NICE National Institute for Health and Care Excellence

NICE Pathways

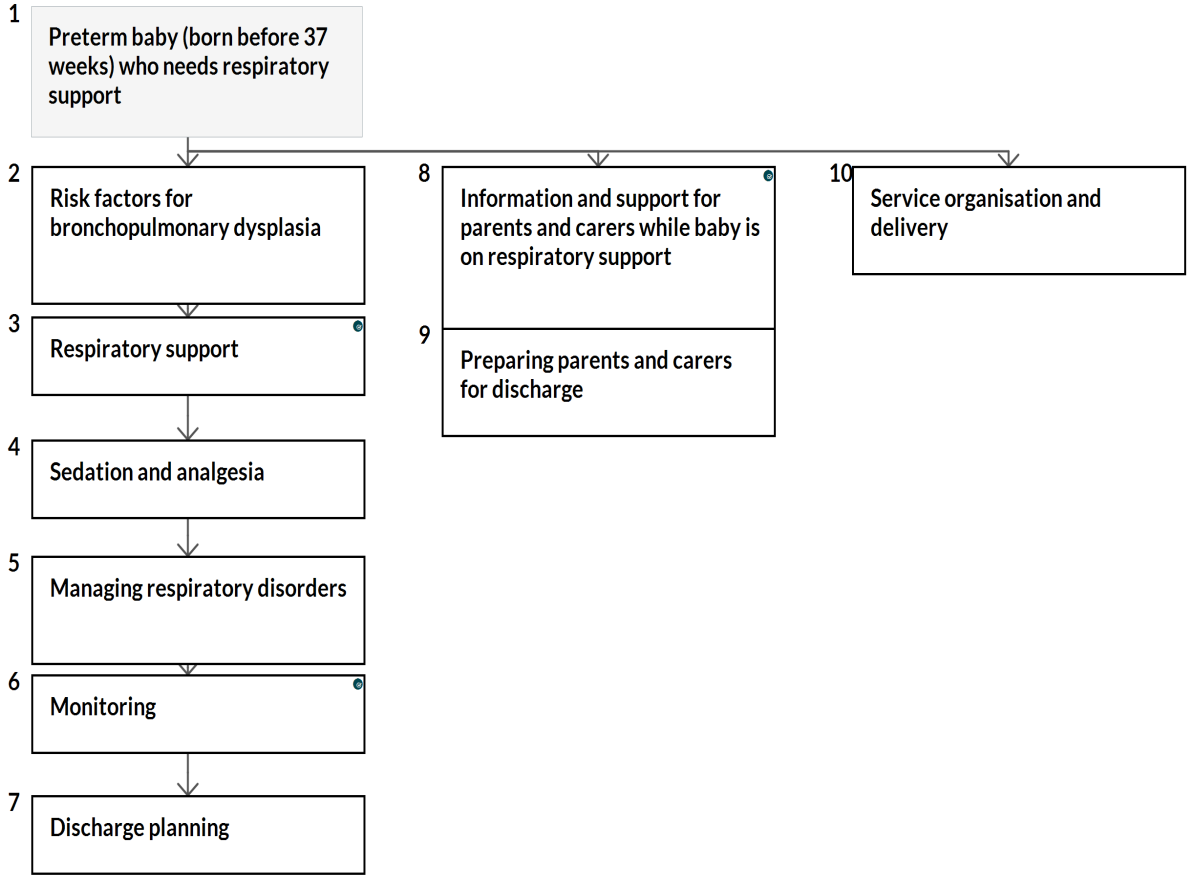
Specialist neonatal respiratory care in preterm babies overview

NICE Pathways bring together everything NICE says on a topic in an interactive flowchart. NICE Pathways are interactive and designed to be used online.

They are updated regularly as new NICE guidance is published. To view the latest version of this NICE Pathway see:

http://pathways.nice.org.uk/pathways/specialist-neonatal-respiratory-care-in-preterm-babies
NICE Pathway last updated: 15 July 2020

This document contains a single flowchart and uses numbering to link the boxes to the associated recommendations.



1 Preterm baby (born before 37 weeks) who needs respiratory support

No additional information

2 Risk factors for bronchopulmonary dysplasia

Be aware that the risk factors for BPD include those in the table [See page 21]. Note that the risk factors 'treated with surfactant' and 'treated for a PDA' are likely to reflect the severity of the baby's condition. Surfactant should be used, and a PDA should be treated, where clinically appropriate.

See the NICE guideline to find out why we made this recommendation and how it might affect practice.

3 Respiratory support

NICE has produced a visual timeline of interventions and support for babies born preterm who need specialist neonatal respiratory care.

Stabilisation immediately after birth

When stabilising preterm babies who need respiratory support soon after birth and before admission to the neonatal unit, use CPAP where clinically appropriate, rather than invasive ventilation [See page 21].

See the NICE guideline to find out why we made this recommendation and how it might affect practice.

Surfactant

Give surfactant to preterm babies who need invasive ventilation for stabilisation in the early postnatal period.

When giving surfactant[1] to a preterm baby who does not need invasive ventilation, use a minimally invasive administration technique. If this is not possible, for example, in units without the facilities or trained staff to carry out these techniques, use endotracheal intubation to give surfactant, with early extubation afterwards.

[1] At the time of publication (April 2019), some brands of surfactant did not have a UK marketing authorisation for minimally invasive administration. The prescriber should follow relevant professional guidance, taking full responsibility for the decision. Informed consent should be obtained and documented. See the General Medical Council's Prescribing guidance: prescribing unlicensed medicines for further information.

See the NICE guideline to find out why we made these recommendations and how they might affect practice.

Oxygen

Use nasal cannula or incubator oxygen for preterm babies who need supplemental oxygen.

Humidify oxygen when giving oxygen at higher flow rates, such as 2 litres per minute or more.

See the NICE guideline to find out why we made these recommendations and how they might affect practice.

Non-invasive ventilation techniques

For preterm babies who need non-invasive ventilation, consider nasal CPAP or nasal high-flow therapy as the primary mode of respiratory support.

See the NICE guideline to find out why we made this recommendation and how it might affect practice.

Invasive ventilation techniques

For preterm babies who need invasive ventilation, use VTV in combination with synchronised ventilation as the primary mode of respiratory support. If this is not effective, consider HFOV.

For preterm babies who need invasive ventilation but VTV and HFOV are not available or not suitable, consider SIMV.

Do not use synchronised pressure-limited ventilation such as AC, SIPPV, PTV, PSV or STCPLV.

See the NICE guideline to find out why we made these recommendations and how they might affect practice.

Nitric oxide

Do not routinely use inhaled nitric oxide for preterm babies who need respiratory support for RDS, unless there are other indications such as pulmonary hypoplasia[1] or pulmonary hypertension[2].

See the NICE guideline to find out why we made this recommendation and it might affect

[1] At the time of publication (April 2019), inhaled nitric oxide did not have a UK marketing authorisation for this indication. The prescriber should follow relevant professional guidance, taking full responsibility for the decision. Informed consent should be obtained and documented. See the General Medical Council's Prescribing guidance: prescribing unlicensed medicines for further information.

[2] At the time of publication (April 2019), inhaled nitric oxide did not have a UK marketing authorisation for this indication in babies less than 34 weeks' gestation. The prescriber should follow relevant professional guidance, taking full responsibility for the decision. Informed consent should be obtained and documented. See the General Medical Council's Prescribing guidance: prescribing unlicensed medicines for further information.

practice.

Quality standards

The following quality statements are relevant to this part of the interactive flowchart.

1. Respiratory support soon after birth
2. Minimally invasive administration of surfactant
3. Invasive ventilation

4 Sedation and analgesia

Morphine

Do not routinely use morphine for preterm babies on respiratory support.

Consider morphine[1] if the baby is in pain. Assess the baby's pain using locally agreed protocols or guidelines.

Regularly reassess babies on morphine to ensure that it is stopped as soon as possible.

See the NICE guideline to find out why we made these recommendations and how they might affect practice.

Premedication before intubation

Consider premedication before elective non-urgent intubation in preterm babies.

If giving premedication, consider either:

- an opioid analgesic (for example, morphine or fentanyl[2]), combined with a neuromuscular blocking agent (for example, suxamethonium) **or**
- propofol[3] alone.

See the NICE guideline to find out why we made these recommendations and how they might affect practice.

[1] Although this is common in UK clinical practice, at the time of publication (April 2019), morphine did not have a UK marketing authorisation for children under 12 years (intravenous administration) or under 1 year (oral

administration). The prescriber should follow relevant professional guidance, taking full responsibility for the decision. Informed consent should be obtained and documented. See the General Medical Council's Prescribing guidance: prescribing unlicensed medicines for further information.

[2] Although this is common in UK clinical practice, at the time of publication (April 2019), fentanyl did not have a UK marketing authorisation for children under 2 years. The prescriber should follow relevant professional guidance, taking full responsibility for the decision. Informed consent should be obtained and documented. See the General Medical Council's Prescribing guidance: prescribing unlicensed medicines for further information.

[3] Although this is common in UK clinical practice, at the time of publication (April 2019), propofol did not have a UK marketing authorisation for children under 1 month. The prescriber should follow relevant professional guidance, taking full responsibility for the decision. Informed consent should be obtained and documented. See the General Medical Council's Prescribing guidance: prescribing unlicensed medicines for further information.

5 Managing respiratory disorders

Corticosteroids

Consider dexamethasone[1] to reduce the risk of BPD for preterm babies who are 8 days or older and still need invasive ventilation [See page 21] for respiratory disease. When considering whether to use dexamethasone in these babies:

- take into account the risk factors for BPD in the table on identified risk factors for bronchopulmonary dysplasia [See page 21] **and**
- discuss the possible benefits and harms with the parents or carers. Topics to discuss include those in the table on the benefits and harms of dexamethasone in preterm babies 8 days or older [See page 18].

For preterm babies who are younger than 8 days old, be aware that dexamethasone increases the risk of gastrointestinal perforation.

Do not use dexamethasone with NSAIDs.

Monitor the blood pressure of babies who receive dexamethasone, because of the risk of hypertension.

See the NICE guideline to find out why we made these recommendations and how they might affect practice.

Diuretics

See the NICE guideline to find out why we did not make any recommendations on diuretics.

Caffeine citrate

Use caffeine citrate routinely in preterm babies born at or before 30 weeks, starting it as early as possible and ideally before 3 days of age.

Consider stopping caffeine citrate at 33 to 35 weeks' corrected gestational age if the baby is clinically stable.

Consider caffeine citrate for any preterm baby with apnoea.

Give a loading dose of 20 mg/kg of caffeine citrate, followed 24 hours later by a maintenance

[1] Although this use is common in UK clinical practice, at the time of publication (April 2019), dexamethasone did not have a UK marketing authorisation for this indication. The prescriber should follow relevant professional guidance, taking full responsibility for the decision. Informed consent should be obtained and documented. See the General Medical Council's Prescribing guidance: prescribing unlicensed medicines for further information.

dosage of 5 mg/kg once daily, increasing up to 20 mg/kg[1] if episodes of apnoea persist.

Consider a maintenance dosage higher than 20 mg/kg daily if therapeutic efficacy is not achieved, while ensuring that a safe plasma level is maintained[2].

See the NICE guideline to find out why we made these recommendations and how they might affect practice.

Patent ductus arteriosus

Do not treat a PDA in a preterm baby unless the PDA causes a significant clinical problem, for example, difficulty weaning the baby from a ventilator.

See the NICE guideline to find out why we made this recommendation and how it might affect practice.

6 Monitoring

Oxygen

Use continuous pulse oximetry to measure oxygen saturation in preterm babies, supplemented by arterial sampling if clinically indicated.

After initial stabilisation, aim for an oxygen saturation of 91% to 95% in preterm babies.

For preterm babies on invasive ventilation [See page 21] who are clinically unstable, consider transcutaneous oxygen monitoring.

See the NICE guideline to find out why we made these recommendations and how they might affect practice.

Carbon dioxide

For preterm babies on invasive ventilation, aim for a PCO_2 of:

- 4.5 kPa to 8.5 kPa on days 1 to 3 **and**
- 4.5 kPa to 10 kPa from day 4 onwards.

Reduce minute ventilation without delay in preterm babies with a low PCO_2, and check the PCO_2 within an hour of the low measurement being identified.

[1] At the time of publication (April 2019), caffeine citrate did not have a marketing authorisation for use in children and young people at this dosage. The prescriber should follow relevant professional guidance, taking full responsibility for the decision. Informed consent should be obtained and documented. See the General Medical Council's Prescribing guidance: prescribing unlicensed medicines for further information.

[2] When measuring plasma levels, prescribers should use the local laboratory's reference ranges. See the British National Formulary for Children for further information about caffeine citrate.

See the NICE guideline to find out why we made these recommendations and how they might affect practice.

Blood pressure

Do not treat preterm babies for hypotension based solely on specific blood pressure thresholds, but take into account other factors, such as evidence of poor tissue perfusion. The aim of treatment should be to improve perfusion.

See the NICE guideline to find out why we made this recommendation and how it might affect practice.

Quality standards

The following quality statement is relevant to this part of the interactive flowchart.

4. Oxygen saturation

7 Discharge planning

Neonatal units should consider appointing a member of staff as a designated neonatal discharge coordinator to discuss the following with parents and carers:

- ongoing support and follow-up after discharge (also see NICE's recommendations on developmental follow-up of children and young people born preterm)
- how to care for their baby at home
- how to use specialist equipment safely
- how to travel with their baby and specialist equipment.

When planning to discharge a preterm baby on respiratory support from the neonatal unit:

- follow the principles in NICE's guideline on postnatal care
- consider early referral to, and regular contact with, community and continuing healthcare teams
- consider an interim discharge placement to, for example, a hospice, alternative family member's home, step-down unit, transitional care unit, or alternative suitable accommodation, where appropriate.

See the NICE guideline to find out why we made these recommendations and how they might affect practice.

8 Information and support for parents and carers while baby is on respiratory support

Involving parents and carers

Explain to the parents and carers of preterm babies on respiratory support that non-nutritive sucking (using a dummy) during periods when the baby is awake is beneficial because:

- it can help soothe the baby between feeds **and**
- in babies fed by a nasogastric tube, dummy use can reduce the length of the baby's hospital stay.

Tell parents and carers about the benefits of using touch, for example, through skin-to-skin contact, to communicate with their baby.

Consider providing the Newborn individualized developmental care and assessment program (NIDCAP®) to improve cognitive development in babies born at less than 27 weeks.

See the NICE guideline to find out why we made these recommendations and how they might affect practice.

Providing information and support

Recognise parents and carers as partners in their baby's care, and support them in this role.

Encourage and support parents and carers to:

- be involved in planning and providing their baby's day-to-day care, for example, feeding and nappy changing
- participate in discussions and decisions about their baby during ward rounds, providing input into planning and providing care.

Provide regular opportunities and time for parents and carers to discuss their baby's care, ask questions about the information they have been given, and discuss concerns.

Give parents and carers the time, support and encouragement they need to become confident in caring effectively for their baby.

Offer parents and carers psychological support from a professional who is trained to deliver this type of help and advice.

Ask parents and carers about how and when they would like to receive information about their baby's treatment and progress, and how they would prefer to be contacted when they are away from the neonatal unit.

Support discussions with parents and carers using written information. Ensure that information is up to date, relevant, appropriate to the parents' and carers' needs and preferences, and consistent between healthcare professionals. For more guidance on communication (including different formats and languages), providing information, and shared decision making, see NICE's recommendations on patient experience in adult NHS services.

Ensure that information for parents and carers is delivered by an appropriate healthcare professional, and information for hospitalised mothers who cannot visit their baby is delivered by a senior healthcare professional, for example, a neonatologist or specialist registrar, face-to-face whenever possible.

Be sensitive about the timing of discussions with parents and carers. In particular, discuss significant perinatal events without delay, providing the mother has sufficiently recovered from the birth.

Provide information for parents and carers that includes:

- explanations and regular updates about their baby's condition and treatment, especially if there are any changes
- what happens in the neonatal unit, and the equipment being used to support their baby
- what respiratory support is being provided for their baby
- how to get involved in their baby's day-to-day care, interact with their baby and interpret the baby's neurobehavioural cues
- the roles and responsibilities of different members of their baby's healthcare team, and key contacts
- information about caring for a premature baby to share with family and friends, and practical suggestions about how to get help and support from family and friends
- opportunities for peer support from neonatal unit graduate parents or parent buddies
- details of local support groups, online forums and national charities, and how to get in touch with them.

See the NICE guideline to find out why we made these recommendations and how they might affect practice.

NICE has written information for the public on specialist neonatal respiratory care.

Quality standards

The following quality statement is relevant to this part of the interactive flowchart.

5. Involving parents and carers

9 Preparing parents and carers for discharge

Recognise parents and carers as partners in the discharge planning process. Answer their questions and concerns as they arise, and support them in making joint decisions with the discharge team.

Throughout the baby's neonatal admission, provide support and guidance for parents and carers with constructive and supportive feedback about how to care for their baby and how to use specialist equipment. Use a formal competency-based assessment tool to evaluate the safe use of specialist equipment.

Discuss any modifications that parents and carers might need to make to their home as soon as possible.

Educate parents and carers about possible emergencies that may arise, how to deal with them and who to contact for help and advice. This should include how to carry out cardiopulmonary resuscitation, and what to do if there are problems with any specialist equipment.

Provide parents and carers with opportunities to care for their baby overnight.

Provide information for parents and carers to help them care for their baby safely and confidently after discharge. Follow the principles on communication and information-giving in information and support for parents and carers while baby is on respiratory support [See page 14] and also see NICE's recommendations on postnatal care. Information should include:

- how to recognise signs of illness in their baby, and what to do
- how to adapt routines such as feeding and sleeping after discharge, and information about safe sleep guidance
- how to make follow-up appointments and timing of immunisations
- who to contact after discharge, as well as a list of useful medical contacts.

Tell parents and carers about sources of support after discharge, for example:

- opportunities for peer support

- help and support for their own needs, for example, postnatal depression (also see NICE's recommendations on antenatal and postnatal mental health).

See the NICE guideline to find out why we made these recommendations and how they might affect practice.

10 Service organisation and delivery

Those responsible for planning and delivering neonatal services should ensure that neonatal units:

- are welcoming and friendly
- foster positive and supportive relationships by providing parents and carers with 24-hour access to their baby
- provide privacy for skin-to-skin contact and feeding
- have private areas for difficult conversations
- have comfortable furniture and provide a relaxing environment for families.

Ensure that healthcare professionals in neonatal units can support parents and carers by being competent in:

- communicating complex and sensitive information clearly
- tailoring information and support to the person's individual needs and circumstances.

See the NICE guideline to find out why we made these recommendations and how they might affect practice.

Benefits and harms of dexamethasone in preterm babies 8 days or older		
Outcome	**Benefit or harm for preterm babies 8 days or older**	**Notes**
Mortality before discharge	There is no difference in mortality before discharge in babies who receive dexamethasone compared with babies who do not receive dexamethasone.	There was evidence demonstrating this lack of difference.
BPD **at 36 weeks' postmenstrual age**	Babies who receive dexamethasone are less likely to develop BPD compared with babies who do not receive dexamethasone. On average: • without dexamethasone treatment, 63 babies per 100 would develop BPD (and 37 would not) • with dexamethasone treatment, 47 babies per 100 would develop BPD (and 53 would not).	There was evidence demonstrating this difference.
Cerebral palsy	There is no difference in	Although there was evidence

	the incidence of cerebral palsy in babies who receive dexamethasone compared with babies who do not receive dexamethasone.	demonstrating this lack of difference, there is uncertainty about the risk, so the possibility of cerebral palsy occurring could not be excluded.
Other neurodevelopmental outcomes (neurodevelopmental delay and neurosensory impairment)[1]	There is no difference in neurodevelopmental outcomes in babies who receive dexamethasone compared with babies who do not receive dexamethasone.	Although there was evidence demonstrating this lack of difference, there is uncertainty about the risk of neurodevelopmental delay and neurosensory impairment because the studies reported neurodevelopmental assessments at different timepoints.
Days on invasive ventilation	Babies who receive dexamethasone have fewer days on invasive ventilation compared with babies who do not receive dexamethasone.	Although there was evidence demonstrating this difference, there is uncertainty about the difference in the number of days on invasive ventilation because of the different ways the studies reported it.
Gastrointestinal perforation	There is no difference in gastrointestinal perforation in babies who receive dexamethasone compared with babies who do not receive dexamethasone.	Although there was evidence demonstrating this lack of difference, there is uncertainty about the risk, so the possibility of gastrointestinal perforation occurring cannot be excluded.
Hypertension	Babies who receive dexamethasone are more likely to develop hypertension compared	There was evidence demonstrating this difference.

	with babies who do not receive dexamethasone. On average: • without dexamethasone treatment, 3 preterm babies per 100 would develop hypertension (and 97 would not) • with dexamethasone treatment, 11 babies per 100 would develop hypertension (and 89 would not).	

Full details of the evidence for the benefits and harms of dexamethasone for preterm babies 8 days or older are in evidence review C: managing respiratory disorders.

[1] In this NICE Pathway, neurodevelopmental outcomes at 18 months or older have been defined as:

- cerebral palsy (reported as presence or absence of condition, not severity)
- neurodevelopmental delay (reported as dichotomous outcomes, not continuous outcomes such as mean change in score)
  - severe (score of more than 2 SD below normal on validated assessment scales, or a score of less than 70 on the Bayley II scale of infant development MDI or PDI, or complete inability to assign score because of cerebral palsy or severe cognitive delay)
  - moderate (score of 1 to 2 SD below normal on validated assessment scales, or a score of 70 to 84 on the Bayley II scale of infant development MDI or PDI)
- neurosensory impairment (reported as presence or absence of condition, not severity):
  - severe hearing impairment (for example, deaf)
  - severe visual impairment (for example, blind).

Invasive ventilation

Administration of respiratory support via an endotracheal tube or tracheostomy, using a mechanical ventilator – see the table for a summary of the definitions of invasive ventilation modes.

Identified risk factors for bronchopulmonary dysplasia[a]	
In babies born before 32 weeks	• lower gestational age • Lower birthweight • Small for gestational age • Male sex • Core body temperature of less than 35°C on admission to neonatal unit • Invasive ventilation begun within 24 hours of birth • Clinical sepsis with or without positive blood cultures • Feeding with formula milk (exclusively or in addition to breast milk) • Treated with surfactant[b] • Treated for a PDA[b]
In babies born before 30 weeks	• Cardiopulmonary resuscitation performed at birth

[a] These risk factors have been identified in large prospective cohort studies, but other gestational ages and other risk factors not listed here might also be associated with an increased risk of bronchopulmonary dysplasia.

[b] These risk factors are likely to reflect the severity of the baby's condition. Surfactant should be used, and a PDA should be treated, where clinically appropriate.

Glossary

AC

assist control

BPD

bronchopulmonary dysplasia

CPAP

continuous positive airways pressure

HFOV

high-frequency oscillatory ventilation

NSAIDs

non-steroidal anti-inflammatory drugs

PCO2

carbon dioxide partial pressure

PDA

patent ductus arteriosus

PSV

pressure support ventilation

PTV

patient-triggered ventilation

RDS

respiratory distress syndrome

SIMV

synchronised intermittent mandatory ventilation

SIPPV

synchronised intermittent positive pressure ventilation

STCPLV

synchronised time-cycled pressure-limited ventilation

VTV

volume-targeted ventilation

Minimally invasive administration technique

(administration of surfactant through a thin endotracheal catheter without insertion of an endotracheal tube or invasive ventilation [See page 21])

Minute ventilation

(the tidal volume of each breath in millilitres [ml] multiplied by the number of breaths per minute gives the minute ventilation in ml/min (usually expressed as ml/kg/min, which is achieved by dividing by the baby's weight in kg))

Neurobehavioural cues

(sounds, characteristics of movements including facial expressions and physiological parameters such as heart rate, breathing patterns and skin tone that reflect the baby's current level of sensitivity or wellbeing, and reveal their current developmental stage)

Non-invasive ventilation

(administration of respiratory support using a ventilator or flow driver, but not via an endotracheal tube or tracheostomy)

Perinatal

(in this guidance, the perinatal period is defined as the period of time from 48 hours before birth up until 7 completed days after birth)

Skin-to-skin contact

(holding a naked baby, or a baby wearing only a nappy, on the skin of a parent or carer, usually on the chest)

Stabilisation

(facilitating and supporting a smooth transition from fetal to neonatal life; involves careful assessment of heart rate, colour [oxygenation] and breathing, with provision of appropriate interventions where indicated)

Sources

Specialist neonatal respiratory care for babies born preterm (2019) NICE guideline NG124

Your responsibility

Guidelines

The recommendations in this guideline represent the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, professionals and practitioners are expected to take this guideline fully into account, alongside the individual needs, preferences and values of their patients or the people using their service. It is not mandatory to apply the recommendations, and the guideline does not override the responsibility to make decisions appropriate to the circumstances of the individual, in consultation with them and their families and carers or guardian.

Local commissioners and providers of healthcare have a responsibility to enable the guideline to be applied when individual professionals and people using services wish to use it. They should do so in the context of local and national priorities for funding and developing services, and in light of their duties to have due regard to the need to eliminate unlawful discrimination, to

advance equality of opportunity and to reduce health inequalities. Nothing in this guideline should be interpreted in a way that would be inconsistent with complying with those duties.

Commissioners and providers have a responsibility to promote an environmentally sustainable health and care system and should assess and reduce the environmental impact of implementing NICE recommendations wherever possible.

Technology appraisals

The recommendations in this interactive flowchart represent the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, health professionals are expected to take these recommendations fully into account, alongside the individual needs, preferences and values of their patients. The application of the recommendations in this interactive flowchart is at the discretion of health professionals and their individual patients and do not override the responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient, in consultation with the patient and/or their carer or guardian.

Commissioners and/or providers have a responsibility to provide the funding required to enable the recommendations to be applied when individual health professionals and their patients wish to use it, in accordance with the NHS Constitution. They should do so in light of their duties to have due regard to the need to eliminate unlawful discrimination, to advance equality of opportunity and to reduce health inequalities.

Commissioners and providers have a responsibility to promote an environmentally sustainable health and care system and should assess and reduce the environmental impact of implementing NICE recommendations wherever possible.

Medical technologies guidance, diagnostics guidance and interventional procedures guidance

The recommendations in this interactive flowchart represent the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, healthcare professionals are expected to take these recommendations fully into account. However, the interactive flowchart does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient, in consultation with

the patient and/or guardian or carer.

Commissioners and/or providers have a responsibility to implement the recommendations, in their local context, in light of their duties to have due regard to the need to eliminate unlawful discrimination, advance equality of opportunity, and foster good relations. Nothing in this interactive flowchart should be interpreted in a way that would be inconsistent with compliance with those duties.

Commissioners and providers have a responsibility to promote an environmentally sustainable health and care system and should assess and reduce the environmental impact of implementing NICE recommendations wherever possible.