SCHEDULE 2 – THE SERVICES

A. Service Specifications

Service name	Extra Corporeal Membrane Oxygenation (ECMO) for Neonates, Infants and Children
Service specification number	E07/S(HSS)/a - 260716
Date published	16/07/2026
Accountable Commissioner	NHS England Highly Specialised Services

5	Population and/or geography to be served
5.1	**Population Covered** This specification is for neonates, infants, and children up to the age of 16 years with respiratory failure, cardiac failure and/or circulatory failure which is potentially reversible and is refractory to conventional critical care management. Following discussion and agreement with a designated adult ECMO centre, it may be clinically appropriate to provide ECMO support to a young person aged 16 or over, where their clinical condition or presenting co-morbidities may be more suited to management within a paediatric ECMO service. Similarly, by exception, and following discussion and agreement with a designated adult ECMO centre, it may be clinically appropriate to transfer care of a child under the age of 16 to an adult ECMO service if it is agreed that their clinical condition or presenting co-morbidities may be more suited to management within that service. **Evidence Base** The national paediatric respiratory ECMO service was initially established in 1997 following publication in The Lancet in 1996 of the UK Collaborative randomised controlled trial of neonatal ECMO, which demonstrated a significant survival and outcome benefit for those receiving ECMO support compared with conventional therapy (1). Since its establishment, the UK paediatric ECMO service has consistently demonstrated outcomes above international standards, as reported by the international Extracorporeal Life Support Organisation (ELSO) registry (2). The number of UK paediatric ECMO service providers able to provide support for children with acute severe respiratory failure has increased, with all centres providing paediatric cardiac surgery now able to provide ECMO support for both cardiac failure and respiratory failure. There is variation in the level of ECMO experience across the UK ECMO centres, as such a collaborative approach is essential to ensure high quality patient care is provided. All paediatric ECMO centres will be subject to regular peer review on an ongoing

	basis. The lessons learnt from the expansion of providers for the paediatric respiratory ECMO service in the UK will continue to help shape these service specifications. Due to a lack of clinical equipoise, there have been no further randomised controlled trials comparing ECMO with conventional therapy for respiratory or cardio-respiratory failure in children. In 2009, the results of the HTA-funded 'CESAR' trial demonstrated improved outcomes for adults with severe respiratory failure who were transferred to severe acute respiratory failure services which also provided ECMO support, regardless of whether or not they ultimately received ECMO support. This indicated that early access to appropriate expertise can help facilitate timely decision-making and appropriate clinical intervention. This is reflected in paediatrics where a significant proportion of patients transferred to ECMO centres improve without the need for ECMO. One study demonstrated that after acceptance for ECMO, more children died before reaching a paediatric ECMO centre than subsequently died at that centre due to their disease or complications of ECMO suggesting earlier transfer would be beneficial (3, 4). NHS England commissioned the ECMO service for Respiratory Failure in Adults (section 51 in The Manual) in 2011 and a UK case-matched study undertaken during the influenza A (H1N1) pandemic in 2009/2010 demonstrated significantly lower mortality in patients referred for ECMO to one of the nationally designated ECMO respiratory centres (5). This has to be balanced with the results of the EOLIA (6) trial published in 2018 which showed that among adults with very severe Acute Respiratory Distress Syndrome, 60-day mortality was not significantly lower with ECMO than with a strategy of conventional mechanical ventilation that included ECMO as rescue therapy. The provision of ECMO for clinically eligible neonates, infants, and children with respiratory or cardio-respiratory failure has been established firmly by international clinical consensus (7). In addition, the recent guidance from ELSO regarding the importance of follow-up for all neonatal and paediatric ECMO patients is key to maintaining and developing the high standards in neonatal and paediatric ECMO in the UK (8). References: 1. UK Collaborative ECMO Trial Group. UK collaborative randomised trial of neonatal extracorporeal membrane oxygenation. *Lancet* 1996;348(9020):75-82 2. ELSO – https://www.elso.org/default.aspx 3. Peek GJ et al. CESAR trial collaboration. Efficacy and economic assessment of conventional ventilatory support versus extracorporeal membrane oxygenation for severe adult respiratory failure (CESAR): a multicentre randomised controlled trial. *Lancet* 2009;374(9698):1351-63 4. Annicq ASJM et al. Clinical characteristics and outcomes for neonates, infants, and children referred to a regional pediatric

	intensive care transport service for extracorporeal membrane oxygenation. PCCM 2020;21:966-974 5. Noah MA et al. Referral to an extracorporeal membrane oxygenation centre and mortality among patients with severe 2009 influenza A (H1N1). JAMA 2011;306(15):1659-68 6. Combes A et al Extracorporeal membrane oxygenation for severe acute respiratory distress syndrome N Engl J Med 2018; 378:1965-1975 7. https://www.elso.org/ecmo-resources/elso-ecmo-guidelines.aspx 8. Ijsselstijn H et al Extracorporeal Life Support Organization (ELSO) Guidelines for Follow-up After Neonatal and Pediatric Extracorporeal Membrane Oxygenation ASAIO 67(9):955-963; 2021.
5.2	**Minimum population size** • It is estimated that approximately 100 neonates, infants and children require ECMO support for respiratory failure each year in line with the care pathways covered in this specification. • It is estimated that approximately 160 children each year will require ECMO support for cardiac and/or circulatory failure, including those post-cardiotomy, in line with the care pathways covered in this specification. This data is reported by all the UK paediatric ECMO centres at the national annual meeting from 2013. Similar data is also reported to ELSO and PICAnet. **Expected Significant Future Demographic Changes** Demographic changes associated with this service are expected in line with general demographic changes in the population which is >1% per year.
6.	**Service aims and outcomes**
6.1	**Service aims** The aim of the national paediatric ECMO service is to meet the needs of critically ill neonates, infants and children with potentially reversible severe respiratory, cardiac, cardio-respiratory and/or circulatory failure in whom ECMO support is considered clinically appropriate. This is to be achieved via collaboration and data sharing with a key focus on evidence-based care, quality and high performance. There are multiple key inter-dependencies to this service specification including links with Level 3 Paediatric Critical Care and Paediatric Critical Care Transport, as well as the Neonatal Intensive Care Transport, Paediatric Congenital Heart Disease, Cardiothoracic Transplantation Service (Paediatrics) and ECMO for respiratory failure in adults' service specifications.

A further aim of this unified cardiac and respiratory paediatric ECMO service specification is to assist with these key inter-dependencies whilst developing the capacity and training of all paediatric ECMO centres and therefore improve access to ECMO for all children within England.

6.2 Outcomes

NHS Outcomes Framework Domains & Indicators

Domain 1	Preventing people from dying prematurely
Domain 2	Enhancing quality of life for people with long-term conditions
Domain 3	Helping people to recover from episodes of ill-health or following injury
Domain 4	Ensuring people have a positive experience of care
Domain 5	Treating and caring for people in safe environment and protecting them from avoidable harm

Service defined outcomes

No	Indicator	Data source	Domain
1	Percentage of paediatric patients surviving >30 days from decannulation	Provider	Domain 1
2	Percentage of neonatal patients surviving >30 days from decannulation	Provider	Domain 1
3	Percentage of paediatric patients surviving >180 days from decannulation	Provider	Domain 1
4	Percentage of neonatal patients surviving >180 days from decannulation	Provider	Domain 1

Detailed definitions of indicators, setting out how they will be measured, are included in schedule 6A reporting requirements of the NHS Standard Contract (Specialised Commissioning template).

Commissioned providers are required to participate in annual quality assurance and collect and submit data to support the assessment of compliance with the service specification as set out in Schedule 4A-C of the NHS Standard Contract.

The service will engage in audit and monitoring of the service as agreed by NHS England including reporting of detailed activity data as set out in Schedule 4 of the standard NHS Contract.

The full definition of the quality outcomes and metrics together with their descriptions including the numerators, denominators and all relevant guidance will be accessible on the https://www.england.nhs.uk/commissioning/spec-services/npccrg/specdashboards/.

7.	Service description
7.1	**Service model** Due to the specialised nature, providers of this service will already be commissioned to provide paediatric intensive care (PICU); as well as services for the care of or management of Paediatric Congenital Heart Disease (section 83 of The Manual); and they will meet the additional requirements as set out in this service specification. The service is delivered through designated providers to ensure patients have equity of access and receive parity of service. All ECMO centres are expected to work collaboratively to optimise the care of children with cardiac and/or severe respiratory failure who may benefit from support with ECMO. This service specification **does not** include the following which are covered in separate specifications: • Extra Corporeal Life Support (ECLS) in the form of Ventricular Assist Devices (VAD) for bridge to transplant, which is included in the specification for Ventricular Assist Devices (VADs) as a bridge to heart transplantation or myocardial recovery (all ages). • Mobile ECMO for the transfer of children requiring or already established on ECMO which is aligned with the paediatric critical care transport specification and can be found in the appendix section.
7.2	**Pathways** Overall patient care pathway Extra Corporeal Membrane Oxygenation (ECMO) is a form of life support used for children with severe acute respiratory, cardiac, cardio-respiratory and/or circulatory failure that is potentially reversible. ECMO is used to support organ function pending potential recovery. The paediatric ECMO service care pathway encompasses: • Provision of advice to referring clinicians • Admission to paediatric intensive care for inpatient assessment from a neonatal unit, another hospital or Trust for potential ECMO support (up to a maximum of 48 hours). • Treatment: provision of extracorporeal membrane oxygenation (ECMO) life support • Those patients transferred from another hospital, NICU or Trust to paediatric intensive care for inpatient assessment and who receive ECMO support will be entitled to a maximum of 48 hours “post-ECMO support” funding, after which the funding will revert to the relevant paediatric intensive care tariff. • Provision and/or facilitation of follow-up care for children and their families in line with national and international guidance • End of life care, if needed

	• Staff expertise and resources to maintain 2 or more children on ECMO support for the indications outlined in this specification. This is to ensure that associated inter-dependant services, such as paediatric cardiac surgery, are not impacted by the provision of ECMO in any one centre. All paediatric ECMO centres will be expected to: • Ensure the utilisation of the national referral process is maintained at all times. • Provide rapid response to referrals (within one hour of referral), to discuss potential candidacy for ECMO, including accessing input and insights from professionals in other ECMO centres if indicated, timescales for further review or advice on alternative appropriate treatment pathway. • Liaise with neonatal and paediatric transport teams as well as mobile ECMO transfer teams as indicated to ensure the timely safe transfer of children. • Anticipate, plan for and manage seasonal variation, and respond on a national basis to unanticipated surges in demand, over and above the seasonal demands. Specialised patient pathway Centres providing ECMO for children will as a minimum be able to provide the following: • Trained staff with the expertise and resources to maintain two or more children on ECMO support for the indications outlined in this specification • Expertise in both VA and VV cannulation • 24/7 availability of consultant paediatric intensivist with expertise and training in paediatric ECMO • 24/7 availability of cardiac surgical team • 24/7 availability of paediatric perfusionists • 24/7 availability of flexible bronchoscopy • 24/7 availability of respiratory physiotherapy • 24/7 availability of other essential clinical team members including paediatric anaesthesia, general surgery, haematology, metabolic medicine, microbiology, nephrology, neurology and neurosurgery • 24/7 availability of CT scanning and ultrasound • 24/7 availability of essential laboratory services including blood transfusion, biochemistry and haematology • Standard-working-hours availability of other paediatric health professional team members as per PCCS standards. All ECMO bedside staff must be trained in line with the current PCCS ECMO training standards. Centres providing ECMO for children will as a minimum be expected to have the estate and equipment capacity as noted in appendix 2.

	Patient referral: Referrals to the ECMO provider should be made by neonatal or paediatric intensive care units for children who are critically ill with failure refractory to conventional critical care management. The ECMO provider will provide advice to referring clinicians on the management of children who may potentially benefit from ECMO support. Early referral to the service is encouraged to enable joint discussion, care planning and timely transfer (if required). All referral information must be recorded in the automated national referral system for ECMO. The ECMO provider will accept patients who: • Have potentially reversible severe acute respiratory, cardiac, cardio-respiratory or circulatory failure; and • Are not improving with optimal conventional critical care management; and • Meet the clinical criteria for the care pathways as outlined below. ECMO centres will be expected to provide a rapid response to referrals (within one hour of referral), to discuss: • Potential candidacy for ECMO • Timescales for further review or advice on alternative appropriate treatment pathways • Access to a bed in an ECMO centre if required If the ECMO centre does not have capacity to accept the patient, then it is the immediate responsibility of the ECMO centre taking the referral to source an ECMO bed from another provider in the national network. If a patient is an ECMO candidate but does not require transfer to an ECMO centre at the time of referral it is the responsibility of the ECMO centre managing the referral to follow up the case for at least the ensuing 48 hours to ensure that the treating centre has access to appropriate clinical advice. These details must be recorded in the automated referral system. Once the ECMO provider has confirmed a child meets the criteria for ECMO support or further assessment: • the ECMO centre will assist with the coordination of arrangements for the transfer of the child. • transfer will be arranged through either the neonatal or paediatric critical care transport services (as clinically appropriate) or a paediatric mobile ECMO service. Conditions that lead to severe acute respiratory failure and respond to ECMO should ideally be referred early to an ECMO provider. These diagnoses may include neonates with meconium aspiration syndrome, congenital diaphragmatic hernia or sepsis and children with pneumonia or sepsis. This list is not exhaustive and early referral for discussion should occur.

	Centres which are developing their respiratory ECMO experience are expected to host a joint referral call with their nominated link centre prior to accepting or cannulating these patients onto ECMO. Paediatric ECMO centres may nominate to divert ECMO referrals if they have more than one patient supported on ECMO if it will impact on other core services such as paediatric cardiac surgery. If this is the case, it is the responsibility of that ECMO centre to source an ECMO bed for the patient in an alternative ECMO centre if deemed clinically appropriate. Children with new onset cardiac failure and an acute cardiac collapse/decompensation (broadly encompassing the diagnoses of cardiomyopathy and myocarditis), will be commenced on ECMO as clinically indicated: • The initiating centre must notify the paediatric cardiothoracic transplant service within 24 hours of starting ECMO and agree the treatment plan • A multi-disciplinary discussion must be held within 5 days • Referral to the paediatric cardiothoracic transplant service must be made for children who have failed to respond to maximum conventional management and who may be candidates for extra-corporeal bridging devices or transplantation • If the child is considered suitable for transfer to a transplant centre, it is expected that this will occur within 7 days of initiating ECMO. Children with progressive heart failure who are known to a paediatric cardiothoracic transplantation service must have an agreed joint plan in place for their ongoing clinical management, including where appropriate the commencement and review of ECMO, should it be required. If ECMO is commenced: • The transplant service must be notified within 24 hours of commencing ECMO • A multi-disciplinary discussion must be held within 5 days to review and agree the care plan • Children who fail to respond to support or those who require more complex or longer-term support should be discussed with the transplant service to arrange transfer if considered clinically appropriate If the child is considered suitable for transfer, it is expected that this will occur within 7 days of initiating ECMO. Children either pre- or post-cardiotomy in cardio-respiratory failure (including arrhythmia which may or may not be associated with cardiac intervention) who may need support with ECMO are also covered in this service specification. Follow-up care • The ECMO centre will provide and/or facilitate follow-up for children receiving ECMO in line with agreed national and international standards. End of life care

	• The ECMO centre will provide of end-of-life care support in line with agreed paediatric critical care standards and guidelines. Paediatric ECMO centres will: • Work collaboratively with paediatric and neonatal critical care transport teams (as per PCC transport specification) and regional neonatal and paediatric intensive care teams • Liaise with local maternity/ neonatal services in planning care for children with high-risk conditions diagnosed antenatally. • Work collaboratively as part of a national ECMO network
7.3	**Clinical Networking** Paediatric ECMO centres will: • Be located within tertiary paediatric intensive care units • Be co-located with paediatric cardiothoracic surgery teams • Work collaboratively with other paediatric and adult ECMO centres, to include a Peer Review process • Work collaboratively with paediatric and neonatal critical care transport teams and regional neonatal, paediatric and adult intensive care teams • Liaise with local maternity/ neonatal services in planning care for children diagnosed antenatally with high-risk conditions. • Work collaboratively as part of the national ECMO network • Work collaboratively with the paediatric, neonatal and cardiac regional networks • Adhere to guidance issued by NHS England such as 'Management of surge and escalation in paediatric critical care services: standard operating procedure for paediatric extra-corporeal membrane oxygenation' or other equivalent documents. • Support NHS England Emergency Preparedness, Resilience and Response (EPRR) planning in relation to any incident, event or outbreak of disease that may result in the need for support by a paediatric ECMO centre
7.4	**Essential Staff Groups** Managing children on ECMO requires a highly trained multi-disciplinary team. This team includes as a minimum: • Named ECMO Programme Director - consultant with demonstrable higher training and experience in paediatric ECMO and named deputy. • At least 2 additional consultant paediatric intensivists with demonstrable higher training and experience in ECMO • ECMO co-ordinator and deputy • ECMO trained paediatric perfusionists and named lead perfusionist • ECMO paediatric nurse specialists

	• Physiotherapist with experience of working with ECMO patients • Dietician with experience of working with ECMO patients • Pharmacist with experience of working with ECMO patients • Paediatric consultant cardiac surgeon • Paediatric cardiology consultant • Paediatric respiratory consultant
7.5	**Essential equipment and/or facilities (Appendix 3)** The ECMO centre is responsible for ensuring appropriate facilities to support delivery of a paediatric ECMO service and must ensure that there is a planned programme for the maintenance of buildings and associated facilities. The provider premises will comply with all relevant legislation and standards. It is the provider's responsibility to ensure that an equipment replacement programme is in place to allow the continued delivery and development of the necessary services. The above responsibilities must comply with the most recent standards from PCCS and NHSE service specifications for both Paediatric Critical Care and Congenital heart disease. See appendix 3.
7.6	**Inter-dependent service components – Links with other NHS services** ECMO delivery has multiple key inter-dependencies. These include: • Paediatric congenital heart disease and cardiac surgical services • Paediatric cardiothoracic transplantation services • Paediatric lung transplantation services • Paediatric critical care services • Further areas as noted in section 7.3 These inter-dependencies mean that the capacity across the ECMO network must be used flexibly and collaboratively to ensure optimum care is delivered across all these inter-dependant areas. This will be reviewed annually and include outcomes for those not supported on ECMO.
7.7	**Additional requirements** **Peer review** All Paediatric ECMO centres will facilitate a three yearly review of their ECMO service by a peer review team of fellow professionals as detailed in Appendix 4. If issues are identified, more regular peer review may be required. Each ECMO centre will also provide input from their ECMO Programme Director (or their named deputy) and the ECMO Coordinator (or their named

	deputy) to undertake a peer review visit of a fellow ECMO centre at least once every three years. Evidence of best practice and lessons learnt from peer reviews will be shared nationally to improve care across all services. **Data flows and reporting** Providers who are commissioned to deliver this service specification will be expected to comply with the provision of information via local data flows and reporting of key service outcomes. This includes but is not limited to: • External referral activity • Mobile ECMO activity • Admission and assessment bed day activity • ECMO activity bed day activity • Post ECMO bed day activity • ECMO Follow-up activity Centres will be expected to submit data to specified patient registries, including PICANet, ELSO and other defined databases as indicated or commissioned. Other ECMO service quality metrics are reported in Appendix 5, these will be updated as clinically indicated or by updated commissioning policy and will be agreed on an annual basis between NHSE and the ECMO providers.
7.8	**Quality assurance** Centres provide paediatric ECMO will be required to: • Complete a service standard analysis in line with previous “surge” centre approval • Undertake and contribute to the teams delivering a formal peer review process on a 3-year rolling cycle • Present service level data (as per 7.7) for national discussion on an annual basis • Present and participate in national discussion on complex cases and case reviews on an annual basis to include review of referrals • Present and participate in national discussion of processes and pathways for the safe and timely transfer of patients on an annual basis • Present and participate in national multi-disciplinary team meetings. • Present and participate in national discussions in the management of surge and escalation • Ensure appropriate planning to enable timely access to ECMO support in line with the care pathways described, including the tracking of expected and observed bed capacity • Lead and coordinate awareness sessions with local and regional referrers to improve early identification and referral of children who may benefit from ECMO support

	• Develop referral and transport pathways at a regional level between neonates and paediatrics for these cases • Lead and coordinate debrief sessions with referrers to learn from cases referred for ECMO and engage in the statutory Child Death Review process when required. Participate in national quality improvement work relating to ECMO provision and participate in the annual review process of the service.
7.9	**Links to other key documents** This service specification relates to the population defined as the commissioning responsibility of NHS England as set out in "Who Pays? Determining responsibility for payments to providers" (2013) guidance https://www.england.nhs.uk/wp-content/uploads/2014/05/who-pays.pdf (or subsequent published updates). Commissioning arrangements for the devolved nations in relation to this service are as set out in "UK-wide Commissioning Arrangements of Highly Specialised Services" https://www.england.nhs.uk/publication/nhs-providers-of-highly-specialised-services/.

Appendix 1. Mobile ECMO specification

- Development of this service specification is a separate piece of work and will be linked here once available.

Date published: July 2026

Appendix 2 Laboratory & estate issues relating to ECMO provision

Laboratory and other Diagnostic Facilities

- Each centre should have access to a 24-hour microbiology (including virology), biochemistry and haematology service.
- Each centre must have access to a regional blood transfusion laboratory to ensure prompt provision of blood and related products.
- A comprehensive infection control service will be available and compliant with HSC2001/002 (The management and control of hospital infection) and has evidence of continual improvement to the meet the NHS Executive Controls Assurance Standard in Infection Control.
- All laboratories must be Clinical Pathology Accreditation (CPA) laboratory accredited.
- All laboratories must meet the requirements of the Health and Safety Good Practice Guidelines and the Royal College of Pathologists Standards.
- All laboratories must participate in National External Quality Assurance Schemes.
- Specialist paediatric pathology services are to be available.
- Each centre needs access to a range of paediatric diagnostic imaging on a 7-day basis, including – echocardiography, cardiac catheterisation, angiography, bronchoscopy, ultrasound, CT scanning. MR imaging and radionuclide imaging should be available post ECMO.
- Each centre should have full facilities for comprehensive pulmonary function testing for all ages (**NOT** needed whilst on ECMO)

Equipment

- ECMO will be conducted within a PICU in an appropriate location and in an environment that is safe and well-suited to the age and stage of development of the child or young person.
- The ECMO system consists of an appropriate circuit suitable for prolonged extracorporeal support.
- Equipment used must be the correct size for the child, and its design must be tailored to different needs at different ages and stages of development
- The following equipment will be readily available:
    - Back up components of the ECMO system and supplies for all circuit components
    - Adequate lighting to support surgical interventions
    - Surgical instrument set for revision of cannulae or exploration for bleeding complications.

Appendix 3 Leadership and accountability of the paediatric ECMO centre

All Paediatric ECMO centres will have a named:

ECMO Programme Director and deputy

- There must be clear and accountable leadership of the ECMO service within each Centre with a named ECMO Programme Director and deputy.
- Will have adequate job-planned time available to perform this role.
- Have responsibility for ensuring the ECMO medical team members attain the required training and education standards as set out in the PCCS standards
- Are accountable for governance issues and will have overall responsibility:
    - For ensuring staff are fully aware of the standards against which centres will be assessed and that mechanisms are in place to achieve compliance with the standards.
    - For actively participating in the local clinical governance activities, which are of relevance to the ECMO service.
    - For ensuring effective communication with all members of the ECMO service and to facilitate multidisciplinary team working in the delivery of ECMO services.
    - For ensuring regular communication with colleagues from other ECMO Centres and the National Specialist Commissioning Team to address regional and national service delivery issues.

ECMO Nurse Co-ordinator and deputy

- Will have responsibility for overseeing data collection relevant for the ECMO Programme:
    - Robust arrangements must be in place for timely and accurate collection of activity and outcome data. Data must be made available to the commissioning teams under agreed reporting mechanisms.
    - Patient referral data
    - ELSO data submission
- Will also have responsibility for ensuring the ECMO Nurse Specialist team attain the required training and education standards as set out in the PCCS standards

Lead paediatric perfusionist

- Have responsibility for ensuring the ECMO Perfusion team attain the required training and education standards as set out in the PCCS standards

Appendix 4 Peer review process of the national ECMO service

Peer review process are expected to be undertaken on a rolling 3-year basis.

This peer review team should include the following team members:

- ECMO Programme Director or Deputy
- ECMO Coordinator or Deputy
- Member of NHSE/Multi-ICB Commissioning team
- Clinical Lead of Paediatric Critical Care Network
- Member of quality team
- Administrative support

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