

**Brain Injury  
MedTech Co-operative**

  
**National Institute for  
Health Research**

# **Paediatrics and Neuro-development**

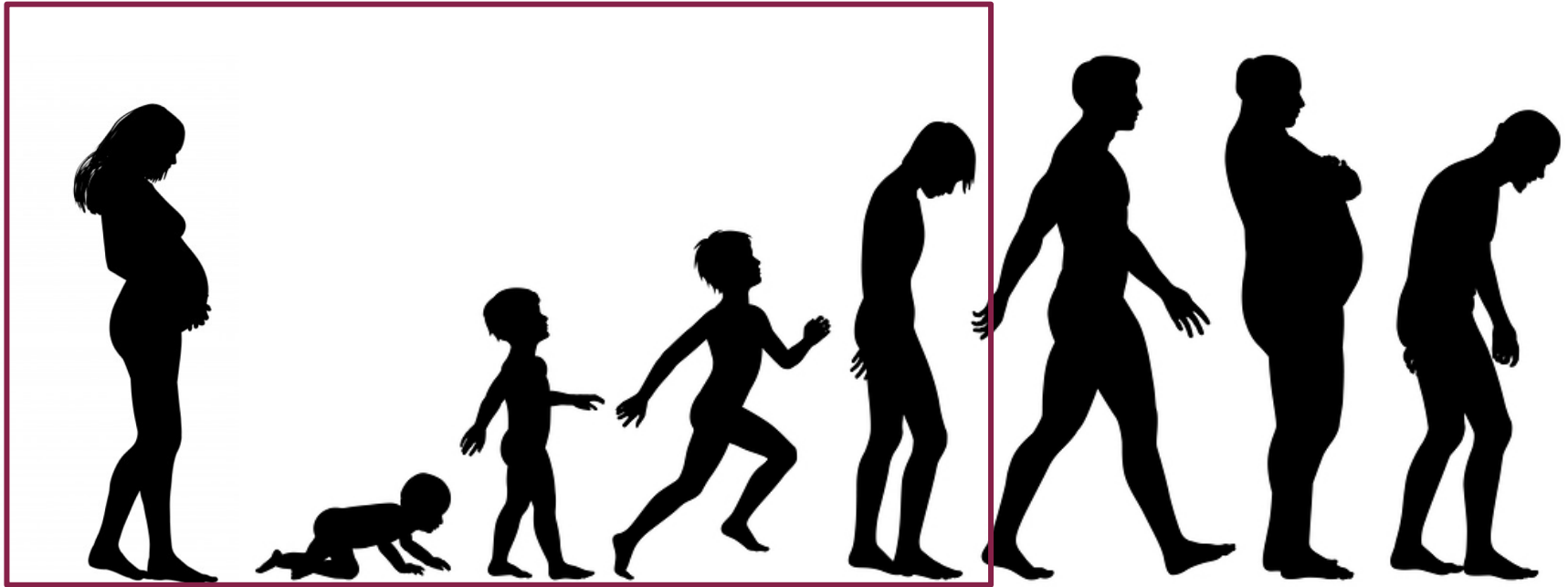
## **MIC Theme 7**

***Professor David Rowitch & Professor Topun Austin***

# Paediatrics & Neurodevelopment

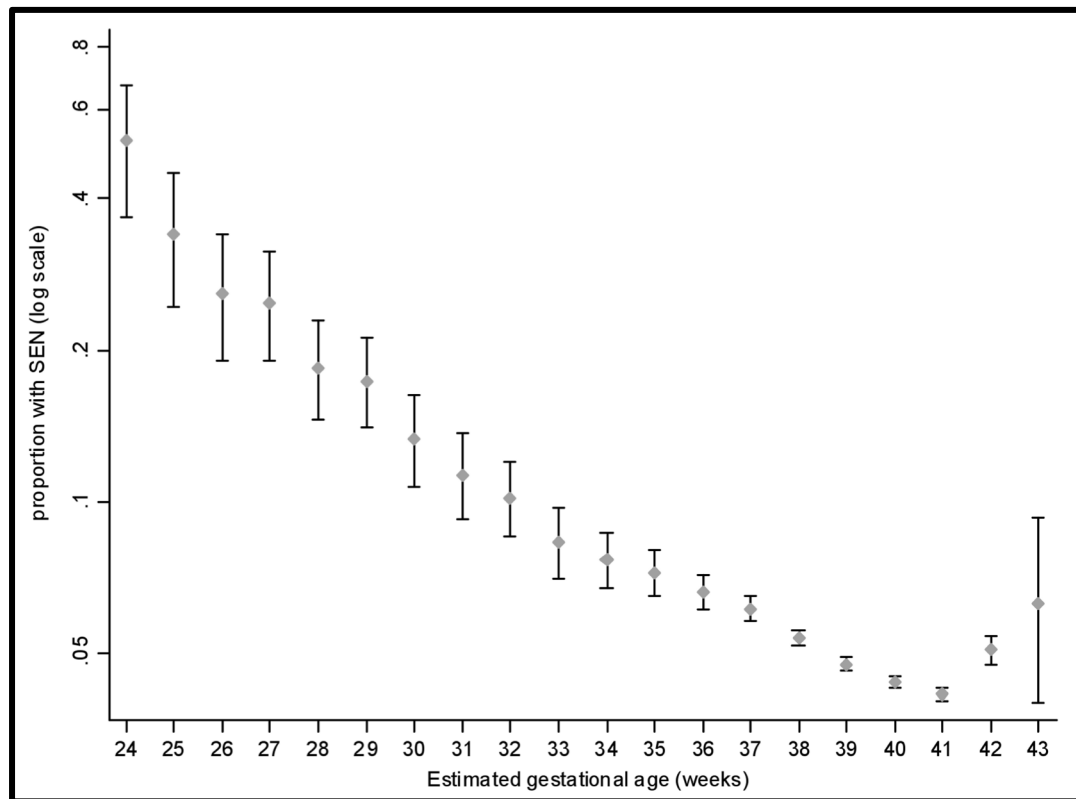


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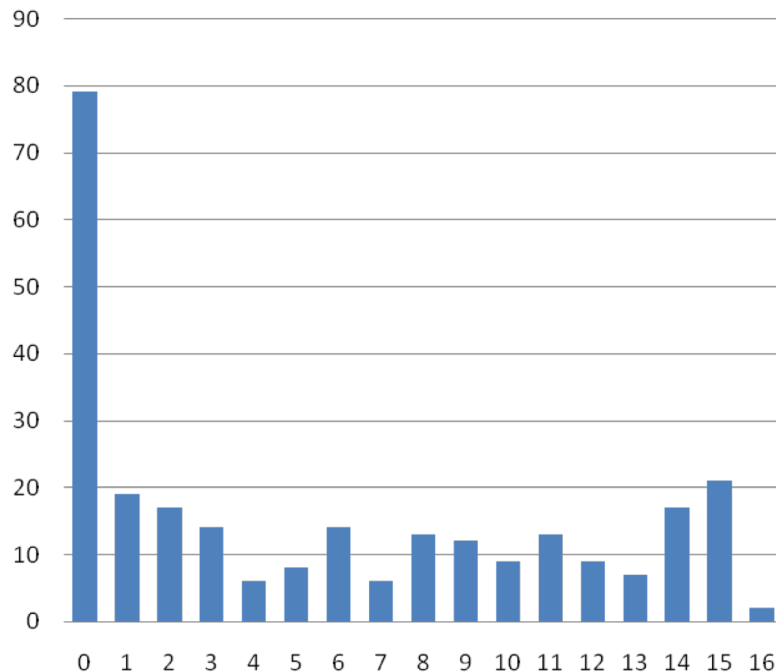




A long journey of brain development.....  
.....is much harder with an injured brain



Total ABI by age



- Up to 40,000 children suffer an acquired brain injury (ABI) each year.
- Equity of access to follow-up and interdisciplinary expertise in paediatric neurorehabilitation is lacking.



# Perinatal & Paediatrics HTC

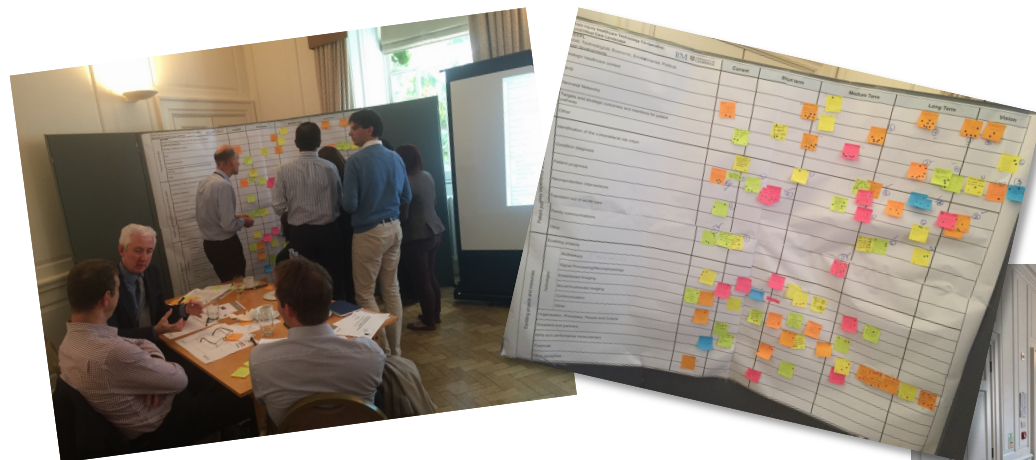


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The overarching aim of this workstream is to advance research and *technology development* by producing a comprehensive and strategic list of recommendations generated from ongoing and prospective *projects, workshops, networks and collaborations.*



# Roadmapping – Linking future to present



**Bringing together the ‘experts’:**  
patients, scientists, engineers, doctors,  
nurses, allied healthcare professionals







## Four priorities were identified:

- 1) Access to medical and therapy expertise close(r) to home.
- 2) Shared understanding across family, school and health.
- 3) Family and professional awareness of resources and support.
- 4) Establishing a centre for rehabilitation technology evaluation, advice and co-ordination of services and research.



## Five priorities were identified:

- 1) Real-time video monitoring for parents.
- 2) Individualised management of preterm infants in neonatal neurocritical care based on real time multimodal monitoring.
- 3) Continuous EEG monitoring for early seizure diagnosis.
- 4) Neuroprotection: understanding basic mechanisms.
- 5) Sleep measurement.

# Safer Maternity Care



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Department  
of Health

On 13 November 2015, the Secretary of State for Health announced a national ambition to halve the rates of stillbirths, neonatal and maternal deaths and intrapartum brain injuries in babies by 2030, with a 20% reduction by 2020.



Technology Solutions to reduce still births and perinatal brain injury:  
Strategic road-mapping event in 2018

# Perinatal & Paediatrics MedTech



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The aim of this theme is building a *collaborative group of clinical, technology- and laboratory-based investigators to provide expertise in basic and translational research relevant to Paediatrics* through next generation sequencing (NGS), bioinformatics, biotechnology and deep phenotyping.



# Strategy

## Paediatrics & Neuro-development

### Year 1 Short-term

- Publication and dissemination of roadmapping workshops in Paediatric Neurorehabilitation and Neonatal Neurocritical Care orchestrated by the current HTC in 2016.
- Collaboration with DoH on perinatal theme to reduce stillbirths and perinatal brain injury
- Continue to collaborate with the TITCH network
- Establish access for patients and families to record their experiences on the ORION platform
- Development of the neuroNICU

### Year 2-3 Medium - term

#### **Catalyse further development to bedside implementation:**

- Neonatal neuromonitoring (Austin/Smielewski)
- Multimodality Monitoring in Paediatric Neuro-intensive Care (Young/Hutchinson/Czosnyka/Smielewski).
- Study of Novel Proteomic Biomarkers of Brain Injury in Term Newborns with Hypoxia-Ischemia (Divyen Shah).
- Seizures: remote detection of seizures initially in adults with cognitive impairment; extracranial detection of seizures during sleep (Noctusense)

#### **New Subthemes to develop platforms and technologies**

- Develop a national perinatal neuroscience research group to identify and investigate neonates with brain injury, neurological rare diseases and atypical neurocognitive phenotypes.
- Early Detection and Stratified Medicine for Neonatal Seizures

### Year 4-5 Long-term

Improve clinical outcomes in children through (i) personalised care using novel predictive algorithms, and (ii) individualized interventions (eg, anti-epileptic drug repurposing); both based on enhanced mechanistic understanding of pathways leading to adverse and atypical outcome.

# Team

## Paediatrics & Neuro-development



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### Theme Leads



Professor David Rowitch



Professor Topun Austin

### Key Researchers



Professor Patrick Chinnery



Professor Helen Cross, OBE



Dr. Anna Maw

### Collaborators

Dr. Adam Young (NIHR-Academic-Clinical Fellow),  
Dr. Peter Smielewski (Senior Research Associate),  
Prof. Marek Czosnyka (Professor of Brain Physics),  
Dr. Shruti Agrawal (Consultant Paediatric Intensivist),  
Prof. Peter Hutchinson (NIHR-Professor of Neurotrauma),  
Dr. Joan Lasenby (Reader, Signal Processing),  
Dr. Amos Burke (Consultant Paediatric Oncologist),  
Dr. Howard Ring (Honorary Consultant Psychiatrist)  
Prof. Julie Mytton (Associate Professor of Child Health,  
Centre for Child and Adolescent Health),  
Dr. Mark Lyttle (Consultant in Paediatric Emergency  
Medicine; Chair, Paediatric Emergency Research in the  
United Kingdom & Ireland (PERUKI))  
Dr. Divyen Shah (Consultant Neonatologist)

# Neonatal Seizure Stratification



## Possible Seizure Aetiologies

- Injury
- Metabolic
- Genetic
- Brain Malformation

## Diagnostic Array: 4 tests stratify diagnosis

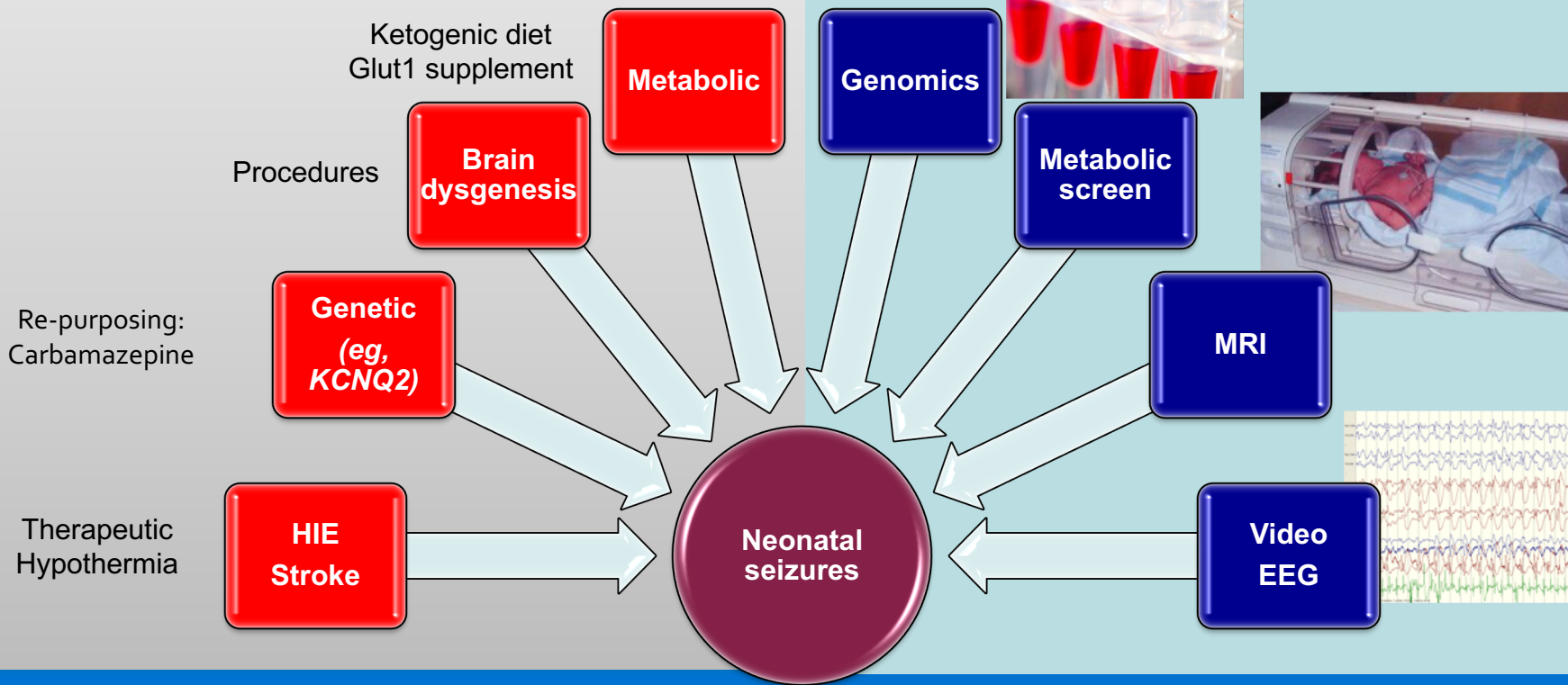
- MRI
- EEG
- Metabolic screen
- Whole Genome Sequencing

## Stratified Treatments

- Drug repurposing (eg, carbamazepine for KCNQ2 mutation)
- Ketogenic diet, other supplements
- Procedure (eg, Hypothermia, Surgery)
- Novel clinical trials (eg, UX007 for Glut1 deficiency)

# Possible Seizure Aetiologies – Stratified Therapies

# Diagnostic array





# East of England Neural Net



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Neural NET

illumina®

*Epic*

Genomics  
england



wellcome trust  
**sanger**  
institute



**ANTS** Acute Neonatal Transfer Service  
East of England NHS

# UK Network and Industry Collaborations



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## Early Detection

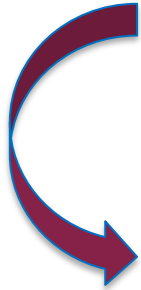
- Stratified diagnosis
- Stratified treatments
- 'Virtual' genotype-phenotype cohorts with long-term EMR follow up

## Mechanism

- Stem Cell Institute

## Intervention

- Gene therapy
- Cell-based
- Repurposing



- Genomics
- Diagnostics
- Pharma

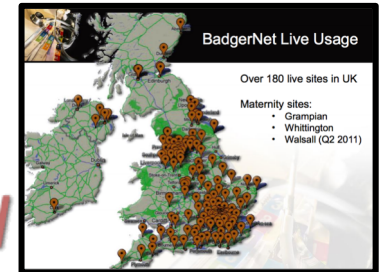
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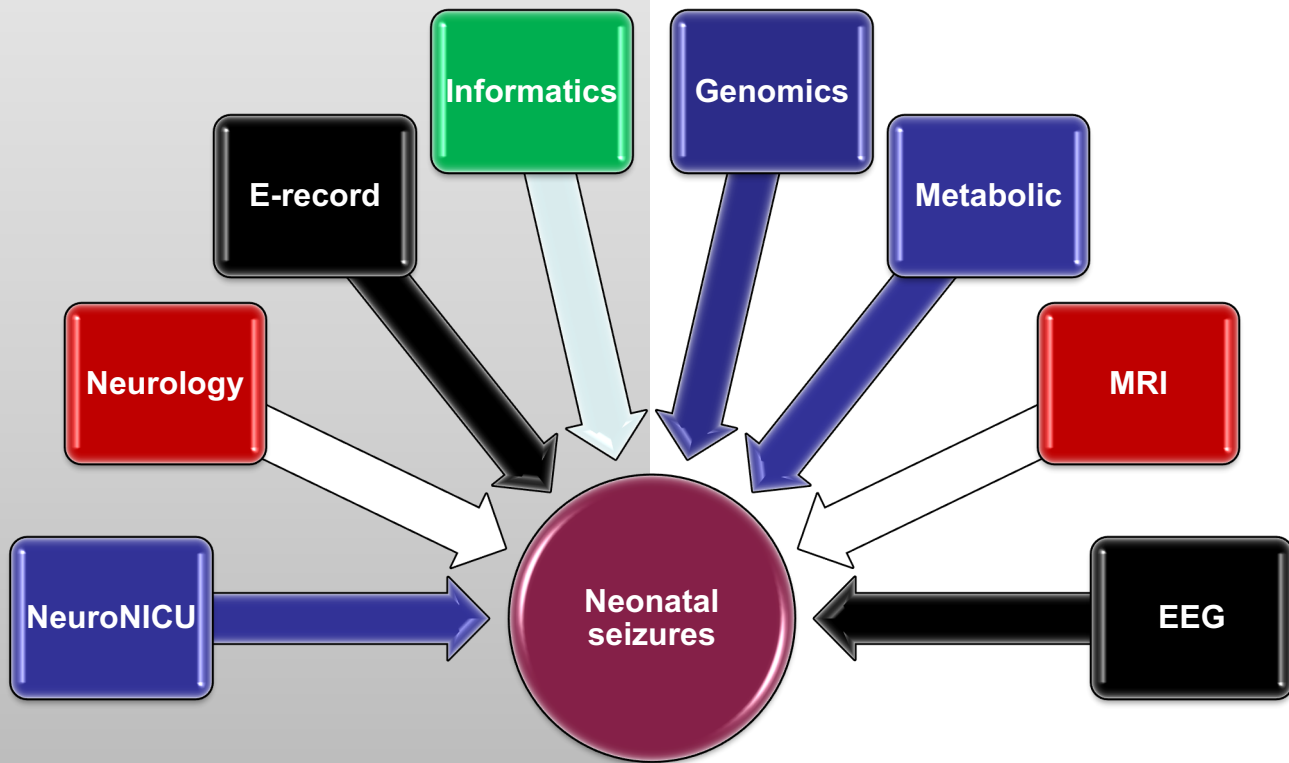


clevermed



*Protocol Management  
and Data Analysis*

*Diagnostic Hubs*



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