Neonatal Society Spring Meeting, 10th March 2023

Royal Society of Medicine, 1 Wimpole Street, London, W1G 0AE
Meeting Virtual Link: To be emailed to delegates on 9th March 2023

08:45. Tea/Coffee

Session 1
09:15. Rupa Rubinstein
Fathers’ experiences of family integrated care (FiCare) in the neonatal unit, a systematic review

09:30. Topun Austin
Developing a digital support tool for the families of babies being cared for in neonatal units

09:45. David Wertheim
Changes in blood oxygen saturations associated with seizures in term babies

10:00. Vinita Verma
Impact of neonatal seizures on brain temperature in a preclinical model

10:15. Tea / coffee

Session 2
10:45. James Webbe
Primary outcomes in neonatal trials: heterogeneity, gaps and how to strengthen reporting

11:00. Emily Prior
Childhood body composition following preterm birth: a systematic review and meta-analysis

11:15. Jessica Burgess-Shannon
Outcomes following the introduction of standard parenteral nutrition in preterm infants: A whole population non-concurrent control study

11:30. Kadi Vaher
Neonatal gut microbiota and brain dysmaturation in preterm infants

11:45. Keynote Lecture
Prof Samantha Johnson, Professor of Child Development, Department of Population Health Sciences, University of Leicester
Interventions to improve neurodevelopmental outcomes in children born preterm

12:45. Lunch break (90 minutes)
Session 3
14:15. Ela Chakkarapani
Heart rate variability during cuddling encephalopathic infants undergoing therapeutic hypothermia and intensive care

14:30. Lancelot Jamie Millar
Hypoglycaemia in Neonates with Moderate-to-Severe Hypoxic Ischaemic Encephalopathy (HIE) undergoing Therapeutic Hypothermia

14:45. Isabell Nessel
Neonates with Substantial Brain Injury After Therapeutic Hypothermia for Hypoxic-Ischemic Encephalopathy Have Decreased Omega-3 Long-Chain Polyunsaturated Fatty Acids

15:00. Arthur Spencer
School-age children cooled for neonatal encephalopathy without cerebral palsy retain healthy resting-state static and dynamic functional connectivity

15:15. Katie McKinnon
Integrated analysis of preterm birth and socioeconomic status with neonatal brain structure

15:30. Afternoon Tea / Coffee

Session 4
16:00. Rising Star Annual Invited Lecture
Dr Rebecca Gentek, Chancellor’s Fellow & Kennedy Trust Senior Research Fellow, Centre for Inflammation Research, University of Edinburgh
The intrauterine environment, immune development, and disease in later life

16:30. Federica Amati
Infant body composition and long-term health outcomes: a systematic review and gap analysis

16:45. Tilly Pillay
Place of preterm births at 27-31weeks: mortality and morbidity outcomes from OPTIPREM

Session 5
17:00. Prize for best presentation by a trainee

17:10. McCance Lecture – Introduced by Professor Andy Ewer, President
Prof John Cryan, Professor & Chair, Dept. of Anatomy & Neuroscience / Vice President for Research & Innovation, University College Cork
The neonatal microbiome: gut-brain axis: implications for lifelong health

18:10. Close of meeting
FATHERS’ EXPERIENCES OF FAMILY INTEGRATED CARE (FICARE) IN THE NEONATAL UNIT, A SYSTEMATIC REVIEW

Authors (Presenting author underlined. If no author is a Society member please provide the name of the member introducing the author to the Society)

Rupa Rubinstein1,2, Valentina Pompa3, Kaye Bagshaw4, Julian Bose5, Minesh Khashu6, Katie Gallagher7, Narendra Aladangady1,2

Corresponding author e-mail address: N.Aladangady@nhs.net

Institution(s)


Introduction (include hypothesis)

Family Integrated Care (FICare) is an ethos whereby parents are considered as partners and collaborators in the care of their baby on the neonatal unit (NU). However, FICare studies primarily involve mothers, and the fathers are rarely active participants. This systematic review aimed to explore the reported experiences of fathers within the FICare model.

Methods (include source of funding and ethical approval if required)

The systematic review was conducted according to PRISMA guidelines & registered with the PROSPERO database1.6 databases were searched in October 2022. We considered primary research published from January 2000 onwards, in English, with at least 50% father participants. 264 papers were identified (Fig 1), after removal of duplicates and non-English papers. 109 papers were screened by 2 independent researchers (RR & VP). Third researcher mediation was arranged (NA). 8 papers (3 qualitative, 4 quantitative, 1 mixed methods) were included. Quality assessments were performed with the COREQ and CASP (Cohort and RCT) checklists.

Results

450 fathers of babies born from 24 weeks (majority 30 to 35 weeks) gestation who were admitted to a NU were included. The fathers’ mean age was 35.4 years. Demographics of fathers were inconsistently reported, but the majority of fathers were native to the country of study origin. FICare interventions ranged from three 50-minute education sessions with ongoing support in an open bay, to single family rooms with couplet care and expectation of parents to be primary caregivers. The qualitative studies only included fathers and used semi-structured interviews. 10 different questionnaires were used with the focus on ‘parental mental health’, ‘bonding and attachment’, ‘parental needs and satisfaction’, and ‘relationship with neonatal nurses’. Assuming the parental role was significantly improved with FICare and the adoption of parenting responsibility was positively reported. Fears, worries & the need for honest clear communication featured strongly. Attachment & nurse-parent partnership was improved as was perception of the infants’ appearance & behaviours.

Conclusions

FICare improves fathers’ parental role perception and supports their transition into fatherhood. Most fathers studied were parents of late preterm or term infants. Further research is needed to assess the impact of FICare on fathers a variety of backgrounds and fathers of extremely premature infants.

References (include acknowledgement here if appropriate)


Check box if presenting author is a trainee: basic science trainee ☐ clinical trainee ☒

All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously: ☒

Senior author supporting presentation on day of meeting: Professor Narendra Aladangady
Records identified from:
Databases n = 264
(BNI= 21, CINAHL= 82,
Embase= 59, Emcare= 45,
Medline= 48, Psychology and
Behavioural Sciences and
Disorders= 2, PSYCInfo= 6)
Other sources (n = 1)

Records removed before
screening:
Duplicate records n = 138

Records screened n = 126

Records excluded as not in
English n = 17

Records sought for retrieval
n = 109

Records not retrieved (n = 0)

Records assessed for eligibility
n = 109

Records excluded: n = 101
Not in NICU (n = 14)
Not FiCare (n = 38)
<50% fathers (n = 45)
Not primary research (n = 1)
Not focussed on fathers’
experiences (n = 3)

Records included in review
(n = 8)
Title (Upper case)

Developing a digital support tool for the families of babies being cared for in neonatal units.

Authors (Presenting author underlined. If no author is a Society member please provide the name of the member introducing the author to the Society)

Austin T1, Cullum K2, Merchant N3, Chetcuti Ganado C4, Walston F5, Beake L6, Joughin J6, Copley S6, Evans C6.

Corresponding author e-mail address: ta338@cam.ac.uk

Institution(s)


Introduction (include hypothesis)

NICU's are increasingly adopting a family integrated approach to the management of sick and preterm infants1. Having a baby on NICU is incredibly stressful for parents and other family members, particularly if their baby requires transfer to another unit. Communication at this time can be challenging and parents are often overwhelmed with information which they are often not able to process. The aim of this project was to develop a digital support tool for families to help navigate their baby's journey from birth to discharge.

Methods (include source of funding and ethical approval if required)

Initial funding for this project was from the Health Foundation Q Community2. The project was divided into two key phases: firstly, to look at the patient pathway, identify unmet needs and scope potential solutions. The second phase was to develop the chosen technology in a real-world setting. To this end we worked with the company Little Journey, who had successfully developed an app for children requiring admission to hospital for surgery. The development of the neonatal Little Journey app followed an iterative process with continual stakeholder engagement and focus on the end user (www.littlejourney.health).

Results

Stakeholder Identification & Patient Pathway Mapping Working with the Cambridge University Institute for Manufacturing3 we undertook an ecosystem modelling workshop, which uses a standard process for development and prioritization to identify candidate technologies. Parent Engagement This was central to both phases of the projects with consultation with parent advisory groups following each iteration of the project. At a macro level key themes emerged, such as lack of early communication and need for practical information about each hospital; during the design phase of the app parents guided the overall design and content based on their experience. Identifying a Suitable Platform The NIHR Brain Injury MedTech Cooperative4 organised a Brain Injury Technology Transfer think tank where representatives from SME’s and regulators met to discuss unmet needs and potential technology solutions within the NHS Digital regulatory framework. Based on this the Little Journey platform was selected as it best aligned with the project aims and was NHS Digital compliant.

Conclusions

Using a standardised methodological approach to identify the best technological solution to help support parents, the Little Journey neonatal app will be launched in the Spring of 2023. As well as bespoke information on each participating hospital (including 360 virtual tours), the app will contain content helpful to families.

References (include acknowledgement here if appropriate)


Check box if presenting author is a trainee: basic science trainee ☐ clinical trainee ☐

All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously: ☐

Senior author supporting presentation on day of meeting: T. Austin
Introduction (include hypothesis)

Seizures in newborn infants are considered a neurological emergency requiring prompt treatment to minimise further brain injury. Heart rate and respiratory rate changes have been observed associated with seizures in preterm infants (1). However, there is little data about such measurements during seizures in term newborns. The aim of this study was to investigate routinely collected physiological measurements associated with seizures in term neonates.

Methods (include source of funding and ethical approval if required)

Newborn term infants admitted to the tertiary level neonatal unit at the Royal London Hospital had routine cerebral function monitoring (CFM); two channels (left and right) of amplitude-integrated EEG (aEEG) with raw EEG for seizures and electrocortical background. The CFM recordings were synchronised with physiological data obtained (ECG, SpO₂ oxygen saturations and respiratory rate). Sections of traces with evidence of clear EEG seizure activity from the CFM recordings were compared with physiological data recorded at the same time. Data were analysed using iCollect (GE Healthcare, Finland), CFM Olympic Brainz Monitor Viewer (Natus Medical Inc., USA), Excel (Microsoft Corporation, USA), Minitab v19 (Minitab LLC., USA) and software we developed in MATLAB (The MathWorks Inc., USA). This study was supported by a grant from Barts Charity and NHS REC Ethics approval was obtained (REC reference 20/PR/0969).

Results

Recordings were obtained in 36 term born babies at risk of seizures. 36% (13/36) of the babies who had CFM monitoring were noted to have clear electrographic seizures. Simultaneous measurements of physiological data were recorded for 10 of these neonates; of the ten babies the median (range) gestation was 39 (37 to 41) weeks and the primary diagnosis was hypoxic ischaemic encephalopathy (HIE) in 6 of the babies and perinatal stroke in 3 of the neonates. In 9 of these babies, an acute drop in SpO₂ oxygen saturation of at least 8% was associated with at least one EEG seizure; there were accompanying apnoeas in three babies.

Conclusions

 Decreases in oxygen saturations were observed in association with EEG seizures in term infants. Recording physiological data alongside EEG monitoring may assist in improving seizure detection. Seizures should be considered in the aetiology in infants with unexplained drops in blood oxygen saturations observed in at-risk newborn infants.

References (include acknowledgement here if appropriate)


All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously:

Senior author supporting presentation on day of meeting: Dr Divyen Shah.
IMPACT OF NEONATAL SEIZURES ON BRAIN TEMPERATURE IN A PRECLINICAL MODEL

Authors
Vinita Verma1, Frédéric Lange2, Chris Meehan1, Alison Mintoft1, Georgina Norris1, Ellie Campbell1, Katie Tucker1, Kelly Harvey-Jones1, Xavier Golay3, Geraldine Boylan4, Ilias Tachtsidis2, Nicola Robertson1, Subhabrata Mitra1

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Institution(s)
1Institute for Women’s Health, University College London, UK, 2Department of Medical Physics and Biomedical Engineering, University College London, UK, 3Institute of Neurology, University College London, UK, 4INFANT Research Centre, University College Cork, Ireland

Introduction (include hypothesis)

Brain tissue temperature (BT) is a dynamic balance of heat production from metabolism and heat removal via a thermoregulatory process. Perinatal brain injuries and seizures are likely to induce changes in brain temperature. Seizures are the most common neonatal emergencies in neonates and are associated with poor neurodevelopmental outcomes. This study aims to assess the possibility of monitoring brain temperature at the cot side using optical technologies and investigate the impact of seizures on brain temperature (1).

Methods (include source of funding and ethical approval if required)

Study funded by NIHR UCLH BRC. 16 healthy male newborn piglets were divided into 3 cohort groups to either receive normal saline vehicles (control group A, n=3), bicuculline 4mg/kg IV (seizure group B, n=7) to induce seizures or bicuculline 4mg/kg IV followed by phenobarbitone loading dose 20mg/kg after 10 min of continuous seizure activity on EEG (treated seizure group C, n=6). Piglets were continuously monitored with systemic monitoring, optical neuro monitoring and continuous video EEG. The novel optical platform combines broadband near-infrared spectroscopy (BNIRS) and diffuse correlation spectroscopy (DCS) that can monitor cerebral mitochondrial metabolism (oxCCO, cytochrome-c-oxidase), oxygenation and microvascular blood flow (BFI). A novel algorithm based on the linear temperature-dependent changes in NIR water absorption spectra on BNIRS was used to estimate the tissue temperature (1).

Results

Tonic clinic seizures noted immediately after starting the bicuculline infusion. Brain temperature increased in the untreated Seizure group (B) at 30min after induction of seizures, but this wasn’t noticed in the treated seizure group (C). The difference between the untreated and treated seizure group was not statistically significant at 30min (p=0.59). The difference decreased at 2 hours after seizure induction as well in both groups (p=0.75).

Conclusions

This study demonstrated the possibility of using optical monitoring to continuously monitor BT in a preclinical model of neonatal seizures. BT increased following neonatal seizures but normalized within 2 hours. The findings in this preclinical study need to be further validated in a larger clinical study.

References (include acknowledgement here if appropriate)


Check box if presenting author is a trainee: basic science trainee ☐ clinical trainee ☒

All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously: ☐

Senior author supporting presentation on day of meeting: Subhabrata Mitra
Introduction (include hypothesis)
There is wide variability in the selection and reporting of outcomes in neonatal trials with key information frequently omitted: this can impact usability of trial findings. CONSORT-Outcomes 2022 is a new, harmonised, evidence-based reporting guideline for trial outcomes. We reviewed recently published large neonatal trials using this guidance to identify strengths and weaknesses of primary outcome reporting and identify exemplars to strengthen outcome reporting for future neonatal trials.

Methods (include source of funding and ethical approval if required)
Neonatal randomised controlled trials including ≥100 participants in each arm published between 2015-2020 with a primary outcome included in the Neonatal Core Outcomes Set were identified. Primary outcome reporting was reviewed using CONSORT 2010 and CONSORT-Outcomes 2022 (1) guidelines by raters recruited from Cochrane Neonatal. They evaluated reporting completeness for the primary outcome for each trial. In addition, examples of clear and complete outcome reporting were identified with verbatim text extracted from the original trial reports.

Results
Thirty-six trials were reviewed by 39 assessors. Levels of outcome reporting completeness were highly variable. All trials fully reported the primary outcome measurement domain, statistical methods used to compare treatment groups, and participant flow. However, other items were only reported in a minority of trials. These items related to concepts like handling of outcome multiplicity (42% of trials), minimally important difference (28% of trials), and outcome data missingness (24% of trials). Examples of good reporting were identified and are presented to strengthen future research reporting. One instance of a good reporting example that we identified was related to Results - Outcomes and Estimation: “There was no significant difference in mortality between the 2 groups with 83 deaths (20.5%) in the wrap group and 79 deaths (20%) in the no-wrap group (OR 1.0, 95% CI 0.7-1.5)” (Reilly et al., 2015)

Conclusions
Primary outcome reporting in neonatal trials often lacks information needed for interpretability of results, knowledge synthesis, and evidence-based decision-making. Use of existing reporting guidelines and the examples of good reporting will enhance neonatal trials by improving the transmission of outcomes information.

References (include acknowledgement here if appropriate)

Check box if presenting author is a trainee: basic science trainee ☑ clinical trainee ☑

All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously: ☑

Senior author supporting presentation on day of meeting:
CHILDHOOD BODY COMPOSITION FOLLOWING PRETERM BIRTH: A SYSTEMATIC REVIEW AND META-ANALYSIS

Authors (Presenting author underlined. If no author is a Society member please provide the name of the member introducing the author to the Society)

Emily Prior¹, Shahnia Surendra ², Federica Amati ³, Chris Gale⁴, Sabita Uthaya⁵

Corresponding author e-mail address: emily.prior05@imperial.ac.uk

Institution(s)

1,4,5 Section of Neonatal Medicine, School of Public Health, Imperial College London, London, UK, ² Imperial College London School of Medicine, ³ Department of Primary Care and Public Health, School of Public Health, Imperial College London

Introduction (include hypothesis)

Preterm infants at term corrected age have been observed to have altered body composition compared to term born infants with increased abdominal adipose tissue¹ and total greater percentage body fat but reduced absolute fat and fat-free mass². It is unknown if these differences persist through childhood although similar changes have been observed in cross sectional studies of young adults born preterm³. Altered body composition may be important for future health as increased adiposity is associated with conditions such as insulin resistance and high blood pressure in later life and to which preterm born young adults also appear to be at greater risk⁴.

Methods (include source of funding and ethical approval if required)

The databases Embase, Medline and Maternity & Infant Care Database were searched between 1947 and November 2021. The search strategy was reviewed by a medical librarian. Included studies had to have directly compared measures of body composition between preterm and term children at the same chronological age between 1 and 12 years old. There was no restriction on language or study setting. The review protocol was registered prospectively on Prospero (CRD42021209698). Meta-analyses were performed in Rev-Man 5. Risk of bias assessment was carried out according to the Joanna Biggs Institute checklist for Analytical Cross-Sectional Studies.

Results

The final search strategy identified 3203 results. Following removal of 672 duplicates, 2531 studies were screened against title and abstract and 140 reviewed in full text; 27 studies were included in final review and meta-analysis. On request six authors provided additional data. The outcomes analysed included % body fat, fat mass (FM) (Kg) and fat-free mass (FFM) (Kg) in preterm born compared to term born children at between 3-12 years old. The methods used to measure body composition were dual energy x ray absorptiometry, air displacement plethysmography and bioelectrical impedance analysis. Primary analyses pooled data from different body composition measurement methods with planned sub-group analyses by method. Preterm children had reduced % body fat (mean difference 0.74%, P=0.02) (21 studies, n=31268), reduced fat mass (0.86kg, p<0.00001, 13 studies, n= 11939) and reduced fat-free mass (0.98kg, p<0.00001, 11 studies, n=5123) (figure i).

Conclusions

Children born preterm display reduced FM and FFM suggesting the persistence of altered body composition from infancy through childhood. Further longitudinal studies are needed to evaluate the long term health risks of these changes in children and young adults.

References (include acknowledgement here if appropriate)


Check box if presenting author is a trainee:  basic science trainee ☐  clinical trainee ☒
Figure i: Forest plot comparing Fat-free mass (FFM) (Kg) between preterm and term children aged 3-11 years old children: Preterm children have reduced FFM (0.98kg)

<table>
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<th>Study or Subgroup</th>
<th>FFM (kg) Preterm children</th>
<th>FFM (kg) Term children</th>
<th>Mean Difference</th>
<th>Mean Difference</th>
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<td></td>
<td>Mean (kg)</td>
<td>SD (kg)</td>
<td>Total</td>
<td>Mean (kg)</td>
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<td>12.29</td>
<td>2.39</td>
<td>91</td>
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<td>20</td>
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<td>0.8437</td>
<td>38</td>
<td>14.08</td>
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<tr>
<td>Total (95% CI)</td>
<td></td>
<td></td>
<td>1196</td>
<td>3927</td>
</tr>
</tbody>
</table>

Heterogeneity: Tau² = 2.29; Chi² = 34.44, df = 10 (p = 0.0002); I² = 71%
Test for overall effect Z = 5.34 (p < 0.00001)
Title (Upper case)

Outcomes following the introduction of standard parenteral nutrition in preterm infants: A whole population non-concurrent control study

Authors

Jessica Burgess-Shannon², Mohammad Chehrazi¹, Julia Lanoue¹, Neena Modi¹,², Sabita Uthaya¹,²

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Institution(s)

¹ Section of Neonatal Medicine, School of Public Health, Faculty of Medicine, Imperial College London
² Chelsea and Westminster Hospital London

Introduction (include hypothesis)

International guidelines including from the UK National Institute of Health and Care Excellence recommend standard parenteral nutrition (PN) formulations; however, evidence in preterm infants is weak. In 2018, as part of a quality improvement project, neonatal units in London, UK that are organised into three geographical networks, switched to using one of two standard PN formulations. Units in one network adopted the formulation used in the NEON trial which examined immediate versus incremental delivery of recommended daily amino acids; two networks adopted the of the SCAMP trial formulation which delivers a higher macronutrient intake.

Methods (include source of funding and ethical approval if required)

We conducted a retrospective, multi-centre, whole population, non-concurrent control study using data from the UK National Neonatal Research Database for the period 1st January 2008 to 31st December 2020. We compared outcomes in preterm infants born <31 weeks gestation before and after the adoption of standard PN using augmented inverse probability weighting to control for confounders. The primary outcome was morbidity-free survival to discharge from neonatal care. In sub-group analyses, we compared outcomes between the London networks that adopted different formulations.

Results

Of 12,633 eligible infants, 10,788 were born before, and 1845 after the adoption of standard PN. Morbidity free survival decreased by an average of 10.2% (95% CI 6.4 to 14.1) p = 0.001, following the introduction of standard PN. There was no difference in survival to discharge but there were higher rates of late onset sepsis, bronchopulmonary dysplasia, treatment of retinopathy of prematurity and severe brain injury following the adoption of standard PN. The average treatment effect (ATE) varied by geographical region. The network that adopted the NEON formulation showed no difference in morbidity free survival (ATE -1.9%, 95% CI -10.7 to -6.9, p=0.68). In contrast, in both networks that adopted the SCAMP formulation there was a statistically significant decrease in morbidity free survival following the introduction of standard PN (ATE -13%, 95% CI -19.5 to -6.5, p<0.0001; ATE -10.9%, 95% CI -17.1 to -4.6, p<0.0001).

Conclusions

This study indicates that universal adoption of standard PN may not be beneficial and that the type of formulation is also an important consideration. It adds to the growing body of evidence across age groups that suggests that high and high intakes of parenteral macronutrients may be harmful in intensive care patients. The optimal composition of PN in preterm infants requires identification in rigorous studies addressing functional outcomes. Our study highlights the potential dangers of implementing non-evidenced based guidelines, and the necessity for rigorous evaluation of the impacts of quality improvement programmes.

References (include acknowledgement here if appropriate)


Check box if presenting author is a trainee: basic science trainee □ clinical trainee x□

All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously: x□

Senior author supporting presentation on day of meeting: Dr Sabita Uthaya
NEONATAL GUT MICROBIOTA AND BRAIN DYSMATURATION IN PRETERM INFANTS

Authors (Presenting author underlined. If no author is a Society member please provide the name of the member introducing the author to the Society)

K Vaher\(^1\), M Blesa Cabeza\(^2\), P Lusarreta Parga\(^2\), J Binkowska\(^3\), G Sullivan\(^4\), DQ Stoye\(^5\), J Hall\(^6\), AJ Quigley\(^7\), MJ Thripleton\(^d\), ME Bastin\(^d\), D Bogaert\(^d\), and JP Boardman\(^n,d\)

Corresponding author e-mail address: james.boardman@ed.ac.uk

Institution(s)

\(^n\)MRC Centre for Reproductive Health, University of Edinburgh, \(^d\)Centre for Inflammation Research, University of Edinburgh, \(^d\)Department of Paediatric Radiology, Royal Hospital for Children and Young People, \(^d\)Centre for Clinical Brain Sciences, University of Edinburgh

Introduction (include hypothesis)

The gut microbiota is associated with brain development and behaviour in typically developing infants and children\(^1\). However, the relationship between the early-life gut microbiota and brain structure in preterm infants, who are at risk for cerebral dysmaturation (encephalopathy of prematurity, EoP), adverse neurodevelopmental outcomes and gut dysbiosis, is poorly understood. We tested the hypothesis that the gut microbiota community composition and diversity are associated with MRI features of EoP.

Methods (include source of funding and ethical approval if required)

79 preterm (median gestational age [GA] at birth 29\(^{+6}\) weeks) neonates\(^2\) (NRES 16/SS/0154) underwent brain structural and diffusion MRI (median GA at MRI 40\(^{+4}\) weeks). Brain tissue volumes and mean diffusion MRI metrics, and mean cortical measures were calculated\(^3\). Faecal samples were collected at the end of neonatal unit care (median GA at sample collection 35\(^{+6}\) weeks) and microbiota profiles generated by 16S rRNA sequencing. We used principal coordinates (PCo) analysis to capture variance in the microbial community structure and calculated Observed species and Shannon index for alpha diversity. Linear regression modelling was used to test for associations between gut microbiota and brain structural features. Post-hoc taxa-level analyses were conducted using the MaAsLin2 tool\(^4\).

Results

Four PCo-s captured 41% of variance in microbiota composition data. PCo1 mainly indicated lower abundance of \textit{Bifidobacterium}, PCo2 lower \textit{Escherichia/Shigella} and higher \textit{Enterobacteriaceae}, PCo3 lower \textit{Klebsiella}, and PCo4 lower \textit{Enterococcus}. PCo1 correlated with brain tissue volumes, but none remained significant after adjustment for multiple comparisons (Fig 1A). PCo2 correlated with deep grey matter NDI and ODI, PCo3 with white matter RD, and PCo4 with cortical grey matter ODI; microbiota richness (Observed species) correlated with deep grey matter microstructure (Fig 1B). MaAsLin2 results were partially in line with these findings, but also revealed relationships not captured with the PCo-s: taxa associated with deep grey matter microstructure included \textit{Veillonella} (β range -0.93 to 1.27), \textit{Streptococcus} (β range 0.76 to 0.82), \textit{Klebsiella} (β range -1.01 to 1.23) and \textit{Finegoldia} (β range 0.65 to 0.74), whereas \textit{Staphylococcus} correlated with cortical ODI (β=0.49).

Conclusions

Preterm gut microbial community composition and diversity associate with MRI markers of EoP in white matter and deep and cortical grey matter, suggesting that microbiota-brain interactions may be involved in the dysmaturational processes linked to preterm birth.

References (include acknowledgement here if appropriate)


Check box if presenting author is a trainee: basic science trainee ☒ clinical trainee □

All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously: ☒

Senior author supporting presentation on day of meeting: Prof James P Boardman
**Fig 1. Microbiota associations with brain volumetric (A) and microstructural (B) measures.** Models are adjusted for gestational age at birth and at scan; microbiota features were first adjusted for gestational age at sample collection via linear regression, retaining the residuals. Full colour points indicate nominal p-value < 0.05; asterisks (*) indicate FDR-adjusted p-value < 0.25. Relative volumes are calculated by normalising to total tissue volume (the sum of the volumes of cortical grey matter, white matter, deep grey matter, cerebellum, brainstem, hippocampi and amygdalae). The variance in microbiota composition data explained by each of the PCo-s is the following: PCo1 15.05%, PCo2 13.22%, PCo3 8.07%, PCo4 4.53%. FA = fractional anisotropy; RD = radial diffusivity; NDI = neurite density index; ODI = orientation dispersion index; ISO = isotropic volume fraction; cGM = cortical grey matter; dGM = deep grey matter, CB = cerebellum; sulc = sulcal depth; GI = gyrification index, g = general factor.
HEART RATE VARIABILITY DURING CUDDLING ENCEPHALOPATHIC INFANTS UNDERGOING THERAPEUTIC HYPOTHERMIA AND INTENSIVE CARE

Authors (Presenting author underlined. If no author is a Society member please provide the name of the member introducing the author to the Society)

Odd D1, Okano S2, E Chakkarapani2,3 on behalf of CoolCuddle study investigators.

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Introduction (include hypothesis)

Parent-infant coregulation during kangaroo care in preterm infants with constant skin-to-skin contact may influence the regulation of infant’s autonomic nervous system.1 We hypothesised that “CoolCuddle”, parents interacting physically and emotionally with their babies placed on their laps, whilst undergoing therapeutic hypothermia and intensive care (TH) for hypoxic ischaemic encephalopathy (HIE), and characteristics of infants will influence the regulation of autonomic nervous system.

Methods (include source of funding and ethical approval if required)

In this prospective observational study, we included infants born at ≥36 weeks gestation with HIE and underwent CoolCuddle during TH. We measured autonomic nervous system regulation using heart rate variability (HRV) analysed from ECG recordings (VitaLogik 6000 series). Primary outcomes included mean RR interval of normal beats (ANN), standard deviation of RR interval of normal beats (SDNN), and root mean square of differences of successive intervals of normal beats (RMSSD). Multilevel clustered linear models (by infants and cuddle) were performed. Comparisons were made by likelihood ratio test. Funding: NIHR RfPB. HRA approval: 19/NI/0143.

Results

Twenty-six infants with HIE (24/26 with moderate-severe abnormal aEEG before TH), had HRV measures recorded across 65 CoolCuddles. Mean age of the infants was 51.5 (39.5) hours of age at the start of the cuddle. Pre-cuddle HRV measures were not related to patient characteristics, and overall heart rate, ANN, SDDNN and RMSSD did not differ between pre-cuddle, cuddle and post-cuddle period. The profile of change across the pre, cuddle and post-cuddle period varied in heart rate (p=0.02) and ANN (p=0.02) between infants with low (<7) or normal 1-min Apgar scores, for SDNN (p=0.04) between infants with low (<7) or normal 5-min Apgar scores and for ANN (p=0.04) between infants with moderate-severe or normal baseline aEEG. ANN and SDNN showed greater reductions during the cuddle and post cuddle (compared to pre-cuddle) in infants with lower Apgar score and more abnormal baseline aEEGs.

Conclusions

Overall CoolCuddle did not impact the regulation of autonomic nervous system. However, infants exposed to moderate to severe asphyxia, and those with moderate to severe encephalopathy, appeared to react differently during the cuddle.

References (include acknowledgement here if appropriate)


All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously: ☒

Senior author supporting presentation on day of meeting: Dr Ela Chakkarapani
Hypoglycaemia in Neonates with Moderate-to-Severe Hypoxic Ischaemic Encephalopathy (HIE) undergoing Therapeutic Hypothermia

Authors (Presenting author underlined. If no author is a Society member please provide the name of the member introducing the author to the Society)
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Institution(s)
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Introduction
Early neonatal hypoglycaemia is associated with negative impacts on long-term neurodevelopment1, including in infants diagnosed with HIE2. Although the threshold for active management remains contended3,4, the British Association of Perinatal Medicine recommends maintaining blood glucose ≥ 2.6 mmol/l in an intensive care setting1. Incidence of hypoglycaemia and correlation with HIE severity and neonatal nutrition was explored.

Methods
76 infants undergoing therapeutic hypothermia for confirmed HIE at a tertiary centre serving the South West of England between January 2021 and August 2022 were identified retrospectively from the national BadgerNet Neonatal electronic patient record system. Blood glucose levels were extracted from capillary blood gas reports across the first 72 hours of life, hypoglycaemia was defined as ≤ 2.6 mmol/l. Retrospective data on clinical HIE diagnostic grade at discharge, need for mechanical ventilation and/or inotropes, and daily nutritional intake including colostrum mouth care, were also recorded for all cases for each 24 hour interval.

Results
Capillary blood gas glucose measurements were available for 58 of 76 infants. Hypoglycaemia criteria were met on at least one occasion for 22% of infants (13/58), and on more than one consecutive blood gas for 9% infants (5/58). Hypoglycaemia was associated with clinically more severe HIE, 54% hypoglycaemic infants were coded as HIE grade 3 on discharge (7/13), compared to 27% cooled infants who did not suffer a hypoglycaemic episode (12/45). Hypoglycaemic infants were also more likely to require inotropic support in the first 72 hours.

Infants who experienced hypoglycaemia had lower rates of enteral feeding within 24 hours of the hypoglycaemic event at 8% (1/13), compared to cooled infants who did not experience hypoglycaemia at 47% (21/45). Colostrum mouth care was also marginally less common in the hypoglycaemic infants (6/13 vs 27/45).

Conclusions
Hypoglycaemia is not uncommon among neurologically vulnerable patients undergoing therapeutic hypothermia at our centre. Most neonates did not have capillary blood glucose monitoring at 4-6 hour intervals recorded in line with local and national guidelines.

References

Check box if presenting author is a trainee:  basic science trainee  ☐  clinical trainee  ☑

All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously:  ☑

Senior author supporting presentation on day of meeting:
Title (Upper case)

Neonates with Substantial Brain Injury After Therapeutic Hypothermia for Hypoxic-Ischemic Encephalopathy Have Decreased Omega-3 Long-Chain Polyunsaturated Fatty Acids

Authors (Presenting author underlined. If no author is a Society member please provide the name of the member introducing the author to the Society)

Isabell Nessel¹*, Simon C. Dyall²*, Jennine A Sharpe², Ping Yip¹, Adina T. Michael-Titus¹, Divyen K. Shah¹,³

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Introduction (include hypothesis)

Hypoxic-ischemic encephalopathy (HIE) remains a major cause of neonatal morbidity. Therapeutic hypothermia (TH) is an effective treatment, although substantial chronic neurological impairment often persists. Omega-3 polyunsaturated fatty acids (PUFAs) offer therapeutic potential in the post-acute phase. However, it is important to understand how they are affected by HIE and TH to develop treatments. We therefore quantified for the first time the effects of HIE and TH on blood PUFA levels and markers of lipid peroxidation.

Methods (include source of funding and ethical approval if required)

Newborns with moderate to severe HIE, who underwent TH (sHIE group) were compared to newborns with mild HIE, and cord blood controls. The sHIE group was further stratified to 10 infants with cerebral MRI predictive of good outcomes and 10 predictive of poor outcome (nine of whom developed cerebral palsy). PUFAs were determined in the cell pellet and lipid peroxidation products, (thiobarbituric acid reactive substances and 4-hydroxy-2-nonenal), in plasma. Barts Charity grant: 498/1747; BIBINS: REC 13/LO/17380 Bromley, UK;

Results

Although there were no significant differences in the Omega-3 Index (docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) content of cell pellet, expressed as % of total identified fatty acids) between the groups at baseline, over the time-course of TH the Omega-3 Index was significantly lower in the poor vs. good cerebral MRI prognosis sHIE group. Estimated Δ-6-desaturase (D6D) activity was also significantly lower in sHIE groups compared to mild HIE and controls, and the omega-6 PUFA, linoleic acid (LA) significantly increased in the sHIE group with good prognosis. No changes in lipid peroxidation were identified over the time-course of TH.

Conclusions

The Omega-3 Index is reduced in sHIE associated with poor outcomes, potentially due to decreased biosynthesis and tissue incorporation, as suggested by low D6D activity and elevated LA levels. Therefore, the addition of omega-3 PUFAs to standard care, may offer greater therapeutic potential than standard care alone.

References (include acknowledgement here if appropriate)

We would like to thank the families of the babies included in this study as well as the medical and nursing staff in the collaborating neonatal units.

Check box if presenting author is a trainee: basic science trainee ☐ clinical trainee ☐

All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously: ☒

Senior author supporting presentation on day of meeting: Divyen K. Shah
SCHOOL-AGE CHILDREN COOLED FOR NEONATAL ENCEPHALOPATHY WITHOUT CEREBRAL PALSY RETAIN HEALTHY RESTING-STATE STATIC AND DYNAMIC FUNCTIONAL CONNECTIVITY

Authors (Presenting author underlined. If no author is a Society member please provide the name of the member introducing the author to the Society)

Arthur PC Spencer,† Marc Goodfellow,‡ Ela Chakkarapani,¶ Jonathan CW Brooks**

†equal contribution

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Introduction (include hypothesis)

Previous studies have demonstrated altered brain structural connectivity in school-age children cooled for neonatal hypoxic-ischaemic encephalopathy (HIE), however no studies have reported functional connectivity (FC) findings in cooled children beyond the neonatal period. We used resting-state fMRI data from the CoolMRI study† to investigate resting-state FC in children aged 6-8 years without cerebral palsy who were cooled for neonatal HIE (cases, n = 22), and healthy controls matched for age, sex and socioeconomic status (n = 20).

Methods (include source of funding and ethical approval if required)

Using a common FC analysis pipeline,‡ the we applied group independent component analysis to resting-state fMRI data and identified 33 independent components (ICs) which correspond to those previously reported in children and adults.¶ For each subject, we measured static FC by calculating pairwise Pearson correlation between the resting-state activity of each IC over the duration of the scan. We also measured dynamic (i.e. time-varying) FC characteristics, using sliding-window correlations and deep clustering to identify repetitively occurring FC patterns (states).¶

Results

There were no case-control differences (p>0.05) in the spatial maps of ICs (i.e. no case-control difference in the spatial extent of the brain regions which contributed to the key components of the resting-state signal). After FDR correction, there were no case-control differences (p>0.05) in static FC (i.e. no case-control difference in the statistical association between the resting-state activity of pairs of ICs). Dynamic FC analysis revealed that time-varying FC across the cohort was characterised by 4 repetitively occurring FC states. These dynamic FC states did not differ between cases and controls (p>0.05). Additionally, there were no case-control differences (p>0.05) in the occurrence (measured by fractional occupancy) or duration (measured by dwell time) of any of these states.

Conclusions

The spatiotemporal characteristics of resting-state brain networks in cooled children at school-age without severe disability did not differ significantly from healthy controls, despite underlying differences in cognitive and motor outcomes, brain structure and white matter connectivity.†

References (include acknowledgement here if appropriate)


Check box if presenting author is a trainee: basic science trainee ☒ clinical trainee ☐

All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously: ☒

Senior author supporting presentation on day of meeting: Ela Chakkarapani
Title (Upper case)

INTEGRATED ANALYSIS OF PRETERM BIRTH AND SOCIOECONOMIC STATUS WITH NEONATAL BRAIN STRUCTURE

Authors (Presenting author underlined)

Katie Mckinnon¹, Paola Galdi¹, Manuel Blesa-Cávez¹, Gemma Sullivan¹,², Kadi Vaher¹, Amy Corrigan¹, Jill Hall¹, Lorena Jiménez-Sánchez², Michael Thripplenton², Mark E Bastin², Alan J. Quigley³, Evdokia Valavaní⁴, Athanasios Tsanás⁴, Hilary Richardson⁵, James P. Boardman¹,².

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Introduction (include hypothesis)

Socioeconomic status (SES) associates with childhood brain morphology, but its contribution to brain development after preterm birth and timing of impact are unknown. We tested three hypotheses: gestational age (GA) and SES associate with neonatal brain morphology in mutually adjusted models; associations between SES and brain morphology vary across the GA range; associations with SES depend how SES is measured.

Methods (include source of funding and ethical approval if required)

Participants: 170 preterm and 91 term infants, median (range) birth GA 30⁺⁰ (22⁺¹⁻⁻³⁻⁰) and 39⁻⁴ (36⁻³⁻⁻⁻⁻⁻⁴⁻¹) weeks recruited to a longitudinal cohort study¹ (NRES 16/SS/0154). SES was operationalised at neighbourhood-level (Scottish Index of Multiple Deprivation [SIMD], primary measure), family-level (parent education/ occupation), and subjectively (WHO Quality of Life). MRI brain scans were performed at term-equivalent age¹. Brain volumes (85 parcels) and 5 whole-brain cortical measures (gyrification index [GI], sulcal depth, cortical thickness, curvature, surface area [SA]) were calculated using the developing Human Connectome Project pipeline². Associations of GA and SES with morphology measures were investigated with linear ridge regression models, including an interaction term (GA×SES) and covariates (birth weight z-score, birth head circumference z-score, GA at MRI, infant sex, smoking in pregnancy, breast milk at discharge), as necessary

Results

In fully adjusted models, GA associated with a higher proportion of brain volumes (22/85 [26%], β range [0.13 to 0.22]) than neighbourhood SES (1/85 [1%], β=0.17), p<.001. GA-associated parcels included grey and white matter and CSF. GA was associated with SA (β=0.10 [95% CI 0.02-0.18]) and GI (β=0.16 [95% CI 0.07-0.25]); neighbourhood SES was not associated with any whole-cortex measure. Correlations between SES measures ranged from very weak to strong. Family SES associated with more parcel volumes than neighbourhood SES, but fewer than GA. There were interactions between GA and family and subjective SES measures on brain structure. Six parcels were associated with SES measures; maternal education with left and right cerebellum, left middle superior temporal gyrus, and left anterior lateral occipitotemporal gyrus/gyrus fusiformis, β range [0.09] to [-0.15], p=0.01-0.0496; maternal occupation with right occipital lobe (grey matter), β=0.06, p=0.0496, and neighbourhood SES with right anterior medial and inferior temporal gyri (white matter), 0.12 to 0.22 (p<.01).

Conclusions

GA and SES are associated with neonatal brain morphology but GA has more widely distributed effects than SES. Family-level measures of SES (parental education/occupation) are associated with more alterations in brain structure than neighbourhood and subjective SES. Further work is warranted to elucidate mechanisms that embed low GA and SES in brain development. Reducing socioeconomic disadvantage in the neonatal period could optimise brain development of preterm infants.

References (include acknowledgement here if appropriate)


Check box if presenting author is a trainee: basic science trainee ☐ clinical trainee x

All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously: x

Senior author supporting presentation on day of meeting: Prof James Boardman
**Figure 1. Socioeconomic status measures.**

A: Spearman rank correlations between socioeconomic status measures in the cohort, showing coefficients when $p<0.05$.

B: Parcels associated with socioeconomic status measures.

C: Parcels associated with the interaction between socioeconomic status and gestational age.

D: Parcels associated with gestational age at birth.

B-D show all regions/parcels that were significantly associated with respective measures after Benjamini-Hochberg correction in fully adjusted ridge regression models.

GA = gestational age, SES = socioeconomic status, SIMD = Scottish Index of Multiple Deprivation, WHO QoL = World Health Organization Quality of Life assessment.
INFANT BODY COMPOSITION AND LONG-TERM HEALTH OUTCOMES: A SYSTEMATIC REVIEW AND GAP ANALYSIS

Authors (Presenting author underlined. If no author is a Society member please provide the name of the member introducing the author to the Society)

Federica Amati¹, Lucy McCann², Eurídice Castañeda-Gutiérrez³, Emily Prior⁴, Carolien Annika van Loo-Bouwman⁵, Marieke Abrahamse-Berkeveld⁶, Elena Oliveros⁷, Susan E Ozanne⁸, Ching-Yu Chang⁹, Neena Modi⁴

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Introduction (include hypothesis)

Excess adiposity, which may be influenced by early life exposures, is a leading cause of morbidity and mortality. We examined the relationship between infant body composition (0-2 years of age), future adiposity (> 2 years of age) and obesity, Body Mass Index (BMI), and other outcomes. We hypothesise that infant body composition could be a marker of interest for later metabolic health.

Methods (include source of funding and ethical approval if required)

We pre-registered the study on PROSPERO (ID 288013). We searched Embase, PubMed, and Cochrane databases for English language publications using the MeSH terms ‘infant’ and ‘body composition’ and ‘risk’ over the period from January 1946 to 16th February 2022. We also hand searched records. FA, LM and EP were responsible for screening, data extraction, and quality assessment using Covidence and the Cochrane tool for systematic reviews. The International Life Sciences Institute EU funded the study.

Results

We identified 6,014 articles including one following hand searching, and after abstract screening reviewed 129 full text publications. 30 were included in the final analysis and narrative synthesis. Meta-analysis was not possible due to heterogeneity of results. All studies were of high quality. The studies reported associations between infant body composition and 19 different outcomes after the age of 2 years. The strongest associations were found between infant body composition and body composition after age 2 years (7 studies), and later BMI (5 studies). The remaining studies found no relationship between infant adiposity and any of the following: blood pressure (5 studies), T1D (1 study), adiponectin (1 study), resistin (1 study), fasting glucose (2 studies), fasting insulin (3 studies), C-peptide (1), HbA1C (1), triglycerides (3 studies), HOMA-IR (2 studies) and cognitive function (2 studies). One study showed a positive association with leptin, HDL and LDL cholesterol (see Table).

Conclusions

Available evidence suggests a positive association between infant adiposity and future adiposity or BMI. The number of studies for each outcome is limited, and the evidence base for infant body composition as a biomarker of future health remains inconclusive. Carefully designed, standardised studies are needed.

References (include acknowledgement here if appropriate)

We acknowledge the support of Michael Symonds, Rebecca Jones, Matthieu Flourakis, Celine Tabche and Noor Al-Rubaye.

Check box if presenting author is a trainee: basic science trainee ☐ clinical trainee ☐

All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously: ☒

Senior author supporting presentation on day of meeting: Neena Modi
### Results Table

<table>
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<tr>
<td>FFM</td>
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<td>BMI</td>
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<tr>
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<td>TIDM</td>
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<tr>
<td>Cognitive function/processing speed</td>
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</table>

19* associated with an increase in blood pressure until 4 months, thereafter no association
26** Total subcutaneous (SC) fat mass at 24 months associated with total SC fat mass at 6 years, but not total SC FM at 1.5 months
29***FM accretion in 0-3 months and 3-6 months were associated with higher FM at 5 years
PLACE OF PRETERM BIRTHS AT 27-31WEEKS: MORTALITY AND MORBIDITY OUTCOMES FROM OPTIPREM

Authors (Presenting author underlined. If no author is a Society member please provide the name of the member introducing the author to the Society)

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3University of Leicester, UK; 4National Perinatal Epidemiology Unit, University of Oxford, UK; 5National Institute for Health and Care Excellence UK; 6Great Ormond Street NHS Trust, UK; 7 Imperial College London, UK.

Introduction (include hypothesis)

OPTIPREM investigated, for preterm babies born at 27-31 weeks gestation in England admitted to neonatal units, whether birth in maternity services co-located with Neonatal Intensive Care Units (NICU) compared to Local Neonatal Units (LNU) offered survival and/or morbidity advantages. This was undertaken to provide scientific evidence to inform ongoing optimisation of perinatal services.

Methods (include source of funding and ethical approval if required)

Design: National population-based cohort study of babies born at 27-31 weeks gestation in maternity services co-located with NICU or LNU in England, using routinely captured electronic patient records within the National Neonatal Research Database, and linked with mortality information from the Office for National Statistics. Method: We used an instrumental variable approach to control for measured and unmeasured differences between units. The instrument selected was maternal excess travel time between NICU and LNU was selected. We conducted overall and gestation-specific analyses, adjusted for sex, birthweight z-score, multiplicity, mode of delivery, ethnicity, maternal age and IMD. We performed sensitivity analyses excluding early ex-utero transfers (up to 72 hours after birth), and singleton and multiple births. Outcome measures included death in neonatal care, and the first year of life (infant mortality), necrotising enterocolitis (NEC), retinopathy of prematurity (ROP), severe brain injury (SBI), bronchopulmonary dysplasia (BPD), and receipt of any breast milk feeds at discharge from neonatal care (BMD). We calculated adjusted mean proportions in each unit with associated mean differences and 99% CI. Funding: NIHR HS&DR Project 15/70/104; IRAS 212 304

Results

We included 18,847 babies (10,379 born into maternity services co-located with NICU and 8,468 with LNU). There was no effect of place of birth on mortality in neonatal care (mean difference -0.001; p=0.8) nor infant mortality (mean difference -0.002; p=0.6). This lack of effect remained after sensitivity analyses. We observed a statistically significant increase in SBI in babies born in maternity services co-located with LNU (mean difference -0.011; p=0.007). Significance was lost after exclusion of early postnatal transfers (n=1,545) for the whole group, and then separately, on exclusion of all babies born at 27 weeks gestation. There was no effect of place of birth on ROP, NEC or BMD. There was a higher probability of BPD in births in maternity services co-located with NICU, which remained after exclusion of early transfers.

Conclusions

We identify increased likelihood of SBI in babies born in maternity centres co-located with LNU. This appears related to the process of postnatal transfer, and not to the quality of care provided by LNU. Our data indicate an urgent need to support antenatal transfers of mothers with expected preterm births at 27 weeks gestation to maternity services co-located with NICU.

References (include acknowledgement here if appropriate)


All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously: X
Senior author supporting presentation on day of meeting: T Pillay, N Modi, E Boyle