients, carers and visitors (including students and contractors)
- be continually reassessed to align with the emerging evidence, knowledge and lessons learned
- not be undertaken in isolation but as one element of the hierarchy of control (refer to Section 2.2)
- be confirmed through a consultative approach with key stakeholders working in a cooperative and multidisciplinary way (i.e., management, infection prevention and control, infectious diseases, clinical specialties and engineering experts) to address a range of controls including engineering strategies
- consider the impact on clinical and operational practice so that any permanent infrastructure changes made do not significantly impact on workforce and patients
- be sustainable and affordable ensuring the level of risk is assessed in conjunction with the capital and recurrent cost impacts, with consideration of the ongoing cost of controlling outbreaks and healthcare associated infections (HAIs).
- promote an environmentally sustainable footprint with a high quality, low carbon and climate resilient approach to reduce emissions
- consider evolving models of care. For example, COVID-19 is no longer the main reason for admission to hospital and in many facilities, patients are managed on specialty inpatient units, where appropriate ventilation systems are in place, rather than being cohorted within a dedicated COVID-19 unit or contained pod.

1.4 POLICY FRAMEWORK

The recent experience with COVID-19 highlighted that the response to pandemics continues to evolve over time. Therefore, it is essential that this document is read in conjunction with current national and jurisdictional policies, guidelines and reports.

Key sources of information are noted below, noting that a number of these are COVID-19 specific and any future pandemics will require reference to any pathogen specific advice. Jurisdictional specific information, where available, is included in the References and Further Reading Section 08.

- Australian Government Department of Health, Communicable Diseases Network Australia (CDNA) National Guidelines
- Australian Government Department of Health, Communicable Diseases Network Australia (CDNA) National Guidelines for Public Health Units – Coronavirus Disease 2019 (COVID-19)

- Australian Government Department of Health, Infection Control Expert Group (ICEG), ICEG-Endorsed Resources for Infection Prevention and Control
- Australian Government Department of Health, Infection Control Expert Group (ICEG), The hierarchy of controls for minimising the risk of COVID-19 transmission
- Australian Commission on Safety and Quality in Health Care, Australian Guidelines for the Prevention and Control of Infection in Healthcare
- Australian Commission on Safety and Quality in Health Care, Optimising ventilation for infection prevention and control in healthcare settings
- Australian Commission on Safety and Quality in Healthcare, COVID-19 Resources
- AusHFG Part D: Infection Prevention and Control
- National Health and Medical Research Council, 2019, Australian Guidelines for the Prevention and Control of Infection in Healthcare, Australian Government, Canberra
- Te Whatu Ora Health New Zealand: COVID-19: Advice for all Health Professionals
- World Health Organization, April 2021, Roadmap to improve and ensure good indoor ventilation in the context of COVID-19
- World Health Organization, July 2021, Infection prevention and control during health care when coronavirus disease (COVID-19) is suspected or confirmed.

1.5 KEY RECOMMENDATIONS

The table below provides a summary of recommendations relating to the planning and design of healthcare facilities to support increased resilience against future pandemics. The implementation of these infrastructure strategies must be undertaken in line with the principles set out in Section 1.3 to ensure consideration of jurisdictional, service and facility specific requirements, as well as emerging knowledge, evidence, models of care and policy directions. It is also essential that any recommended solutions are established through a consultative approach with key stakeholders.

The information is delineated into considerations relating to new build facilities and refurbishment of existing facilities. This is provided as an overview of key recommendations supported by AHIA but must be read in conjunction with the detailed information included in the remaining sections of this document and the existing AusHFG resources. Any proposed changes / enhancements to the planning and design of new build units, as documented in this guideline, will be addressed within future AusHFG review processes.

Table 1: Summary of recommendations relating to the planning and design of healthcare facilities to support increased resilience against future pandemics

New Build Projects – Recommended Planning & Design Considerations for New Build Healthcare Facilities	

Engineering Controls / HVAC Systems	• Deliver HVAC systems in line with jurisdictional engineering services guidelines for healthcare facilities: https://www.healthfacilityguidelines.com.au/part/part-e-building-services-and-environmental-design. These are based on International and Australian Standards, international engineering societies such as ASHRAE, and meet the requirements set out by the WHO "Roadmap to improve and ensure good indoor ventilation in the context of COVID-19".
	• The risk of airborne transmission is minimised through the following HVAC parameters, as guided by local jurisdictional guidelines:
	  ○ room ventilation rates (air changes per hour)
	  ○ outside air rates, i.e., the proportion of fresh air provided each hour which aims to significantly reduce the number of particles, including airborne particles, recirculating in the air

New Build Projects – Recommended Planning & Design Considerations for New Build Healthcare Facilities	
	○ air pathways across a unit with consideration of targeted strategies in high risk units or pods i.e. negative airflow into high risk areas ○ airflow direction and airflow patterns within the full occupied space, i.e., the movement of air within the room with attention to 'dead spots' or short circuiting of air flow ○ filtration requirements for HVAC recirculating systems. Filtration is used to significantly dilute / reduce the concentration of particles, including airborne virus. • 100% outside air provision ('outside air economy cycle') may be achieved in some facilities depending on the local outdoor ambient temperature. This mode is commonly provided as an Environmentally Sustainable Design (ESD) solution and can be used during pandemic periods so that all air is extracted to the outside rather than being recirculated. • Where 100% outside air is not possible, each hospital may consider the possibility of increasing the outside air quantity depending on their own system configuration, along with provision of high grade filtration (minimum G4/F8 filter). • Consider enhancements to high risk areas as outlined in Sections 4 and 6 of this document (and summarised below by service area).
All Areas	• Design of hospital entry and exit points must consider requirements for patient, staff and visitor screening during pandemics and the ability to separate flows. • All patient care areas must include furniture, fittings and equipment (FFE) that are compatible with cleaning and disinfection processes. • Additional storage and waste disposal areas will be required during pandemic periods so opportunities for temporary expansion to these areas must be considered. • Consider the approach to signage and use of strategically located display frames to contain information and optimise communication.
Waiting and Reception Areas	• The size of waiting rooms, and associated ventilation requirements, for both new and existing facilities should be informed by the anticipated number of patients and support people to be accommodated both during and outside of pandemic periods. • Waiting areas should not be significantly expanded to manage future pandemics as this impacts services outside of pandemic periods due to the larger areas to operate, maintain and staff/supervise. Instead, flexible use rooms, such as meeting rooms, should be located close to waiting areas to provide overflow capacity during pandemic periods, with consideration of patient and visitor travel paths. • A range of operational strategies outlined in Section 3.1.1 may be implemented during pandemic periods to achieve appropriate physical distancing. • Consider the use of physical barriers such as glass or plastic screens in triage and reception areas, with attention to the impact on air directionality and appropriate cleaning regimes.
Personal Protective Equipment (PPE)	• All clinical units require appropriate areas to support the safe donning (putting on) and doffing (taking off) of PPE at the patient bay / room with physical separation of 2m between PPE stations to prevent cross contamination.. • PPE donning and doffing areas will also be required at the entry and exit points of designated clinical units and isolatable pods. These may be used for an alternative function outside of pandemic periods, such as a mobile equipment bay or adjacent office or interview room that will not be commonly used during a pandemic. Activity flows should be carefully considered to clearly separate flows associated with donning and doffing PPE.

New Build Projects – Recommended Planning & Design Considerations for New Build Healthcare Facilities	
	• EDs, ICUs and Operating Units require capacity to clean, reprocess, charge and store Powered Air Purifying Respirator (PAPR) units adjacent to PPE stations.
Virtual Care Models	• All patient consult and meeting rooms should be designed to support virtual care. The systems and equipment required will depend on service need and local ICT policies. • Facilities provided in remote areas may consider provision of a 'telehealth room' that can be flexibly used during pandemic periods to minimise travel and where travel restrictions may be in place to support patients who may not have reliable internet access, or the appropriate devices required to support telehealth services from their home.
Single Room Configuration	• The proportion of single bedrooms provided within a new build facility is the single most effective infection prevention and control strategy to reduce the risk of exposure and transmission to others. Refer to Section 05 and Leah et al 2023. • There is no single recommended solution regarding the optimal or preferred proportion of single bedrooms. It is recommended, for new build facilities, that 60-80% of beds are provided as single bedrooms, however this must be determined on a project by project basis with consideration of the role of the health service, anticipated patient case mix, epidemiological trends, safety and workforce considerations, and recurrent and capital cost impacts. • AHIA is undertaking further analysis regarding recommendations relating to this issue as part of the update to HPU 340 Adult Acute Inpatient Unit, with consideration of the full range of impacts including infection, prevention and control. Once these recommendations are agreed by all jurisdictions this guideline will be updated accordingly. • A number of units will require 100% single rooms as outlined in Section 05.
Emergency Departments (ED)	• For waiting areas, consider opportunities to provide overflow capacity and a separated area during pandemic periods, while ensuring all patients remain in view of the triage nurse/s. • Separate air handling systems should be provided for each major ED zone, e.g., acute, fast track etc. • For EDs with multiple resuscitation rooms, a number of these rooms should be enclosed with the ability to provide a temporary negative flow through a 'pandemic mode' controlled via the BMS. Direct access to a PPE donning and doffing area outside the rooms will be required. This may be a repurposed space that is used for alternative functions outside of pandemic periods. • For large EDs with multiple pods, it is recommended that one pod is created (e.g., in the acute zone) that has a separate air handling unit to become an isolatable pod, with provision of HVAC system enhancements as noted under Section 6.1.2. • All new EDs should include a minimum of 1 Class N room. • For smaller EDs, the Class N room may be increased from 15m^2 to 20m^2 and located near to the resuscitation zone to support resuscitation and other procedures when required. • For EDs that may provide swabbing services during infectious outbreaks (e.g., small rural facilities), the layout of the ED should be considered to support separation of patient flows for pathology specimen collection and assessment. This should be designed for flexible use of the associated treatment spaces / consult rooms outside of pandemic periods. • A large undercover area should be provided outside EDs for temporary provision of screening stations and support for communication systems, along with capacity for outdoor seating and hand hygiene facilities.

New Build Projects – Recommended Planning & Design Considerations for New Build Healthcare Facilities	
ICU	• For all large ICUs (i.e., with 3 or more discrete pods), the provision of a pandemic pod with a separate air handling unit should be considered, along with HVAC system enhancements as noted under Section 6.2.2. • For smaller ICUs, it is recommended that a proportion of beds are fitted with negative flow capability, as an adjunct to Class N rooms.
Operating Suite	• New operating theatres are designed to AS1668.2 with positively pressured, ultra-clean HEPA-filtered air handling systems that achieve a minimum of 20 air changes per hour (ACH). The air handling design, along with PPE, ensure that the risk of airborne spread to both patients and staff is extremely low. • In order to reduce the time taken for airborne contaminants to be removed during pandemic periods, jurisdictions may consider adopting higher minimum ACH adequate to achieve required pressure regimens. • Open bays are preferred in recovery areas to optimise patient observation so the provision of single enclosed rooms should be minimised. However, larger recovery areas may be zoned to support cohorting of patients when required.
Maternity & Neonatal Care Units	• Contemporary birth rooms are designed with negative airflow. • One birth room should include an area for donning and doffing PPE for patients requiring airborne isolation precautions. This may be required for additional birth rooms on larger units depending on the outcomes of a risk assessment and consideration of the local epidemiological profile. • Maternity inpatient units and neonatal care units will require N class rooms as recommended in the relevant AusHFG guidelines.
Inpatient Units	• Refer above regarding the provision of single rooms. • Features of the HVAC design in contemporary inpatient units enhances their adaptability when managing large numbers of patients with ARIs. These include the ability to operate in 100% outside air mode (subject to local outdoor ambient temperature) or maximise the amount of outside air achievable and provide high grade filtration, and dedicated air handling units provided to each inpatient unit. • For high risk inpatient units, i.e., respiratory and infectious diseases units / pods, targeted air pathway strategies should be adopted in line with local jurisdictional guidelines. For example, the provision of ducted return air within individual patient rooms, rather than via a common corridor, may be considered in high risk units or pods. This may also be considered for units planned to be used for surge capacity during pandemic periods.
Medical Imaging	• Planning must consider the flows for infectious patients, particularly for modalities that are frequently required for urgent scans, including during pandemic periods, such as CT. • Interventional imaging rooms should be routinely equipped with air handling systems that are consistent with operating theatre design. • A Class S isolation room, with toilet, is recommended for the main Medical Imaging unit of new developments in the holding / recovery zone.
Ambulatory Care	• As recommended in AusHFG HPU 155, medical day stay services, such as renal dialysis, chemotherapy and other infusions services, should be designed to support cohorting of patients in isolatable pods and include the provision of single enclosed room/s. • Where pandemic swabbing assessments may be provided in outpatient areas, the design should consider separation of patient flows from entry through to exit with access to consult / treatment rooms and pathology specimen collection areas.

New Build Projects – Recommended Planning & Design Considerations for New Build Healthcare Facilities	
Oral Health	• Some larger, specialised facilities may be required to treat clients with a confirmed ARI and will ideally require access to a negative pressure room. In the context of a pandemic, this would only be undertaken for urgent / emergency dental treatment. • Where open plan units are provided (commonly associated with teaching and supervision of students), physical barriers such as screens or partitions will be required between chairs, ensuring optimal cleaning practices are implemented.
Staff Work Areas and Amenities	• Where possible, new facilities should be designed to separate staff workspace and amenities into staff only zones, however this needs to be balanced against the need for staff safety where they are rostered 24/7 (e.g., inpatient units). • Where possible, locate meeting / training rooms for use as temporary expanded capacity for staff rooms when required. Refer to Section 6.9 regarding ventilation considerations. • Ensure shared work spaces support a minimum of 1.5m between desks. Note the AusHFG Workstation Standard Components allows for an 1800mm wide desk within the 4.5m2 area allocation. • Access to hand hygiene and cleaning stations must be provided in shared work areas.

Refurbishment Projects – Key Considerations for Existing Facilities	
Engineering Controls / HVAC Systems	• Undertake an analysis of existing HVAC systems and physical infrastructure to inform containment and ventilation strategies. Consider the following enhancements during pandemic periods depending on the status of existing systems, service requirements and facility location: o Optimise exhaust air in high risk settings to minimise the amount of air being recirculated by switching the system to 100% outside air cycle (where appropriate subject to local conditions). o Where 100% outside air cannot be achieved, maximise the amount of outside air achievable and provide high-grade filtration. o Support the approach to high risk clinical areas through associated HVAC design. This may include the provision of ‘negative airflow’ in selected areas as per service specific considerations below. o Refer to Section 4 regarding consideration of supply air diffusers and portable air filtration units.
All Areas	• Refer to information in the table above.
ED	• Where enclosed resuscitation rooms with the ability to provide negative airflow (as noted above) cannot be achieved, the entire resuscitation area may be designed with HVAC enhancements including increased ventilation rates, enhanced filtration, and balanced airflows to cultivate negative or neutral airflow within the resuscitation room/s. • Consideration of a physically isolatable pod in large EDs, as noted above, where feasible and necessary depending on the size, configuration and role of the unit. This may not be achievable in all instances depending on existing HVAC systems and physical infrastructure. • While many services have used temporary outdoor structures to screen and separate patients, the long term use of strategies such as this have been problematic. Repurposing of adjacent, flexible use areas such as meeting rooms should be considered, along with a review of patient flow pathways.

Refurbishment Projects – Key Considerations for Existing Facilities	
ICU	• Consideration of an isolatable pod in large ICUs, as noted above, where feasible and necessary depending on the size, configuration and role of the unit. This may not be achievable in all instances, particularly for older ICUs with an open plan design. • Provide negative flow capability within a proportion of beds, as an adjunct to Class N rooms.
Inpatient Units	• Refer to principles noted in the table above where achievable within existing systems and in line with jurisdictional guidance and the anticipated casemix for the facility. • Requirements will depend on the status of existing HVAC systems and the number of existing N class and single rooms to isolate patients. These rooms will continue to be required to manage patients with high risk pathogens such as Tuberculosis (TB), Measles, Chickenpox, Gastroenteritis and Carbapenemase-Producing Organisms (CPO).
Operating Suite	• Jurisdictions may consider increasing the ventilation rate in operating and interventional procedural rooms to acceptable levels within existing systems to increase the efficiency of contaminant removal.
Maternity & Neonatal Care Units	• One birth room should include an area for donning and doffing PPE for those patients requiring airborne isolation precautions. This can be provided through an existing bay that is used for alternative functions outside of pandemic periods (e.g., mobile equipment bay). This may be required for additional birth rooms on larger units depending on the outcomes of a risk assessment and consideration of the local epidemiological profile.
Oral Health	• Refer to section above.

02 INTEGRATED APPROACH TO PANDEMIC PREPAREDNESS

2.1 MECHANISM OF DISEASE TRANSMISSION

Future infrastructure solutions must be informed by the mechanism of disease transmission and associated level of risk to health workers, patients, carers and visitors. The principal mode by which people are infected with SARS-CoV-2 (the virus that causes COVID-19), and is applied to many other respiratory viral illnesses, is through exposure to microscopic respiratory fluids carrying infectious virus. People release microscopic respiratory fluids during Aerosol Generating Behaviours (AGBs), e.g., quiet breathing, speaking, singing, exercise, coughing and sneezing, in the form of droplets across a spectrum of sizes. These droplets carry microorganisms and transmit infection.

The largest droplets (>200µm) settle out of the air rapidly, within seconds to minutes. The WHO and CDC define airborne transmission as the presence of infectious microbes within droplets, (generally considered to be particles <5µm in diameter), which can remain in the air for long periods of time and be transmitted to other places over distances greater than 1 metre. These aerosols tend to settle slowly (minutes to hours), and therefore have increased opportunity to travel with air currents away from the source.

The following references provide information relating to the transmission of infectious aerosols and the factors affecting respiratory infection risk:

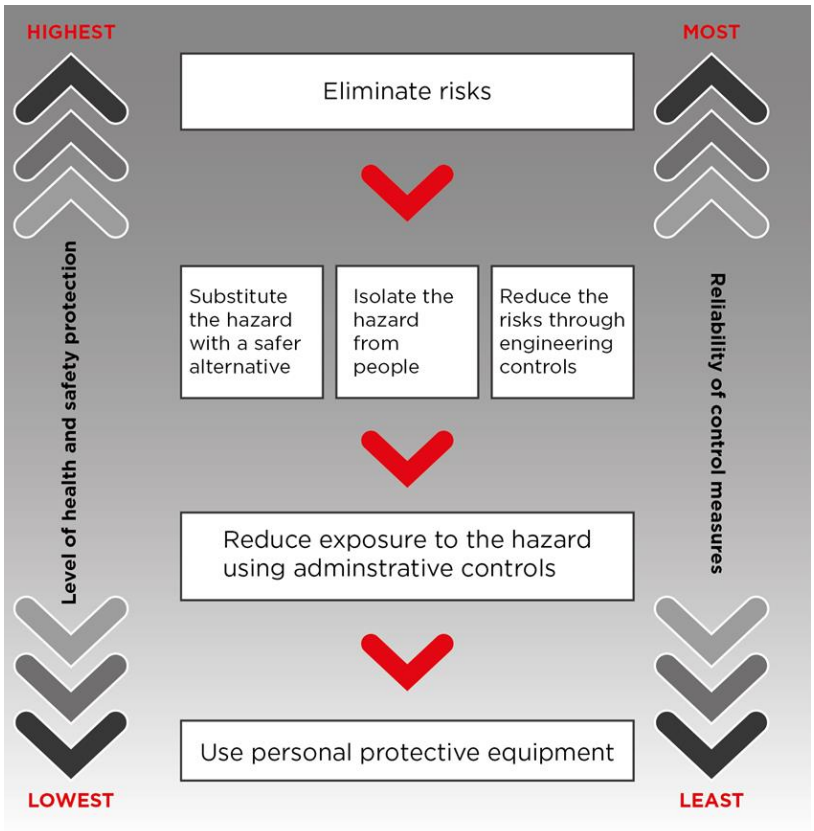
- ASHRAE, October 2022, ASHRAE Positions on Infectious Aerosols
- Centers for Disease Control and Prevention (CDC), May 2022, CDC Scientific Brief – SARS-CoV-2 Transmission
- Victorian Department of Health, June 2022, COVID-19 Policy. Infection control measures to optimise ventilation and reduce transmission of COVID-19 in acute healthcare settings
- Ma, J. et al, May 2021, Coronavirus Disease 2019 Patients in Earlier Stages Exhaled Millions of Severe Acute Respiratory Syndrome Coronavirus 2 Per Hour, Clinical Infectious Diseases, Volume 72, Issue 10, 15 May 2021, Pages e652–e654
- Fears et al, September 2020, Persistence of Severe Acute Respiratory Syndrome Coronavirus 2 in Aerosol Suspensions , Emerging Infectious Diseases Journal – CDC, Volume 26, Number 9.

The airborne transmission of respiratory pathogens, as noted in these references, underpins the requirement for adequate and evidence-based ventilation infrastructure within healthcare facilities as further described in Section 04. This must be provided in conjunction with other strategies to minimise the risk of disease transmission through controlling the mechanism of exposure, including the appropriate use of PPE, physical distancing and others outlined in Section 2.2.

2.2 INFECTION PREVENTION AND CONTROL AND THE HIERARCHY OF CONTROL

Managing the risk of disease transmission in healthcare facilities requires the implementation of multiple, integrated strategies. Well established infection prevention and control strategies should be further supported by the ‘hierarchy of control’ model used in work health and safety risk assessment. The model lists various risk avoidance or mitigation strategies from the highest level of protection and reliability through to the lowest and least reliable protection. Multiple control strategies are implemented until the hazard is eliminated or effectively minimised. The strategies can be implemented at the same time and/or following on from one another.

The levels of the hierarchy of control are noted in the diagram below:



Source: Safe Work Australia, How to manage work health and safety risks Code of Practice May 2018.

The Australian Department of Heath Infection Control Expert Group (ICEG) document 'The hierarchy of controls for minimising the risk of COVID-19 transmission' provides a comprehensive list of risk minimisation strategies for high impact infectious respiratory pathogens, based on infection prevention and control, supported by the hierarchy of control. Many of these strategies were at the forefront of the COVID-19 response to protect health workers, patients, carers and visitors in health settings.

Table 2 summarises the potential strategies outlined by the ICEG relating to health infrastructure, acknowledging that these should not be considered in isolation but are part of the overall hierarchy of controls. This is included as an example of the recommended strategies in response to COVID-19.

Table 2. Example of risk minimisation strategies used during COVID-19

Eliminate Risks - Physically remove the hazard
Limit the number of patients or residents going into hospitals or outpatient settings. For example: • set up offsite or outdoor fever/ testing clinics • consider telehealth appointments.
Proactively detect and prevent entry to the facility of potentially infectious personnel (health workers, students, contractors, volunteers or visitors).
Reduce the number of visitors and non-essential staff in addition to entry points into the facility/ campus and monitor all entry movements. Simplify visitor registration.
Isolate People from the Hazard and Reduce the Risk through Engineering Controls
Review and optimise ventilation and air quality including: • air exchange rates • airflow and air filtration systems • temperature • ambient humidity.

Use negative pressure rooms with anteroom for SARS-CoV-2-positive patients where available. If a negative pressure room is not available, use a standard isolation room or single room with negative airflow. Do not accommodate these patients in rooms with positive pressure airflow.
Consider grouping cohorts of patients with SARS-CoV-2- in dedicated wards or zones separate to: • uninfected patients/residents • those with uncertain SARS-CoV-2 status.[1]
Redesign work areas to limit the number of workers at workstations. Maintain airflow direction away from workstations towards patient care areas where possible.
Place physical barriers such as glass or plastic screens in triage and reception areas where physical distancing is difficult to maintain (whilst ensuring optimal cleaning practices are implemented).
Administrative Controls - Change the way people work
Use signage (in appropriate languages) at the facility entrance to alert visitors to not attend while unwell.
Triage and manage visitors. Ensure they comply with hand hygiene and PPE requirements.
Reduce opportunities for transmission between health workers by promoting use of telehealth technology for all staff meetings.
Manage all workspaces to reduce respiratory transmission risk by adopting measures to improve physical distancing. For example, floor markings, spaced seating, maximum room occupancy notices.
Adopt general measures to reduce contact spread, such as education and training. Promote good hand hygiene with sufficient products and facilities available and increase cleaning and disinfection of shared areas.
Personal Protective Equipment (PPE) - Protect the worker
Ensure supply of PPE items and related equipment at the point of use and access to the facility.
Provide effective training and education.
Ensure provision of appropriate areas for donning and doffing of PPE with a minimum distance of 2m separation to prevent cross contamination from infection particles onto clean PPE.
Ensure provision of appropriate PPE disposal areas.

Source: Adapted from the Australian Department of Health, Infection Control Expert Group (ICEG), 2022

[1] Noting most services have reverted to managing patients in specialty wards, rather than cohorting those with ARIs.

03 CLINICAL AND OPERATIONAL PRACTICES IMPACTING HEALTH INFRASTRUCTURE

3.1 WAITING AREAS AND PHYSICAL DISTANCING

During the COVID-19 pandemic, the Australian Commission on Safety and Quality in Health Care (ACSQHC) recommended that 'health service organisations should ensure that arrangements are in place to enable the workforce, patients, carers and visitors (including students and contractors) to comply with physical distancing requirements of 1.5 metres during planning, preparation and post treatment, and in all clinical and non-clinical areas. The exception is during physical examination and provision of one-to-one care, when standard precautions are required for all patients, regardless of known COVID-19 status; and transmission-based precautions should be employed, as appropriate' (ACSQHC, 2021).

Limits placed on the number of people allowed in enclosed spaces as well as limits on gathering sizes, although varying between jurisdictions, attempt to reduce overall environmental exposure risk. These requirements have impacted waiting areas across health facilities.

3.1.1 Design Implications and Operational Strategies

The size of waiting rooms for both new and existing facilities should be informed by the anticipated number of patients and support people to be accommodated both during and outside of pandemic periods. It is important to acknowledge that waiting areas should not be significantly expanded to manage future pandemics as this impacts services outside of pandemic periods due to larger areas to operate, maintain and staff/supervise. Instead, consideration should be given to the location of flexible use rooms, such as meeting rooms, close to waiting rooms to provide an overflow waiting space during pandemic periods. Meeting rooms are less utilised during pandemic periods and can provide a temporary solution to effectively accommodate waiting patients within the required physical distancing requirements. It is also important to consider the patient path of travel into and out of waiting areas.

In addition to this, the following operational strategies may be implemented during pandemic periods to achieve appropriate physical distancing without having to significantly expand the available waiting area:

- restricting the number of visitors attending the unit
- considering if telehealth options may be used for patient consultations and/or to communicate with family members while the patient attends the unit
- scheduling appointments to minimise wait times
- providing queue management / flow systems to minimise the number of patients in the waiting area
- using signage and placement of chairs to support physical distancing
- considering other appropriate strategies e.g., patients wait in their car, or outside in existing or temporary covered structures, until their appointment
- cohorting of patients waiting for care in emergency departments, according to risk.

Ventilation requirements within waiting areas will be informed by the maximum room occupancy. In existing facilities, where the system does not allow enhanced ventilation to the recommended minimum per person requirements, services will need to consider reducing the maximum room occupancy and implementing the strategies outlined above and other HVAC strategies as noted in Section 04 of this document and the WHO's "Roadmap to improve and ensure good indoor ventilation in the context of COVID-19".

3.2 PERSONAL PROTECTIVE EQUIPMENT

The Australian Guidelines for the Prevention and Control of Infection in Healthcare contain guidance on the use of PPE under standard and transmission-based precautions, as well as during outbreak situations.

The Australian Government Department of Health ICEG provides information relating to PPE and COVID-19 as part of the ICEG endorsed infection control guidance including 'Guidance on the use of personal protective equipment (PPE) for health care workers in the context of COVID-19.

The NZ Ministry of Health provides information relating to PPE within the Te Whatu Ora Health New Zealand: COVID-19: Infection prevention and control recommendations for health and disability care workers'.

3.2.1 Design Implications

The standard design of patient care areas in hospitals includes storage of PPE relating to standard and transmission-based precautions. AusHFG Part D recommends that PPE is located outside of each single bedroom or pair of single rooms or multi-bed rooms where cohorting is common. PPE may be stored in a range of ways but is typically provided in wall mounted units or stored on trolleys in a location that minimises opportunities for contamination. All inpatient areas require support for donning and doffing of PPE at the room or bay with physical separation of 2m between PPE stations to prevent cross contamination. In negative pressure isolation rooms, PPE is stored in the anteroom. This room should include the appropriate signage

Clinical areas will require a dedicated space at entry and exit points to support the safe donning and doffing of PPE including storage of items and access to hand hygiene and cleaning products (refer to Service Specific Considerations Section 06 for further detail). This may be a room or bay that is used for an alternative function outside of pandemic periods, such as a mobile equipment bay or an adjacent office or interview room that will not be commonly utilised during a pandemic. The space at the end of a corridor that has no through traffic may also provide effective use of space for this function, assuming it supports optimal staff workflows, i.e., staff are not having to travel long distances.

PPE donning and doffing areas should also be included at the entry / exit points to the following areas:

- designated isolatable pods in large EDs
- designated isolatable pods in large ICUs
- designated birthing room/s used to manage patients requiring airborne isolation precautions.

Repurposing space for PPE activities would not be required for operating theatres and interventional imaging areas, given these functions are already undertaken in scrub bays.

EDs, ICUs and Operating Units will require capacity to clean, reprocess, charge and store Powered Air Purifying Respirator (PAPR) units adjacent to PPE stations.

Storage capacity needs to be considered along the supply chain so that provision at the point of care is optimised. Appropriate waste disposal locations also require consideration.

3.3 HAND HYGIENE

Recommended hand hygiene practices are provided in the following guidelines:

- Australian Commission on Safety and Quality in Health Care (ACSQHC), Australian Guidelines for the Prevention and Control of Infection in Healthcare
- Australian Commission on Safety and Quality in Health Care (ACSQHC), National Hand Hygiene Initiative

- Health Quality and Safety Commission New Zealand, 'Ringa Horoia - Hand hygiene - Prevention the spread of infection through good hand hygiene'

3.3.1 Design Implications

AusHFG Part D provides detailed information relating to design requirements to support optimal hand hygiene practices including the types of basins and recommended placement within the various hospital units. There are no anticipated changes to the placement and design of hand hygiene facilities within health care facilities in response to COVID-19. Enhanced access to ABHR will be required when responding to outbreaks and pandemics. Consideration should be given to the provision of automated stations for ABHR to minimise incidents of theft.

3.4 AEROSOL GENERATING PROCEDURES

There are many procedures that may be 'respiratory aerosol-generating' that increase the risk of transmission through increased generation of respiratory particles including virus laden particles such as SARS-CoV-1, SARS-CoV-2 and Middle East respiratory syndrome (MERS–CoV) (WHO 2021). These AGPs may include tracheal intubation, non-invasive ventilation, tracheotomy, and bronchoscopy.

3.4.1 Design Implications

Where AGPs may be performed, facility planning strategies need to focus on containment and optimising ventilation to manage the risk of transmission.

Access to negative pressure rooms (Class N) or negative flow should be provided, or if unavailable, a single room (that is not a Class P room) with the door closed (Refer to Section 04 of this document and the WHO "Roadmap to improve and ensure good indoor ventilation in the context of COVID-19").

For mechanically ventilated areas, the "WHO Roadmap" recommends minimum airflow requirements of 12 ACH where AGPs are performed and a minimum of 6 ACH for other patient care areas. This is consistent with the recommendations in most jurisdictional engineering services guidelines for healthcare facilities across Australia. This includes the following recommended ACH for locations where AGPs are commonly provided. Refer to jurisdictional engineering guidelines for further information.

Table 3. Recommended ACH for locations where AGPs are commonly provided

Service Area	Minimum Total Air Changes per Hour (ACH)
Operating Theatres	20-25
Interventional Imaging	20-25
Emergency Department Resuscitation Room	15
Intensive Care Unit	12
Bronchoscopy Procedure Room	12
Rooms supporting Sputum Induction and Nebulised Pentamidine	12
Lung Function Testing Rooms	12
Class N Isolation Room	12

Although operating theatres are positively pressured to protect the patient, AGPs can still be provided as the air change regime will ensure there is sufficient and ongoing dilution of the air within the room. Consideration may be given to increasing the minimum number of air exchanges per hour (refer to Section 6.3). This increase in ACH may not be possible in an existing facility.

For further information refer to:

- NSW Health Clinical Excellence Commission, COVID-19 and Other Acute Respiratory Infections, Infection Prevention and Control Manual
- Queensland Health, COVID-19 Infection Prevention and Control Manual
- Victorian Health Building Authority (VHBA), December 2020, HVAC System Strategies to Airborne Infectious Outbreaks, Health Technical Advice: HTA-2020-001-Rev B
- World Health Organisation: Infection prevention and control during health care when coronavirus disease (COVID-19) is suspected or confirmed.
- Centers for Disease Control and Prevention, Environmental Infection Control Guidelines.

3.5 VIRTUAL CARE / TELEHEALTH

Virtual care involves an interaction between a patient and a clinician, or between clinicians, occurring remotely through the use of information technologies (NSW Health Virtual Care Strategy 2021 - 2026). It supports increased access to care by providing patients choice to have care delivered at a distance where it is clinically appropriate and more useful for the patient. Telehealth services have been referred to and supported by health planning and design for many years, however 'virtual care' is increasingly being referenced to better reflect the broader range of technologies available. For example, advances in cameras, monitoring devices and apps are increasingly enabling patients to be monitored remotely with the use of technology to support improved diagnostic and predictive capabilities, as well as real time patient data collection.

COVID-19 has resulted in a significant growth in virtual care across Australia and internationally. The rapid uptake of these models has mainly been due to necessity in order to comply with social distancing requirements and reduce the risk of transmission. It is anticipated that there will be continued growth in virtual care, in line with innovations in technology, as an efficient and effective model of care to complement, or supplement face-to-face consultation. It has a role across the care continuum from first response and emergency care through to community and primary healthcare. Virtual care can also support the integration of the multidisciplinary team including specialists, allied health and primary care to enhance holistic comprehensive care and improve continuity of care.

3.5.1 Design Implications

All patient consult and meeting rooms should be designed to support virtual care to enable clinicians to move seamlessly between in-person and virtual consultations / meetings with patients, family members and other clinicians. The systems and equipment required will depend on service need and local ICT policies, but will include a camera, monitor/display system, sound system and microphone. Refer to the AusHFG Meeting Room Standard Components for further information relating to the provision of video conferencing systems.

The provision of other virtual modalities will depend on the models of care to be supported and these should be clearly defined in the Clinical Services Plan. Even prior to COVID-19 some jurisdictions have developed 'virtual care centres' that comprise of workstations or 'virtual care pods' to support remote consultations and remote monitoring technologies. Hospital type monitoring can be undertaken remotely via the virtual care centre through the delivery of monitoring devices to the patient, such as wearable pulse oximeters, temperature patches and remote spirometers. Key design consideration relating to virtual care centres include:

- workstations will typically require multiple screens, a webcam, and headset with access to videoconferencing platforms
- appropriate acoustic design is essential to minimise noise transfer to and from adjacent workstations for privacy and to minimise disruption. Background noise (e.g., from air conditioning) should also be minimised
- decor should be light / neutral and free from busy patterns for optimal image quality.

All of the above must consider infection prevention and control, such as the ability to comply with any cleaning requirements implemented as part of standard or transmission-based precautions.

3.5.2 Regional and Rural Considerations

In regional and rural facilities, there is increasing provision of fixed or mobile telehealth units and critical care cameras to support the assessment and liaison with expert clinicians located in other networked health services. This enables more patients to be managed locally, potentially avoiding the need to be transferred to another facility and promotes the upskilling of staff.

Remote services may also provide facilities for patients to attend their local rural hospital for follow up specialist appointments via telehealth with clinicians located in other facilities, e.g., metropolitan or large regional hospitals. AusHFG HPU 350 Small Rural Hospitals and MPS includes an optional 'Telehealth Room' for services providing local patients with access to specialist appointments via telehealth. This includes recommendations relating to typical design requirements for the room. This may be a dedicated space depending on anticipated utilisation or a flexible use space within the facility. It is commonly provided in remote areas to minimise patient travel where large geographical distances are involved and where patients may not have reliable internet access, or the appropriate devices required to support telehealth services from their home. It can also be used flexibly during pandemic periods to minimise travel and where travel restrictions may be in place.

3.5.3 ICT Systems

ICT systems necessary to support clinical measurement and virtual models of care must be assessed during planning and design processes to ensure an appropriate level of capability is provided that also supports future flexibility. There are a range of integrated ICT systems, all of which need to ensure appropriate data privacy and security:

- appropriate bandwidth, reliability and redundancy to support videoconferencing without interruption and working remotely interactive technologies such videoconferencing and instant messaging
- monitoring or diagnostic technologies, e.g., physiological monitoring devices and sensors
- patient communication systems, such as intercoms, to support patients and staff within isolation rooms
- other e-health technologies such as Picture Archiving and Communication Systems (PACS) and electronic health records to support the integration of virtual occasions of service directly into the patient record.

These must be able to withstand environmental cleaning requirements.

04 ENGINEERING CONTROLS / HVAC SYSTEM STRATEGIES

Detailed engineering guidelines are outside the scope of the AusHFG, however, key references and overarching principles relating to engineering controls to prevent the transmission of respiratory pathogens are described below. Information may need to be adapted to respond to local environmental conditions such as high levels of humidity.

Key reference documents at the time of writing this guidance include:

- Jurisdictional engineering services guidelines for healthcare facilities. Relevant references are available on the AusHFG website: https://www.healthfacilityguidelines.com.au/part/part-e-building-services-and-environmental-design
- Standards Australia 2012, AS 1668.2: The use of air conditioning and ventilation in buildings, SAI Global.
- World Health Organization, April 2021, Roadmap to improve and ensure good indoor ventilation in the context of COVID-19
- Australian Commission on Safety and Quality in Health Care, Optimising ventilation for infection prevention and control in healthcare settings
- American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) COVID-19 Response Resources: ASHRAE COVID-19 Response Resources.
- ASHRAE, October 2022, ASHRAE Positions on Infectious Aerosols
- Centers for Disease Control and Prevention, July 2019, Guidelines for Environmental Infection Control in Health-Care Facilities
- Victorian Health Building Authority (VHBA), December 2020, HVAC System Strategies to Airborne Infectious Outbreaks, Health Technical Advice: HTA-2020-001-Rev B
- Victorian Health Building Authority (VHBA), May 2021, Aerosol Hot Spot Study within Healthcare Environments: HTA-2021-001

4.1.1 Key Principles

Engineering controls to prevent infectious disease transmission are a key part of infection prevention and the hierarchy of controls in high-risk settings and should always be implemented in conjunction with other prevention and control strategies. The key focus relates to **containment** and **optimising ventilation** to manage the risk of transmission.

Containment can include isolating patients in single rooms where the door can be closed. Where this is not available, patients may be cohorted or separated by distance. Containment is further achieved through design in new facilities where HVAC systems are typically dedicated to a particular clinical area (e.g., an inpatient unit).

Ventilation and filtration provided by HVAC systems can significantly reduce and dilute the airborne concentration of infectious particles and thus the risk of transmission through the air (American Society of Heating, Refrigerating and Air-Conditioning Engineers – ASHRAE).

To minimise the risk of airborne transmission the following HVAC parameters must be considered.

- room ventilation rates, i.e., number of air changes per hour (ACH),
- outside air rates (i.e., the proportion of fresh air provided each hour which aims to significantly reduce the number of particles, including airborne virus, recirculating in the air),
- air pathways across a unit with consideration of targeted strategies in high risk units or pods (refer to Section 06 for further details),

- airflow direction and airflow patterns across the full occupied space, i.e., the movement of air within the room with attention to dead spots or short circuiting of air flow, and
- filtration requirements for HVAC recirculating systems. Filtration is used to dilute / reduce the concentration of particles, including airborne virus.

For healthcare settings the WHO "Roadmap to improve and ensure good indoor ventilation in the context of COVID-19" provides recommendations relating to HVAC systems, as well as recommended strategies for those facilities that do not meet the minimum requirements.

4.1.2 HVAC Systems in New Build Hospitals

HVAC systems delivered in recently developed hospitals across Australia are consistent with facilities across the developed world and are based on International and Australian Standards and international engineering societies such as ASHRAE. For this reason, the current ventilation and filtration regimes in most recently delivered facilities (10 to 12 years old) are likely to be of high standard and able to meet the requirements set out in the WHO Roadmap. For details relating to the mechanical and related design of specific healthcare spaces, refer to jurisdictional engineering guidelines. Most will include a ventilation table that provides detailed recommendations relating to all design parameters.

In addition to ventilation, a range of general hospital design trends over the last decade supported the management of patients during COVID-19 to minimise transmission rates, such as an increased proportion of single bedrooms, the provision of negative pressure isolation (class N) rooms and 100% single bedrooms in ICUs.

General design approaches for new HVAC systems in high risk areas are consistent with the information included in Section 4.1.3. Recommendations relating to the design of specific high-risk service areas / units are outlined in Section 6, along with considerations relating to associated HVAC system strategies. These strategies must be established in line with the planning principles outlined in Section 1.3 of this guideline. This includes consideration of emerging knowledge and evidence; evolving models of patient care; local, national and international policies; and the impact on sustainability and affordability.

4.1.3 Enhancements to Existing Systems

During the COVID-19 pandemic hospital HVAC designs were adapted by some health services to enhance safety in high-risk settings. The WHO Roadmap provides excellent guidance on minimum requirements and strategies that might be implemented to manage risk

These enhancements for high-risk areas have included:

- Optimising exhaust air to minimise the amount of air being recirculated by switching the system to 100% outside air cycle. This mode is commonly provided in modern HVAC systems as an Environmentally Sustainable Design (ESD) solution and can be used during pandemic periods so that all air is extracted to the outside rather than being recirculated. This arrangement is optimised when temperatures fall within a prescribed range as temperature control and comfort may be an issue outside these parameters. For example, hospitals in northern Queensland and the Northern Territory may not be able to operate on 100% outside air. Humidity also needs to be considered as it can impact on diagnostic equipment and the creation of mould when used for extended periods during very wet and/or humid weather. Routine inspections and interventions must be in place to prevent mould. The BMS can be used to target the use of this mode as it can be 'set' for individual air handling units. Where 100% outside air is implemented, each hospital should consider and monitor its own local climate and the daily weather conditions and the indoor conditions. Higher or lower outdoor temperature and humidity conditions may lead to indoor conditions going outside the desired control range.

- For hospitals that cannot achieve 100% outside air when operating in pandemic mode, the possibility of increasing the outside air quantity, depending on their individual system configuration, may be considered. This would be undertaken in conjunction with the provision of high-grade filtration to minimise recirculation of droplet nuclei through the system and will require a minimum G4/F8 filter (known internationally as MERV 14).
- Development of controlled segregation zones or 'pandemic pods' that are configured with appropriate HVAC design to cohort patients at risk of transmitting infection. This may not be achievable in all instances depending on existing HVAC systems and physical infrastructure. In addition to the HVAC design there will be a range of other design considerations for isolatable pods including provision of sufficient support areas to minimise movement in and out of the pod, and consideration of workflows relating to donning and doffing PPE.
- Increasing the provision of 'negative airflow' in selected areas. For example, for small ICUs where provision of a 'pandemic pod' is not achievable, a percentage of beds may be equipped with 'negative airflow' in addition to existing Class N rooms. This may also be provided to a number of ED resuscitation bays (refer to Sections 6.1 and 6.2).
- Enhanced airflow in selected high-risk rooms, such as ED resuscitation rooms (refer to Section 06).
- Consideration of the location and type of supply air diffusers provided in high risk areas, as described in the VHBA, 2021, 'Aerosol Hot Spot Study within Health Care Environments'.
- The use of portable air filtration units. These are designed to filter the air in an enclosed space and only relevant for existing facilities where the recommended air exchange rates are unable to be achieved. Refer to:
    - NSW Health, Safety Information 009/21 Recirculating air filtration device use in NSW Hospitals
    - Victorian Department of Health, 2023, Guidelines for optimising ventilation to reduce the risk of transmission of COVID-19 in healthcare settings.

Further detail relating to engineering control strategies for specific clinical service areas is included in Section 06 Service Specific Considerations.

05 ISOLATION ROOMS AND NEGATIVE AIRFLOW

The provision of single rooms within a facility is the single most effective infection prevention and control strategy to reduce the risk of exposure and transmission from patient to patient. A recent study by Leal et al, 2023 determined that the strongest independent risk factor for nosocomial COVID-19 was exposure in a multi-bedded room.

The Australian Government's Communicable Diseases Network Australia recommends that hospitalised patients with a suspected, confirmed or probable respiratory infectious disease should be isolated in a negative pressure room (Class N) with anteroom where available. Negative pressure rooms must be maintained and regularly serviced to ensure compliance with relevant Standards. If a negative pressure room is not available, the hospitalised case can isolate in a standard isolation room or single room with negative airflow as an alternative. Both room types would have a dedicated ensuite. In situations where these room types are not available or are in use, the infection prevention and control team should be contacted to discuss how to best manage cohorting of patients.

The AusHFG resources recommend the inclusion of negative pressure rooms in EDs, acute inpatient units, ICUs, and neonatal care units. Guidance is provided in the AusHFG Health Planning Units (HPUs) regarding the recommended number of negative pressure rooms, with at least one recommended for all inpatient units, however, it is acknowledged that final numbers will depend on the cohort of patients to be managed. For example, respiratory medicine inpatient units will usually require a higher than average number of negative pressure isolation rooms.

Standard isolation rooms (Class S) are also recommended to be provided on all overnight patient care units and EDs, as well as day surgery units and medical day stay units, such as renal dialysis and chemotherapy. The recommended proportion of single bedrooms to be provided on inpatient units will vary depending on the role of the health service, anticipated patient case mix and consideration of local epidemiological trends. However, it is recommended for new build facilities that 60-80% of beds should be provided as single bedrooms. AHIA is undertaking further analysis regarding recommendations relating to this issue as part of the update to HPU 340 Adult Acute Inpatient Unit, with consideration of the full range of impacts including infection, prevention and control. Once these recommendations are agreed by all jurisdictions this guideline will be updated accordingly.

A number of units are recommended to be delivered as 100% single bedrooms in new facilities including Intensive Care, Infectious Diseases and Mental Health Units. Contemporary Maternity Units are also predominantly delivered as 100% single room units.

It is not anticipated that the recommended number of negative pressure rooms in new build facilities should increase significantly in response to the COVID-19 pandemic. Class N rooms can impact on patient comfort as increased air changes and pressure differentials can impact, making the environment noisy. Instead, the provision of 'negative airflow', in a number of additional spaces, may be provided to better manage pandemic periods. The negative flow capability would be 'switched' to a pandemic mode as needed via the BMS. Under this mode, room air will be drawn directly from each single bedroom space and vented to the outside. The discharge is assumed to be Type A effluent as detailed in AS1668.2. Recommendations relating to the consideration of this capability within specific service areas are provided in the following section.

Quarantine isolation rooms (Q Class) are not considered in this guideline as jurisdictions will typically provide these beds at a single facility as part of jurisdictional planning.

Communication systems in isolation rooms, such as intercoms, should be considered to reduce the amount of time health workers are required in the room. Project teams should consult with ICT experts regarding new technology that is currently being introduced to support this.

For further information relating to isolation rooms and the associated design requirements refer to the AusHFG Resource - Isolation Rooms: Engineering & Design Requirements and relevant jurisdictional engineering services guidelines for healthcare facilities. The WHO Roadmap also provides excellent guidance on minimum requirements and strategies that might be implemented to manage risk.

06 SERVICE SPECIFIC CONSIDERATIONS

The information included in this section is focussed on future / new build facility requirements to support increased resilience against respiratory infectious diseases transmission and future pandemics. It also outlines temporary solutions that may be implemented that will allow the facility to better return to non-pandemic periods.

The upgrading of existing facilities to meet these requirements will depend on jurisdictional approaches with reference to the principles outlined in Section 1.3. This includes ensuring that the strategies implemented are established through a consultative approach with key stakeholders including infection prevention and control, infectious diseases and engineering experts. Understanding the existing HVAC systems is an essential initial step in guiding any required enhancements, as outlined in Section 04.

Detailed information is provided regarding health planning and design considerations associated with COVID-19 as an example to inform current and future pandemic responses. Information is provided relating to a number of high-risk areas given the greater level of controls required. For example, EDs are challenging environments during a pandemic, managing a mix of undifferentiated patients in a high turnover environment, and patients in ICUs are often critically unwell and require therapies that may increase the risk of transmission.

Changes to normal facility design, systems or processes, either permanent or temporary, will require consideration of any inappropriate sequelae and will need to be communicated to key partners (e.g., ambulance services) to ensure patient care is optimised.

6.1 EMERGENCY DEPARTMENTS

6.1.1 Clinical Guidelines

The Australasian College for Emergency Medicine (ACEM) 'COVID-19 Resources' webpage outlines universal principles of care that apply to all Emergency Departments (EDs). All EDs should have clear processes to identify and isolate patients who may be a source of disease transmission and all patients should be considered as potentially infectious during high rates of community transmission. Clinical protocols implemented during pandemic periods must be developed in response to a risk assessment of harm versus benefits for ED patients and staff.

The Hierarchy of Controls approach was used during the COVID-19 pandemic to guide the establishment of infection transmission risk mitigation strategies in EDs. The strategies outlined below, as provided by the Australian Government ICEG in Minimising the risk of COVID-19 transmission in the Emergency Department, can be used as an example for responding to future pandemics associated with respiratory infectious diseases.

Table 4. Example of risk minimisation strategies for Emergency Departments

Category	Examples of control measures
Elimination	**Physically remove the hazard**
	Contact with infectious organism is avoided where possible of, e.g., re-direct a person to a fever/testing clinic where required.
Engineering	**Isolate people from the hazard**
	Ventilation is adequate and air flow/exchange in high-risk areas optimised. **Cohort** patients. A dedicated separate area for those with suspected or known COVID-19 in both waiting and clinical zones is provided.
Administrative	**Change the way people work**
	Staff are **vaccinated**. Limit the number of persons in a setting at one time, ensure **physical distancing** through barriers, spaced seating, and floor markings. Staff and visitors are **screened** on arrival to setting. **Source control.** Routine use of N95 respirator masks by staff and, where possible, by patients or Level 2 flat fitted surgical masks for patients, remote working where possible, reassign high risk staff, avoid aerosol generating procedures. Increased **cleaning.** **Infection control training**, hand hygiene, respiratory etiquette. **Stagger** shifts and teams.
PPE	**Protect the worker**
	All staff are provided with practical infection prevention control **training.** Adequate **supply** of hand hygiene, Personal Protective Equipment (PPE) and related equipment and resources. Display and provide **guidance** for patients and visitors.

Source: Adapted from Australian Government ICEG, January 2022, Minimising the risk of COVID-19 transmission in the Emergency Department

6.1.2 Design Implications

Waiting Areas

It is recommended that, depending on the physical infrastructure of the ED, it may be desirable to have a separate waiting area for patients with confirmed respiratory infectious disease and those who meet case definition criteria for disease or other communicable infection, and will subsequently be allocated to a high-risk zone. However, all patients in the waiting area should remain within view of the triage nurse. When planning new facilities, the use of adjacent flexible use areas such as meetings rooms may be considered for use as overflow waiting space during pandemic periods.

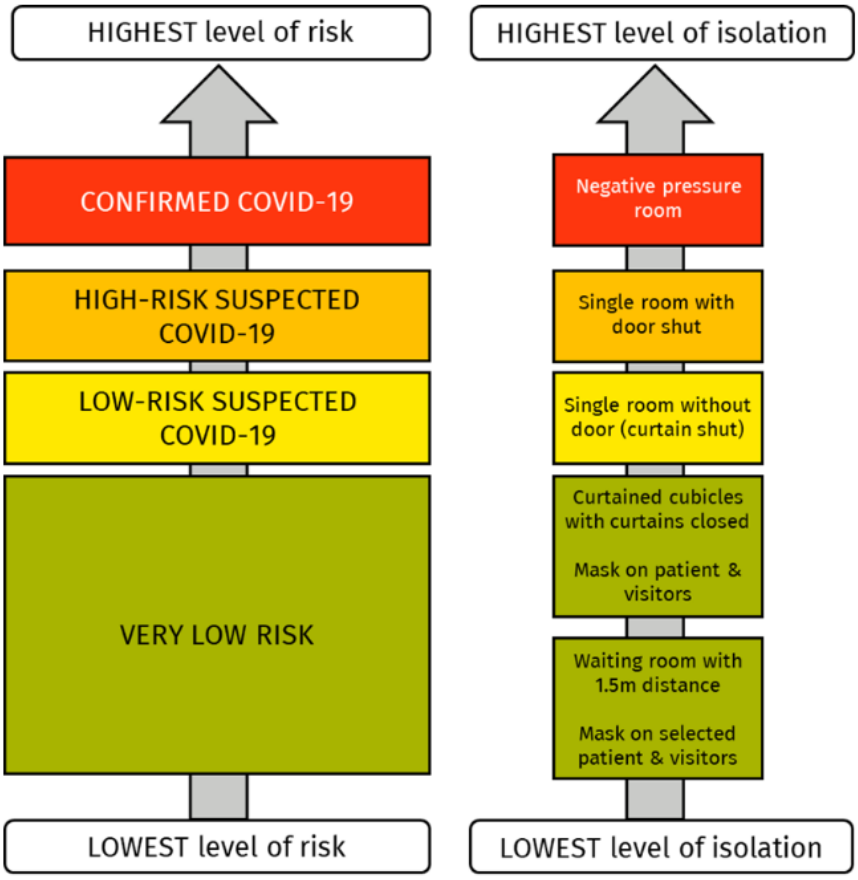
A large undercover area should be provided outside EDs to support the screening and separation of patients, however, this should only be provided as a temporary arrangement. While many services used temporary outdoor structures to screen and separate patients during the COVID-19 pandemic, the long term use of these strategies was problematic as it is not always possible to create a comfortable environment, especially during the colder months and hotter/humid climates.

As recommended in the AusHFG HPU 300 Emergency Unit, CCTV should be installed both outside and inside the ED waiting room. This is to support safety and security but can also support contact tracing when required.

Treatment Spaces

The flow chart below, provided by ACEM as an example during the COVID-19 pandemic, outlines an approach that balances the risk of virus transmission and the level of isolation required.

Figure: Example model of treatment space allocation based on transmission and clinical risk.



Source: Australasian College for Emergency Medicine, 2021, 'Clinical guidelines for the management of COVID-19 in Australasian emergency department. Note – these guidelines have since been archived but have been referenced here as an example developed during COVID-19 that can be adapted for future pandemics.

Note: Negative flow rooms should also be considered for higher risk patients. Patients with a suspected or confirmed respiratory infectious disease must not be managed in rooms with positive pressure airflow.

This flow chart supports the range of treatment spaces required across EDs to appropriately manage patients with varying levels of risk. It is acknowledged that while patients with a suspected or confirmed respiratory infectious disease should ideally be managed in a negative pressure room, this may not be feasible as patient numbers escalate. Where prevalence and cases exceed this capacity, consideration to cohorting zones and implementation of protective precautions, in line with jurisdiction guidelines, may need to be implemented.

The AusHFG HPU 300 Emergency Unit recommends the provision of negative pressure rooms and standard isolation rooms (single enclosed rooms with dedicated ensuites) within EDs. All new EDs should include a minimum of 1 Class N room. The number to be provided will be informed by a risk assessment process that will include consideration of the role delineation of the health service and patient profile.

Separate air handling systems should be provided for each major ED zone, e.g., acute, fast track etc.

Resuscitation Areas

It is recommended that EDs with multiple resuscitation rooms (typically level 5 and 6 services or large level 4 services) should:

- provide a number of enclosed resuscitation rooms with the ability to provide a temporary negative flow environment within these rooms. When the area is 'switched' to a 'pandemic mode' via the BMS, air will be drawn directly into the enclosed resuscitation room from adjacent areas (negative airflow) and the air within the room then vented to the outside. The discharge is assumed to be Type A effluent as detailed in AS1668.2. Where this approach cannot be achieved the entire resuscitation area may instead be designed with other HVAC enhancements as described in section 04, including increased ACH, enhanced filtration, and balanced airflows within the resuscitation room to cultivate negative or neutral airflow
- provide an additional storage area located close to any enclosed resus bay to enable this to be converted into a PPE donning and doffing area in the event of a patient under transmission-based precautions.

The approach to storage within resuscitation areas should be considered to prevent contamination.

High Risk Treatment Zones

For large EDs with multiple pods, it is recommended that one pod is created (e.g., in the acute zone) that has a separate air handling unit to become an isolatable pod so 'hot' and 'cold' zones are possible This may not be achievable for existing EDs in all instances depending on existing HVAC systems and physical infrastructure. Where achievable, this pod would also have access to enhancements such as 100% outside air (subject to local conditions) to further improve air quality. The isolatable pod must be clearly demarcated with a minimum number of entry and exit points and designated areas for staff to don and doff PPE. Activity flows in and out of this zone requires careful consideration.

For smaller EDs, where it is not possible to create a separate pod, alternate use of the Class N room should be considered to also support resuscitation and other procedures. For example, this room may be increased from 15m^2 to 20m^2 and located near to the resuscitation zone to provide flexible use when required.

Screening Services for Infectious Outbreaks

Emergency departments may provide swabbing services for infectious outbreaks. Some jurisdictions are now incorporating pandemic planning in the design of their hospital EDs to include a secure ambulant entry for swabbing purposes which may comprise of a covered outdoor waiting area and secure, direct access to a flexible use ED patient care space that can be used for pathology specimen collection and assessment. This minimises the impact on other flows across the ED, mitigates the spread of infection and reduces the impact on cleaning services. These spaces can be flexibly used by other patients outside of pandemic periods.

6.2 INTENSIVE CARE UNITS

6.2.1 Clinical Guidelines

The following recommendations outlined in the Australian and New Zealand Intensive Care Society (ANZICS) COVID-19 Guidelines (Version 4), relating to the management of patients with COVID-19, may be used as an example for responding to future pandemics associated with respiratory infectious diseases.

- COVID-19 patients are ideally 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 appropriate engineering and ventilation considerations) with clear areas designated for donning and doffing of PPE.

- Once all Class N and Class S rooms are exhausted, then consideration could be given to moving patients to a facility with available Class N or Class S rooms. If not possible, patients will need to be cohorted in areas that are physically separate to areas containing non-COVID-19 patients. These areas must be reviewed by engineering to optimise airflow and air exchanges. In an open ICU cohorted area with one or more COVID-19 patients, the whole area requires airborne PPE precautions with careful attention to the clear designation of safe donning and doffing areas.
- Aerosol-generating procedures (AGP) are performed in Class N rooms. If performed in a Class S room or cohorted area, engineering controls should be optimised for rooms selected for this purpose.

6.2.2 Design Implications

The current AusHFG guidance for adult and paediatric intensive care units (HPU 360 Intensive Care Unit) recommends the provision of 100% single bedrooms, including one negative pressure room per pod (approximately 14 beds) with acknowledgment that the actual number provided will depend on the patient cohort and local jurisdictional policies. Additional capacity to manage patients with a suspected or confirmed ARI can be provided by creating spaces with negative airflow. The proportion of rooms to be provided with negative flow will depend on the size, configuration and role delineation / service level of the ICU. Any enhancements must be considered for management outside of a pandemic to ensure continued operations.

For all large ICUs providing high level critical care services, the provision of a pandemic pod should be considered. This may not be achievable for all existing ICUs, particularly for older ICUs with an open plan design. A large ICU, in the context of these recommendations, is one with three or more discrete pods. This will provide additional negative flow capacity in the event of a pandemic. When the area is 'switched' to pandemic mode via the BMS, the room air will be drawn directly from each single bedroom space from adjacent areas and vented to the outside. The discharge is assumed to be Type A effluent as detailed in AS1668.2. No additional Class N bedrooms are recommended within this pod, beyond the number required to manage the caseload during normal operating periods. A negative flow airlock will be required at entry points to the pandemic pod. This would only be recommended for ICUs with at least three pods so that there is still significant available capacity across the rest of the unit when the pandemic pod is in operation. It should also be considered as a networked approach with only designated ICUs providing this capability.

For smaller ICUs a pandemic pod may not be feasible as it may introduce operational inefficiency given:

- during normal business a pod arrangement will likely require additional staff
- during an outbreak, the pandemic pod will only be used to manage the infectious patient cohort and this may affect total unit occupancy (i.e., pandemic pod with 50% occupancy).

For smaller units it is recommended that a proportion of beds are fitted with negative flow capability, as an adjunct to Class N rooms.

6.3 OPERATING THEATRES AND PROCEDURE ROOMS

6.3.1 Clinical protocols

During the COVID-19 pandemic, operational restrictions relating to surgery/procedures for patients suspected, probable or confirmed COVID-19 were applied. Whilst future pandemics will most likely see similar restrictions, the primary foundation of operating theatres is to minimise the risk of infection with and between patients and for this reason there are already high level clinical, operational and design controls in place.

There may be occasions where surgery is unavoidable in potentially infectious patients and models of care should reflect these risk mitigation strategies.

6.3.2 Theatre design

New operating theatres are designed to AS1668.2 with positively pressured, HEPA- filtered air handling systems that achieve a minimum of 20 ACH. The aim of these systems is to ensure the air is free from aerosolised 'particles' that may result in surgical site infections. The air changes significantly reduce the opportunity for aerosols to linger as the air within the suite is completely (99.9%) changed over every 21 minutes. The air handling design, along with PPE, ensure that the risk of airborne spread to both patients and staff is extremely low.

Based on this, negatively pressured theatres are not recommended. However, in order to reduce the time taken for airborne contaminants to be removed during pandemic periods jurisdictions may consider adopting higher minimum ACH adequate to achieve required pressure regimens. Although this will impact on operational costs, it is anticipated to be minimal given this would only be implemented during a pandemic or when other high-risk cases are expected.

AGPs can still be undertaken in operating theatres during pandemic periods as the air change regime will ensure there is sufficient and ongoing dilution of the air within the room.

The provision of anaesthetic preparation rooms, where required to support patient preparation and flow, may assist in controlling the movement of aerosols into surrounding areas.

Procedural services providing endoscopy and bronchoscopy would conduct high risk procedures in a room with negative pressure. This is routinely provided where bronchoscopy services are delivered.

6.3.3 Recovery Areas

In terms of the recovery of patients following their procedure, the AusHFG HPU 520 Operating Unit and HPU 270 Day Surgery / Procedure Unit currently include an option for the provision of a single room/s within recovery areas. Operational practices that may supplement this approach are also described such as scheduling infectious patients as the last procedure of the day or recovering the patient within the operating room.

Open bays are preferred in recovery areas to optimise patient observation and to support the short length of stay and so the provision of single enclosed rooms should be minimised. However, larger recovery areas may be zoned to support cohorting of patients when required. HVAC system strategies should be implemented to optimise ventilation rates and support airflow direction away from staff areas.

6.4 MATERNITY, NEONATAL CARE AND PAEDIATRIC SERVICES

Jurisdictional clinical guidelines relating to maternity and neonatal care services, where the mother or baby is COVID-19 suspected or positive, have underpinned infrastructure responses that are relevant to future pandemics.

6.4.1 Maternity Unit Design

Contemporary birth rooms are designed with negative airflow and support the use of PPE for standard precautions. In response to the lessons learned during the COVID-19 pandemic it is recommended that one birth room should include an area for donning PPE for those patients requiring airborne isolation precautions. A space of $3m^2$ is recommended in an area that supports optimal PPE donning and doffing protocols. This may be provided as a dedicated bay or a dual use bay for alternative functions outside of pandemic periods (e.g., mobile equipment). This may be required for additional birth rooms on larger units depending on the outcomes of a risk assessment and consideration of the local epidemiological profile.

The provision of an N class room/s on maternity inpatient units is recommended as per the current AusHFG guidance.

6.4.2 Neonatal Care Unit Design

There is no recommended change to the design of neonatal care units. During the COVID-19 pandemic, babies requiring admission to a neonatal care unit whose mothers are COVID suspected or confirmed are managed in a negative pressure isolation room, single room or cohorted together. The AusHFG HPU 390 Neonatal Care Unit recommends the provision of one negative pressure room per pod, as well as standard isolation rooms with the number required dependent on the outcome of a risk assessment process including consideration of the role delineation of the health service and patient profile, acknowledging that isolation rooms are provided for a range of reasons including palliative care. For example, units that have a high number of admissions from outside hospitals, such as those in paediatric hospitals, may require a higher proportion of single rooms.

6.4.3 Paediatric Services Design

Although COVID-19 did not significantly impact the paediatric cohort, it is acknowledged that children under the age of 5 are at risk of severe disease and hospitalisation from other ARIs, such as influenza. Paediatric services incorporate a range of units covered in this section e.g., ED, ICU, and Inpatient Units, and will be guided by the same recommended approaches. However, area allocations and ventilation strategies, including for waiting areas, will need to consider accompanying caregivers. The standard paediatric inpatient bedroom and consult room, as recommended by the AusHFG, is larger than those provided on adult units for this reason. As recommended in the schedule of accommodation within AusHFG HPU 300, moderate to large EDs should include a dedicated area for paediatrics.

6.5 MEDICAL IMAGING INCLUDING NUCLEAR MEDICINE

6.5.1 Clinical Guidelines

Operational practices relating to medical imaging during COVID-19 are documented in the following resources:

- Royal Australia and New Zealand College of Radiologists (RANZCR). COVID-19: Position Statements and Guidance
- NSW Health Agency for Clinical Innovation, September 2020, 'Information for Medical Imaging Managers and Clinicians - Building capacity and protection during COVID-19 surge'.

6.5.2 Design Implications

Planning for medical imaging units must consider the activity flows for infectious patients, particularly for modalities that are frequently required for urgent scans, including during pandemic periods, such as CT. HVAC design of these areas must be in line with contemporary requirements.

As noted for operating theatres, it is recommended that interventional imaging rooms should be routinely equipped with air handling systems that are consistent with operating theatre design.

It is also recommended that a Class S isolation room, with toilet, should be considered for the main Medical Imaging unit of new developments in the holding / recovery zone. This approach may instead be managed operationally, especially where holding recovery zones have few spaces and minimal staff to monitor them.

6.6 INPATIENT UNITS

The AusHFG HPU 340 Adult Acute Inpatient Unit currently recommends one Class N room per inpatient unit for general medical / surgical inpatient units. There is no recommended change to this for future hospital developments, however it is acknowledged that some specialties, such as respiratory medicine, may require a higher number of Class N rooms.

There is no single recommended solution regarding the optimal or preferred proportion of single bedrooms and there are varying opinions across and within jurisdictions regarding this. It is recommended that for new build facilities, 60-80% of beds should be provided as single bedrooms. The actual proportion of single bedrooms provided will be determined by individual jurisdictions on a project by project basis depending on the patient case mix and other factors outlined in HPU 340 Adult Acute Inpatient Unit.

A number of units are recommended to be delivered as 100% single rooms as noted in Section 05.

AHIA is undertaking further analysis regarding recommendations relating to this issue as part of the update to HPU 340 Adult Acute Inpatient Unit, with consideration of the full range of impacts including infection, prevention and control. Once these recommendations are agreed by all jurisdictions this guideline will be updated accordingly.

Features of the HVAC design in contemporary inpatient units also enhances their adaptability when managing large numbers of patients with ARIs. These include:

- ability to operate in 100% outside air mode (subject to local climate conditions) or maximising the amount of outside air achievable and provide high grade filtration, and
- dedicated air handling units provided to each inpatient unit.

For high risk inpatient units or pods, for example respiratory and infectious diseases units, targeted air pathway strategies should be adopted in line with local jurisdictional guidelines. For example, the provision of ducted return air within individual patient rooms, rather than via a common corridor, should be considered. This may also be considered for units planned to be used for surge capacity during pandemic periods.

Consideration should be given to the provision of mobile x-ray for infectious patients through a window in the bedroom door to minimise the need for health workers to access the room. This requires provision of an appropriately sized window with window coverings that can be moved out of the way while still allowing patients to have control over their privacy.

Where possible, non-patient areas, such as staff work areas and amenities, should be zoned separately from patient areas and optimal HVAC strategies implemented.

6.7 ORAL HEALTH

6.7.1 Clinical Guidelines

Oral Health units are a potential high-risk area for transmission of infectious diseases due to the AGPs that are undertaken. In dentistry this includes procedures using devices such as high-speed hand pieces, surgical hand pieces, ultrasonic and sonic devices, air polishing devices, lasers.

The approach to the COVID-19 pandemic, as documented below, provides key lessons learned for future pandemics including a number of planning and design considerations.

The NSW Health Centre for Oral Health Strategy provides COVID-19 Guidelines for Dental Services. This includes recommended treatment room requirements (and other operational strategies) required depending on the level of assessed risk. For a patient confirmed or suspected to have COVID-19 it is recommended that:

- a single room should be used with the door closed. Where available, use negative air flow and good ventilation in line with engineering services guidelines
- high risk AGPs should be performed in a negative pressure room.

6.7.2 Design Implications

The recommended management of patients in oral health units during a pandemic is supported by the AusHFG resources that recommend the provision of enclosed dental surgery rooms for most units to ensure patient privacy and contain noise. However, it is acknowledged that some open plan designs may be provided, and this is usually associated with units providing teaching and supervision of students. It is also noted in the AusHFG HPU 280 Oral Health Unit that some larger, specialised facilities may be required to treat clients with a confirmed airborne infection and will ideally require access to a negative pressure room. In the context of a pandemic this would only be undertaken for urgent / emergency dental treatment. The use of mobile dental units may also be considered.

The NSW Health Centre for Oral Health Strategy recommends that where shared open clinics are used a minimum of 2m distance between the headrests of patient chairs should be provided and 3m may be more appropriate depending on the procedure and physical space available. The current AusHFG Standard Components reflect room widths of 3.8m so would still achieve this requirement if adapted to an open plan design. It is also noted that physical barriers such as screens or partitions may be provided between chairs to assist in separating spaces. Where these are provided optimal cleaning practices must be implemented.

For further information, refer to the Australian Dental Association, 2021, ADA Guidelines for Infection Control (Fourth Edition). This edition incorporates some reference to infection prevention and control learnings from the COVID-19 pandemic and notes that supplementary information will be made available as further evidence emerges.

6.8 AMBULATORY AND OTHER PRIMARY CARE SERVICES

6.8.1 Clinical guidelines

During the COVID-19 pandemic, ICEG released guidance outlining infection transmission risk mitigation strategies relating to ambulatory and primary care services including allied health and community health services. The information has since been rescinded and incorporated generally in the infection prevention and control guidelines. This included a range of strategies in line with the Hierarchy of Controls including:

- Physically remove the hazard – avoidance of contact with infectious organism where possible, e.g., pre appointment screening, isolation and use of telehealth.
- Isolate people from the hazard – consider whether ventilation is adequate and optimise air flow/exchange in high-risk areas.
- Change the way people work – limit the number of persons in a setting at one time, ensure physical distancing through barriers, spaced seating, and floor markings
- Protect the worker – ensure adequate supply of hand hygiene, PPE and related equipment and resources.

These strategies will be applicable to future pandemics, including screening of all patients and visitors with respiratory symptoms and/or risk of exposure to novel organisms of concern. Where possible, telehealth services may be provided for these patients. Other strategies include delaying the appointment until the patient is no longer infectious or planning care so that the patient is seen at the end of the day.

During the COVID-19 pandemic many ambulatory, outpatient and primary care services were ceased due to the risk of transmission and the need to re-deploy staff to respond to the pandemic. Some services were changed to be delivered virtually. Many consultations which don't require a physical examination or treatment can be delivered virtually, including talking therapies. There is, however, a need to continue to provide some face-to-face ambulatory, outpatient and primary care services for patients who require physical treatment and examinations or are unable to engage with virtual care.

Refer also to Section 2.2 regarding the hierarchy of control.

6.8.2 Design Implications and Operational Strategies

Refer to Section 3.1 regarding waiting area considerations.

The provision of virtual models of care are described in the AusHFG including the relevant HPUs 151 Ambulatory Care & Community Health, 140 Allied Health / Therapy Unit and 350 Small Rural Hospitals / Multipurpose Services. All patient consult rooms should be enabled for the use of telehealth services that will allow clinicians to seamlessly move between in-person and virtual models of care to meet requirements.

Virtual group activities are also increasingly being provided, e.g., for allied health / therapy classes. These services often require 360-degree cameras and sufficient space to demonstrate exercises or activities.

Some services may provide facilities for patients to attend their local rural hospital for follow up specialist appointments via telehealth with clinicians located in other facilities, e.g., metropolitan or large regional hospitals. Refer to Section 3.5 for further detail.

Many medical day stay services, such as renal dialysis, oncology and hematology services, cannot be delivered virtually or delayed. For these services it is recommended that pods of patient bays are provided that can support cohorting of patients as required, and provision of single enclosed room/s to support patient isolation.

Outpatient areas may be used to provide pandemic swabbing assessments. Where this may be provided in the future, the design should consider separation of patient flows from entry through to exit with access to consult / treatment rooms and pathology specimen collection areas.

6.9 STAFF WORK AREAS AND AMENITIES

During the COVID-19 pandemic, policies were implemented to comply with physical distancing requirements such as limiting the number of staff within work areas and meeting rooms, encouraging staff to work remotely where possible and optimising the use of technology to support continued operations.

Shared work spaces should support a minimum of 1.5m between desks. The AusHFG ‘Office – Workstation’ Standard Components support physical distancing requirements with allowance for an 1800mm wide desk within the 4.5m^2 area allocation. Access to ABHR and cleaning stations must be provided in shared work areas.

Where possible, new facilities should be designed to separate staff workspace and amenities into staff only zones but this needs to be balanced against the need for staff safety where they are rostered 24/7 (e.g., inpatient units).

Operational protocols will also be implemented relating to the use of staff amenities, although design solutions such as a separation of staff rooms and lockers will reduce the need for staff to enter unnecessarily. Where possible meeting / training rooms may be able to be used to provide temporary expanded capacity for staff rooms. It is recommended, however, that staff rooms and staff kitchens serving large numbers of staff (e.g., large ICU, ED or theatres) will include an additional sink (or sinks, depending on the staff numbers) to support food and drink preparation and clean up. ABHR will be provided, so staff can undertake hand hygiene prior to entering staff rooms. Access should be provided to showers for staff in case the choose to use them. This does not mean that it needs to be provided on each clinical unit and may be provided centrally or a patient room repurposed for staff change.

It is not recommended that dedicated outdoor space for staff is provided for each clinical department. Instead, health facilities should seek to provide shared outdoor space that can be accessed by a range of staff, patients and visitors. This provision is a major focus of new developments and enhances the overall experience of those who use health services.

Ventilation requirements within staff rooms will be informed by the maximum room occupancy. In existing facilities, where the system does not allow increasing the ventilation to the recommended minimum per person requirements, services will need to consider reducing the maximum room occupancy and implementing the strategies outlined above and other HVAC strategies as outlined in Section 04. HVAC system strategies should support airflow direction away from staff work areas towards patient care areas where possible.

6.10 BACK OF HOUSE SERVICES

There are no recommended changes to the design of hospital 'back of house' services in response to COVID-19. Each jurisdiction has detailed operational policies relating to linen, food services, waste management and environmental cleaning and disinfection in relation to COVID-19, as would be implemented for future pandemics. These operational protocols, based on an assessment of risk, are essential in preventing the transmission of infection but do not impact on the design of facilities.

The HVAC design of back of house services must align with contemporary requirements to optimise ventilation and minimise the risk of outbreaks.

07 SURGE CAPACITY MANAGEMENT

During the COVID-19 pandemic, public health authorities identified a range of strategies to rapidly increase hospital capacity for treating COVID-19 infected patients. These strategies included freeing up bed capacity by reducing elective surgery activity, commissioning existing spare capacity, repurposing existing areas, establishing arrangements with private hospital facilities, and development of relocatable / modular facilities for temporary use during the pandemic.

A major focus has been on preparing appropriate critical care beds for the expected surge in caseload presentations, as well as consideration of ED, inpatient unit and morgue capacity. Again, the infrastructure solutions for surge capacity have been one element of the overall approach, alongside strategies relating to workforce and supply chains for PPE and equipment including ventilators.

The Australian and New Zealand Intensive Care Society (ANZICS) COVID-19 Guidelines (Version 4) provides detailed recommendations relating to increasing ICU capacity. ANZICS recommend that all clinical areas with the physical infrastructure 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).

The ‘Australasian College for Emergency Medicine, 2020, ‘Clinical guidelines for the management of COVID-19 in Australasian emergency department’ provides information relating to the temporary expansion of ED infrastructure capacity. This may be undertaken by using other available hospital spaces and/or temporary structures. ACEM recommends that, if an expansion is required, EDs select an area that is in close proximity to the main department and can be rapidly fitted out to meet ED design and ventilation standards (to the extent that is possible). Nearby outpatient clinics and day treatment areas may provide appropriate areas. In exceptional circumstances, the use of temporary structures (such as tents and marquees) may be required and should align with the same design and infection control principles as the main ED.

Discussions regarding local surge capacity management and implementation should ensure consultation with infectious diseases and infection prevention and control experts, and other key stakeholders.

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FURTHER READING

NPAAC Guidelines for the COVID-19 Temporary Collection Facilities (Drive-through and Pop-up)

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The Pandemic-Resilient Hospital: How Design Can Help Facilities Stay Operational and Safe, July 2021

09 TERMINOLOGY / DEFINITIONS

Aerosols	Aerosols are defined as a suspension of fine solid particles or liquid droplets in air or another gas.
Aerosol Generating Procedures (AGP)	Medical procedures that can promote the generation of aerosols that remain suspended in the air for longer periods and are considered to increase the risk of transmission of SARS-CoV-2.
Aerosol Generating Behaviours	Respiratory droplets of various sizes are produced by breathing, talking, coughing, sneezing and behaviours such as singing
Class N Room	Respiratory isolation room used to isolate patients capable of transmitting infection by airborne droplet nuclei. This room will include a dedicated anteroom. Refer to AusHFG 'Isolation Rooms – Engineering & Design Requirements' for further information.
Class S Room	Standard isolation room used for isolating patients capable of transmitting infection by droplet or contact routes. Refer to AusHFG 'Isolation Rooms – Engineering & Design Requirements' for further information.
Class P Room	Positively pressured room used to isolate profoundly immuno-compromised patients by reducing the risk of transmission of infection to a susceptible patient via the airborne route. Refer to AusHFG 'Isolation Rooms – Engineering & Design Requirements' for further information.
Class Q Room	Quarantine Isolation – a Class N room including an anteroom and fumigation facilities.
Isolatable	The ability to control access to a particular area or pod of a service/department
Negative Flow Room	Room capable of being switched to negative airflow whereby the room air is drawn into the bedroom from adjacent areas and vented to the atmosphere. May also be referred to as 'low pressure negative environments'.
Pod	A cluster of patient beds, typically provided in large intensive care units, with access to a range of support spaces to minimise staff travel and reduce the potential for cross infection. For example, a 56 bed ICU may be provided as four pods each with 14 beds. These may be provided as an isolatable pod for pandemic containment capability. This may also translate to EDs through establishment of an isolatable pod or zone of acute patient treatment bays. In the context of this document, a large ICU is defined as one with three or more pods.
SARS-CoV-2	The novel coronavirus (SARS-CoV-2) responsible for the disease named COVID-19
Virtual Care	Virtual care involves an interaction between a patient and a clinician, or between clinicians, occurring remotely through the use of information technologies
Zoning	Zoning (cohorting, ring fencing) refers to the grouping of patients with the same condition in the same area. The goal of zoning or cohorting patients (and the health worker/s that attend to them) is to minimise interaction between infectious and non-infectious patients as much as possible. The following are examples of how zoning was applied for the management of patients with COVID-19: • Red zone – COVID-19 positive patients. May also be referred to as a hot zone • Amber zone – COVID-19 high risk contacts or suspected cases • Green zone – patients that have been cleared of being COVID-19 cases or contacts. May also be referred to as a cool or cold zone • Blue zone – areas only accessed by staff.