THAMES VALLEY & WESSEX NEONATAL OPERATIONAL DELIVERY NETWORK

GUIDELINE FRAMEWORK FOR CONSIDERATION OF LIGHT	
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Related documents	**References**

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Implications of race, equality & other diversity duties for this document	**This guideline must be implemented fairly and without prejudice whether on the grounds of race, gender, sexual orientation or religion.**

Contents

1.0 Aim of Guideline Framework

To provide a framework to ensure that all premature infants are cared for in the optimum environment: ensuring light exposure is appropriate and does not cause stress or discomfort to babies being cared for in the neonatal unit.

2.0 Scope of Guideline Framework

The guideline applies to all babies receiving care within Thames Valley & Wessex Neonatal Operational Delivery Network. This includes the following hospitals:

Thames Valley		
TRUST	**Hospital**	**Designation**
Oxford University Hospitals NHS Foundation Trust	- John Radcliffe Hospital, Oxford	NICU
Buckinghamshire Healthcare NHS Trust	- Stoke Mandeville Hospital, Aylesbury	LNU
Frimley Health NHS Foundation Trust	- Wexham Park Hospital, Slough	LNU
Milton Keynes University Hospital NHS Foundation Trust	- Milton Keynes General Hospital	LNU
Royal Berkshire NHS Foundation Trust	- Reading	LNU

Wessex		
TRUST	**Hospital**	**Designation**
University Hospital Southampton NHS Foundation Trust	- Princess Anne Hospital	NICU
Portsmouth Hospitals University NHS Trust	- Queen Alexandra Hospital	NICU
University Hospitals Dorset NHS Foundation Trust	- Poole Hospital	LNU
Salisbury NHS Foundation Trust	- Salisbury District Hospital	LNU
Hampshire Hospitals NHS Foundation Trust	- Basingstoke and North Hampshire Hospital	SCU (Temporary designation)
Hampshire Hospitals NHS Foundation Trust	- Royal Hampshire County Hospital, Winchester	SCU (Temporary designation)
Dorset County Hospital NHS Foundation Trust	- Dorset County Hospital, Dorchester	SCU
Isle of Wight NHS Trust	- St Mary's Hospital	SCU
University Hospitals Sussex NHS Foundation Trust	- St Richard's Hospital, Chichester	SCU

3.0 Guideline summary

- Premature babies have thin eye lids that allow light through; they cannot contract their pupils to keep light out until after 32 weeks gestation (pupillary reflex).
- Babies find it difficult to turn away from a light source.
- It is important to observe a baby's response to light and adjust the environment accordingly.
- Safety is essential when considering light levels on a neonatal unit, and lighting levels must be sufficient for staff to carry out clinical procedures safely.
- All babies nursed in an incubator should have incubators covers to reduce the light levels they are exposed to.
- All babies in cots, require a cot canopy to reduce their exposure to bright, overhead hospital lighting.
- Reduce light levels (<50 lux) at night to promote circadian rhythms for the term and near-term babies.
- Near term and term babies need moderate natural lighting during the day to support their visual development.
- All babies receiving phototherapy should have their eyes protected by eye bands designed for the purpose.
- All babies in close proximity to phototherapy should be shielded from exposure to the light,
- Routine use of eye protection is not recommended, other than during bright procedures; babies show high levels of stress responses in a trial of this.
- During eye examination to screen for ROP, eye drops are used to dilate the pupils. The baby's eyes must be protected from the light for 18 hours, until the effect of the drops has completely passed.
- Parents should be informed about the need to protect their baby's eyes from exposure to excessive or bright light whilst on the Neonatal Unit and should be supported to be involved in this process.
- When in low and moderate lighting, babies are more likely to open their eyes and interact with parents.

4.0 Background Information

Babies are exposed to bright unnatural environmental lights in the NICU, which they find uncomfortable and stressful. This includes phototherapy, procedural lighting, overhead lighting and uncontrolled sunlight. These bright lighting conditions are known to cause retinal damage, sleep pattern disturbance, disturbance of circadian rhythms and poor growth.

Recent evidence suggests that cycled lighting, usually with a nighttime phase and daytime phase of 12 hours each helps prevent many of the problems listed. Babies exposed to cyclical lighting also show better growth and hormone regulation. They are less anxious, cry less, sleep better and are more active during the day. (Draeger)

The visual system of a newborn infant continues to develop well after birth until about the age of three years.

Lighting influences postnatal development of vision, visual processes and the maturation of the visual cortex. Being born prematurely impacts on this visual development. (Roberto 2016).

The Neonatal Intensive Care (NICU) environment is complex and generally over stimulating to the sick preterm infant. It creates a state of sensory overload and maladaption. Exposure to bright light can be harmful to the immature eye and has been theorised to cause retinal damage, sleep pattern disturbance, disturbance of circadian rhythms and poor growth. Being nursed in elevated light levels has been seen to disturb infant's length and quality of sleep, as well as cause fluctuations in heart rate, respiratory rate and blood pressure.

Preterm infants are visually more vulnerable, they get tired easily, have very thin eyelids and their immaturity prevents them from closing their eyes consistently. The pupillary reflex that enables the pupils to dilate/contract to filter the amount of light the eye receives doesn't develop until 30-34 weeks gestation. Although the womb environment is near darkness, this environment is rich in sensory stimulation.

It is believed that keeping preterm infants in a constantly dark environment, while in the NICU deprives them of the circadian rhythms they would have received during gestation. (Hazelhoff,2021)

There is increasing evidence that cycled lighting (providing 12 hours of moderate lighting < 300 lux during the day and lowering levels at night < 50 lux) is beneficial to circadian rhythmicity, sleep, improved weight gain and improved cardiorespiratory function. (Morag and Ohlsson 2016, Roberto G et al 2016, Hazelhoff 2021, Marzouk et al 2019). However, it is also essential to ensure individual high level, glare free lights to enable health professionals to carry out critical visual tasks such as inserting a catheter into an infant's vein.

5.0 Practice Guidelines

5.1 Lighting Exposure

- Safety is essential when considering light levels on a neonatal unit. Staff require individual high level, glare free lighting to carry out their clinical procedures and observations safely.
- Maintain moderate lighting levels during the day (< 300 lux).
- Need to ensure that baby is not directly under lighting or looking up at lighting when in cot.
- Reduce light levels at night (<50 lux) to promote circadian rhythms for the term and near term babies.
- When more light is needed, where possible gradually increase the light level using dimmer switches until the minimum light level required is achieved. This gives babies a chance to adapt gradually to the change in light levels and may reduce the level of sleep disturbance and/or negative physiological responses.
- Use spotlights for procedures/cares, instead of turning the main room light on. This will minimise the disturbance to other babies in the room.
- Staff should be aware of sources of light that could inadvertently affect a baby, and act immediately to prevent or reduce their effects. For example, sunlight, cold light sources, procedural lights, reflected light, desk lamps used by staff.
- Extra consideration of environmental light levels and sources should be given to babies suffering from Hypoxic Ischaemic Encephalopathy (HIE) or seizures, who may benefit from lower light levels.
- A pen torch can be used to provide enough light to check intravenous line sites, without needing to turn on large lights or remove light protecting covers.
- All babies nursed in an incubator should have incubators covers to reduce the light levels they are exposed to.

- Covers should be designed for the purpose and be effective at blocking light. They should still enable observation of the baby for safety and behavioural cues.
- Covers may be flapped back, or if necessary, removed whilst visualisation of a baby is necessary for an activity. However, in most circumstances the cover should be replaced as soon as an activity is completed.
- When possible, assess each baby's sleep/wake state and self-regulating behaviour before removal of the covers.
- When it is necessary to expose a baby to bright lighting conditions make every effort to reduce the negative effects for the baby, for example.
    - Angle the light away from the baby's eyes
    - Aim the light beam only onto the area required, (i.e. foot)
    - Consider using eye bands temporarily to protect the baby from light.
    - Position a hand/small cover/ teddy between the light source and baby's eyes so that they are shaded from the beam.
- When babies are nursed in cots, a cot canopy offers some shade and privacy. Ideally all babies less than 37 weeks gestation should have a cot canopy to reduce their exposure to light. Older babies may continue to require a cot canopy.
- All babies receiving phototherapy should have their eyes protected by eye bands designed for the purpose. Care should be taken to ensure the bands are securely fitted and are replaced over the baby's eyes as soon as they are noted to have come off.
- All babies in close proximity to the phototherapy should be shielded from exposure to the light. Consider using incubator covers, cot canopy, or where absolutely necessary, eye bands.

5.2 Quiet Time

Many neonatal units implement quiet time during the day. This is a predetermined time slot, often 1-2 hours in length, where lights are dimmed, sound is reduced, and routine procedures postponed. This time is felt to be an opportunity for infants to have a rest from procedural handling, an opportunity for good quality sleep, a chance to reduce babies stress and promote healthy brain and sensory development and a time where infants can spend undisturbed quiet time with their parents. Dimming the lights for quiet time could conflict with the practice of providing cycled lighting.

Cycled lighting in the neonatal unit refers to the practice of mimicking natural light patterns to create a more normal day-night cycle for premature infants. However, implementing cycled lighting doesn't mean that dimming lights for quiet time is unnecessary. On the contrary, both practices can be complementary.

1. **Day-Night Cycles**: Cycled lighting involves having brighter light during the day and dimmer light during the night. This helps establish circadian rhythms, which are crucial for the development of infants.
2. **Quiet Time**: Dimming the lights during specific periods of the day, often referred to as quiet time, can help reduce overstimulation and stress for infants. This period can be incorporated into the cycled lighting schedule **as part of the evening or night-time phase** when the lights are naturally dimmer or to leave the lighting the same but just reduce stimulation for the baby.

Integrating both cycled lighting and designated quiet time can provide a balanced approach that supports the infants' developmental needs while also ensuring they have periods of reduced stimulation for rest and recovery.

5.3 Following Eye Examinations

- Following eye examination where drops have been used to dilate the pupil, it is considered best practice to protect the baby's eyes from the light for 18 hours, until the effect of the drug has completely passed.
- It is known that the pupil dilating drugs can be effective for up to 18 hours. During this time a baby will not be able to effectively constrict its pupils down to reduce the light coming into the eye. For preterm babies this will be in addition to having thin eyelids that allow much light to pass through and eye lids that they cannot effectively keep closed, when asleep.
- The long-term effects of high light levels on preterm baby's eyes is not yet known, so caution must be taken. Light is also likely to affect their ability to sleep, and may cause physiological instability such as apnoea, bradycardia, desaturations, tachycardia, and/ or tachypnoea.
- Babies do not need to routinely wear eye protection bands following eye examination, but should have a cover over their incubator or a cot canopy over their cot. Extra caution should be taken to ensure that lighting levels are kept low, and babies being cuddled are not exposed to the bright fluorescent ceiling lights. If bright lighting is needed for example to take blood, it may be safest to place eye bands on the baby for that short period.
- Staff caring for each baby must take responsibility for noting the time that dilating eye drops are instilled, and ensuring that each baby receives appropriate protection for 18 hours from then.
- Commonly used drugs for pupil dilatation in neonates include; Cyclopentolate Hydrochloride 1%, Phenylephrine Hydrochloride 2.5% and Tropicamide 0.5%.

5.4 Preparing for Discharge

- Babies past term need different lighting than preterm infants, as they need to see objects clearly enough to begin to focus and to pick out shape and form (Warren 2010). As parents may be used to low level lighting in hospital, this should be discussed with them before taking their baby home.
- Consider gradually giving the baby time without a cot canopy once a baby has reached 37 weeks gestation or is preparing for discharge. This should not be done in one stage, but should be a gradual process, promoting circadian rhythms. Careful observations of the baby need to be carried out, to determine their response to light, and appropriate adjustments made to the environment.

5.5 Parents

- Parents should be informed about the need to protect their baby's eyes from exposure to excessive or bright light whilst on the Neonatal Unit. They can be supported to be involved in this process, for example not removing incubator covers totally or rapidly on their arrival, or informing staff if their baby's phototherapy eye protection had slipped off.
- Understanding their baby's behavioural cues is necessary to determine their baby's individual responses to environmental stimuli.

5.6 Staff

- All staff should receive information and training about light exposure on the Neonatal Unit, during their orientation to the Unit. This may be in the form of self-directed learning, e-learning or formal training sessions. Ideally staff should be attaining an agreed level of competence which is documented and retained for the records.
- All staff should keep their knowledge and practice around light up to date. For example they may be directed towards practice guidelines, developmental care leads, e- learning, internet resources, current literature, etc.

5.7 Resources

- Neonatal Units have a responsibility to provide equipment and resources that will enable staff and parents to control light level to the sick and preterm infant. Useful resources are likely to include.
    - Incubator covers
    - Cot canopies
    - Individualised lighting at each cot space - with dimmer switch control (or similar).
    - Individual bedside lamp/spot light
    - Pen torch/head torch for staff
    - Eye bands designed for the purpose - for babies receiving phototherapy or exposed to procedural lighting.
    - Notices for identifying infants who have had pupil dilating eye drops instilled, and require special consideration.

5.8 Audit

- Neonatal Units practice around light exposure of sick and preterm infants should be reviewed according to their local audit policy. All staff should contribute to this process when required. This is most likely to be by completing an audit document or benchmarking questionnaire.

5.9 Parent's Information Leaflet

- See 'Light on the Neonatal Unit: A Parent's Guide'. Page 11-12

Version Control:

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Light on the Neonatal Unit: A Parent's Guide

- Babies are exposed to bright unnatural environmental lights in the Neonatal unit. This comes from phototherapy, procedural lighting and uncontrolled sunlight. Babies appear to find bright light uncomfortable and stressful.

- Preterm babies in particular have difficulty coping with excess light; they may become agitated and their oxygen levels and heart rate may alter. This is in part because they have thin eye lids that allow light through, and they cannot constrict their pupils to keep light out until after 32 weeks gestation.

- In addition, bright lights can mean a baby's sleep is disturbed. This is a problem as babies grow and heal best when they are sleeping, so we need to work hard to help babies get to sleep and stay asleep.

- In order to try and protect babies from the light and promote rest and growth unit staff and parents/ families can try to;

    - ✓ Keep incubators covered to reduce ceiling light exposure and use a large, thick, effective cover.

    - ✓ Use cot canopies for babies in the nursery (harsh ceiling lighting is not normal for anyone to lie underneath).

    - ✓ Protect babies receiving phototherapy using eye protection- babies next to someone else's phototherapy might need protecting too!

    - ✓ Avoid direct light to the baby's eyes when possible. Use nest walls, a teddy or your hand to act as a barrier.

    - ✓ Turn off bright lights, so babies are more likely to open their eyes and interact with you.

    - ✓ Try to have a cycled light pattern, where it is darker at night. This is better for babies who can often sleep more, grow better and be more settled.

    - ✓ Consider the lighting levels when you are visiting or handling your baby. If the nursery is bright, only pull back part of the incubator cover.

    - ✓ When doing cares observe your baby's response to the light. If the lights are too bright, ask a member of staff if the lighting can be dimmed a little, or use your hand to shade your baby's eyes.

    - ✓ Babies may struggle to cope with lots of visual stimulation at the same time as physical and sound stimulation. Think about just offering one type of stimulation at a time, if your baby is still very sick or extremely preterm. For example- try only touching, or only talking to them or removing visual stimulation when they seem tired.

- ✓ Your baby can begin to be exposed to more ‘normal’ lighting levels as they feel better, and are preparing for home. However, some protection may stay in place until discharge as a hospital does not have the gentle controllable lights that you would choose for your baby at home.



And a little bit about baby’s vision….

- In order to see a baby needs healthy and mature visual system which includes eyes, optic nerves – between the eyes and the brain and special pathways in the brain. A foetus in the womb can sense light from 16 weeks and their visual system is fully formed by 26/60, when their eyelids can also open.

- We know a full term baby has vision which is out of focus, and sees in black and white. They can focus best at the distance between Mum’s breast and face (8-10 inches). 1 week after birth they can see red/orange/yellow, but seeing blue and purple takes longer. By 6 months of corrected age a baby’s colour vision is similar to an adult.

- We know that preterm babies see less well than term babies. They are aware of light as they close their eyes when exposed to light, and are more likely to open them when the light level is lower. Babies 30 weeks and older can fix their gaze, for a short time. The length of time they can do this for then gradually increases as they are also able to stay awake and calm for longer.

- Around 33-34 weeks babies can focus on an object and follow it with their eyes when it moves, Preterm babies seems to prefer to look at patterns, curves, bright contrasts in tone and large patterns and their sight will gradually progress to be the same as a term baby.