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Saturday, August 13, 2016

(Plenary)

8:30 - 8:45 Modern Management of Hypoxia in Neonates

Modern Management of Perinatal Hypoxia in the Newborn



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August 2016

Hypothermia for Hypoxic Ischaemic Encephalopathy



15th August 2011

Definition of neonatal encephalopathy

- A clinically defined syndrome of disturbed neurological function within the first week of life in the term (≥ 37 weeks) infant,
- Manifested by
 - difficulty in initiating and maintaining respiration,
 - depression of tone and reflexes,
 - subnormal level of consciousness
 - often seizures.

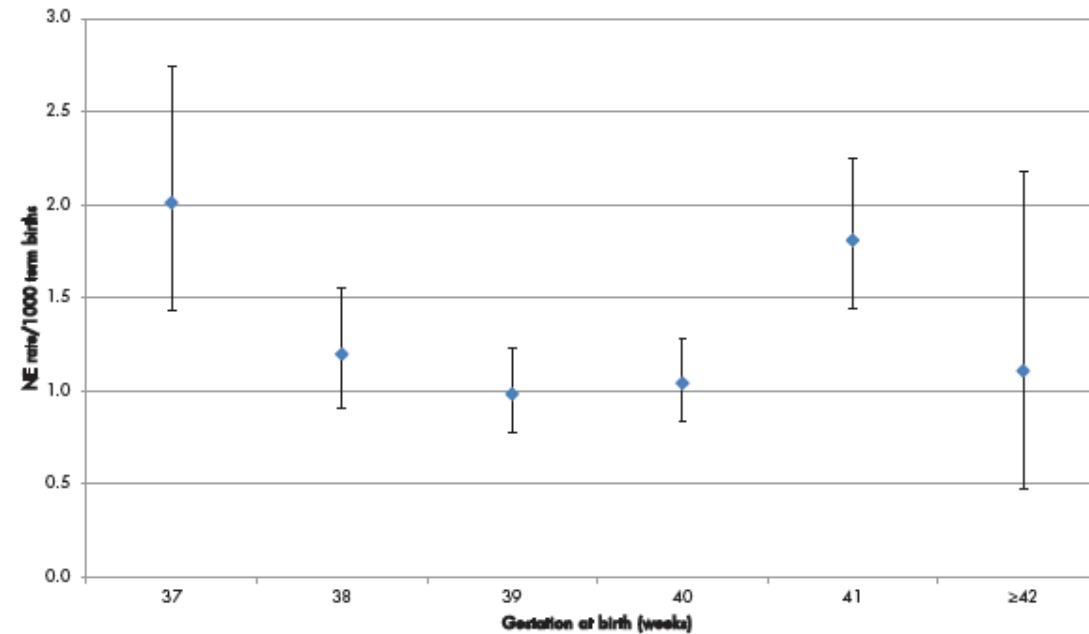
Asphyxia and Hypoxic Ischaemic Encephalopathy

- Asphyxia: An infant who has experienced a critical failure of oxygen delivery during labor and delivery sufficient to produce a lactic acidosis and delayed onset of respiration
- HIE: A clinically evident disturbance in brain function within the first 48 hours as demonstrated by:
 - abnormal tone and responsiveness
 - and / or clinical seizures
 - Altered mental state

- Term newborns affected by perinatal hypoxia had little therapeutic options until the early 2000's.
- Now cooled to 33-34 oC for 72 hours
 - 82% of those with an NE diagnosis
 - 86.7% within 6 hours
- Significant improvements in outcomes.

NE - Gestation
2010-14 1.14/1000 livebirths
1.24/1000 born at term

Figure 3.4: Neonatal encephalopathy rates (per 1000 term births) by gestation at birth 2010–2014



Perinatal hypoxia

The three parameters reported supporting perinatal hypoxia are

- cord pH ≤ 7.2 , < 7.1 < 7.0
- Base excess ≤ -10 < -12 or -16
- Lactate ≥ 6

Any of the above in 73%.

No cord gases 28% in 2010, 14.5% in 2014

APGAR < 7 at 5 minutes 78-80%% ≤ 5 @10 min

Hypothermia inclusion criteria

- Infants of 35 weeks' gestation or more
- Evidence of moderate or severe encephalopathy (Sarnat 2 3)
- Evidence of intrapartum hypoxia, at least two of:
 - Apgar score of ≤ 5 at 10 minutes
 - Mechanical ventilation, CPAP or ongoing resuscitation at 10 minutes
 - Cord pH < 7.00 , or
 - Arterial pH < 7.00 or base deficit of ≥ 12 within 60 minutes of birth

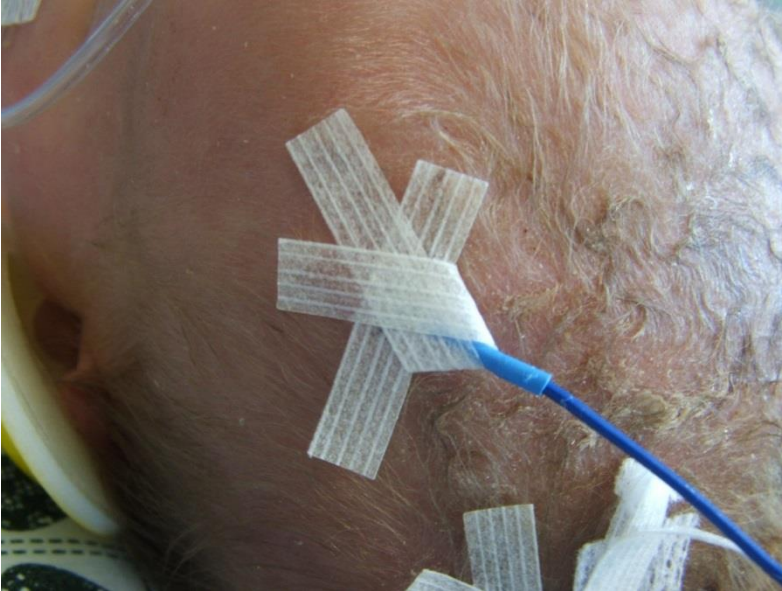
Adverse effect of hypothermia

- Mild hypothermia well tolerated.
 - Sinus bradycardia,
 - Increased blood pressure
 - Increased oxygen requirement
 - All transient and reversible with re-warming
-
- There has been a median increase in FiO₂ of 10–15% reported in infants with severe respiratory failure (oxygen requirement greater than 80%) up to 6 hours of age and because of this they are not eligible for cooling, or we may have to stop early.
-
- Coagulopathy

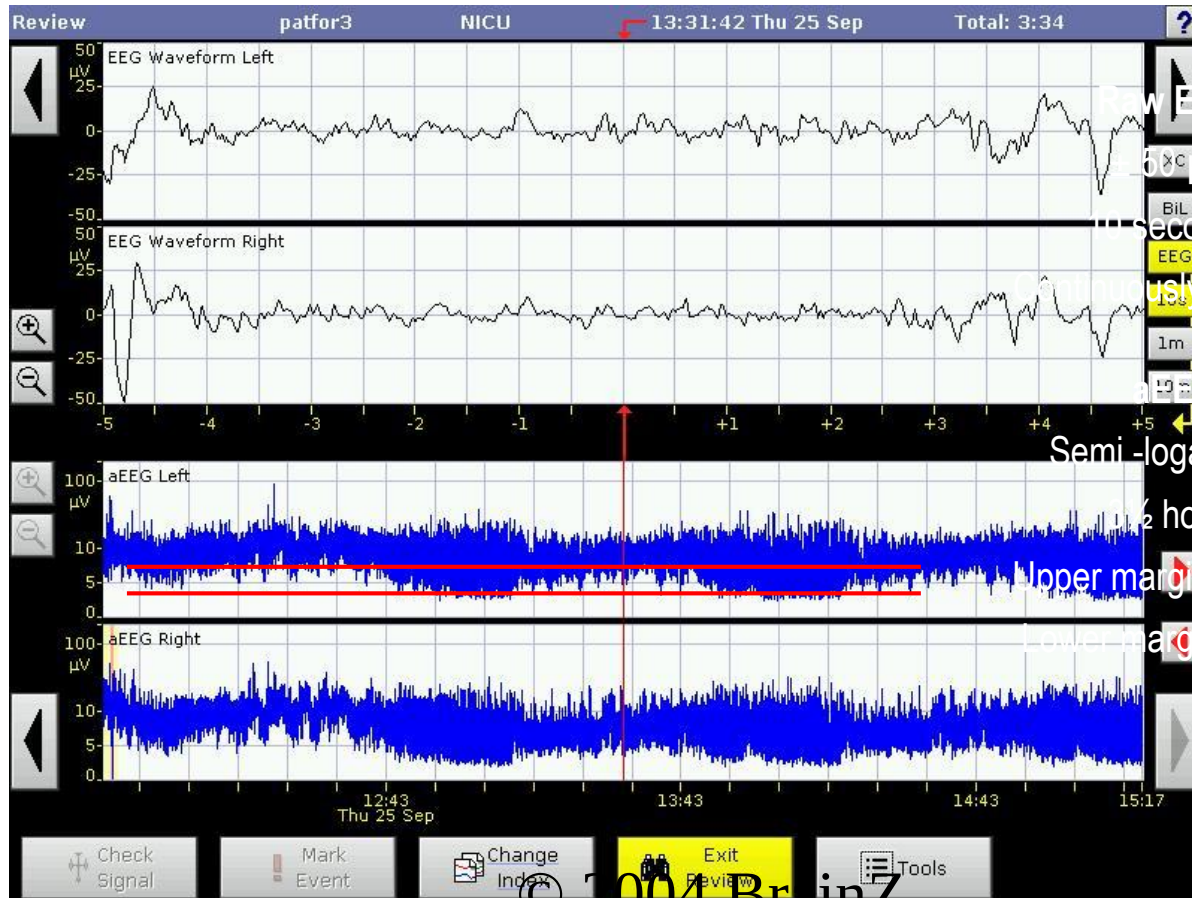
What do we want to know?

- **What is the neurological status of the baby?**
 - Is there any cerebral injury?
 - How is this baby's brain coping hour by hour, or day by day with severe illness?
 - Does the baby need further neurological evaluation – MRI?
 - What is the impact of our NICU treatments on this baby's brain functioning?
- **Is the baby having seizures?**
 - Are the seizures responding to my medical therapy?
- **Is there a cause for the perinatal hypoxia?**
 - What did the placenta show?

Seizures: Needle placement for bedside EEG



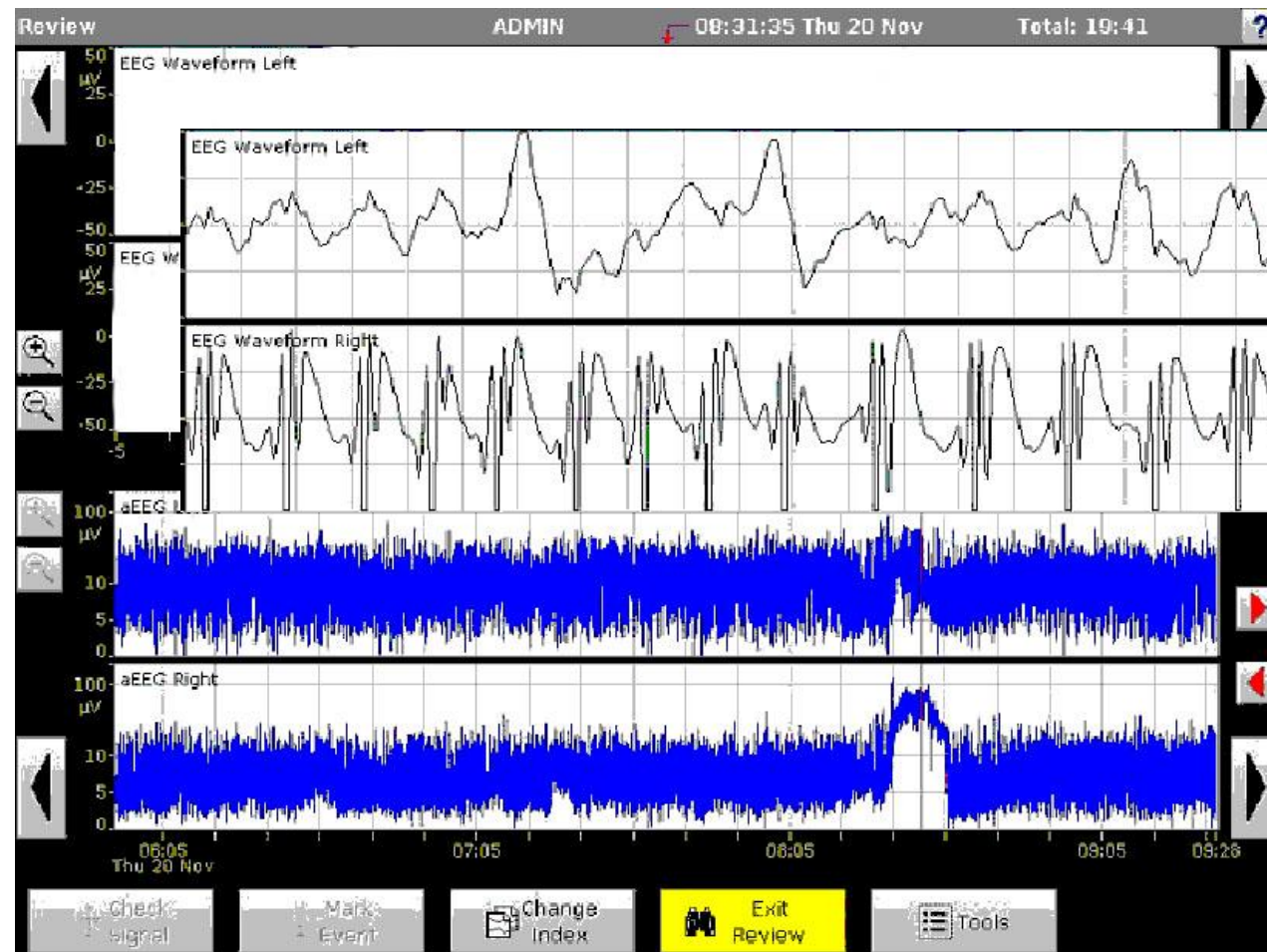
Background- Continuous Normal Voltage



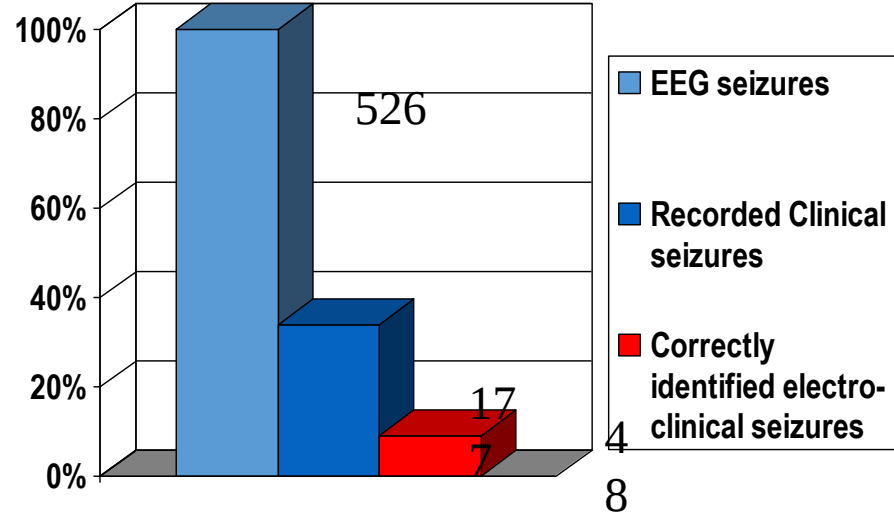
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Seizure detection



Clinical observation for seizure detection?



Only 9% (48/526) of electrographic seizures were accompanied by clinical manifestation identified by neonatal staff

Value of aEEG after asphyxia

- Confirmation or exclusion of encephalopathy when clinical assessment may be difficult
- Objective record for later comparison
- Prognostic information on encephalopathy within the first 6 hours
- Within the first 72 hours can show improvement or deterioration in encephalopathy
- Shows electrographic seizures
- Informs the assessment of anticonvulsant therapy

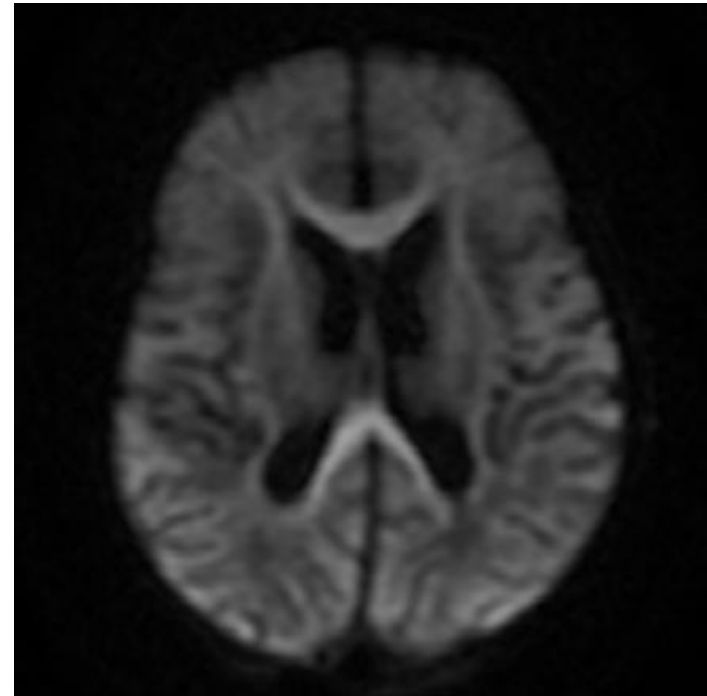
Why do we care about seizures?

- Neonatal seizures are associated with significant incidence of brain injury and long-term neuro-developmental delay
 - Miller S P et al. Neurology 2002
 - Levene M. Arch. Dis. Child Fetal Neonatal Ed 2002
- Neonates who have seizures are at high risk for death or significant neurological disability
 - McBride MC et al. Neurology 2000
 - Scher et al., 1989
 - Rutten et al., 2002

MRI- in 86%

- Easy to do - feed, wrap, constrain in a vacuum bean pillow
- Diffusion changes greatest between 24-96 hours (1-4 days)
- 10 days or later to delineate the extent of injury. (7-21 days)
 - Deep grey matter injury 29%
 - Watershed cortical injury 25%
 - Arterial / venous infarction
 - Potential for metabolic / other cause
- MRI abnormality was lower in the cooled infants.
30% significant abnormality
64% in stage 3, 21% Stage 2

Neonatal Encephalopathy and Neurologic Outcome, Second Edition
Pediatrics 2014;133:e1482; originally published online April 28, 2014;
DOI: 10.1542/peds.2014-0724



Cooling for newborns with HIE Cochrane 2013

Susan E Jacobs, Marie Berg, Rod Hunt, William O Tarnow-Mordi, Terrie E Inder, Peter G Davis.

- 11 RCT's, 1505 term and late preterm infants with moderate/ severe encephalopathy and evidence of intrapartum asphyxia.
- Therapeutic hypothermia resulted in a statistically significant and clinically important **reduction in the combined outcome of mortality or major neurodevelopmental disability to 18 months of age**
 - typical RR 0.75 (95% CI 0.68 to 0.83);

Cooling for newborns with HIE

Cochrane 2013

- **Number needed to treat** for an additional beneficial outcome **NNTB 7** (95% CI 5 to 10)
- Cooling resulted in statistically significant **reductions in mortality**
 - typical RR 0.75 (95% CI 0.64 to 0.88),
 - **NNTB 11** (95% CI 8 to 25)
- **Reduction in neurodevelopmental disability in survivors**
 - typical RR 0.77 (95% CI 0.63 to 0.94),
 - **NNTB 8** (95% CI 5 to 14)

Other assessments:

- Physiotherapy assessment Day 7
 - referral for neurodevelopmental support **74%**
- Feeding and SLT assessment
 - Feeding difficulties 20% at discharge
- Before discharge a detailed feedback session with the family.
- High needs – Child Disability allowance

Hypothermia for newborn encephalopathy

Practice Points

- Early identification of high risk babies essential < 6 hours.
- Strong evidence that cooling especially of infants with moderate encephalopathy reduces mortality (21%) and improves neurologic outcomes.
- MRI gives the best detail for prognosis
- Long term followup needed

The Perinatal and Maternal Mortality Review Committee

- Review and identification of modifiable factors have and can further reduce stillbirth, intrapartum death and morbidity and mortality from neonatal encephalopathy.
- Reduction in stillbirth since 2007 but remains higher in those most socioeconomically deprived.

<http://www.hqsc.govt.nz/assets/PMMRC/Publications/tenth-annual-report-FINAL-NS-Jun-2016.pdf>

Figure 1.23: Stillbirth risk (per 1000 ongoing pregnancies) by gestational age at birth and year 2007–2014

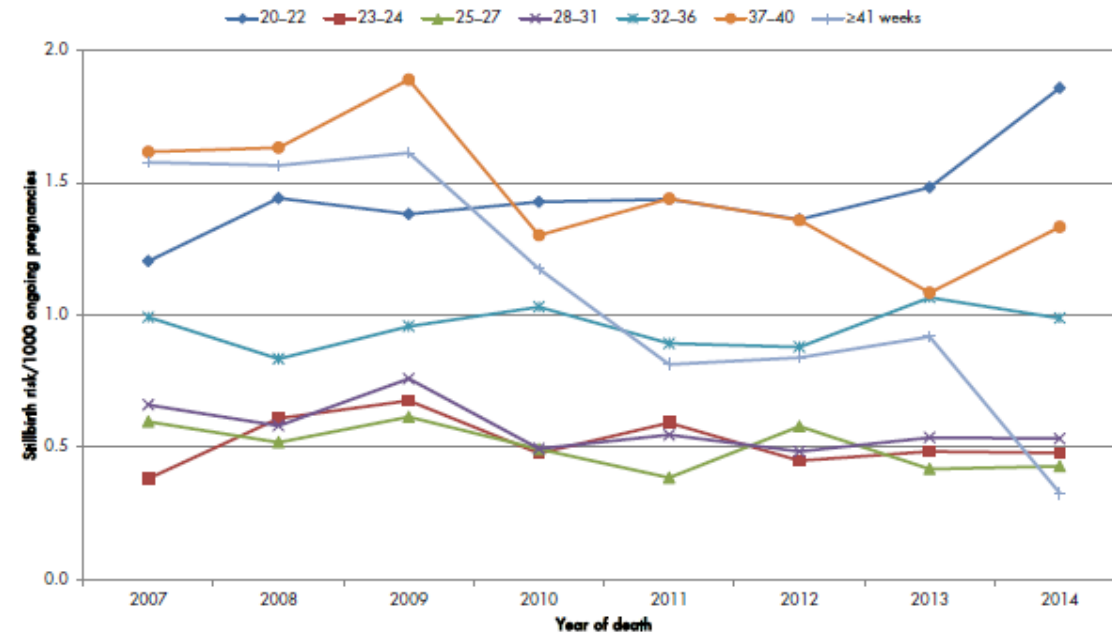
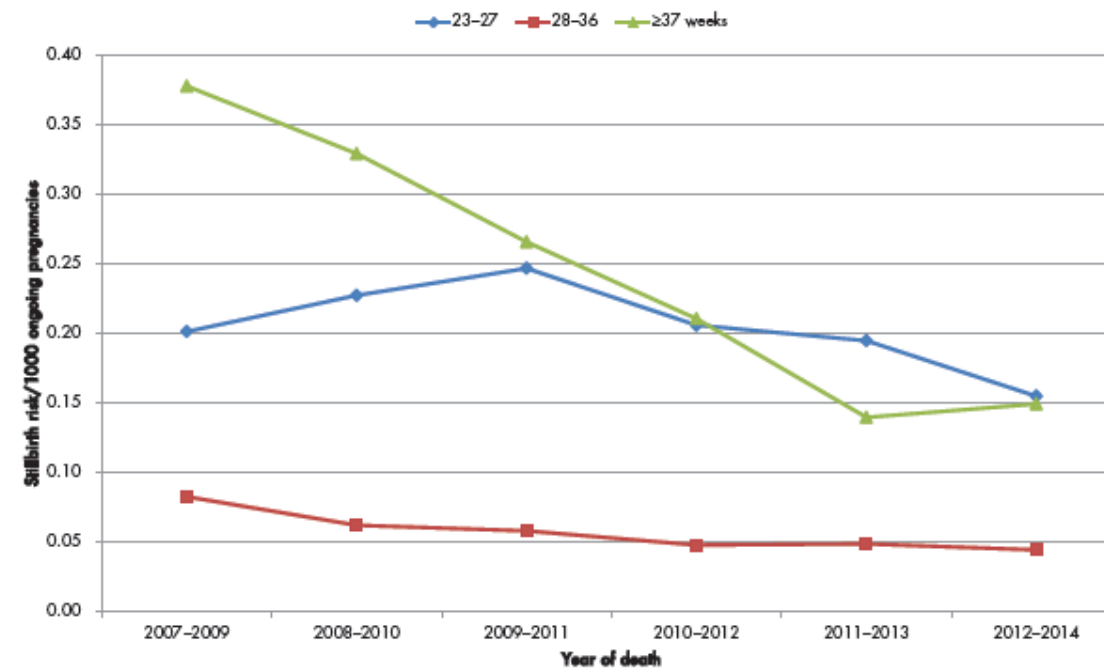


Figure 1.24: Intrapartum stillbirth rolling three-year risks (per 1000 ongoing pregnancies) by gestation at birth (weeks) excluding congenital abnormalities 2007–2014



NE: Modifiable factors

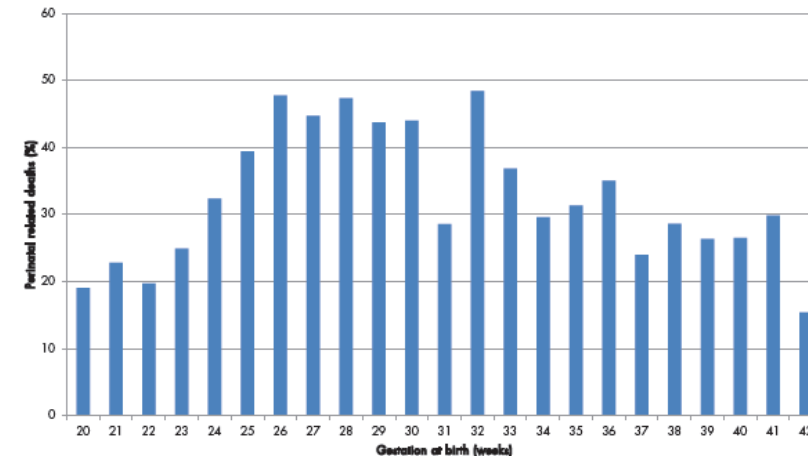
Increased risk for

- Women of lowest socioeconomic quintile 5, 25.7% of births (Chi square $p=0.005$)
 - 1.8/1000 live births vs 0.98/1000 (quintile 1)
- Smokers 23.3%
- Women not booked with an LMC in the first trimester.
- Infants of Pacific Island and probably Indian ethnicity. Regional distribution varies.
- First pregnancies - 56%
- An elevated BMI at booking - 36.6% >30

NE: Modifiable factors

- Size at birth
 - small for gestation age (SGA) who are at higher risk of hypoxic stress
 - 20.7% in NE, but 29.2 % of NE deaths
 - large for gestation age (LGA)
 - obstructed labour or
 - need for operative delivery
- Assessment of fetal growth is needed at each visit especially in the last trimester.
- More avoidable deaths in Maori and Pacific – access and engagement with care.

Figure 1.28: Small for gestational age (customised SGA) by gestation among perinatal related deaths (excluding multiples and congenital abnormalities) 2007–2014

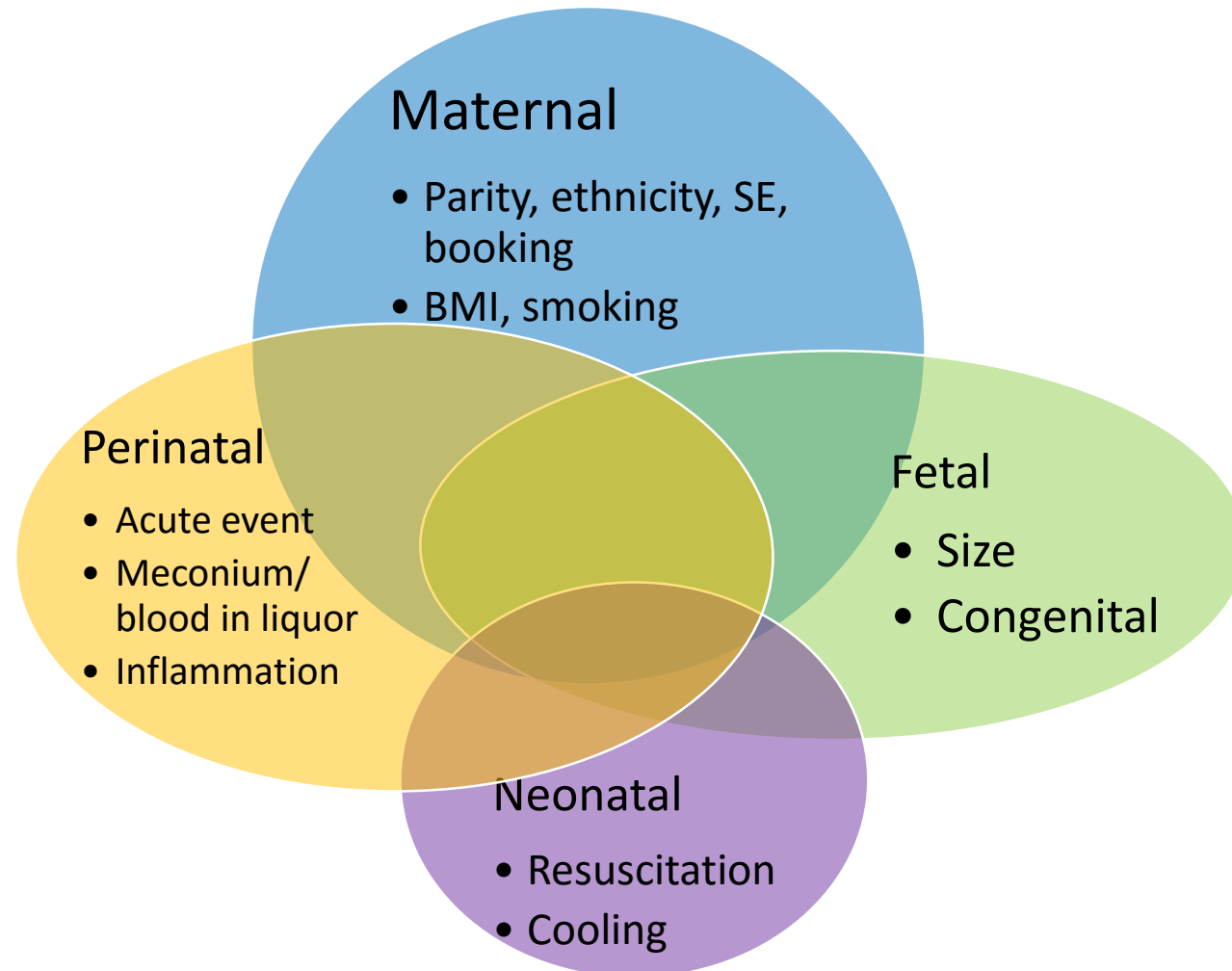


Obstetric strategies to reduce NE

- Reduced foetal movements presentation – if no movements in 2 hours call your LMC
- PROMPT - PRactical Obstetric Multi-Professional Training – education programme for management of intrapartum emergencies, focus on teamwork and communication
- CTG training
- “Fresh eyes”

Strategies to reduce neonatal encephalopathy

- Newborn Resuscitation – needed in 92%
 - 40% cardiac massage
 - 15.9% features of concern in NE case review
 - Training, national standards
 - Requirement for NLS
- Reduce impact of encephalopathy
 - Cooling – reduce the number commencing after 6 hours
 - Seizure monitoring and management
- Transport of babies to L3 centres



Case reviews

- Allows insights and learnings from the case that can alter future care and outcomes.
- Standardised review: SAC1 and 2 , (Severity assessment code)
- Goal to identify modifiable factors and areas to improve practice.
- What do we need to undertake reviews?
- Are we adequately trained and resourced?
- When should there be an ACC or HDC review?
- If the baby dies – referral to the coroner. Reports take a minimum of 6 months

Summary

- Perinatal hypoxia rates along with stillbirth and intrapartum death are falling.
- Cooling has been a significant therapeutic addition improving survival.
- Impact on neurodevelopmental outcome of affected babies now significantly improved.