Management of paediatric patients requiring intensive care

A COVID-19 pandemic response

This document provides recommendations for the management of paediatric patients requiring intensive care during the COVID-19 pandemic and will be revised as the situation evolves. It should be used to inform local policies and procedures which should be current and reviewed regularly.

The purpose of this document is to provide guidance to managers and clinicians for the critical care management of paediatric patients during the COVID-19 pandemic.

The goal is to maintain existing best practices for the management of respiratory conditions, while alerting clinicians and managers to the additional complexities and changes to practice that will be necessary. This document also aims to identify alternate strategies that should be considered during the COVID-19 pandemic when existing resources are nearing or are at capacity.

This document aligns to existing NSW Health documents and is designed to complement these, while providing specific COVID-19 advice. In addition, it supports local best practice guidelines, policy and emerging evidence.[1,2,3]

At a very high level, this document identifies three key elements that are core to the critical care management of paediatric patients requiring respiratory care during the COVID-19 pandemic:

1. Physical capacity
2. Workforce
3. Equipment

Contents

NSW GOVERNMENT

AGENCY FOR CLINICAL INNOVATION

Physical capacity

Intensive care bed capacity

A paediatric intensive care unit (PICU) provides state of the art intensive care services to critically ill children.

In NSW PICUs are located at three facilities: Sydney Children's Hospital Randwick, The Children's Hospital at Westmead and John Hunter Children's Hospital.

Private hospitals in NSW do not provide paediatric intensive care services.

Table 1. PICU Bed Capacity in NSW

Hospital	Number of purchased beds*	Number of negative pressure rooms (included in purchased beds)	Number of single rooms	Surge capacity within each unit
Sydney Children's Hospital Randwick	17	5	5	4
The Children's Hospital at Westmead	25	1	13	4
John Hunter Children's Hospital	5	2	5	3

Increasing intensive care bed capacity for paediatric patients

Options for increasing ICU capacity are limited, but the following strategies apply equally to adult and paediatric ICUs.

- Opening non-commissioned beds.
- Deferring non-urgent elective surgery, specifically those surgeries with a known requirement for post-operative ICU management whilst maintaining emergency surgery.
- Facilitating end of life discussions and decisions for appropriate patients.

The following points should also be considered as options for creating additional PICU capacity if appropriate.

- Accessing non-utilised NICU (Neonatal Intensive Care Unit) beds for PICU patients. Close geographic location of PICUs with NICUs on the same campus would better facilitate this option.
- Admitting discharged neonatal patients to the NICU rather than to a PICU.
- Optimising PICU discharge planning and transfer.
- Converting appropriately staffed and equipped ward beds in children's hospitals into PICU beds.
- Changing the nursing dependency, where clinically appropriate.

* as per 2019–20 Service Agreements

Managing PICU bed status – patient flow portal

All patient movements at the three PICUs can be tracked by the patient flow portal (PFP). Staff must update the PFP at least every four hours to ensure accurate information on current bed status is available across NSW.

Specific information requiring frequent updates to include; facility and ward short-term escalation plan (STEP) level colour, bed availability by nursing dependency (Nur Dep), respiratory support status (Resp), ventilation vs non-ventilation, Bi-PAP/CPAP and the name and contact details of PICU consultant on duty.

Figure 1. Patient Flow Portal dashboard[4]

Scope of PICU

Where current guidelines exist in relation to the ages and weights of children and where these children are best managed, consideration should be given to where exceptions can be safely made to these guidelines. These include children younger than 16 years, for problems without specific paediatric therapy implications e.g. neurosurgery for head injury. There may be a need to manage some patients for longer locally that is outside of a children's hospital as retrieval services may be overwhelmed. Children's hospitals should consider how to better assist paediatric services providing intensive care in those referring hospitals, with telehealth support.

Ventilator capacity

All paediatric medicine level 3[5] sites and above will need to be aware of the number of ventilators they have available, including the number of transport ventilators and what suggested weight ranges the ventilators are capable of ventilating, maintenance cycles and availability of associated equipment and consumables. (Appendix 1).

Other considerations

It will also be important to understand unit configurations and variables for specific clinical management.

Consideration should be given to the:

- negative pressure rooms and ensure they are functioning properly
- single rooms available for patient isolation.

The ANZICS COVID-19 Guidelines recommend that COVID-19 patients be treated in a Class N negative pressure single room.[8] If a Class N room is not available, a Class S single room should be utilised. Class S rooms require demarcated areas for donning and doffing of personal protection equipment (PPE).

When both these options are exhausted hospitals will need open bays and to convert the unit to a COVID-19 unit and moving non-COVID-19 patients to different areas of the hospital. The patients will remain under the care of staff with appropriate critical care skills.

Triaging intensive care

During a pandemic-related surge it will be important that consistent decisions are made regarding both admission to PICU and continuing care when a meaningful recovery is unlikely, with the use of end of life plans where appropriate. Triage will be enacted at the same level across the state, to promote equity of access of patients to intensive care. It is important that the triage principles to maximise access to PICU are used for all potential admissions, not just infection-related admissions.

The ANZICS COVID-19 guidelines recommend that admission to intensive care should reflect routine practice and be open and transparent and incorporate a shared decision-making model which includes the treating intensivist, other clinicians and the family.[8]

Managing children with respiratory problems

During the COVID-19 pandemic, children will continue to present to hospital emergency departments with other respiratory tract problems.

ANZICS COVID-19 Guidelines advises against the use of non-invasive ventilation (NIV). The guidelines state, '… deteriorating patients should be considered for early endotracheal intubation and invasive mechanical ventilation.'[8]

In the presence of suspected or confirmed acute respiratory viral illness, including COVID-19, aerosol generation increases the risk of virus transmission to other people. Additional precautions are required in the way care is delivered. The routine use of NIV for COVID-19 patients with deteriorating respiratory failure is not recommended.[9]

If NIV is to be used, this should be administered in a negative pressure single room with full PPE to protect staff from aerosolising procedures. If negative pressure rooms are exhausted, patients on NIV should be kept in units with other COVID-19 positive patients. Staff should wear PPE appropriate for aerosolising procedures.

High flow nasal oxygen delivery

Children with pre-existing chronic respiratory disease will need to be managed as per existing protocols with appropriate infection control precautions.

Managing children in the emergency department

Emergency departments will be required to manage respiratory patients in line with existing COVID-19 protocols.

Other considerations for emergency departments will be the safe transportation of the patients through the hospital to the required ward.

Protocols will need to be developed for:

- direct presentation to the emergency department
- transfers to other wards including PICU.

Other considerations for emergency departments will be in relation to:

- prompt access to ICU consultation
- intubation procedures.
- managing children while COVID test results are pending
- caring for a ventilated patient while waiting for a PICU bed.

Currently the time for returning results for COVID-19 tests is variable. The requirement to expedite COVID-19 tests should be identified as urgent and communicated to the testing laboratory.

Patients should be assessed and screened in line with the latest national recommendations for COVID-19.[8]

This includes:

- clinical history
- contact history
- travel history.

If the patient is identified as 'at risk' the patient should be isolated and tested for COVID-19 until results confirm otherwise.

If a child is requiring transfer to another facility for care, it is ideal that the results of the COVID-19 testing are available prior to transport.

Advice to families

There will also be a requirement to advise families that only one carer will be permitted to visit the patient. Every effort should be made to protect siblings and extended family, particularly those individuals identified as high risk.

In cases where infection is present the following should be communicated to the family.

- Only one carer can visit the child at a time.
- The immediate family is required to self-isolate.
- The immediate family must avoid contact with grandparents and people over the age of 60.
- All family members who have been in contact with the infected child must undergo COVID-19 testing.
- Families of children with suspected COVID-19 cannot travel with their child if they are symptomatic, if asymptomatic they must wear a mask. Child must wear a mask if self-ventilating when being moved on a stretcher.

Adult patients in paediatric ICUs

International trends identify that the paediatric population is less likely to require admission to PICU. This may create some capacity in the PICUs.

Accessing PICUs for adult patients will need to be undertaken in consultation with the director of the PICU and hospital management. The Childrens Hospital executive will need to decide if the consultation is local or coordinated state-wide. While it adds another layer, state-wide management may enable more equitable access to limited resources.

There may also be a need to consider ways to safely manage co-located adult and paediatric patients in PICUs and ICUs. This could include both patient groups being COVID-19 positive and both groups being COVID-19 negative.

Cross border paediatric bed management – Victoria, Queensland, South Australia and ACT

There are existing historical cross border practices but no formal agreements for the management of patients requiring access to a PICU.

For NSW these include Southern Local Health District (LHD) with Canberra, Northern NSW LHD with Queensland, Far West LHD with South Australia and Southern NSW LHD with Victoria.

The processes for activating these pathways should be reviewed to ensure there are minimal barriers to accessing the right people to initiate the transfers when required.

Rural and regional intensive care considerations

Rural and regional facilities have limited ventilation capacity. With some additional support from the newborn and paediatric emergency transport service (NETS), or their networked hospital, patients could be managed for longer periods of time in these facilities. Consideration will need to be given to operational staff requirements and workload and any additional equipment requirements.

Early consultation with NETS and PICU to enable shared decision making will be required on a case by case basis.

Telehealth

Telehealth should be considered as an enabler to increasing ICU capacity across NSW. Effective telehealth models of care could reduce patient transfers, keep patients closer to home longer, and support medical, nursing and allied health staff to provide critical care to patients who are assessed as suitable for this model.

Telehealth can be used to:

- support low level ventilation in non PICU units
- support 'surge models' where extra staff are deployed
- support rural and regional facilities
- facilitate early return transfers of children
- support close observation units.[5]

NSW Newborn and Paediatric Emergency Transport Service

NETS is the statewide emergency service for medical retrieval of critically ill newborns, infants and children in NSW. The expectation is NETS may receive higher than normal call volumes for both clinical advice and patient transfers. Although this will most likely involve patients not needing ICU, and many will be for possible pandemic related infections rather than other clinical considerations. Children's hospitals should ensure that accepting clinicians are aware of the patients infectious status and this information is provided to NETS prior to transfer.

NETS staff will need to have the same access to appropriate PPE and training as hospital staff to ensure staff safety.

It is important not to duplicate or create alternate pathways to the existing NETS procedures.

This can be achieved by:

- supporting existing services
- supporting existing models of care
- networking facilities with PICUs to support management of the child
- accessing telehealth to provide support to manage the child closer to home.

Other considerations for supporting NETS during a pandemic include:

- rostering a dedicated PICU consultant to provide clinical advice and support local care (with or without transport) in collaboration with NETS
- identify staff with NETS or transport experience to be available to supplement NETS team.

Workforce

Intensive care workforce

The *Public Health Workforce Surge Guidelines* have been identified to assist LHDs understand when and how to identify, recruit and use surge staff in the event of a pandemic.[6] These guidelines should be used in conjunction with local PICU pandemic or disaster policies.

Consideration for the types of staff required, potential pools of staff, logistics and staff wellbeing will also be important.

Other models for staffing for consideration

- team based models[8, 11]
- Community of practice – where clinicians can obtain information and raise issues and concerns in a safe environment.[11]

Surge planning

Planning for surge capacity staffing will need to cover at least the next 72 hours, with monitoring for staff fatigue and stress, and include hospital or LHD strategies to mitigate these. Staffing in the middle of the respiratory pandemic will need to consider a team orientated approach if lesser experienced staff are used in the PICU to support more skilled staff. This is an appropriate response for phase 4 of a pandemic.[7]

Deployment of PICU staff

Hospital managers will be required to consider if PICU staff will be deployed to other wards during times of low occupancy. Assigning a patient load to PICU staff deployed to other units could negatively impact the availability of PICU beds and expanding into PICU at short notice.

Consideration will need to be given to where staff are deployed based on their clinical experience and qualifications.

Alternatives to deployment might include starting education and upskilling of staff. Then, if there is an influx of PICU patients, there is a skilled workforce to care for them. This could also be extended to the respiratory wards, so they are able to manage a deteriorating patient while waiting for a PICU bed.

Other considerations for PICU staffing

There are other potential considerations to both maintain and increase the access to front line staff during acute times of need.

The following options should be explored at a statewide and local level.

- Co-ordinate with adult ICU staff.
- Recalling staff on non-clinical secondments.
- Consider pooling staff with other units.
- Prepare a register of staff with critical care experience who are not currently working in a critical care unit and place them on a standby list.
- Extending the visas for clinical staff nearing the end of their permitted working time.
- Identification of staff who have secondary appointments and/or cross appointments across LHDs.

Workforce training and upskilling

There will be a need to review and provide additional training to clinical staff managing infected patients and all other staff who will be near infected patients.

Each facility will need to review the training requirements of staff depending on their skill level and recent experience. The following would be considered essential skills clinicians are required to demonstrate proficiency in:

- Donning and doffing (the use and fitting of PPE – gowns, gloves and N95 and P2 masks)
- Intubation
- Extubation
- Bronchoscopy
- High flow nasal oxygen use
- Non-invasive ventilation
- Procedures on distressed children
- Cardiopulmonary resuscitation
- How to manage a ventilated patient
  - Endotracheal tube placement
  - Endotracheal CO_2 monitoring
- Equipment used
- Medication management.

Consideration also needs to be given to the development of training and educational materials and how staff access these resources. Information should be available in a variety of modalities to meet varying needs including:

- printed materials
- online learning options including video options
- webinars
- face to face opportunities
- checklists.

There will also be a need to identify a mechanism where new information can be published and accessed by those who need it in a timely way, with the use of an collaborative platform.

The Clinical Excellence Commission (CEC) and the Health Education and Training Institute (HETI) have resources to assist with staff education.

Simulated training should not deplete scarce stock that is essential for minimising infection and protecting staff.

Equipment

Infrastructure and logistics

All inpatient facilities providing paediatric medicine services must take an inventory of the following resources to inform their local critical care surge response.

- Equipment and consumables required to set-up and sustain a typical PICU bed space

- Standard PICU ventilators

- Other ventilation devices including transport ventilators and those located outside the PICU e.g. occupational therapy, emergency department

- Portable monitoring devices including portable oxygen saturation monitors, inside the PICU and in other clinical areas

- PPE

Facilities should also identify the number of children with NIV in the local community.

Ventilation capacity

Ventilation capacity is most relevant to rural sites that may need to manage a child while a more appropriate bed is being identified.

All facilities should have an accurate oversight of all ventilators available to clinicians and their limitations. This includes number of:

- NICU (equivalent) ventilators

- PICU (equivalent) ventilators

- adult ventilators.

Other considerations

Communication and coordination[8, 11]

During a pandemic a communication framework, with clearly defined channels to ensure timely and accurate information sharing between pandemic response authorities and all intensive care service providers, will be used.

The NSW Minister of Health will engage and obtain strategic advice from the Secretary of Health, ACI, NETS, the Sydney Children's Hospitals Network (SCHN) and the John Hunter Children's Hospital on the prioritisation and delivery of intensive care services for adults and children during a pandemic.

NSW Health governance[1,10]

The Secretary of Health, as Incident Controller, will have overarching responsibility for NSW Health's response to a pandemic and will establish an incident management team to oversee the response across the NSW Health system. Core members of the State Pandemic Management Team include:

- Secretary of Health, Ministry of Health (Chair)
- Chief Health Officer / Deputy Secretary Population and Public Health, Ministry of Health
- State Health Services Functional Area Coordinator, Ministry of Health
- Deputy Secretary – System Purchasing and Performance, Ministry of Health
- Deputy Secretary – Governance Workforce and Corporate, Ministry of Health
- Deputy Secretary – Strategy and Resources, Ministry of Health
- Director – Public Affairs, Ministry of Health
- Chief Executive, Agency for Clinical Innovation
- Chief Executive, Clinical Excellence Commission
- Chief Executive, HealthShare NSW
- Chief Executive, NSW Health Pathology
- Chief executive representation from metropolitan and regional NSW local health districts.

Timeline for action

The below table identifies the activities that should be undertaken in preparation for an increase in cases by PICU's, LHD's and Networks.

What to do when NSW Health reaches a critical point and the ongoing actions required by PICUs.

Domain	Planning (do now)	Undertake at a critical point	Ongoing actions during the period of escalation
Physical capacity			
Bed capacity	Audit current and surge bed capacity	Open surge beds as requested	Convert appropriate beds to PICU beds Reassess nursing dependency to where clinically appropriate
Managing capacity	Maintain Patient Flow Portal information on timely basis. (Every four hours as a minimum)	Defer non-urgent elective surgery requiring intensive care management post operatively	
Admission to PICU	Review admission criteria to critical care units and remove any potential barriers that limit access to these beds (e.g. age and weight limits)	All admission requests are reviewed by senior clinicians before acceptance	Ensure all clinicians are aware of the admission criteria to ensure compliance
Room audit	Audit current number of negative pressure rooms and isolation capacity		
Airflow	Check functioning of the air-conditioning cycling and exhaust		
Managing adults in PICU	Develop protocols for the management of adult patients in paediatric units	Regular contact with network or co-located hospital adult ICU via phone or telehealth	Ensure staff are trained and informed of the policies
Cross border flows	Review and formalise cross border arrangements for patient transfers	Review referrals from cross borders depending on capacity	
Rural capability	Identify capabilities of rural and regional facilities	Provide advice using telehealth to enable patients to stay close to home	Continue networks with regular contact for improved patient care and tertiary oversight of the patients and the priority to transfer
Telehealth capability	Develop a telehealth strategy for management of COVID-19 patients	Use of telehealth to support rural and remote patient management and families to connect with patient due to visitor restrictions	Ensure the hardware and software is functional and staff are trained if required
End of life	Develop guidelines to assist clinicians in initiating end of life discussions	Facilitate end of life discussions for appropriate patients	
Workforce			

Domain	Planning (do now)	Undertake at a critical point	Ongoing actions during the period of escalation
PPE training	Start PPE training on COVID-19 specific items	Monitor PPE compliance – consider a 'buddy system' or audit compliance	
Clinical skills	Identify staff with critical care experience who are currently not working in a critical care area and develop a standby list	Access staff with critical care experience from other non-critical care areas	
Education	Develop educational resources for staff, e.g. general PICU up skilling and deteriorating respiratory paediatric patient		
Equipment			
Audit and monitor	Audit of equipment required to manage COVID-19 patients	Monitor levels of required equipment and usage	
Audit and monitor	Order appropriate levels of equipment	Escalate early any issues with stock levels or equipment function (breakages, malfunction)	
Ordering	Bring forward purchase of key equipment required such as ventilators		
Maintenance	Ensure maintenance of standard ICU ventilators is timed not to coincide with the period of expected surge		

References

1. NSW Ministry of Health. NSW Health Influenza Pandemic Plan. Sydney: NSW Ministry of Health; 2016. https://www1.health.nsw.gov.au/pds/ActivePDSDocuments/PD2016_016.pdf

2. Office of Emergency Management. NSW Human Influenza Pandemic Plan: A Sub Plan of the NSW State Emergency Management Plan. Sydney: NSW Communities and Justice; 2018. https://www.emergency.nsw.gov.au/Documents/plans/sub-plans/subplan-human-influenza-pandemic.pdf

3. NSW Ministry of Health. The NSW Health Services Functional Area Supporting Plan (NSW HEALTHPLAN). Sydney: NSW Communities and Justice; 2013. https://www.emergency.nsw.gov.au/Documents/plans/supporting-plans/Supporting-Plan-Healthplan.pdf

4. NSW Ministry of Health. Patient Flow Portal Dashboard User Guide. V.5. Sydney: NSW Ministry of Health; 2016. https://www.health.nsw.gov.au/pfs/Documents/pfp-dashboard-user-guide.pdf

5. NSW Ministry of Health. Guide to the Role Delineation of Clinical Services. Sydney: NSW Ministry of Health; 2019. https://www.health.nsw.gov.au/services/Publications/role-delineation-of-clinical-services.pdf

6. NSW Ministry of Health. Public Health Workforce Surge Guidelines. Sydney: NSW Ministry of Health; 2014. https://www1.health.nsw.gov.au/pds/ActivePDSDocuments/GL2014_003.pdf

7. NSW Ministry of Health. Influenza Pandemic – Providing Critical Care. Sydney: NSW Ministry of Health; 2010. https://www1.health.nsw.gov.au/pds/ActivePDSDocuments/PD2010_028.pdf

8. Australian and New Zealand Intensive Care Society. The Australian and New Zealand Care Society (ANZICS) COVID-19 Guidelines. V.1 16 March 2020. Melbourne: ANZICS: 2020. https://www.health.nsw.gov.au/Infectious/diseases/Documents/anzics-covid-19-guidelines.pdf

9. NSW Agency for Clinical Innovation. Information About Aerosol Generating Respiratory Therapies: COVID-19. Sydney: ACI; 2020. https://www.aci.health.nsw.gov.au/resources/respiratory/covid-19/information-about-aerosol-generating-respiratory-therapies-covid-19

10. NSW Ministry of Health. NSW Health Incident Coordination Framework (PD2019_023). Sydney: NSW Ministry of Health; 2019. https://www1.health.nsw.gov.au/pds/ActivePDSDocuments/PD2019_023.pdf

11. Ministry of Health, Community of Practice website. https://www.health.nsw.gov.au/Infectious/covid-19/Pages/community-of-practice.aspx

12. 12. Australian and New Zealand Intensive Care Society. The Australian and New Zealand Care Society (ANZICS) COVID-19 Guidelines. V.2 15 April 2020. Melbourne: ANZICS: 2020.

Acronyms

Acronym	Meaning
ACI	NSW Agency for Clinical Innovation
ANZICS	Australian and New Zealand Intensive Care Society
CEC	Clinical Excellence Commission
HETI	Health Education and Training Institute
LHD	Local health district
Ministry	NSW Ministry of Health
NETS	Newborn and Paediatric Emergency Transport Service
NICU	Neonatal intensive care unit
NIV	Non-invasive ventilation
NSW	New South Wales
PFP	Patient Flow Portal
PICU	Paediatric intensive care unit
PPE	Personal protective equipment
SCHN	Sydney Children's Hospital Network

Appendix - PICU checklist

ICU	Total beds	Available beds	Single rooms available	Negative pressure rooms available	Ventilators available	Total number of patients