

The British Association of Perinatal Medicine DRAFT Neonatal Airway Safety Standard

A Framework for Practice

November 2023

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Neonatal Airway Safety Standards A DRAFT BAPM Framework for Practice

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Process

The scope and content of this document were determined by members of the working group. Development of the BAPM Neonatal Airway Capability Framework and BAPM Neonatal Airway Safety Standards were predominantly consensus based, due to lack of available evidence, using a modified Delphi technique over multiple teleconference meetings. Literature review, including use of existing national policies and guidelines, was undertaken in the key topic areas and where this was available it has been used to support recommendations in the framework.

Recognising that this standard will be challenging for many neonatal services, the working group has also provided links to existing materials and developed training and assessment resources to support the capability framework. Permission to use some training materials has kindly been provided by Dr Fiona Wood and the Resuscitation Council UK. The group will meet by video conference to respond to comments raised during consultation and to agree the final version of the revised Framework.

Term/ Abbreviation	Meaning
NICU	Neonatal Intensive Care Unit
LNU	Local Neonatal Unit
SCU	Special Care Unit
Laryngeal Mask (LM)*	Laryngeal Mask Airway (LMA) or i-gel devices
СРАР	Continuous Positive Airway Pressure
nHFT	Nasal High Flow Therapy
LISA	Less Invasive Surfactant Administration

Glossary

*Throughout this document the term laryngeal mask (LM) is used as a general term to cover all laryngeal Mask Airway (LMA) and i-gel devices, which is consistent with Resuscitation Council UK terminology.

Executive Summary

BAPM Neonatal Airway Safety Standards

This document sets out standards for safely managing the neonatal airway in neonatal services in the UK. The document focuses on unit capability and aims to ensure that a safe service is always available. The working group recognises that meeting this standard may be challenging for some neonatal services, particularly NICUs, whilst also formally recognising that maintaining universal intubation competency in all neonatal units is not possible and that initiation of the local difficult airway pathway may be needed to support intubation in some units.

Although the document focuses on unit capability and standards, airway management will be delivered by individuals. We define unit capabilities in Table 1, but delivery of these capabilities is underpinned by the skills and capability of individuals which are outlined in Table 2. More detail on the skills required to achieve, maintain, and assess each capability level are described in the main airway capability framework; teaching and assessment tools to support the framework are included in the appendices. All neonatal staff involved in airway management should be assessed.

Type of Unit	*Immediately Available	Available within 30 minutes	Difficult Airway Pathway	
NICUs	Advanced	Advanced		
LNUs	Standard	Intermediate		
SCUs	Standard	Standard	Extra support	
MLU/ Home Delivery	Basic	N/A	according to local	
			protocols	
	ICU Transfer	Non-ICU Transfer		
Neonatal Transport Services	Intermediate	Standard		

Table 1: BAPM Neonatal Unit Minimum Airway Capability Safety Standards

*on-site and available in an emergency within a few minutes

Table 2: BAPM Neonatal Airway Capability Levels

	Definition of Capability				
Beginner	Has not yet reached all skills required to achieve basic capability				
Basic	Can provide effective airway support and ventilation via facemask or laryngeal mask for				
	babies ≥ 34 weeks with #normal anatomy.				
Standard	Can provide effective airway and ventilatory management for preterm and term infants with				
	#normal anatomy using a wide range of airway adjuncts and non-invasive respiratory support				
	(eg CPAP/nHFT). Has limited or no intubation experience.				
Intermediate	As for standard capability and can intubate the trachea under optimal conditions but not able				
	to consistently intubate in urgent/emergency settings and/or across all gestations.				
Advanced	As for standard capability and can consistently intubate most babies with #normal anatomy				
	including extreme preterm infants.				
Specialist	As for advanced capability and can intubate or manage the neonatal airway in most situations				
	including those presenting with a difficult airway				

#Normal anatomy = normal head, neck and upper airway anatomy

- Secure skills at Standard capability, across a wide range of staff should be a key focus in all neonatal units.
- Training and opportunities for developing capability beyond Standard should be focussed on a much smaller group of individuals who are likely to be working in NICUs/LNUs over the longer-term.
- All units should be appropriately resourced to undertake training and assessment of staff airway capability.
- Units should audit their compliance with the airway safety standard and escalate significant deviations through local trust and network governance processes. Additional resource and/or training may be required to support improvements in safety.

Optimising the Chances of Successful Airway Management

Skills and simulated training

- Skills and simulated training for the multidisciplinary team are important for safe airway management.
- Managing the neonatal airway without intubation is a critical skill for all staff to reduce the risks of unnecessary intubation with its associated adverse events and complications.
- Training for Laryngeal Mask (LM) insertion (LMA/ i-gel) can be quickly and successfully learned in a simulated environment and translates well to clinical practice including emergency resuscitation.
- Learning intubation skills in a simulated environment has **NOT** been shown to translate to intubating in real life. Practitioners must therefore maintain competency through clinical exposure.
- Intubation failure is commonly due to failure to recognise anatomical structures and this should be a focus during training.

Planning and Preparation

- Pre-delivery planning should take place where delivery of a baby who may need more complex additional airway support is imminently anticipated.
- Where intubation is needed:
 - o Checklists should be used for intubation. An example is included in Appendix E
 - \circ $\;$ Aim to match the experience of the intubator with the perceived level of difficulty of intubation
 - Unsupervised intubations should be performed by intermediate intubators as a minimum, but where possible by advanced intubators.
 - The following are not considered suitable for practitioners below Intermediate capability and Advanced capability is highly desirable:
 - Extremely premature babies <27 weeks gestation and <4 days old
 - Unstable babies requiring emergency intubation
 - Babies with congenital anomalies affecting airway anatomy
 - Third or more attempt at intubation should be by experienced intubators (Advanced or Specialist) as risk of adverse events is much more likely with ≥3 intubation attempts.

Use of videolaryngoscope for intubation

- Use of a videolaryngoscope is strongly recommended both for supervising inexperienced intubators and in routine clinical practice.
- Staff need to be aware of the differences in shape between conventional and some videolaryngoscopy blades and the potential need for minor adaptations of intubation technique (see Appendix B)

Patient Preparation and Stabilisation

- Almost all neonatal airways can be successfully managed initially without the need for intubation. The use of optimal airway positioning and use of CPAP/nHFT, facemask/ LM ventilation and appropriate oxygen therapy should be the main focus.
- Non-invasive respiratory support (CPAP or nHFT) should be first line respiratory support at birth for preterm babies who establish regular respiration and may also be used for older infants.
- Laryngeal masks (LM) may often safely avoid the need for emergency intubation. Short-term

use can be considered for babies >1000g (~27 weeks) with consideration given to use in babies from 800g (~25 weeks) where the baby is in extremis and other airway manoeuvres have failed (see Appendix D).

- **Oxygen therapy** should be used to keep saturations as near the upper end of the normal preterm infant target range as possible (95%). Higher saturations can be targeted where a difficult airway is anticipated.
- After assessment and stabilisation, where intubation is required:
 - Nasal High Flow Therapy during the intubation procedure is strongly recommended as it improves the likelihood of successful first attempt intubation without physiological instability.
 - **Premedication** (drugs to facilitate tracheal intubation) should be used for all nonemergency neonatal intubations and all intubators should have a good working knowledge of commonly used premedication drugs.
- **Surfactant** should be administered according to local/network guidelines which should conform with international consensus:
 - Less Invasive Surfactant Administration (LISA) is the preferred route for surfactant administration in babies who do not have severe respiratory distress and have established respiration. All networks should have practical guidelines and educational support for LISA technique. (See Appendix F)
 - Laryngeal Mask surfactant administration is a less invasive technique which does not require premedication. Studies comparing LISA to LM surfactant administration are ongoing. BAPM suggests that a decision to administer surfactant via LM should be made at a local level *where LISA is not possible*. Where units decide to use this technique, they should have practical guidelines, training and educational support to ensure this is carried out safely.

Patient Safety During Intubation

- Patient monitoring:
 - Continuous heart rate and saturation monitoring should be in place.
 - Exhaled Carbon Dioxide should be monitored using exhaled CO2 calorimetric detectors or capnography.
- **CO2 detection** is the primary method for confirming a laryngeal mask/tracheal tube is in the airway and achieving lung ventilation, supported by stable appropriate heart rate and oxygen saturations and auscultation.
- Confirmation of correct depth of tube insertion is by CXR (or lung ultrasound in experienced hands).
- Airway fixation should be secure and according to local guidelines.
- Unintended extubation is a serious adverse event and should be reported and closely audited.

Parent Presence During Airway Management

- Families should be informed that their baby requires intubation/ reintubation whenever practically possible.
- Units should strongly consider asking parents whether they wish to remain with their baby during elective or semi-elective intubation as part of maintaining a family centred approach to care. Where parents choose to remain, they should be supported by a member of staff who is not involved in the procedure itself.
- Unit audit of parent information, choices and parental presence during intubation, including collection of parent and staff feedback is strongly advised.

Full Document

Aims

The purpose of this document is to

- set out standards for ensuring safe airway management for babies in Maternity and Neonatal Services in the UK
- outline the minimum expected departmental capabilities for airway management in different settings, recognising the current challenges in maintaining universal intubation competency in all units
- provide guidance on optimising airway management.
- Provide supporting training and assessment materials as well as signposting other suitable training resources
- suggest areas for research and innovation to improve safe neonatal airway management.

This framework complements the existing BAPM Framework for Practise on Managing the Difficult Airway in the Neonate¹.

Background

Changes in exposure to neonatal intubation

Several changes to resuscitation and stabilisation guidance over the last two decades have reduced the number of babies who need intubation. These changes include no longer routinely intubating infants born through meconium-stained liquor; increased use of non-invasive breathing support from birth; increased use of less invasive surfactant administration and increased use of the laryngeal mask as an alternative to intubation for larger infants^{2,3,4,5}.

During this time there has also been a significant increase in trainees due to the implementation of the European Working Time Directive and an increase in neonatal advanced nurse practitioners. Consequently, a smaller number of intubation opportunities are being spread across a wider pool of trainees. Unsurprisingly, recent surveys reveal a high proportion of trainees in the UK do not feel confident or competent at intubation^{6,7}. In addition, many non-tertiary paediatricians working in LNUs and SCUs also intubate very infrequently and feel less confident and competent in this skill^{8,9}.

There is evidence both from the UK and internationally that neonatal intubation success rates are low and falling with overall first attempt success rates of 40-53%, and 22-23% requiring three or more attempts^{10,11,12}. Rates of success are lower for trainees compared with consultants. Tracheal intubation associated adverse events (including prolonged hypoxaemia, bradycardia, airway and pharyngeal damage, air leak, mortality and neuro-disability) are common and increase with multiple intubation attempts^{13,14,15,16}.

Changes to Paediatric Training

The RCPCH Progress+ curriculum¹⁷ changes mean more flexible training pathways tailored to training needs. Core trainees will need to develop capabilities in a neonatal setting and to step up to tier 2 rotas from ST3 onwards but may not have as much neonatal exposure as previously. This will mean that tier 2 rotas will include doctors in training who are less experienced in neonatal airway management, and most will not be competent at intubation. From 2022, RCPCH has removed neonatal intubation from the mandatory list of assessments for core trainees (ST1-4). The new requirement is to demonstrate capability to maintain the neonatal airway up to the point of intubation (including the use of a laryngeal mask).

In light of these challenges, it is timely to outline the standards expected to support safe airway management in maternity and neonatal services.

BAPM Neonatal Airway Safety Standards

This BAPM safety standard focuses on unit capability and aims to ensure that a safe service is always available. Delivery of these standards will rely on the skills and experience of individuals and an airway capabilities framework has therefore also been developed to support the safety standard. Both the safety standards and capabilities framework have been developed by the BAPM Airway Standards Group. The working group recognises that meeting this standard may be challenging for some neonatal services, particularly NICUs, whilst also formally recognising that maintaining universal intubation competency in all neonatal units is not possible and that initiation of the local difficult airway pathway may be needed to support intubation in some units.

Although the document focuses on unit capability and standards, airway management will be delivered by individuals. We define unit capabilities in Table 1 but delivery of these capabilities is underpinned by the skills and capability of individuals which are outlined in Table 2.

Type of Unit	*Immediately Available	Available within 30 minutes	Difficult Airway Pathway	
NICUs	Advanced	Advanced		
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SCUs	Standard	Standard	Extra support	
MLU/ Home Delivery	Basic	N/A	according to	
			local	
		Non-ICU	protocols	
	ICU Transfer	Transfer		
Neonatal Transport Services	Intermediate	Standard		

Table 1: BAPM Neonatal Unit Minimum Airway Capability Safety Standards

*on-site and available in an emergency within a few minutes.

General Notes on Safety Standard

- Neonatal units should have at least one member of staff immediately available at all times, and an additional member of staff available within 30 minutes (may be off site), whose airway skills meet the **minimum capability level** suggested in table 1. Standards are also outlined for standalone maternity services.
- All neonatal staff undertaking responsibilities as first responder for neonatal resuscitation must have reached a minimum of basic capability prior to undertaking this role independently for babies ≥34 weeks. If the first responder is required to attend preterm deliveries<34 weeks without additional support, they should have reached a minimum of Standard capability, with the second on-site immediate responder at Advanced capability for NICUs, and Standard capability for LNUs and SCU.
- Whilst currently, tier 3 paediatricians working in Special Care Units may have Intermediate or Advanced capabilities, this is unlikely to continue to be the case in the future. Escalation of support beyond Standard in Special Care Units will often require activation of the difficult airway pathway for extra support according to local protocols.
- Competency requirements for ICU transfer should be assessed on an individual basis prior to transfer; some transfers will need Advanced or Specialist capabilities.
- All staff undertaking transfers must have reached Standard capability as a minimum, even when transferring stable special care patients.

Infants at high risk of requiring more advanced airway support (Intermediate or above)

- Every effort should be made to ensure all babies at very high risk of requiring more advanced airway support including intubation (<27 weeks, <28 week twins and estimated fetal weight <800g and those with certain antenatally diagnosed conditions) are born in a maternity centre with a co-located NICU¹⁸.
- Where high risk infants have not been transferred, the 30-minute responder should aim to be present for the delivery.
- Neonatal transport services are not set up to provide emergency response teams to support neonatal airway management to regional hospitals and local teams must ensure there are appropriate escalation processes available on site.
- Most adult and paediatric anaesthetists/intensivists and ENT surgeons have other additional airway and ventilation skills that may helpfully provide support although they may not be as familiar with some skills such as surfactant delivery. The expected capability range of different staff groups is shown in Table 3.
- All units should have an agreed approach to managing the difficult airway, with suitable airway equipment available, supported by appropriate staff training. A BAPM Framework for Practise is available to support Managing the Difficult Airway in Neonates¹⁹.

BAPM Neonatal Airway Capability Framework

Table 2 sets out capability levels for managing the neonatal airway, alongside the skills required to achieve and maintain each capability level and a description of how this should be assessed.

- To achieve any given capability level the practitioner must fulfil all skills within the domain.
- The number of intubations required to achieve Advanced capability will vary according to aptitude. We have not set a prescriptive standard but the number of successful intubations is likely to be in the region of 10-40 including at least 5 in babies <28 weeks. Anaesthetic practise suggests approximately 40 intubations are required to achieve proficiency²⁰. Figures from a recent US paper for neonatal trainees suggested a range of 8 to 46 intubations in those who reached a competency level of 80% success rate within 2 attempts²¹. Success rates within 2 attempts for senior clinicians in a large series was 86%²². Videolaryngoscopy may improve learning curves.
- Intermediate intubation skills have been set at a minimum of 5 successful intubations, considering the competency range for Advanced capability.
- The number of intubations required to maintain skills will be highly variable and this should be self-assessed, as well as maintaining an intubation log (Appendix G). Those whose highest capability is Intermediate are unlikely to maintain this over several years unless they had previously achieved Advanced capability. Attrition of intubation skills will be much slower in those who achieve and maintain Advanced or Specialist capabilities over several years.

Supporting Materials for this Capability Framework

• Training Materials

- o BAPM Airway Skills and Simulations (Appendix A)
- Tips for videolaryngoscopy (Appendix B)
- A short guide to use of waveform capnography (Appendix C)

• Practical Support Materials

- Poster: Airway Equipment and Initial Respiratory Support Settings (Appendix D)
- Intubation Checklist (Appendix E)
- LISA Checklist (Appendix F)

• Assessment Materials

- Intubation/ LISA Log (Appendix G)
- Individual Airway Competency Assessment form (Appendix H)
- Neonatal Unit Staff Airway Assessment Log (Appendix I)

Table 2: BAPM Neonatal Airway Capability Framework

	Definition of Capability	Skills Required to Achieve Capability All skills required to be functioning at a given level	Maintenance of Capability (Appendix A&B)	Assessment of capability (Appendix G,H, & I)
Beginner	Has not yet reached all skills required to achieve Basic capability	N/A	N/A	N/A
Basic	Can provide effective airway support and ventilation via facemask or laryngeal mask (LM) for babies ≥ 34 weeks with #normal anatomy.	 Familiar with equipment needed for airway management in babies ≥ 34 weeks. Can demonstrate how to correctly size and apply facemask, Can provide effective mask ventilation (including jaw thrust and 2-person technique), Can determine *laryngeal mask (LM) size required, insert laryngeal mask, & provide effective ventilation via laryngeal mask Can assess facemask/LM ventilation using colorimetric CO2 detector and clinical assessment Familiar with local escalation plan for a baby requiring skills beyond Basic capability 	 Annual skills training to cover BAPM Basic airway skills. BAPM Basic capability simulation training every 1-4 years. Use of skills in clinical practice with feedback and assessment from more experienced practitioners. 	 Annual self-assessment against BAPM capability levels Annual assessment to demonstrate all required BAPM Basic airway skills in a simulated or appropriate clinical setting or a combination of both. BAPM Basic airway skills simulation assessment at least once every 4 years See notes on assessment.
Standard	Can provide effective airway and ventilatory management for preterm and term infants with #normal anatomy using a wide range of airway adjuncts and non-invasive respiratory support (eg CPAP/nHFT). Has limited or no intubation experience.	 As for Basic capability AND Can determine mask size and perform mask skills (positioning and ventilation) in preterm infants ≤33 weeks gestation. Can demonstrate successful use of CPAP/nHFT (depending on local availability), *LM (where appropriate) and oro-pharyngeal airway to support the preterm infant airway and ventilation. Can assess the effects of assisted ventilation on oximetry, heart rate, exhaled CO2 responses and clinical examination. Understands appropriate oxygen saturation targets and principles of oxygen therapy in preterm and term infants. Can trouble-shoot airway and ventilation difficulties associated with non-invasive airway management (**DOPE, ventilation settings, need for surfactant). Can delivery surfactant via LM if used locally. Familiar with the local escalation plan for a baby requiring skills beyond Standard capability 	 Annual skills training to cover BAPM Standard Airway skills. BAPM Standard capability simulation training every 1-4 years. Use of skills in clinical practice with feedback and assessment from more experienced practitioners. 	 Annual self-assessment against BAPM capability levels Annual assessment to demonstrate all required BAPM Standard airway skills in a simulated or appropriate clinical setting or a combination of both. BAPM Standard airway skills simulation assessment at least once every 4 years See notes on assessment.

Neonatal Airway Safety Standards

A DRAFT BAPM Framework for Practice

Intermediate	As for standard capability	• As for Standard capability AND	 Annual skills training to 	 Annual self-assessment against
	and can intubate the	Has completed an intubation competency package to include	cover BAPM Intermediate	BAPM capability levels
	trachea under optimal	understanding drugs monitoring and equipment used during intubation	airway skills	 Annual assessment to
	conditions but not able to	• can correctly identify larvngeal structures when visualising the upper	• BAPM Intermediate	demonstrate all required BAPM
	consistently intubate in	airway	simulation training every	Intermediate airway skills in a
	urgent/emergency	 can successfully intubate and ventilate a suitable term and preterm 	1-4 years	simulated or appropriate clinical
	settings and/or across all	manikin	•Lise of skills in clinical	setting or a combination of
	gestations.	 bas successfully intubated at loast 5 babies or infants or is already deemed 	practice with feedback and	both.
	8000000	• has successfully incubated at least 5 bables of infants of is alleady deemed	assessment from more	BAPM Intermediate airway skills
		adults	experienced practitioners	simulation assessment at least
		 Is familiar with exhaled CO2 monitoring used in the unit 	Comprehensive log of all	once every 4 years.
		• Is familiar with exhaled CO2 monitoring used in the unit.	intubation/LISA attempts	Annual Review of
		• understands capitography wavelorms where these are used in the unit	(Appendix G)	Intubation/LISA log
		(Appendix C&D)	(Appendix Gy	See notes on assessment.
		 Can trouble-shoot common complications of intubation and ventilation (**DORE vontilation softings, need for surfactant) 		
		• Can deliver surfactant via tracheal tube (or LM) if this is locally preferred		
		• Call deliver surfactant via trachear tube (or Livi) if this is locally preferred		
		technique)		
		understands that multiple or prolonged intubation attempts are narmful and is familiar with the legal difficult sinuau escalation plan		
		and is familial with the local difficult all way escalation plan.		
		Recognises the reatures of a baby with a difficult airway and is familiar with equipment used to manage a difficult airway		
		with equipment used to manage a difficult all way.		
		• Familiar with the local escalation plan for a baby requiring skills beyond		
Advanced	As for standard canability	As far Standard capability AND		
Advanced	As for standard capability	AS IOF Standard Capability AND	• Skills training as required	Annual self-assessment against
	intubate most babies with	• Can confidently intubate both term and preterm infants including the	to maintain BAPM	BAPIVI Capability levels
	thermal anatomy	extremely premature with a first of second attempt success rate 280% for habias with thermal anatomy in elective and for emergency settings	Intermediate airway skills.	BAPINI Intermediate airway skills
	including extreme	bables with #normal anatomy in elective and/or emergency settings.		simulation assessment at least
	nreterm infants		 BAPM Intermediate 	once every 4 years.
	precenti intants.	(LISA) system	simulation training every	Annual Review of instrubation (USA log
		Familiar with the local escalation plan for a baby requiring skills beyond Advanced capability	1-4 years.	Intubation/LISA log
Specialist	As for advanced canability	As for Advanced canability AND		
Specialist	and can intubate or	bas experience of managing more difficult airway cituations	 Comprehensive log of all 	
	manage the neonatal	mas experience or managing more difficult all way situations	intubation/LISA attempts	
	airway in most situations	successiuily	(Appendix G).	
	including those presenting			
	with a difficult airway			
	with a difficult airway			

#Normal anatomy = normal head, neck and upper airway anatomy

*Laryngeal mask (LM) = supraglottic airway/Laryngeal Mask Airway (LMA) or i-gel devices **DOPE= **D**isplaced tracheal tube or supraglottic airway, **O**bstructed airway – particulate matter or

secretions, Pneumothorax, Equipment failure

Notes on Assessment

- Annual self-assessment is helpful to review what capability the practitioner has across all airway skills from Basic to Specialist, to support training needs.
- Capability can be assessed under simulated conditions and/or in clinical practice by a resuscitation officer or a neonatal practitioner who has reached at least the level of the competency being assessed.
- No specific training course is mandated but for information, Resuscitation Council UK Neonatal Life Support (NLS) provider certification provides all skills required for Basic capability and most skills required for Standard capability. The Resuscitation Council UK Advanced Resuscitation of the Newborn Infant (ARNI) certification provides most of the competencies required for Intermediate capability.
- New staff should provide the unit with a baseline self-assessment, their previously assessed capability level, date, and method used to assess this, and their current intubation skills log.
- Where capability has not been assessed previously using this framework, new staff should self-assess to determine a provisional capability level which should then be assessed over the next month.
- For existing staff, capability levels should be reviewed and reassessed at least once a year, or sooner if clinical situations suggest capability has improved or has not been maintained.
- Practitioners progressing beyond Standard capability can use a combination of self-assessment, their intubation log and further clinical assessment to support a change in capability level.

Table 3: Expected range of capability for different staff groups

Capability	Basic	Standard	Intermediate	Advanced	Specialist
Staff Type	Can provide effective airway support and ventilation via facemask or laryngeal mask for babies ≥ 34 weeks with #normal anatomy.	Can provide effective airway and ventilatory management for preterm and term infants with #normal anatomy using a wide range of airway adjuncts and non-invasive respiratory support (eg CPAP/nHFT). Has limited or no intubation experience.	As for standard capability and can intubate the trachea under optimal conditions but not able to consistently intubate in urgent/emergency settings and/or across all gestations.	As for standard capability and can consistently intubate most babies with #normal anatomy including extreme preterm infants.	As for advanced capability and can intubate or manage the neonatal airway in most situations including those presenting with a difficult airway
Midwifery Staff					
Neonatal Special Care nurses					
Neonatal ICU/HDU nursing staff					
Tier 1 medical staff and ENNPs					
Neonatal Transport nursing staff					
Tier 2 trainee (not neonatal or paediatric critical care SPIN or GRID)					
SCU Consultant					
Junior ANNPs <3 years' NICU experience					
ST 5 (neonatal SPIN or GRID) or equivalent					
Tier 2 Paediatric critical care trainee					
Tier 2 Adult anaesthetic trainee					
Trained Adult Anaesthetist					
LNU consultant					
ST 6+ Paediatric Critical Care GRID					
Senior ANNPs >3years in NICU					
ST 6+ (neonatal SPIN or GRID) or equivalent					
Adult ENT Surgeon					
Paediatric Anaesthetist/Paediatric Intensivist (no NICU attached)					
NICU Consultant					
Paediatric Anaesthetist (NICU attached)					
Paediatric ENT Surgeon					

Implications for Training

- Secure skills at Standard capability, across a wide range of staff should be a key focus in all neonatal units to maintain airway patency and provide adequate oxygenation and ventilatory support rather than focussing on tracheal intubation.
- Most neonatal airways can be successfully managed initially without the need for intubation. Although tracheal intubation is a necessary requirement for some patients, practitioners functioning at Basic or Standard capability should not attempt intubation without supervision and this should be done under optimal conditions. In Special Care units, Intermediate+ support may require activation of the difficult airway pathway.
- Networks should support training across the region with a particular focus on providing support to special care units, including supporting development of difficult airway plans which will be activated if a baby requires more advanced airway skills including intubation.
- Training and opportunities for developing capability beyond Standard should be focussed on a much smaller group of individuals who are likely to be working in neonatal care over the longer-term. These would include ANNP and trainees who are planning to become either paediatricians with a special interest in neonatology, or neonatologists.

Arrangements to support the Neonatal Airway Safety Standard

- Neonatal units should be appropriately resourced to undertake training and assessment of staff airway capability.
- All units should have a neonatal airway lead with funded supporting PAs, as well as a
 resuscitation officer and/or nursing lead with funded time to support training and
 assessment. Whilst some training can be done as part of a neonatal resuscitation course,
 BAPM recognises that implementation of this framework may require additional resource
 for training and assessment.
- Units must keep an up-to-date log of the capability of all staff whose role requires them to act as immediate responder or secondary responder (within 30 minutes) and all staff undertaking transfer of infants both within the hospital setting (intrahospital transfers) and between hospitals (interhospital transfers).
- Units should ensure appropriate equipment is available to deliver good quality CPAP/nHFT using a nasal mask/nasal prong (this is superior to T-piece resuscitator and facemask²³) in both delivery suite, during transfer, and in the neonatal unit. Good delivery room management with CPAP or HFT can avoid/safely delay intubation in the majority of preterm infants. Please use NLS algorithm for delivery room stabilisation/resuscitation.
- New staff must have a provisional assessment before starting (see notes on assessment) and should be formally assessed within 1 month.
- All unit rotas should clearly delineate the name and contact details for the immediate responder and the second responder (available within 30 minutes). For large units, there may be more than one responder in each category, with primary responsibility for different parts of the unit.

Governance and Audit

- Secure airway management of neonates is a significant safety concern due to the potential for major harm.
- It is recommended that units should audit their compliance with the capability standard and escalate significant deviations from the standard through their trust and network governance processes. Additional resource and/or training may be required to support improvements in safety.
- Units should audit success rates for intubation and rates of adverse events related to airway management to improve practise and refine training.

• Units should also review difficult airway cases in morbidity and mortality meetings with discussion at network level where appropriate.

Optimising the Chances of Successful Airway Management

Skills and Simulated Training

- Skills and simulated training for the multidisciplinary team is important for team communication, familiarity with equipment and learning or reinforcing the process steps involved in airway management, airway escalation planning, and human factors training including safety culture.
- Airway skills training, and simulation exemplars can be found in Appendix A.
- Managing the neonatal airway without intubation is a key skill for all staff to reduce the risks of unnecessary intubation, with its associated adverse events and complications.
- Training for Laryngeal Mask (LM) insertion can be quickly and successfully learned in a simulated environment and translates well to clinical practice²⁴.
- Learning intubation skills in a simulated environment has **NOT** been shown to translate successfully to intubating in real life^{25,26}. Practitioners must therefore maintain competency through clinical exposure.
- Intubation failure is most commonly due to failure to recognise anatomical structures and this should be a focus during training²⁷. Video recordings of successful and unsuccessful intubations are included in Appendix A and interactive discussion of the structures seen during these videos may be helpful to support trainee familiarisation with laryngoscopy views.
- Intubators should be aware that age related presbyopia (long-sightedness) can impact the ability to perform direct intubation before this becomes apparent on the standard eye test due to the very short distance between the eye and vocal cords. Videolaryngoscopy is one option to overcome this issue²⁸.

Planning and Preparation

- Pre-delivery planning should take place where delivery of a baby who may need more complex additional airway support is imminently anticipated
- Suggested sizes for a variety of neonatal airway equipment and initial ventilator settings are shown in Appendix D:
- Where intubation is needed
 - Using a checklist has been shown to reduce tracheal intubation related adverse events such as significant hypoxia, bradycardia, airway and pharyngeal damage in neonates^{29,30}. Checklists should include team roles and responsibilities, an intubation plan, escalation plans, equipment checks, baby identification checks and optimising the stability and comfort of the baby prior to undertaking the intubation. An example intubation checklist is included in Appendix E
 - \circ $\;$ Aim to match the experience of the intubator with the perceived level of difficulty of intubation
 - Unsupervised intubations should be performed by intermediate intubators as a minimum, but where possible by advanced intubators.
 - o If initial 1-2 attempts are unsuccessful, no further attempts should take place until a more experienced operator is available as repeated attempts by the same operator have decreasing success rate and risking harm. Third or more attempt at intubation should be by experienced intubators (Advanced or Specialist) as risk of adverse events is almost 10 times more likely with ≥3 intubation attempts³¹.
 - The following are not considered suitable for practitioners below Intermediate capability and Advanced capability is highly desirable:
 - Extremely premature babies <27 weeks gestation <4 days old.
 - Unstable babies requiring emergency intubation.

Babies with congenital anomalies affecting airway anatomy.

Use of videolaryngoscopy for intubation

- Use of a videolaryngoscope is strongly recommended both for supervising inexperienced intubators and in routine clinical practice.
- Use of videolaryngoscopy compared with direct laryngoscopy has a lower risk of tracheal intubation associated adverse events^{32,33,34,35}.
- Videolaryngoscopy may increase the success of intubation on the first attempt and may result in fewer intubation attempts but may not reduce time required for successful intubation³⁶.
- Use of videolaryngoscopy as a teaching tool, where the view obtained is shared in realtime with a more experienced clinician who can advise on how to improve the view, increases the chance of success when compared with direct laryngoscopy for inexperienced operators^{37,38}. See Appendix B.
- All staff need to be aware of the differences in shape between direct laryngoscopy and some VL (videolaryngoscopy) blades and the potential need for adaptations of intubation technique (see Appendix B). These differences in blade size/shape are reducing with availability of newer VL technology^{39,40}.

Patient Preparation and Stabilisation

Emergency intubation is associated with notably higher rates of intubation failure and complications compared with elective intubation and every effort should be made to optimise the baby's condition prior to attempting intubation. Resuscitation and stabilisation during transition should follow national guidance^{2,}

- Almost all neonatal airways can be successfully managed initially without the need for intubation. The use of optimal airway positioning, CPAP/nHFT, facemask/ laryngeal mask ventilation and appropriate oxygen therapy should be the main focus.
- Non-invasive respiratory support: In preterm infants who are breathing, first line respiratory support at birth should be CPAP 6-8cn H₂O or nHFT 6-8L and caffeine administration should be optimised^{41,42,43}. Non-invasive respiratory support should also be considered for older infants who are breathing. Further details in Appendix D.
- Resuscitation and stabilisation during transition should follow national guidance and a facemask should be used initially for ventilatory support².
- Laryngeal masks (LM): use of LM may often safely avoid the need for emergency intubation ^{44 45}. Whilst manufacturers guidance advises use of size 1 LMs in babies >2000g and/or ≥34weeks, short-term use can be considered for babies >1000g (~27 weeks) who require ventilatory support where advanced intubation skills are not immediately available or where intubation has failed, with consideration given to use in babies from 800g (~25 weeks) when the baby is in extremis^{46,47,48,49,50,51,52} (Appendix D). Smaller size LMs are now starting to be manufactured which require evaluation).
- **Oxygen therapy:** In view of the high incidence of desaturation during intubation, oxygen therapy should be used to keep saturations as near the upper end of the normal preterm infant target range as possible ie 95%⁵³. Higher saturations can be targeted where a difficult airway is anticipated.
- Where intubation is required:
 - Nasal High Flow Therapy during oral intubation: nHFT during intubation improves the likelihood of successful intubation on the first attempt without physiological instability (NNT 6) and this intervention is strongly recommended during intubation for all neonates⁵⁴.
 - **Premedication** should be used for all non-emergency neonatal intubations as this is a distressing and painful invasive procedure. Premedication consisting of a vagolytic

to prevent bradycardia, an analgesic for pain and reflex control, and a neuromuscular blocking agent for paralysis improves intubating conditions, decreases the number of intubation attempts and minimises adverse physiological responses^{55,56}.

- All intubators should have a good working knowledge of the pharmacological properties and side-effects of commonly used premedication drugs (BAPM HEE elearning package is being developed to support this).
- **Surfactant** should be administered according to local/network guidelines which should also conform with international consensus⁵⁷.
- Less Invasive Surfactant Administration (LISA) is the preferred route for surfactant administration in babies who do not have severe respiratory distress and have established respiration ⁵⁸.
 - This technique requires a similar skill level to a confident intubator. It is expected that practitioners would start learning the technique at Intermediate capability and becoming competent (80% success in 2 attempts) at Advanced capability.
 - All networks should have practical guidelines and educational support for LISA technique.
- Laryngeal Mask surfactant administration is a newer method for surfactant administration and has been shown to be effective in reducing rates of intubation and ventilation⁵⁹. It is a less invasive technique which does not require premedication. A recent study confirmed non-inferiority to INSURE in preterm infants down to 800g ⁶⁰ and there are currently trials comparing LISA with LM surfactant administration for preterm babies from 1250g⁶¹. European Consensus guidelines on RDS 2022 makes a weak recommendation that surfactant could be administered via LMA in babies >1kg.
 - BAPM suggests that a decision to administer surfactant via an LM should be made at a local level where LISA is not possible. Where units decide to use this technique, they should have practical guidelines, training and educational support to ensure this is carried out safely. An example of a guideline for this procedure can be found here: GGC LMA Surfactant.
 - Babies receiving LM surfactant should be discussed with the tertiary centre if oxygen requirement and work of breathing do not improve significantly.

Patient Safety During Airway Management

- Patient monitoring:
 - **Continuous Heart rate and saturation monitoring** should be in place
 - **Exhaled Carbon Dioxide** should be monitored using exhaled CO2 calorimetric detectors or capnography
 - Exhaled CO₂ calorimetric detectors, most commonly Pedi-Cap[®] (Nellcor/Medtronic, Minneapolis MN) (1-15kg) and Neo-StatCO2[®] (Mercury Medical, Clearwater FL) (2.5-6kg) can be used with both LMs or tracheal tubes. If the tube is obstructed and there is no exhaled CO₂ there will be no colour change as the lungs are not ventilated. In a low cardiac output state the colour change device may be too insensitive to change colour – other means of confirming tube position must be used. Out of date devices and soiling can lead to false positive results.
 - Capnography (continuous CO2 waveform measurement over time) is the gold standard for CO2 monitoring in older children and adults⁶². Technological difficulties have limited use in neonates until recently⁶³. It is likely that this more sensitive form of monitoring will become more prevalent in neonatology over the next few years. Capnography Traces can be found in Appendix D and a separate more detailed short guide to use of

waveform capnography during intubation is included in Appendix C for those starting to use this technology.

- **CO2 detection** is the primary method for confirming a laryngeal mask/tracheal tube is in the airway and achieving lung ventilation, supported by stable appropriate heart rate and oxygen saturations and auscultation.
- Confirmation of correct depth of tube insertion is by CXR (or lung ultrasound in experienced hands)⁶⁴.
- Airway fixation should be secure and according to local guidelines.
- Unintended extubation is a serious adverse event and should be reported and closely audited to identify modifiable factors.

Parent Presence During Intubation

- Families should be informed that their baby requires intubation/ reintubation whenever practically possible.
- Family presence during neonatal intubation has not been shown to influence the success of intubation or the incidence of adverse events occurring during intubation⁶⁵. Parental presence however, does increase anxiety for junior intubators⁶⁶. Units should strongly consider asking parents whether they wish to remain with their baby during elective or semielective intubation as part of maintaining a family centred approach to care but parents should also feel able to decline if that is their preference. It is recommended that, where parents choose to remain, they should be supported by a member of staff who is not involved in the procedure itself.
- Unit audit of parent information, choices and parental presence during intubation including collection of parent and staff feedback is strongly advised.

New Horizons and Areas For Further Research

- Development and safety testing of laryngeal mask devices or other supraglottic airway devices that can be used to ventilate babies <1000g
- Improved laryngoscope blades and videolaryngoscopes to support intubation of the smallest infants
- More realistic simulation mannikins for neonatal intubation
- Definitive studies on whether LMA surfactant is non-inferior to LISA, allowing a gentler approach to surfactant administration in many babies (trial currently underway).
- Improved technology, research and use of capnography in NICUs
- Further studies on optimal non-invasive respiratory care in the delivery suite
- Studies to further clarify who and when to treat with surfactant, eg lung ultrasound v FiO2, delivery room surfactant via LISA v early rescue
- Further development and research into the value of Teleneonatology and AI to support safer remote neonatal airway management⁶⁷.
- Optimising fixation and monitoring of tracheal tubes to reduce adverse events.

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