4. Infant and Family Centred Developmental Care Toolkit: Healing Environment

Authors:

Jane Fenton-Smith, Lead Occupational Therapist, East of England Neonatal ODN
Rachel Stamp, Lead Physiotherapist, East of England Neonatal ODN

For use in: EoE Neonatal Units
Guidance specific to the care of neonatal patients.

Used by: This guideline is intended for all healthcare professionals and staff working within the neonatal unit. The principles outlined should also be shared with parents, supporting a collaborative approach to caring for premature or unwell infants.

Key Words: Healing environment, Sensory development, Neuroprotection, Family-centred care, Skin-to-skin (Kangaroo Care), Autonomic regulation, Smell and taste (olfactory/gustatory), Noise reduction, Light management, Individualised developmental care.

Date of Ratification: 10th December 2025

Review due: **December 2028**

Registration No: **NEO-ODN-2025-31**

Approved by:

Neonatal Clinical Oversight Group	
Clinical Lead Sajeev Job	

Ratified by ODN Board:

Date of meeting	**10th December 2025**

Introduction:

The 'healing environment' refers to the 'physical environment of the NICU, including space, privacy and safety and the sensory environment of temperature, touch, proprioception, smell, taste, sound and light as well as people (families and staff) and their interactions.[11]

Both scientific and medical research support the provision of a sensory nurturing environment and the essential requirement to protect infants from deleterious environmental stimuli and to support their access to positive sensory stimulations from their parents and other caregivers.[12,14,43]

This document refers to the environmental adaptations and approaches that support the sensory experiences of the infant on the NICU and which impact on their stress, autonomic regulation and development.

It is now recognised that there are eight sensory systems (see Appendix 1) with the Tactile system (touch) being the first sensory system to develop at just 7 weeks gestation.

The following recommendations will focus on light, sound, smell, and taste. Further guidance should be followed in the Positioning and Handling (link here) section regarding touch and movement experiences (including comfort hold, positive touch and movement, 5 step dialogue [15]).

See specific guidance for use of massage interventions on the neonatal unit. Guidelines & Resources - East of England

Partnering with families

There is overwhelming evidence which supports the understanding that parents' presence on the Neonatal unit and partnership in the care of their baby is an essential component of delivering quality developmental care and improving developmental outcomes for infants. [7,11] It is imperative that we coach and empower parents so that they can provide appropriate and individualised support for their baby at the right time. See *'partnering with families'* section for further guidance.

Background:

The sensory system is not fully developed at birth, and the first few months of life are crucial for sensory processing and integration. Early sensory experiences build the foundations of our responses to sensory stimuli and our ability to perceive and interact with the world.

The environment of the neonatal unit is vastly different to the in-utero environment with increased (largely negative) exposure to light and sound.

Preterm babies have limited capacity to inhibit responses to sensory inputs, and the sensory environment can therefore have a significant impact on comfort, stress, and autonomic stability [16.]

Some long-term sensory processing difficulties will be due to genetics or infection, however acute and chronic alterations in the early sensory environments such as those experienced in the NICU, or where there is significant parental stress, can create a stress response in the baby, that will prime the nervous system to process future sensory experiences differently for life. [14,17,18,19]

It is essential that the NICU environment, including our care practices, are modified to reduce the harmful effect of stress, support optimal neurological development of the neonate, and the long-term outcomes and wellbeing of these infants.

Sensory interventions in the NICU, adjusted to the infants' needs and responses, attuned to their current developmental stage, are at best implemented through individualised programmes.[14]

There are general recommendations to be followed to provide a neuroprotective environment and culture however practitioners should be sensitive to an individual babies needs not solely based on gestation but led by a baby's behavioural state and cues. See *'individualising care- behavioural cues'* section. It may be that a baby with more complex needs would benefit from assessment from the unit therapist and provision of a more specialist individualised program.

Supporting Sensory Experiences:

Skin to skin (Kangaroo Care)

Skin to skin is recognised as the optimal neuroprotective environment and the best strategy to restore some of the sensory discontinuity associated with preterm birth.[11, 14] Some organisations strive to achieve a practice of zero separation with neonates being cared for 24/7 in skin to skin. [20,21]

The benefits of skin to skin are well documented [1] and further practical guidance can be found in the 'facilitating skin to skin' document.

Smell and Taste, Olfactory and Gustatory Systems[2,3,12]

- Primary smell receptors are formed by gestational week 8, and functional at week 24.
- Smell and taste are known to increase gut motility, insulin secretion and the release of digestive and metabolic hormones.
- Smell and taste receptors are functional in the foetus, and there is evidence to support antenatal learning of odours.
- Respiration and cerebral blood flow may be affected by odours. Infants show that some smells and tastes are pleasurable.

- New- born infants are able to recognise the smell of amniotic fluid, the scent of breastmilk and odour components of human sweat.
- The sense of smell is well defined at birth it is therefore important to consider the influence that care givers can have by using strong smelling personal hygiene products and the type of equipment cleaning products used, which the infant is exposed to.
- Taste cells begin to form at gestational week 7-8, and are considered fully functional and mature at 17 weeks gestation.
- Taste and smell is enhanced by sucking. The inhalation and swallowing of amniotic fluid in uterine are the first flavour and smell experiences of the foetus.
- Experience of flavour is influenced by experience of smell, a new-born infants taste buds will detect sweetness, bitterness sourness and Umami (found in milk and Meaty flavours), with a preference for sweetness. Saltiness is not detected until about 4 months of age.
- A combination of oral sucrose and non-nutritive sucking provides **short term** pain relief, (2mins following administration).[6]
- It is known that infants who are extensively nasogastric tube fed/parentally fed on the neonatal unit are disadvantaged from those early taste and smell exposures normally experienced by infants born at term gestation. It is therefore important to provide positive sensory experiences through other methods.
- Absence of positive sensory experiences and requirement for invasive perioral and perinasal interventions may adversely affect future perceptions of oral experiences. [4]

Aims:
• **Minimise exposure to noxious odours and unpleasant tastes.** • **Provide positive smell and taste experiences.** • **Support early exposure to parent's natural scent (reduce stress, maximise parent-infant attachment).** • **Support feeding and lactation.[9]**

Recommendations to support smell and taste experiences:
Encourage parents (mothers in particular) to leave a muslin cloth, bonding square or small piece of clothing with their natural scent next to their baby.[8] The mother can place the cloth near her breasts whilst expressing to obtain her odour. The mother will also benefit from be able to experience her baby's scent by taking another muslin cloth that has been with her baby. This will support her when expressing milk.
Encourage regular skin to skin contact so they can experience each other's scent. The mother's scent provides comfort with recognisable tactile and olfactory inputs from mother's skin.[5]
Where possible use expressed breast milk for mouth care. Refer to EoE ODN Mouth care guideline East of England Mouthcare Guideline or local trust guideline.
Offer a dummy dipped in breast milk for non-nutritive sucking, especially during tube feeds and procedures.[8,9]

Avoid the use of vanilla smelling or scented dummies to minimise unnatural scent which may impact on breast feeding. [3,8]
During feeding observe and follow a baby's behavioural cues to ensure an attuned and responsive feeding experience.
Where possible, give oral medications via NG/OG tube.
Allow alcohol gel to 'dry' on hands before handling babies.
When using alcohol wipes for procedures, remove from the incubator immediately following use.
Educate staff and parents about the need to avoid introducing noxious smells when handling infants; e.g. strong perfumes or cigarette smoke.

The East of England Neonatal ODN has a range of nutrition and feeding focussed guidelines designed to support optimal nutrition strategies to support growth and development. These include non-nutritive sucking and mouth care guidelines. The guidelines can be found on the East of England Neonatal ODN website and are also listed in the '*Optimising Nutrition'* section.

Sound and the Auditory System[2]

- At 20 weeks hearing structures are formed and hearing apparatus is mature by 28weeks.[2]
- As early as 24 weeks gestation sound may affect behaviour. Eye movement can be observed in response to sound at 26 weeks. [2]
- In the uterus, the fetus is exposed to lower frequency sounds of around 500Hz and protected from higher frequency and loud external noise through absorption of sound by the maternal abdominal wall, uterus and amniotic fluid environment.[22]
- At 28-29 weeks infants can begin to distinguish between voices and others sounds and at 30 weeks can typically recognise a mother's voice. They are still unable to tune out unwelcome sounds and their sleep is easily disrupted.
- At 34weeks babies show some ability to habituate to sounds and protect their sleep from some noise disruptions.
- At term many babies may be able to localise different sounds. Stress responses may still be observed to certain sounds.
- Noise levels in the neonatal unit are a major source of stress for premature infants, causing increased blood pressure, heart rate and oxygen consumption [23]. Preterm infants can be exposed to an overwhelming level of noise for weeks or even months during their hospital stay.
- A baby born preterm can have a reduced ability to shut out their response to sound which can impact on state regulation, quality of sleep, feeding and subsequently growth. [24]
- The more immature the cochlea the more sensitive to damage it is.[25]
- Hearing impairment is diagnosed in 2% to 10% of preterm infants compared to only 0.1% of the general paediatric population.[25]
- The sound levels in NICUs often exceed the maximum acceptable level recommended by the American Academy of Paediatrics, which is 45

decibels Reducing sound levels under 45 dB can promote growth and reducing adverse neonatal outcomes. [24,25]

- See Appendix 1[28] for a comparison of noise on the NICU.

Aims:
• **Reduce harmful noise** • **Support autonomic stability and protect sleep** • **Support communication and language development**

Recommendations for sound and auditory system:
Environmental audit should be completed 3 times a year (see appendix 4 for suggested format).
Sound EAR or other noise warning sign system in each defined area can highlight when noise levels are increasing. Recognition and adherence to warnings should be monitored. Device function and settings should be checked- consult manufacturer guidance.
Alarms should be set at safe level and silenced promptly.
Conversations in the room should be low and away from the incubator where possible. Staff should use and model quiet voices.
Ensure ventilation equipment is monitored regularly to reduce any unnecessary functional sounds. E.g. Remove water in tubing of ventilators/CPAP.
Mobile phones (staff and families) should be on silent.
Double walled incubators where possible.
Incubator covers with noise reducing properties should be used.
Adequate bedding material inside the incubator can absorb some sound and may reduce the incidence of sound reverberation. [24]
Incubator doors should be closed carefully. Do not place objects on top of the incubator.
Staff (and families preferably) should wear soft soled shoes.
Bins, apron dispensers and hand washing sinks can cause frequent noise disturbance. Effort should be made to perform activities quietly.
Consideration should be taken in the provision of bins and sinks to minimise noise (soft closed bins), located with enough space to prevent clashing with the wall).
Ear muffs only recommended for short-term use, e.g. during magnetic resonance imaging.[26]
No radios or open nursery music (that effects the whole room). Audio toys/musical mobiles should be used with caution and individualised to each infant. Be aware of the gestation and vulnerability of other babies' in the same area/nearby bed space.
Babies also benefit from positive sounds experiences primarily in the form of soft human voice or singing. [2] Support parents to read or sing softly to their baby (if in an incubator open a door to prevent muffling effect on voice).
Careful consideration should be made for the use of Music therapy/interventions- there is a lack of high-quality evidence supporting the benefits. If considered it should be by a qualified trained professional with appropriate knowledge of neonatal behaviour. [27]
Talk to baby softly before and after cares and support parents to do this. This supports an infants anticipation for touch and movement.[15]

Support parents to observe and respond appropriately to their babies' behavioural cues during their interactions (refer also to Behavioural cues section).
Refer to Appendix 6 for useful resources and information

Light and the Visual System[2, 30]

- At 22 weeks gestation a baby's eyelids are developed but may be still fused. Eyelid tissue is still thin, their pupils are unable to constrict, and therefore they are unable to protect themselves from bright light even when eyelids are closed. (Pupillary reflex is not fully developed until after 34-35 weeks.)
- At term the visual system is very primitive, and most visual development would typically happen post birth. Between 28 and 40 weeks there is rapid growth of the eye structures and therefore the preterm visual system is extremely vulnerable to external influences.[30]
- Developing structures are responsible for binocular vision (combining visual fields of each eye and depth perception).
- At 32-34 weeks a baby may be able to look towards a face however looking is brief and they may not be able to maintain an alert state.
- Exposure to light is not needed in the preterm period to support visual development although opportunities to look at parents faces in a conducive environment can support bonding (within the context of the baby's developmental readiness).[16]
- At 37weeks to term, a baby will generally show preference for human face. They can best see objects 20-25cm away.[2]
- Human faces are preferable visual stimuli to high contrast inanimate images.
- The use of black and white images are neither necessary nor suitable for premature infants.[2]
- Screen time is not necessary for a baby's development. The World Health Organisation and many others recommend no screen time for children under 2 years. [31]
- High levels of light exposure are thought to be associated with retinal damage and may harm the developing visual system[34] Poor visual function is a common outcome in very low birth weight children.[33]
- Excessive lighting causes central nervous system arousal and signs of stress including lower oxygen saturation and poor weight gain.[2]
- Sleep may be easily disturbed with small changes in light levels. [32] Reducing light levels can facilitate rest, energy consumption and promote organization and growth.
- REM sleep is particularly important for development of the visual cortex.[35]
- Constant bright light or near darkness exposure can disturb the development of circadian rhythm. Further research is recommended however the development of our circadian rhythm has associations with our long term health outcomes.[29]
- There is increasing evidence that cycled lighting (providing 12 hours of moderate lighting <300lux during the day and reducing to <50lux at night) is beneficial to circadian rhythmicity, sleep, improved weight gain and improved cardiorespiratory function. [37,38,39]

Aims:
• **Reduce harmful light exposure** • **Support autonomic stability, growth and protect sleep** • **Support visual development- right experience at the right time** • **Support the development of circadian rhythmicity** • **Support a safe working environment**

Recommendations for light and visual system[16,36]
Environmental audit should be completed 3 times a year (see appendix 5 for suggested format).
Room lighting should be maintained at a moderate lighting level during the day and should not exceed 600 lux. Reduce lighting whenever possible and use individually appropriate light protection methods based on gestation and fragility. (See appendix 3 for visual lux guide. **)**
The use of cycled lighting has been found to be better for babies than continuous bright light. From 32 weeks' gestation introduce a cycle such as daytime 100-200 lux and natural light if possible, at night aim for <50 lux[47]
Adjustable dimmer switch lighting for rooms
Windows have functional blinds that can prevent sun glare and that babies are not exposed to bright sunlight
Incubator covers should be used to provide appropriate protection from increased levels of light and sound. (For all babies < 32 weeks, also for babies that benefit from reduced light and sound levels to support their regulation) .[42]
The removal of incubator covers should be done gradually to allow a baby to adapt to the change in environment e.g. assess how baby manages with 1 side of cover up and then 2 sides.
When lifting the incubator cover for cares or to move baby into skin to skin, lift slowly to prevent startle response to sudden environmental change.[32]
When additional procedural/inspection light is required then gradually introduce this to allow the baby to adjust. Sudden bright light such as removal of cover can dysregulate a baby.
Ensure babies are not exposed to bright electrical lighting/overhead lighting. If possible, use a pen torch to examine intravenous line sites.
If direct light is unavoidable due to a medical procedure, then ensure baby has additional shade over their eyes, e.g. eye mask or parent uses hand to shade baby's eyes.
Staff may need access to brighter light for safe working. Lighting should be directed away from the cot side. Babies should be protected from workstation light and lighting from computer screens.[16]
Caregivers benefit from moderate levels of ambient light in order to perform tasks and maintain wakefulness.
Parents and caregivers ideally should have ready access to daylight without having to leave the NICU. In the absence of this they should be encouraged to take regular breaks to access natural daylight (without impacting on the care of the baby). [16,44,45]
Open cots should have a canopy to moderate a baby's exposure to light and protect sleep states.

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. [36]
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. [36]
Protect eyes post ROP examination as pupillary dilation and increased light sensitivity can last for 12 hours or more[41]
Encourage parents to observe their baby's behavioural cues, talk interact with them.[40]
The best form of visual stimulation is face to face interaction. Advise parents that a baby may not always maintain visual attention to them and may look away at times. [16],[40]
Support parents in the appropriate use of toys and visual stimuli. High contrast black and white images are not recommended for preterm babies and should be introduced with caution for older babies on the neonatal unit. [2] Screen time is not appropriate and can impact on development.[46]
Activities to support development should be individualised. Refer to neonatal therapists where available for support with recommendations.
Refer to Appendix 6 for useful resources and information

Benchmarking

1. Environmental audit should be completed 3 times a year

References:		
Acknowledgements to:		Thames Valley and Wessex Neonatal ODN Guidelines- Considerations for Light and Sound, Taste and Smell
		Yorkshire and Humber Neonatal ODN Infant and Family Centred Care Light and Sound Guideline.
		South West Neonatal Network Infant Neuro-Developmental Care Bundle
		EoE Neonatal ODN Developmental Guideline Working Party.
1	Bergman et al EFCNI. (2018)	Very early and continuous skin-to-skin contact - ESCNH - European Standards of Care for Newborn Health in *European Standards for the Care of Newborn Health*.
2	Warren and Bond (2010)	A guide to Infant Development in the Newborn Nursery 5th Edition.
3	Thames Valley and Wessex ODN (2019)	Guideline for Taste and Smell on the Neonatal unit
4	Lipchock SV, Reed DR, Mennella JA (2011)	The gustatory and olfactory systems during infancy: implications for development of feeding behaviors in the high-risk neonate. Clin Perinatol. 2011 Dec;38(4):627-41. doi:
5	Thames Valley and Wessex ODN (2023)	Skin to Skin Guideline Skin to Skin - Neonatal Network South East
6	Stevens B, Yamada J, Ohlsson A, Haliburton S, Shorkey A. (2016)	Sucrose for analgesia in newborn infants undergoing painful procedures. Cochrane Database of Systematic Reviews 2016, Issue 7. Art. No.: CD001069. DOI: 10.1002/14651858.CD001
7	EFCNI. (2018)	English version - ESCNH - European Standards of Care for Newborn Health Infant and Family Centred Developmental Care, in *European Standards for the Care of Newborn Health*.
8	Neshat et al (2024)	Effects of Breast Milk and Vanilla Odors on Premature Neonate's Heart Rate and Blood Oxygen Saturation During and After Venipuncture. Pediatr Neonatol. 2016 Jun;57(3):225-31. doi: 10.1016/j.pedneo.2015.09.004. Epub 2015 Oct 20. PMID: 26560183.
9	Delgado et al (2024	Exposure to the smell and taste of milk to accelerate feeding in preterm infants. Cochrane Database of Systematic Reviews 2024, Issue 5. Art. No.: CD013038. DOI: 10.1002/14651858.CD013038.pub3. Accessed 13 May 2025.
10	Yorkshire and Humber ODN (2024)	YandH Infant-and-Family-Centred-Development-Care-Framework-New.pdf
11	Altimer and Phillips (2016)	The Neonatal Integrative Developmental Care Model: Advanced Clinical Applications of the Seven Core Measures for Neuroprotective Family-centered Developmental Care, Newborn and Infant Nursing Reviews Volume 16, Issue 4, P 30-244

12	Graven, Browne(2008)	Sensory Development in the Fetus, Neonate, and Infant: Introduction and Overview,Newborn and Infant Nursing Reviews,Volume 8, Issue 4,Pages 169-172,
13	South West Neonatal Network (2024)	South West Neonatal Network Developmental Care Guideline South West Neonatal Network Guideline
14	EFCNI Kuhn, Westrup et al (2018)	European Standards of Care for Newborn Health: Supportive sensory environment. Supportive sensory environment - ESCNH - European Standards of Care for Newborn Health
15	NIDCAP (2018)	Five Step Dialogue.
16	Yorkshire and Humber ODN (2024)	Infant and family centred developmental care: Light & Sound Guideline
17	Sensory beginnings (2022)	https://sensorybeginnings.com/blog/we-are-all-sensory-beings-living-in-a-sensory-world accessed May 2025
18	Rodriguez (2016)	Neonatal Intensive Care Unit Lighting Update and Recommendations Neonatal_intensive_care_unit_lighting_Update_and_Recommendations
19	White (2004)	The Sensory Environment of the NICU: Scientific and Design-Related Aspects. Clinics in Perinatology 31(2)
20	Bergman (2014)	The neuroscience of birth - and the case for Zero Separation (scielo.org.za)
21	Larsen JN, Navne LE, Hansson H, *et al (2024)*	Mother–newborn couplet care and the expectations, concerns and educational needs of healthcare professionals: a qualitative study*BMJ Open* 2024;**14:**e086572. doi: 10.1136/bmjopen-2024-086572
22	Gerhadt K.J., Abrams R.M. (2000)	Fetal exposures to sound and vibroacoustic stimulation. J Perinatol 2000;20: S20-29
23	Wachman & Lahav (2011).	The effects of noise on preterm infants in the NICU. Arch Dis Child Fetal Neonatal Ed. 2011 Jul;96(4)
24	Edwards A.D., Austin T.	Noise in the NICU: how prevalent is it and is it a problem? Infant 2016; 12(5): 161-65

25	Sibrecht G, Wróblewska-Seniuk K, Bruschettini M. (2024)	Noise or sound management in the neonatal intensive care unit for preterm or very low birth weight infants. Cochrane Database of Systematic Reviews 2024, Issue 5. Art. No.: CD010333. DOI: 10.1002/14651858.CD010333.pub4.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD010333.pub4/epdf/full
26	Philbin.(2000)	The influence of auditory experience on the behavior of preterm newborns. J Perinatol 2000;20:S77-87
27	Haslbeck et al (2023)	Musical and vocal interventions to improve neurodevelopmental outcomes for preterm infants. Cochrane Database Syst Rev. 2023 Sep 7;9(9):CD013472. doi: 10.1002/14651858.CD013472.pub2. PMID: 37675934; PMCID: PMC10483930.
28	MermaidsandOT Accessed May 2025	Ariel, MAOT, OTR/L | How LOUD is a NICU? 🦻 Here's a handout I created to help place some perspective on the noise levels of typical sounds in the NICU... | Instagram
29	Van Gilst et al (2023)	Effects of the neonatal intensive care environment on circadian health and development of preterm infants. Front Physiol. 2023 Aug 31;14:1243162. doi: 10.3389/fphys.2023.1243162. PMID: 37719464; PMCID: PMC10500197.
30	Kenner C., and McGrath J.M. (2023)	Developmental Care of Newborns and Infants; A Guide for Health Professionals (3*rd* Ed) St Louis Elsevier
31	COUNCIL ON COMMUNICATIONS AND MEDIA, Hill et al (2016)	Media and Young Minds. *Pediatrics* November 2016; 138 (5): e20162591. 10.1542/peds.2016-2591
32	Zores et al (2018)	Observational study found that even small variations in light can wake up very preterm infants in a neonatal intensive care unit. Acta Paediatr. 2018 Jul;107(7):1191-1197. doi: 10.1111/apa.14261. Epub 2018 Feb 27. PMID: 29412484.
33	Cook, White, Batterbury, Clark, (2003)	Ocular Growth and Refractive error development in premature Infants without R.O.P. Investigative Opthalmology and Visual Science March 2003 Vol4 No3
34	Birch,O'Connor, A.R., (2001)	Preterm Birth and Visual Development. Semin. Neonatology 6:487-497
35	Lokhandwala ,Spencer (2022)	Relations between sleep patterns early in life and brain development: A review. Dev Cogn Neurosci. 2022 Aug;56:101130. doi: 10.1016/j.dcn.2022.101130. Epub 2022 Jun 26. PMID: 35779333; PMCID: PMC9254005.
36	Thames Valley and Wessex ODN (2025)	Guideline Framework for Consideration of Light on the Neonatal Unit

37	Hazelhoff et al (2021)	Beginning to See the Light: Lessons Learned From the Development of the Circadian System for Optimizing Light Conditions in the Neonatal Intensive Care Unit. Frontiers in Neuroscience, 15. doi:https://doi.org/10.3389/fnins.2021.634034
38	Marzouk, Hussien& Aziz (2019)	Effectiveness of cycled lighting in neonatal intensive care unit on weight and cardiorespiratory function in preterm infants. International Journal of Paediatrics and Geriatrics.
39	Morag I and Ohlsson A.(2016)	Cycled light in the intensive care unit for preterm and low birth weight infants. Cochrane Database of Systematic Reviews. 2016, Issue 8. Art. No.: CD006982. DOI: 10.1002/14651858.CD006982.pub4 https://www.cochrane.org/CD006982/NEONATAL_cycled-light-intensive-care-unit-preterm-and-low-birth-weight-infants
40	Nugent, et al (2007).	Understanding newborn behavior and early relationships: The Newborn Behavioral Observations (NBO) system handbook.
41	Szigiato et al (2019)	Effect of Eye Masks on Neonatal Stress Following Dilated Retinal Examination: The MASK-ROP Randomized Clinical Trial. JAMA Ophthalmol. 2019 Nov 1;137(11):1265-1272. doi: 10.1001/jamaophthalmol.2019.3379. PMID: 31486844; PMCID: PMC6735413.
42	Richter, M., Kellner, P., & Pineda, R. (2023).	Gravens by design: Supporting and Enhancing NICU Sensory Experiences (SENSE) program — an evidence-based guideline for daily parent-delivered positive multisensory exposures for infants in the NICU. *Neonatology Today*, *18*(10), 66–71
43	White RD (2020)	Consensus Committee on Recommended Design Standards for Advanced Neonatal Care. Recommended standards for newborn ICU design, 9th edition. J Perinatol. 2020 Sep;40(Suppl 1):2-4. doi: 10.1038/s41372-020-0766-2. PMID: 32859957.
44	EFCNI, Moen A, Hallberg B et al (2018)	European Standards of Care for Newborn Health: General layout of the unit.
45	University of Notre Dame (accessed 14/07/25)	NICU Standard 23: Ambient Lighting in Infant Care Areas | NICU Design Standards | NICU Recommended Standards | University of Notre Dame
46	EISMART Accessed 14/07/2025	Ei-SMART-and-Brazelton-Screen-time-leaflet-2.pdf
47	NHS Greater Glasgow and Clyde	Developmental care guideline (964) | NHSGGC Accessed 21/07/2025

Appendix 1

Eight sensory Systems:

Tactile (touch) system

Auditory(hearing) system

Vision (sight) system

Olfactory (smell) system

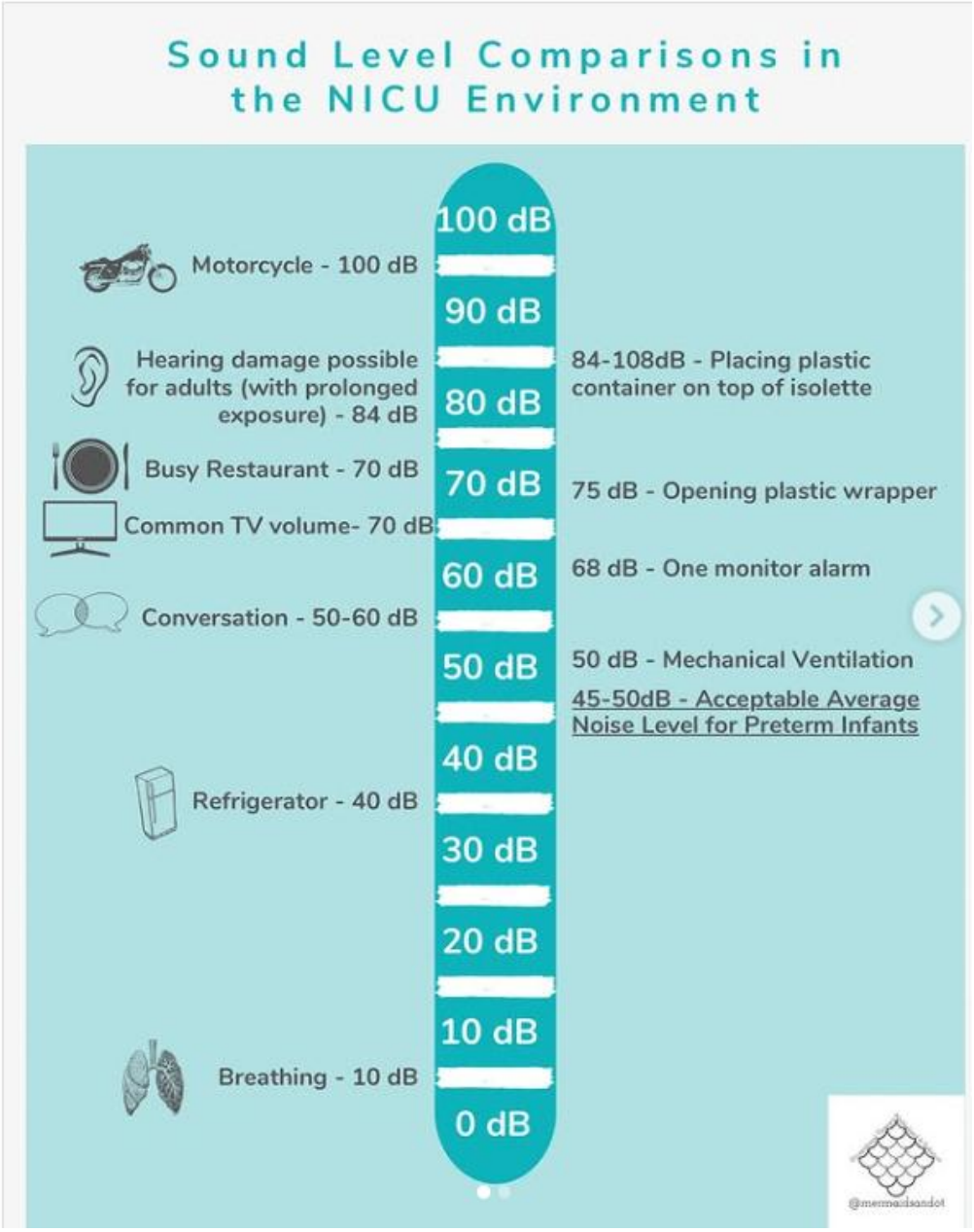
Gustatory (taste) system

Vestibular system (balance and orientation in space, movement and position of head relative to gravity).

Proprioception (sense of muscle and/or joint movements, body awareness) System

Interoception system (physiological/physical condition of the body).

Appendix 2


Sound Level Comparisons in the NICU Environment
100 dB
90 dB
80 dB
70 dB
60 dB
50 dB
40 dB
30 dB
20 dB
10 dB
0 dB
Motorcycle - 100 dB
Hearing damage possible for adults (with prolonged exposure) - 84 dB
Busy Restaurant - 70 dB
Common TV volume- 70 dB
Conversation - 50-60 dB
Refrigerator - 40 dB
Breathing - 10 dB
84-108dB - Placing plastic container on top of isolette
75 dB - Opening plastic wrapper
68 dB - One monitor alarm
50 dB - Mechanical Ventilation
45-50dB - Acceptable Average Noise Level for Preterm Infants

Appendix 3

	LUX	DESCRIPTION
	50,000	British summer sunshine
	5,000	Overcast sky
	500	Well-lit office
	300	Minimum for easy reading
	50	Passageway/outside working area
	15	Good main road lighting
	10	Sunset
	5	Typical side road lighting
	2	Minimum security risk lighting
	1	Twilight

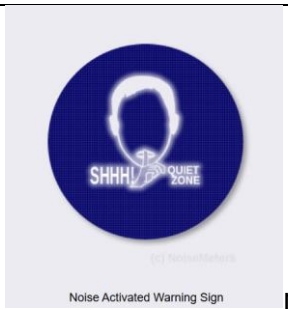
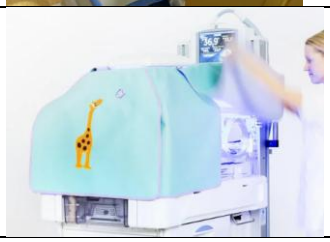
Ref: NHSGGC: Developmental care guideline

Appendix 4 Environmental audit – Noise

Noise Audit for Neonatal Unit					
Location:					
Date:					
Time:	**0**	**1**	**2**	**Score**	**Comments**
Radio/Music devices off in general areas & Mobiles/Bleeps on silent	No	Yes some	Yes		
Alarms/monitors/telephones on safest lowest volume	No	Yes some	Yes all		
Evidence of items being placed on top of incubators	Yes	Some	No		
Incubator covers in use	No	Yes some	Yes all		
Additional environmental noise – please comment	Many sources of additional noise	Some sources of additional noise	No sources of additional noise		
Parents aware of the importance of appropriate sound exposure (including the use of their own voices as well as protection from unnecessary noise)	No	Yes some	Yes all		
Total Score					
Additional Environment noise examples: bin closing noisily, apron dispenser, faulty equipment, excessive talking etc					
12 – Ideal cumulative score;					
Produced by EoE Neonatal ODN Adapted with permission from Yorkshire & Humber ODN Light and sound guideline					

Appendix 5 - Environmental audit - Light

Light Audit for Neonatal Unit					
Location:					
Date:					
Time:	**0**	**1**	**2**	**Score**	**Comments**
Incubator covers in use where appropriate.	No	Yes some	Yes all		
Infants shaded from direct light? (other than under phototherapy)	No	Yes some	Yes all		
Blinds on windows and ability to block out bright sunlight?	No	Yes some	Yes all		
Cot Canopy in use for all cots/bassinets	No	Yes some	Yes all		
Lighting levels adjustable in the rooms?	No	Yes some	Yes all		
Parents aware of the need to protect their baby from excessive light (as is appropriate for their gestational age and developmental stage)	No	Yes some	Yes all		
Total Score /12					
Additional Environment noise examples: bin closing noisily, apron dispenser, faulty equipment, excessive talking etc					
12 – Ideal cumulative score;					
Produced by EoE Neonatal ODN Adapted with permission from Yorkshire & Humber ODN Light and sound guideline					

Appendix 6 - Products to help support a developmentally supportive environment		
Please note this list has been produced to save time when researching products to help promote a developmentally supportive environment, it is not an exclusive list of suppliers and you must consult manufacturers guidelines and your own infection control processes prior to use. The EoE neonatal ODN do not specifically endorse any of these products. This information is for you to arrange a demonstration of products if appropriate.		
	Product	**Contact**
Noise Meter	 Sound Ear – features a large ear that lights up green, yellow or red as the noise levels increase.	https://www.noisemeters.co.uk/ Noise Display SoundEar | Draeger
Noise Meter	 noise level meter lights up Shhh when sound levels too high	Noise Sign - Noise Activated Warning Sign for Quiet Zones
Incubator cover		Cuski Incubator Cover Anti-bacterial Anti-slip & Blackout
Incubator cover		IncuCap - Inspiration Healthcare conceptnatal - Incubator covers

Cot Canopy		Kanmed Cot Tent - Central Medical Supplies

Appendix 7 Resources:

- The SENSE programme NICU Therapy Lab at USC is one example of a resource that can be used by trained administrators, typically Therapists with neonatal training to support the provision of individualised sensory recommendations.
- Sensory Beginnings provide multi-professional education and resources to empower and encourage those working within neonatal, perinatal and early intervention to provide the best possible sensory-informed care for babies and their families.
- Family and Infant Neurodevelopmental Education | FINE Training

Exceptional Circumstances Form

Form to be completed in the **exceptional** circumstances that the Trust is not able to follow ODN approved guidelines.

Details of person completing the form:	
Title:	Organisation:
First name:	Email contact address:
Surname:	Telephone contact number:
Title of document to be excepted from:	
Rationale why Trust is unable to adhere to the document:	

Signature of speciality Clinical Lead: Date:	Signature of Trust Nursing / Medical Director: Date:
Hard Copy Received by ODN (date and sign):	Date acknowledgement receipt sent out:

Please email form to: kelly.hart5@nhs.net requesting receipt.

Send hard signed copy to: Kelly Hart

EOE ODN Office Manager

Box 402

Rosie Hospital

Robinson Way

Cambridge University Hospital

Hills Road

Cambridge CB2 0SW