

Specialty guides for patient management during the coronavirus pandemic

# Clinical guide for the management of paediatric critical care patients during the coronavirus pandemic

26 March 2020 Version 1

“...and there are no more surgeons, urologists, orthopaedists, we are only doctors who suddenly become part of a single team to face this tsunami that has overwhelmed us...”  
Dr Daniele Macchine, Bergamo, Italy. 9 March 2020

As doctors we all have general responsibilities in relation to coronavirus and for these we should seek and act upon national and local guidelines. We also have a specific responsibility to ensure that essential care paediatric critical care continues with the minimum burden on the NHS. We must engage with management and clinical teams planning the local response. We may also need to work outside our specific areas of training and expertise and the General Medical Council has already indicated its support for this in the exceptional circumstances we may face: [www.gmc-uk.org/news/news-archive/how-we-will-continue-to-regulate-in-light-of-novel-coronavirus](http://www.gmc-uk.org/news/news-archive/how-we-will-continue-to-regulate-in-light-of-novel-coronavirus)

As the UK enters the ‘suppress’ phase of the coronavirus pandemic, all hospitals should take action to prepare for super-surge capacity and the peak in demand for paediatric critical care medicine.

This clinical and operational guidance is for paediatric intensive care units (PICUs; level 3) and paediatric high-dependency units (HDUs; level 2). It is also relevant to children’s wards with high dependency capabilities (level 1).

For specific, up-to-date level 3 (PICU) clinical guidance, please refer to the PICS guidelines: <https://picsociety.uk/covid19>

Although the number of paediatric patients admitted with COVID-19 may be low, paediatric departments may be asked to support adult services by:

- providing staff to support adult clinical and non-clinical services
- admitting adult patients (initially up to 25 years of age) with non-COVID/COVID disease should adult units become overwhelmed.

Not all of this operational plan will need to be invoked for level 1 units. However, contingencies in all hospitals admitting children will need to be made, particularly around staffing, and perhaps also preparation for holding critical care patients longer than normally anticipated should level 3 PICU capacity become compromised.

## Operational

Develop an operational delivery team combining expertise from the clinical multidisciplinary team (MDT) and site management team.

<p><b>Oxygen</b></p>	<ul style="list-style-type: none"> <li>• Assess the number of outlets that can be simultaneously supported by the VIE, and the location of those outlets. The hospital engineering team can determine the flow rates that can be achieved and types of ventilator supported.</li> <li>• Ensure any portable oxygen concentrator capacity is ready for use in wards or HDUs.</li> <li>• Communicate to all staff the requirement to reduce oxygen consumption through avoiding hyperoxia and eliminating waste.</li> <li>• All cylinders should be located and filled to facilitate transfers and emergency use with conscious assessment of ventilator flow rate and capacity of the cylinder being used.</li> </ul>
<p><b>Air</b></p>	<ul style="list-style-type: none"> <li>• Assess the piped air supply, number of outlets and location.</li> </ul>
<p><b>Power</b></p>	<ul style="list-style-type: none"> <li>• Assess the power supply and maximum number of devices that can be supported in a sustained manner.</li> </ul>
<p><b>Ventilators</b></p>	<ul style="list-style-type: none"> <li>• Ensure all ventilators are operational, including those on PICU, ward and HDU, transport incubators, any portable machines (if available), anaesthetic machines and any in storage work through any outlet. If ventilator gap based on maximum calculated capacity, please liaise with procurement through the NHS Supply Chain.</li> </ul>

	<ul style="list-style-type: none"> <li>• Ensure all non-invasive ventilators are operational</li> <li>• The circuit must contain an HMEF-bacterial-viral filter between the machine and patient.</li> </ul>
<b>Equipment</b>	<ul style="list-style-type: none"> <li>• Identify the equipment gap for maximum proposed capacity, eg critical care beds, infusion pumps, multi-channel monitors, suction machines, line insertion ultrasound machine use, procedure trolleys, consumables, resuscitation trolleys and difficult airway trolleys.</li> <li>• Identify any equipment that can be relocated from non-critical care areas, eg wards and recovery, and house it in a single site that is known to senior nursing and medical staff.</li> <li>• Use NHS Supply Chain to procure further equipment as required.</li> </ul>
<b>Staff</b>	<ul style="list-style-type: none"> <li>• Identify availability and expertise in staffing groups allied to critical care delivered within your service, eg anaesthesia, NICU intensivists, outreach teams, surgical and medical specialties, specialist nursing, ex-critical care staff, rotating junior doctors in community or educational fellow placements.</li> <li>• Redeploy those within practice development, audit, research and training or mentorship roles to clinical duties where appropriate.</li> <li>• Redeploy clinicians with non-essential managerial roles.</li> <li>• Redeploy clinicians in high-risk patient groups (those who are pregnant or have chronic health complaints) to non-clinical roles, eg drawing up a rota of staff available on any set day in case of self-isolation, short-notice short-staffing or collecting auditable data on patients diagnosed with COVID-19.</li> <li>• Institute workforce leads for redeployment and rostering.</li> <li>• Consider reorganising team-working and patient management predicated on relevant skills and expertise rather than seniority; staff groups with critical care expertise may need to move to supervisory roles rather than bedside clinical care.</li> <li>• Level 2 and 3 units to institute bottom-up training in core skills (ventilation, sedation, nutrition, antimicrobial policies, VTE avoidance if applicable, transfusion policies and investigation panels) with the support of local e-solutions and brief protocols and clinical information summary sheets.</li> <li>• Institute learning for the extension of core skills for non-ICU staff to look after ICU patients.</li> </ul>

	<ul style="list-style-type: none"> <li>Any staff member should assist with moving equipment, restocking units, resupplying bed areas and completing administrative tasks.</li> </ul>
<b>Team communication and working</b>	<ul style="list-style-type: none"> <li>Schedule regular short meetings with clinical team leaders to discuss operational issues. Leadership in a crisis is stressful and demanding. Support each other.</li> <li>Leadership must be shared – the clinical director alone cannot do everything!</li> <li>Encourage open dialogue from all members of the team, with a focus on problem-solving and pragmatic solutions.</li> <li>Ensure strong support of physical and mental wellbeing, focusing on emotional support, nutrition, hydration and sleep.</li> <li>Direct staff to occupational health protocols and develop a pathway for rapid testing for staff with suspected coronavirus (once this is available) prior to self-isolation.</li> <li>Support staff who are in higher risk groups, eg immune suppressed, with significant co-morbidities or nearing retirement.</li> </ul>
<b>Imaging</b>	<ul style="list-style-type: none"> <li>Liaise with the imaging team and provide details on the super-surge capacity.</li> <li>Detail the proposed chest X-ray, cross-sectional imaging and ultrasound requirement.</li> <li>Infection prevention and control (IPC) team to guide cleaning of contaminated bedside imaging equipment.</li> </ul>
<b>Location</b>	<ul style="list-style-type: none"> <li>Conduct hospital walkrounds (medical, nursing, IPC and engineering) to identify ward, theatre and recovery areas that can be used to cohort invasively and/or non-invasively ventilated patients (PHDU, ward, theatres).</li> <li>Determine environmental ventilation specifications (neutral or positive pressure) and air circulation, oxygen and electricity to determine if able to cope with super-surge capacity (PHDU and PICU).</li> <li>Identify air handling exhaust location and if HEPA filtered (PHDU and PICU).</li> <li>Develop a roll-out capacity plan with a focus on cohorting patients to reduce risk of spread of infection.</li> </ul>
<b>Elective activity</b>	<ul style="list-style-type: none"> <li>Early and prompt reduction in elective work with goal to stop all non-urgent elective work by 15 April 2020:  <a href="https://www.england.nhs.uk/coronavirus/wp-content/uploads/sites/52/2020/03/urgent-next-steps-on-nhs-response-to-">https://www.england.nhs.uk/coronavirus/wp-content/uploads/sites/52/2020/03/urgent-next-steps-on-nhs-response-to-</a> </li> </ul>

	<p><a href="#">covid-19-letter-simon-stevens.pdf</a>, beginning with cases likely to require prolonged inpatient admission and/or critical care.</p> <ul style="list-style-type: none"> <li>• This will increase availability of staff members for training and redeployment.</li> <li>• If elective surgery continues, limit to ASA-1 cases unless cancer or urgent.</li> </ul>
<b>Transfers of patients from other hospitals not using PIC retrieval services</b>	<ul style="list-style-type: none"> <li>• Referring team to complete risk assessment of coronavirus risk and test early.</li> <li>• Referring team to complete transfer risk assessment to decide on level of clinical skills needed on transfer .</li> <li>• For transfer of patients to regional PICUs please see PICS pathway advice: <a href="https://picsociety.uk/covid19">https://picsociety.uk/covid19</a></li> </ul>
<b>Medical records</b>	<ul style="list-style-type: none"> <li>• Work through an e-solution or paper solution for entirely contemporaneous note-taking and recording.</li> <li>• Develop by working with the hospital IT team.</li> </ul>
<b>Pharmacy</b>	<ul style="list-style-type: none"> <li>• Pharmacy leads should assess medication requirements based on maximum surge critical care capacity.</li> <li>• Local teams to consider their priorities.</li> <li>• Pharmacy leads should investigate and ensure supply chains of critical care medications to non-critical care areas.</li> <li>• Pharmacy leads should work through any e-solution or paper solution to a large expansion in critical care patients.</li> <li>• Pharmacy leads should be part of any oxygen operational delivery group which should include both static and mobile oxygen.</li> </ul>
<b>Infection prevention and control</b>	<ul style="list-style-type: none"> <li>• IPC leads should ensure appropriate controls are in place in areas repurposed for critical care.</li> <li>• IPC leads should ensure personal protective equipment (PPE) programmes of education and training relating to all PHE guidance, including a mask fit-testing programme, are rapidly rolled out</li> <li>• The IPC team should be embedded in the operational delivery team and advise on all potentially complex, contaminating procedures.</li> <li>• For management of the neonate of a COVID-19-positive mother or parent, please refer to RCOG/RCPCH guidance: <a href="https://www.rcpch.ac.uk/resources/covid-19-guidance-paediatric-services">https://www.rcpch.ac.uk/resources/covid-19-guidance-paediatric-services</a></li> </ul>

<b>Isolation facilities</b>	<ul style="list-style-type: none"> <li>Review any isolation room (negative or neutral pressure) air handling functionality and operation in terms of pressures and air exchanges per hour, to ensure installation specifications are currently being met.</li> </ul>
<b>Investigations</b>	<ul style="list-style-type: none"> <li>Devise daily laboratory investigation safe order sets able to be routinely taken by the phlebotomy team or nursing staff; and designed to minimise number of samples and range of tests, and to eliminate any that are non-essential.</li> <li>Consider increasing point of care testing if available.</li> <li>Consider relevance of all tests to spare laboratory staff for essential work.</li> </ul>
<b>Access to patients</b>	<ul style="list-style-type: none"> <li>Restrict access to critical care areas for non-essential staff and visitors beyond well parents or guardians.</li> <li>No parent should be allowed to visit if suspected to be unwell with COVID-19 until tests have come back as negative.</li> <li>All attempts should be made to admit one parent/carer only with the child and this parent should stay inside the dedicated isolation area until discharge. For COVID-19-positive patients, parents should wear appropriate PPE equipment.</li> <li>Reorientation of care might prompt individual reassessment of this rule.</li> <li>Discuss requirements on using mobile devices and video-calling with the local Caldicott Guardian/information governance team for compassionate use during end-of-life processes. Current guidance may restrict use in clinical areas.</li> </ul>
<b>Procurement</b>	<ul style="list-style-type: none"> <li>Procurement leads should provide a simple procurement process for authorisation requests.</li> </ul>

## Generic clinical guidelines for use in all paediatric critical care facilities (levels 1, 2 and 3)

<p><b>Context</b></p>	<ul style="list-style-type: none"> <li>• Children with COVID-19 seem to have a less severe illness than adults. However, if children meet the case definition the correct PPE must be worn.</li> <li>• Infection control advice from PHE and your local trust must be followed: <a href="https://www.gov.uk/government/publications/wuhan-novel-coronavirus-infection-prevention-and-control">https://www.gov.uk/government/publications/wuhan-novel-coronavirus-infection-prevention-and-control</a></li> <li>• Children with usual childhood infections/conditions will present during this period. Do not inadvertently place them at an increased risk due to procedural changes.</li> <li>• The <a href="#">RCPCH</a> has detailed co-morbidities children may have which put them at an increased risk of the complications of COVID-19.</li> </ul>
<p><b>Conservation of oxygen</b></p>	<ul style="list-style-type: none"> <li>• Where appropriate, avoid unnecessary hyperoxia in patients receiving supplemental oxygen, to reduce oxygen waste (keeping saturations &lt;95%).</li> <li>• Eliminate oxygen waste by ensuring oxygen flowmeters, including NeoPuff devices and resuscitaires, are switched off.</li> </ul>
<p><b>High Flow oxygen delivery devices</b></p>	<ul style="list-style-type: none"> <li>• High flow nasal oxygen or similar devices should be used with care as per normal unit guidelines and awareness that they are aerosol generating.</li> <li>• The risk of environmental viral contamination with HHFNC versus use of oxygen supplementation alone may be higher. However, practical considerations and the fact that the vast majority of symptomatic children will be COVID-19 negative demand that usual treatment pathways are followed.</li> <li>• It is therefore essential that all healthcare workers wear the correct PPE for aerosol-generating procedures (AGP), as described by PHE, in children who meet case definition: <a href="https://www.gov.uk/government/publications/wuhan-novel-coronavirus-infection-prevention-and-control">https://www.gov.uk/government/publications/wuhan-novel-coronavirus-infection-prevention-and-control</a></li> </ul>
<p><b>Non-invasive ventilation devices</b></p>	<ul style="list-style-type: none"> <li>• Use of CPAP or BiPAP should be considered as clinically indicated following advice from the regional PIC transport service/ PID team.</li> <li>• Where COVID-19 is confirmed or suspected, delivery of NIV in an isolated environment (negative or neutral pressure room) is preferred, if available. Discuss ongoing care with regional centre and follow PICS guidelines: <a href="https://picsociety.uk/covid19">https://picsociety.uk/covid19</a></li> </ul>

<b>Location</b>	<ul style="list-style-type: none"> <li>• The number of negative pressure or neutral pressure room facilities is often limited. It may be necessary to cohort ventilated patients in areas on units and wards.</li> <li>• Single-occupancy rooms could be reserved for those receiving NIV (as above) or for non-coronavirus patients, depending on your patient population, or for those with suppressed or compromised immune systems.</li> </ul>
<b>Endotracheal intubation</b>	<ul style="list-style-type: none"> <li>• Follow unit intubation guidance and PICS guidance for children: <a href="https://picsociety.uk/covid19">https://picsociety.uk/covid19</a></li> <li>• Intubation should be performed by a skilled operator wearing appropriate PPE for an AGP: <a href="https://www.gov.uk/government/publications/wuhan-novel-coronavirus-infection-prevention-and-control">https://www.gov.uk/government/publications/wuhan-novel-coronavirus-infection-prevention-and-control</a></li> <li>• There should be no need for deviation away from APLS guidance, for example, but protocols may be revised in adolescents in line with adult COVID guidance: <a href="https://icmanaesthesiacovid-19.org/">https://icmanaesthesiacovid-19.org/</a></li> <li>• All emergency teams must be ready for emergency intubation with all necessary PPE equipment and protocols available in an emergency timeframe.</li> <li>• These teams should practise using simulation.</li> <li>• In a district general hospital, patients must be escalated for tertiary care following PICS guidelines: <a href="https://picsociety.uk/covid19">https://picsociety.uk/covid19</a></li> </ul>
<b>Arrest and peri-arrest</b>	<ul style="list-style-type: none"> <li>• The Resuscitation Council of the UK highlighted the importance of having bag and mask ventilation immediately available for all critically unwell children: <a href="https://www.resus.org.uk/media/statements/resuscitation-council-uk-statements-on-covid-19-coronavirus-cpr-and-resuscitation/covid-paediatrics/">https://www.resus.org.uk/media/statements/resuscitation-council-uk-statements-on-covid-19-coronavirus-cpr-and-resuscitation/covid-paediatrics/</a></li> <li>• The paediatric team must forward plan management of children in a peri-arrest or arrest state in case of reduced anaesthetic support due to high activity elsewhere.</li> <li>• Intubation should be performed by a skilled operator wearing appropriate PPE for an AGP.</li> <li>• If the crash trolley is used, dispose of all used items within the isolation room before taking the trolley outside to be cleaned with hyperchlorite wipes.</li> </ul>

<b>Aerosol-generating procedures (AGP)</b>	<ul style="list-style-type: none"> <li>• AGPs such as intubation, facemask ventilation, circuit disconnection, bronchoscopy and physiotherapy may increase the risk of environmental viral contamination.</li> <li>• Please see the PHE website for guidance on appropriate PPE: <a href="https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/874316/Infection_prevention_and_control_guidance_for_pandemic_coronavirus.pdf">https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/874316/Infection_prevention_and_control_guidance_for_pandemic_coronavirus.pdf</a></li> </ul>
<b>ECMO</b>	<ul style="list-style-type: none"> <li>• Follow established guidance and thresholds for referral to the ECMO network.</li> </ul>
<b>Patients receiving home mechanical ventilation admitted to hospital</b>	<ul style="list-style-type: none"> <li>• If the child is admitted to hospital, it may be necessary to ‘quarantine’ the home ventilator and dispose of any consumable components.</li> <li>• To avoid aerosol generation, prevent droplet spread and minimise exhaled leak dispersion, a well-fitting facemask is advised for all carers.</li> <li>• Change the circuit if switching from a vented mask to a non-vented mask and an exhalation port.</li> <li>• Include an expiratory antimicrobial filter.</li> <li>• In children receiving long-term tracheostomy ventilation, the tracheostomy tube should be exchanged for a cuffed tube to reduce leak dispersion.</li> <li>• Patients should preferably be ventilated in an isolation room.</li> <li>• Cough assist devices should be avoided in suspected cases.</li> </ul>
<b>Ethics</b>	<ul style="list-style-type: none"> <li>• Link in with Hospice CEAC support services.</li> <li>• Ensure any decisions and considerations on withdrawal or refusal of life-sustaining care is contemporaneously recorded.</li> <li>• Ensure guidance on making ethical decisions is available.</li> <li>• Work with palliative care and paediatric networks to ensure that, where appropriate, advanced care plans are developed with families and put in place in the community</li> <li>• Ensure ACPs are reviewed and updated.</li> </ul>