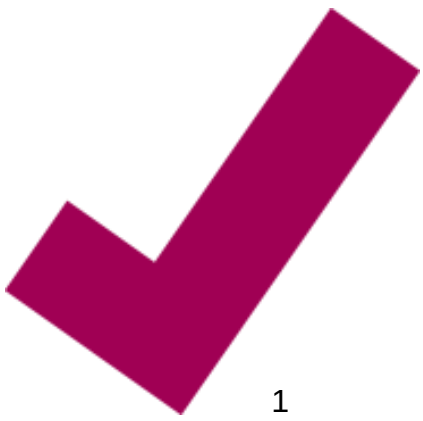
Management of surge and escalation in critical care services: standard operating procedure for paediatric respiratory extra corporeal membrane oxygenation



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Management of surge and escalation in critical care services: standard operating procedure for paediatric respiratory extra corporeal membrane oxygenation

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Contents

1 Introduction and context

The focus of this document is to set out the background, principles and processes for the management of surges in demand for paediatric respiratory extra corporeal membrane oxygenation (ECMO). The nature of paediatric respiratory ECMO services is such that this is a national surge and escalation process rather than a regional process that escalates to a national level.

Extra corporeal membrane oxygenation (ECMO) is a technique that allows babies and children with severe respiratory difficulties (including infection and structural problems with lungs or airway and for whom mechanical ventilation is insufficient to support life) to have the function of their lungs (and also their heart if needed) supported with a mechanical pump and artificial lung.

This Standard Operating Procedure (SOP) forms part of a suite of SOPs that cover the following services:

- Adult critical care
- Adult respiratory extra corporeal membrane oxygenation
- Paediatric intensive care
- Burns services

It is recognised that:

- There are mutual interdependencies between these services and the critical care and intensive care resource they each use; and
- Surge pressures are not solely linked to winter and can occur at any time of year.

In the context of this SOP, the term **surge** is used to describe pressure on the whole paediatric respiratory ECMO system rather than referring to surge pressure experiences within individual Paediatric and Adult Respiratory ECMO Centres.

All capacity reporting and bed management will use, as its basis, the NHS Pathways Directory of Services (Pathways DOS) system. Plans are being progressed to enhance the type of information available to monitor the bed availability for paediatric and adult respiratory ECMO services in England and Scotland. Wales and Northern Ireland utilise the respiratory ECMO beds in England and Scotland but are not involved in the surge and escalation processes.

2 Purpose

The SOP sets out:

- A consistent national approach for England and Scotland by which providers of the services covered by this document can escalate capacity pressures to their commissioners and NHS England;
- How organisations, the services covered by this document and the stakeholders should act;
- The process for the identification of current and potential capacity for

the services covered by this document; and
- The anticipated escalation process nationally across the NHS in England, in support of the services covered by this document (including the NHS Strategic Command arrangements to be implemented by NHS England should they be required).

All processes described take account of the specific commissioning arrangements for the services covered.

In the event of a surge in demand identified via the daily monitoring system or via alerts from the paediatric respiratory ECMO centres, the Paediatric Respiratory ECMO Lead (the PRE Lead) coordinates NHS England's response. All surge issues should be referred to the PRE Lead in-hours.

3 Strategic aim

The strategic aims of this document are for the services covered by this document to:
- Prevent avoidable mortality and morbidity due to patients requiring care and not being able to access this in a timely manner;
- Maximise capacity in the health and social care system in a range of scenarios through a coordinated escalation and de-escalation approach across geographical footprints; and
- Avoid *triage by resource* (as opposed to *triage by outcome*) until all potential escalation options have been exhausted.

Support for **repatriation** of patients able to be discharged is at the centre of arrangements to ensure that the maximum use is made of the highly specialised paediatric respiratory ECMO services.

Appendix 3 gives detail about paediatric respiratory ECMO, the indications for its use, criteria for referral and contraindications.

4 Target audience

The primary audiences for this document are:
- Those involved in planning paediatric respiratory ECMO services;
- Others involved in the oversight of specialised services in NHS England;
- Those involved in strategic command arrangements out-of-hours in NHS England (i.e. EPRR staff)
- Providers of paediatric respiratory ECMO services; and
- communications staff.

Given the small number of providers of paediatric respiratory ECMO services, surge demand is managed on a national (rather than regional or local) basis.

5 Surge and escalation management arrangements

This section sets out the roles and responsibilities to be undertaken at times of surge pressure. The information in this section is incorporated into a series of action cards shown at **Appendix 1.**

The following sections describe actions in **pre-surge** (heightened risk of surge), **surge** (need for extra capacity to be deployed), **escalation** (all surge capacity deployed) and **recovery** (surge and escalation phases passed and pre-surge arrangements reinstated).

5.1 Pre-surge phase

During periods when there are likely to be bed capacity issues (for example, between 1 November and 31 March and/or when there are pandemics), the PRE Lead in-hours convenes a weekly teleconference to discuss bed availability and potential issues. The calls take place every Monday at 14.30 and the individuals taking part include:

- A representative from each of the six centres (the four lead Paediatric Respiratory ECMO Centres and the two Paediatric Respiratory ECMO Centres)
- The PRE Lead in-hours or their deputy (Chair)
- A representative from National Services Division, Scotland (commissioner of paediatric respiratory ECMO services in Scotland)
- A member of the NHS England EPRR Team (as required)

The weekly teleconference covers:

- An update of bed capacity from each of the six centres; and
- Potential issues and a discussion of possible solutions

When a Paediatric Respiratory ECMO Centre is unable to take part in a teleconference, they e-mail information about their bed capacity status to the PRE Lead in-hours prior to the teleconference. This ensures that a complete national picture can be determined at the teleconferences.

The PRE Lead in-hours circulates a brief note of the meeting. The PRE Lead may liaise with NHS England regional staff if, for example, there is an indication that paediatric respiratory ECMO capacity issues may impact on other services.

The teleconference details are as follows:

UK Freefone from landline:	0800 917 1950
From mobiles:	020 3463 9697
Chairperson passcode:	96014943 then #
Participant passcode:	71489424 then #

The PRE Lead in-hours sends an e-mail to the PRE Lead out-of-hours every Friday at 16.00 (or before any bank holiday period) and the PRE Lead out-of-hours sends an e-mail to the PRE Lead in-hours every Monday at 08.00 (or following any bank holiday period). The e-mail either:

a) confirms that there are no known issues; or
b) details potential issues and what has been discussed in terms of possible solutions; or
c) details known issues and what has been put in place as a consequence.

5.2 Surge phase

The surge point is defined as the point at which only one bed is available in the designated centres (excluding surge capacity). This position is confirmed by the PRE Lead in-hours.

Should the surge point be reached **in-hours**, the PRE Lead in-hours:

- Reviews the bed status information from the NHS Pathways Directory of Services (Pathways DOS)
- Convenes a teleconference with the six centres (and the other attendees of the weekly teleconferences where feasible)
- Confirms that the surge point has been reached
- Agrees which surge capacity should be made available
- Liaises with the Adult Respiratory ECMO Lead in-hours to determine if there is bed availability in the adult respiratory ECMO service for any young person referred to the service who could be appropriately treated in an adult bed
- Agrees how the surge point will be monitored, for example, through frequent teleconferences
- Ensures that the EPRR Team is aware of the situation
- Communicates information to NHS England staff as appropriate
- Agrees a communications plan as appropriate
- Follows up any repatriation issues with staff in NHS England, once local escalation between the Paediatric Respiratory ECMO Centre and the hospital to which a patient who no longer needs paediatric respiratory ECMO could be repatriated

The PRE Lead in-hours is responsible for liaising with other NHS England staff to ensure that the agreed actions are implemented alongside the agreed communications plan.

The PRE Lead in-hours decides either:

a) The surge point has passed and pre-surge arrangements can be reinstated; or
b) surge arrangements have been exhausted and the escalation point has been reached.

Should the surge point be reached **out-of-hours**, the centres follow the pathway in line with the agreed flow chart and communicate the position to the PRE Lead in-hours so that any further actions can be followed up.

5.3 Escalation phase

The escalation phase is defined as all designated beds being full and all identified surge capacity being full. This position is confirmed by the PRE Lead in conjunction with the National Clinical Director for EPRR.

Once the escalation point is reached, the PRE Lead:

- Reviews the bed status information from the NHS Pathways Directory of Services (Pathways DOS)
- Convenes a teleconference (to be chaired by the National Clinical Director for EPRR) with the six centres (and other NHS England and NHS Scotland staff as appropriate)
- Confirms that the escalation point has been reached
- Agrees what other actions should be instigated, for example, temporary suspension of elective activity
- Agrees how the escalation point will be monitored, for example, through frequent teleconferences
- Ensures that the EPRR Team is aware of the situation
- Communicates information to NHS England staff as appropriate Agrees a communications plan as appropriate

The PRE Lead, in conjunction with the National Clinical Director for EPRR, is responsible for liaising with other NHS England staff to ensure that the agreed actions are implemented alongside the agreed communications plan.

The PRE Lead, in conjunction with the National Clinical Director for EPRR, decides when the escalation point has passed and surge arrangements can be reinstated.

5.4 Recovery phase

The recovery phase is defined as the point at which surge and escalation phases have passed and pre-surge arrangements can be reinstated. This position is confirmed by the PRE Lead in-hours.

Once the recovery point is reached, the PRE Lead in-hours:

- Prepares (in conjunction with the National Clinical Director for EPRR), a debrief following any escalation phases, including recommendations for improvement in the SOP
- Discusses post-escalation debriefs at the weekly teleconferences
- Implements any changes agreed as a result of post-escalation debrief

6 Interdependencies/links with other services

Critical Care Networks should prioritise repatriation of ECMO patients to create capacity in Adult Respiratory ECMO Centres. Regional leads should support the repatriation of patients during surge and escalation, accepting that repatriation may not be to the originating Trust.

7 Appendix 1: action cards

PAEDIATRIC RESPIRATORY ECMO SERVICES STANDARD OPERATING PROCEDURE ACTION CARD		
Role	**7.1 PAEDIATRIC RESPIRATORY ECMO CENTRES** The role of the Paediatric Respiratory ECMO Centre is to:	
1	Complete/update the NHS Pathways Directory of Services (Pathways DOS) system six-hourly.	
2	Ensure the safety of children at all times escalating concerns about clinical safety arising from capacity constraints to NHS England.	
3	e-mail bed availability status to the Paediatric Respiratory ECMO Lead when unable to take part in teleconferences	
4	Take part in the weekly teleconferences during periods of potential bed capacity issues, reporting bed availability and any known issues.	
5	Take part in surge teleconferences, reporting bed availability; make available surge capacity according the agreed protocol.	
6	Take part in escalation teleconferences, reporting bed availability; instigate other actions, in line with the agreed protocol.	
7	Follow up any repatriation issues through local governance routes and escalate to NHS England if local governance routes are not successful	

PAEDIATRIC RESPIRATORY ECMO SERVICES STANDARD OPERATING PROCEDURE ACTION CARD		
Role	**7.2 NHS ENGLAND PAEDIATRIC RESPIRATORY ECMO LEAD IN- HOURS – PRE-SURGE** Pre-surge is defined as: the period during which there are likely to be bed capacity issues (for example, between 1 November and 31 March and/or when there are pandemics). In-hours is defined as: between the hours of 09.00 and 17.00 from Monday to Friday (except bank holidays). The role of the Paediatric Respiratory ECMO (PRE) Lead in-hours during pre-surge is to:	
1	Be responsible for the day-to-day management of the Standard Operating Procedure	
2	Review the standard operating procedure as necessary	
3	Ensure that appropriate payments are made for activity in line with contracts	
4	Convene and chair the weekly national teleconferences during periods when there are likely to be capacity issues. The calls take place every Monday at 14.30 and the participants include: • A representative from each of the six Paediatric Respiratory ECMO Centres • A representative from National Services Division, Scotland (commissioner of paediatric respiratory ECMO services in Scotland) • A member of the NHS England EPRR Team (as required) The weekly teleconference covers: • An update of bed capacity from each of the six centres • Potential issues and a discussion of possible solutions Circulate a brief note of the meeting. The PRE Lead in-hours is responsible for liaising with NHS England regional staff if, for example, there is an indication that paediatric respiratory ECMO capacity issues may impact on other services. The teleconference details are as follows: UK Freefone from landline: 0800 917 1950 From mobiles: 020 3463 9697	

	Chairperson passcode: 96014943 then # Participant passcode: 71489424 then #	
5	Send an e-mail to the PRE Lead out-of-hours every Friday at 16.00 (or before any bank holiday period).	
6	Confirm (in conjunction with the National Clinical Director for EPRR) when a surge episode is reached and what 'next steps' are required, by whom and the timescales for completion.	
7	Provide support to the PRE Lead out-of-hours during surge and escalation phases.	

PAEDIATRIC RESPIRATORY ECMO SERVICES STANDARD OPERATING PROCEDURE ACTION CARD		
Role	**7.3 NHS ENGLAND PAEDIATRIC RESPIRATORY ECMO LEAD IN-HOURS – SURGE**	
	Surge is defined as: the point at which only one bed is available in the designated centres. This position is confirmed by the Paediatric Respiratory ECMO Lead (PRE Lead) in-hours. In-hours is defined as: between the hours of 09.00 and 17.00 from Monday to Friday (except bank holidays). The role of the PRE Lead in-hours during surge is to:	
1	Be responsible for the day-to-day management of the Standard Operating Procedure	
2	Review the standard operating procedure as necessary	
3	Ensure that appropriate payments are made for surge activity in line with contracts.	
4	In the event that the surge point is reached in-hours: • Review the bed status information from NHS Pathways Directory of Services (Pathways DOS) • Convene a teleconference with the six centres (and the other attendees of the weekly teleconferences where feasible) • Confirm that the surge point has been reached • Agree which surge capacity should be made available • Liaise with the Adult Respiratory ECMO Lead in-hours to determine if there is bed capacity in the adult respiratory ECMO service for any young person referred to the service and who could be appropriately treated in an adult bed • Ensures that the EPRR Team is aware of the situation • Agree how the surge point will be monitored, for example, through frequent teleconferences • Communicate information to NHS England staff as appropriate • Agree a communications plan as appropriate • Follow up an repatriation issues with colleagues in NHS England, once local escalation between the Paediatric Respiratory ECMO Centre and the hospital to which a patient who no longer needs paediatric respiratory ECMO could be repatriated The PRE Lead in-hours is responsible for liaising with other NHS England staff to ensure that the agreed actions are	

	implemented alongside the agreed communications plan. The PRE Lead in-hours decides either: c) The surge point has passed and pre-surge arrangements can be reinstated; or d) surge arrangements have been exhausted and the escalation point has been reached.	
5	Send an update e-mail to the PRE Lead out-of-hours every Friday at 16.00 (or before any bank holiday period) and more frequently as required.	
6	Confirm (in conjunction with the National Clinical Director for EPRR) when a surge episode is reached and what 'next steps' are required, by whom and the timescales for completion.	
7	Monitor bed capacity on a daily basis when a surge episode is reached.	
8	Confirm when a surge episode has passed and pre-surge arrangements and monitoring can be reinstated.	
9	Provide support to the PRE Lead out-of-hours during surge phases.	

PAEDIATRIC RESPIRATORY ECMO SERVICES STANDARD OPERATING PROCEDURE ACTION CARD		
Role	**7.4 NHS ENGLAND PAEDIATRIC RESPIRATORY ECMO LEAD OUT-OF-HOURS – PRE-SURGE**	
	Pre-surge is defined as: the period during which there are likely to be bed capacity issues (for example, between 1 November and 31 March and/or when there are pandemics). Out-of-hours is defined as: between the hours of 17.00 and 09.00 from Monday to Friday, weekends and bank holidays. The Paediatric Respiratory ECMO (PRE) Lead out-of-hours is the NHS England on-call EPRR Officer supported by the NHS England on-call Operations Director and working in collaboration with the National Clinical Director for EPRR.	
	The role of the PRE Lead out-of-hours is to:	
1	Convene and chair the weekly teleconferences during pre-surge phases when the weekly teleconference falls on a bank holiday. The calls take place every Monday at 14.30 and the individuals taking part include: • A representative from each of the six centres • A representative from National Services Division, Scotland (commissioner of paediatric respiratory ECMO services in Scotland) • Other members of the NHS England EPRR Team (as required) The weekly teleconference covers: • An update of bed capacity from each of the six centres • Potential issues and a discussion of possible solutions The PRE Lead out-of-hours circulates a brief note of the meeting. The PRE Lead out-of-hours may liaise with NHS England regional staff if, for example, there is an indication that paediatric respiratory ECMO capacity issues may impact on other services. The teleconference details are as follows: UK Freefone from landline: 0800 917 1950 From mobiles: 020 3463 9697 Chairperson passcode: 96014943 then # Participant passcode: 71489424 then #	
2	Ensure that any actions following the teleconferences are	

	implemented when the weekly teleconference falls on a bank holiday.	
3	Send an update email to the PRE Lead in-hours every Monday at 08.00 (or after a bank holiday).	
4	Confirm (in conjunction with the National Clinical Director for EPRR) when a surge episode is reached out of hours and what 'next steps' are required, by whom and the timescales for completion.	
	NATIONAL CLINICAL DIRECTOR FOR EPRR	
5	Confirm (in conjunction with the PRE Lead out-of-hours) when an escalation point is reached.	

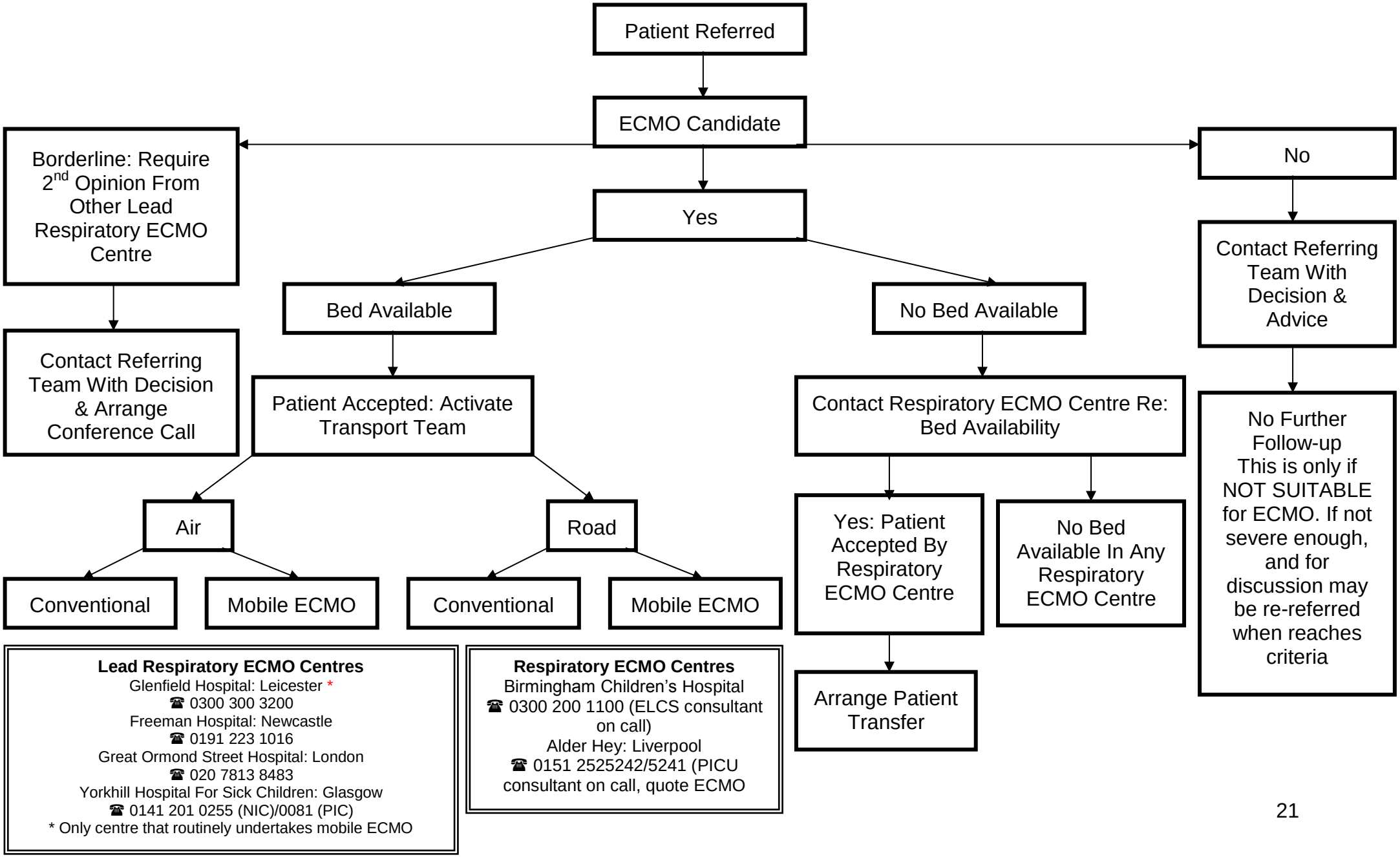
PAEDIATRIC RESPIRATORY ECMO SERVICES STANDARD OPERATING PROCEDURE ACTION CARD		
Role	**7.5 NHS ENGLAND PAEDIATRIC RESPIRATORY ECMO LEAD OUT-OF-HOURS – SURGE**	
	Surge is defined as: the point at which only one bed is available in the designated centres. This position is confirmed by the Paediatric Respiratory ECMO Lead (PRE Lead) out-of-hours. Out-of-hours is defined as: between the hours of 17.00 and 09.00 from Monday to Friday, weekends and bank holidays. The PRE Lead out-of-hours is the NHS England on-call EPRR Officer supported by the NHS England on-call Operations Director and working in collaboration with the National Clinical Director for EPRR.	
	The role of the PRE Lead out-of-hours is to:	
1	Confirm (in conjunction with the National Clinical Director for EPRR) when a surge episode is reached out of hours and what 'next steps' are required, by whom and the timescales for completion.	
2	In the event that the surge point be reached out-of-hours: • ensure that the Paediatric Respiratory ECMO Centres follow the pathway shown at **Appendix 2** in line with the agreed flow chart; and • communicate the position to the PRE Lead in-hours so that any further action can be followed up. Communicate status and agree a communications plan as necessary.	
4	Monitor bed capacity on a daily basis when a surge episode is reached	
5	Liaise with the PRE Lead in-hours to enable comprehensive handover in normal working hours (as outlined above) and confirm key actions arising during the on call period in writing (via email).	
	NATIONAL CLINICAL DIRECTOR FOR EPRR	
6	Confirm (in conjunction with the PRE Lead out-of-hours) when an escalation point is reached.	

PAEDIATRIC RESPIRATORY ECMO SERVICES STANDARD OPERATING PROCEDURE ACTION CARD		
Role	**7.6 NHS ENGLAND PAEDIATRIC RESPIRATORY ECMO LEAD IN-HOURS AND OUT-OF-HOURS – ESCALATION** Escalation is defined as: the point at which all designated beds are full and all identified surge capacity is full. The position is confirmed by the Paediatric Respiratory ECMO (PRE) Lead in conjunction with the National Clinical Director for EPRR.	
	The role of the PRE Lead is to:	
1	Confirm (in conjunction with the National Clinical Director for EPRR) when the escalation phase is reached and what 'next steps' are required, by whom and the timescales for completion.	
2	In the event that escalation point is reached: • Review the bed status information from the NHS Pathways Directory of Services (Pathways DOS) • Convene a teleconference (to be chaired by the National Clinical Director for EPRR) with the six centres (and other NHS England and NHS Scotland staff as appropriate) • Confirm that the escalation point has been reached • Agree what other actions should be instigated, for example, temporary suspension of elective activity • Ensures that the EPRR Team is aware of the situation • Agree how the escalation point will be monitored, for example, through frequent teleconferences • Communicate information to NHS England staff as appropriate • Agree a communications plan as appropriate The PRE Lead, in conjunction with the National Clinical Director for EPRR, is responsible for: • liaising with other NHS England staff to ensure that the agreed actions are implemented alongside the agreed communications plan • agreeing how services will be monitored during the escalation period • agreeing a communications plan as appropriate • deciding when the escalation point has passed and surge arrangements can be reinstated.	
	NATIONAL CLINICAL DIRECTOR FOR EPRR	
4	Confirm (in conjunction with the PRE Lead) when an escalation point is reached.	

5	Chair teleconferences during escalation phases	
6	Ensure (in conjunction with the PRE Lead) that any actions following escalation teleconferences are implemented.	
7	Act as the NHS England lead in the event of any media communications.	
8	Confirm (in conjunction with the PRE Lead) when an escalation point has passed and surge arrangements can be reinstated.	

PAEDIATRIC RESPIRATORY ECMO SERVICES STANDARD OPERATING PROCEDURE ACTION CARD		
Role	**7.7 NHS ENGLAND PAEDIATRIC RESPIRATORY ECMO LEAD IN-HOURS AND OUT-OF-HOURS – RECOVERY** Recovery is defined as: the point at which surge and escalation phases have passed and pre-surge arrangements can be reinstated. This position is confirmed by the Paediatric Respiratory ECMO (PRE) Lead in-hours.	
	The role of the PRE Lead is to:	
1	Once the recovery point is reached: • Prepare (in conjunction with the National Clinical Director for EPRR), a debrief following any escalation phases, including recommendations for improvement • Discuss post-escalation debriefs at the weekly teleconferences • Implement any changes agreed as a result of post-escalation debrief	

8 Appendix 2 – pathway for neonatal / paediatric respiratory ECMO



9 Appendix 3: background to paediatric respiratory ECMO including indications for its use, criteria for referral and contra-indications

Extra corporeal membrane oxygenation (ECMO) is a technique that allows babies and children with severe respiratory difficulties (including infection and structural problems with lungs or airway and for whom mechanical ventilation is insufficient to support life) to have the function of their lungs (and also their heart if needed) supported with a mechanical pump and artificial lung.

ECMO provides support for gas exchange (oxygenation and removal of carbon dioxide) and the circulation, allowing time for intrinsic healing of damaged organs, while minimising iatrogenic injury. The prerequisite for successful ECMO support is that the underlying condition is **potentially reversible**. ECMO is indicated for acute, severe but potentially reversible cardiac or respiratory failure when the risk of dying from the primary disease despite optimal conventional treatment is high, i.e. 50-100%.

Indications for respiratory ECMO include:

- Inadequate oxygenation despite appropriate ventilation
- Air leak syndrome
- Acute deterioration
- Large airway disease/disruption making ventilation impossible
- Refractory septic shock
- Pneumonia

Criteria for referral to an ECMO centre:

1. A neonate with an oxygenation index of >30-35 on optimal treatment for four hours, or >25 on nitric oxide should prompt discussion with an ECMO centre and / or tertiary neonatal centre.
2. An infant or child with a pneumonia / air leak / ARDS and an OI of 25, (assuming no right to left shunt) should prompt a decision regarding an ECMO referral.
3. An arterial CO_2 tension of > 12 kPa for more than three hours should prompt a decision regarding ECMO referral.

Other considerations:

- Technical factors. ECMO is difficult in neonates of 2 kg or less.
- The infant should have achieved a gestational age of > 35 weeks. Patients who are younger than this could be considered if a higher risk of bleeding is accepted.
- All children referred ideally should have had less than fourteen days of high-pressure ventilation**. ECMO centres would consider both the duration and intensity of ventilation in assessing a referral. All the ECMO centres believe that earlier referral is better as they are trying to minimise and allow recovery from ventilator-induced lung injury.**
- Ex-premature infants who may be dependent on home O_2 were thought to have a higher risk. A retrospective clinical survey has shown this not to be the case but this population are at an increased risk of neuro-developmental

disability; it is unclear whether this is due to the pre-existing clinical condition or the ECMO run.

Contra-indications

- Ventricular haemorrhage extending beyond the sub-ependymal and choroidal region. Grade 2 IVH.
- Irreversible cardiopulmonary disease, including pulmonary hypertension in children with chronic lung disease.
- Other lethal congenital abnormalities.
- A period of asystole or cardiopulmonary resuscitation prior to presentation (other than at delivery). This is less often a contraindication in an era when ECMO is used for resuscitation.
- Proven necrotising enterocolitis. ECMO centres have used ECMO on children with gastro-intestinal disease, so this is not absolute.
- Established multi-organ dysfunction.

10 Appendix 4: contact details

Paediatric Respiratory ECMO Lead in-hours:
Fiona Marley
fiona.marley@nhs.net
07795 636 830

Paediatric (and Adult) Respiratory ECMO Lead out-of-hours
England.eprr@nhs.net
0844 822 2888 ask for ‘NHS 05’

Adult Respiratory ECMO Lead in-hours
Sheela Upadhyaya
sheela.upadhyaya@nhs.net
07787 002818

In the event that either of the two in-hours leads are unavailable (for example, because of annual leave), the role will usually be undertaken by the other in-hours lead. An out-of-office message will be left in response to e-mails and a voicemail message will be left in response to phone calls.