born with neonatal encephalopathy on the basis of existing evidence from published studies.[1] The UK TOBY Cooling Register of treatment with moderate hypothermia was set up in order to collect data about all episodes of induced hypothermia for the treatment of neonatal encephalopathy in the United Kingdom.

The aims of the register are: to determine the likely demand in the United Kingdom for treatment of newborn infants with cooling; to identify adverse events associated with treatment with cooling; to ensure uniform clinical management to a high standard in a high-risk group of infants; to support further clinical trials of neuroprotection after asphyxia.

Since the inception of the register in December 2006, 132 infants have been notified (up to January 2008) from 28 centres. Cooling was initiated at $x(y - z)^2$ h after birth, and was maintained within the target range of 33–34°C rectal $x(y - z)\%^1$ of cooling period.[3] Details of patient characteristics, neurological state, complications and outcome at discharge from hospital will be discussed.

- 74.3 (interquartile range 61.6–84.9)%.
- 4 h 15 min (20 min–11:00 h).
- Data analyzed on 107 patients so far.

4.12 A RANDOMISED PILOT FEASIBILITY STUDY OF THERAPEUTIC HYPOTHERMIA FOR NEONATAL ENCEPHALOPATHY IN A LOW-RESOURCE SETTING IN EQUATORIAL AFRICA

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Background: Therapeutic hypothermia is a promising therapy for neonatal encephalopathy (NE) in the developed world;[1] results cannot be directly transferred to low-resource settings.
Aims: To determine the feasibility of whole-body cooling to 33–34°C for 72 h using simple methods and the temperature profile over the first 80 h in term NE infants undergoing standard care in Mulago Hospital, Kampala, Uganda.
Methods: The local ethics committee approved the study. After informed consent, babies were randomly assigned to standard care plus cooling with ''cool'' water bottles or standard care.
Results: Between 27 July 2007 and 31 October 2007, 110 term infants with NE admitted to the neonatal unit were screened. 36 infants were eligible for inclusion (see table).
Conclusions: Initial rectal temperatures were similar in therapeutic hypothermia and standard care groups. Screening, randomisation and cooling to 33–34°C over 72 h with water bottles was feasible in this low-resource setting. Suggestions of adverse outcomes make rigorous randomised trials to determine safety and efficacy of therapeutic hypothermia in low-resource settings imperative.

Abstract 4.12

Mean (SD) unless stated	TH (n = 21)	SC (n = 15)
GA at birth (weeks)	38 (1.45)	38 (1.38)
Birthweight (g)	3300 (550)	3200 (268)
Apgar score at 5 minutes	4.7	5.2
Age (min) at randomisation	115	100
Rectal temp at randomisation	33.66 (1.04)	34.43 (1.12) p = 0.06
Mean rectal temperature over 72 h	33.62 (0.69)	36.29 (0.64) p<0.001
HIV-positive (mother) %	14%	13%
Seizures day 2%	29%	13%
Sarnat stage II/III %	43%/33%	57%/0%
Death %	33% (n = 7)	7% (n = 1)

GA, gestational age; SC, standard care; TH, therapeutic hypothermia.

1. **Jacobs S.** *Cochrane Syst Rev* 2007;4(CD003311).

Session 4C NNA: Positive Parenting

4.13 A CRITICAL INCIDENT REPORTING SYSTEM AND AN ANALYSIS OF CRITICAL INCIDENTS IN A LEVEL 3 NEONATAL INTENSIVE CARE UNIT

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Introduction: Critical incident reporting in a neonatal intensive care unit is a vital part of clinical governance to improve the safety and quality of healthcare. Unfortunately these incidents are not analyzed regularly in any meaningful way to get feedback and effect improvements.
Methods: At this level 3 neonatal intensive care unit, a critical incident reporting system has been developed in which all reported critical incidents are analyzed at monthly multidisciplinary meetings. They are then entered on a database. Incidents are categorised into classes A–E (A, death/risk of death through to E, incident no injury or inconvenience). This database of 2 years (1 January 2005 to 31 December 2006) was analyzed to determine the causes and patterns in critical incidents.
Results: There were 256 discrete incidents reported during this period. Class A incidents accounted for 0.78%, class B 71.5%, class C 8.6%, class D 5.5% and class E 13.7%. 73.4% of incidents were reported by nurses and the rest by doctors. ''Clinical'' incidents accounted for 86.3% of all incidents, ''non-clinical'' for 12.1% and ''organisational'' for 1.5%. ''Drug errors'' accounted for 47.5% of ''clinical'' incidents and all were class B category. These included incorrect administration (34.3%), prescription errors (25.7%), missed doses (20.9%) among others. Root cause analysis showed that ''accident'' (8.6%), ''non-adherence to protocol'' (8.2%), ''communication breakdown'' (6.6%) were the commonest reasons for the incidents.
Conclusions: In our experience, the critical incident reporting system has been very effective in understanding the reasons for incidents and subsequent handling of such events. In the future it is hoped that the system will be instrumental in reducing them.

Session 6

Session 6A BMFMS: Pregnancy Outcome

6.1 THE RELATION BETWEEN SOCIAL DEPRIVATION AND STILLBIRTH CAUSES

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Social deprivation is an important determinant of poor health. We aimed to identify appropriate health targets by investigating associations between social deprivation and causes of stillbirth in Liverpool Women's NHS Foundation Trust.
Methods: All stillbirths occurring between 2004 and 2006 were included in the study and classified with ReCoDe. Maternal postcode was used to determine the index of multiple deprivation (IMD) for each patient. Women in IMD decile 1 (poorest 10% of England) were compared with women in IMD deciles 3–9. Results were analyzed using RevMan v4.2 (see table).
Results: 55% of our antenatal population are from IMD 1. We investigated 152 stillbirths. The numbers of observed and expected stillbirths in each IMD decile are similar. 46% of women from IMD 1 are smokers compared with only 7% in the least deprived group. There is a significant difference in the specific causes of stillbirths.
Conclusions: Current antenatal management is preventing an excess of stillbirths in the most deprived women. However, to make an impact in decreasing stillbirth rates in the next decade, we need

Abstract 6.1

Causes of stillbirths	IMD 1 N = 80 (%)	IMD 3–9 N = 42 (%)	Odds ratio (95% CI)
Placental abruption	14 (17.5)	4 (9.5)	2.02 (0.62 to 6.56)
Congenital anomaly	15 (18.8)	11 (26.2)	0.65 (0.27 to 1.58)
Fetal growth restriction*	23 (28.8)	5 (11.9)	2.99 (1.04 to 8.55)
Infection	3 (3.8)	2 (4.8)	0.78 (0.13 to 4.86)
Intrapartum asphyxia	2 (2.5)	1 (2.4)	1.05 (0.09 to 11.94)
Maternal reason	3 (3.8)	2 (4.8)	0.78 (0.13 to 4.86)
Placental insufficiency	5 (6.3)	2 (4.8)	1.33 (0.25 to 7.18)
Other specific causes	4 (5.0)	4 (9.5)	0.50 (0.12 to 2.11)
Unclassified	11 (13.8)	11 (26.2)	0.45 (0.18 to 1.15)

IMD, index of multiple deprivation. *Statistically significant.

to increase the awareness of fetal growth restriction in the community and to identify methods to diagnose which fetal growth restriction babies are at risk of stillbirth.

6.2 ADVERSE PERINATAL OUTCOMES AND RISK FACTORS FOR PRE-ECLAMPSIA IN WOMEN WITH CHRONIC HYPERTENSION: A PROSPECTIVE STUDY

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Objective: Prospective contemporaneous data on pregnancies in chronic hypertensive women are sparse; the purpose of this study was to characterise pregnancy outcome and risk factors for superimposed pre-eclampsia.
Methods: Indices of maternal and perinatal morbidity and mortality were ascertained in 822 women with chronic hypertension with data prospectively collected and rigorously validated.
Results: The incidence of superimposed pre-eclampsia was 22% (n = 180) with early-onset pre-eclampsia (⩽34 weeks' gestation) accounting for nearly half. Delivering an infant <10th customised birthweight centile complicated 48% (87/180) of those with superimposed pre-eclampsia and 21% (137/642) of those without (relative risk (RR) 2.30; 95% CI 1.85 to 2.84). Delivery at <37 weeks' gestation occurred in 51% of those with superimposed pre-eclampsia and 15% without (RR 3.52; 95% CI 2.79 to 4.45). Using multiple logistic regression, black ethnic origin, raised body mass index, current smoking, booking systolic blood pressure of 130–139 mm Hg and diastolic blood pressure of 80–89 mm Hg, a previous history of pre-eclampsia and chronic renal disease were identified as risk factors for pre-eclampsia.
Conclusions: In the largest study of its kind in chronic hypertensive women, these data demonstrate that the prevalence of infants born small for gestational age and preterm is considerably higher than background rates and is increased further in women with pre-eclampsia. These rates are higher than those previously reported, suggesting that the use of customised birthweight centiles provides a more accurate determination of fetal growth restriction. Smoking is an independent risk factor for superimposed pre-eclampsia, in contrast to the protective effect in low-risk pregnant women.

6.3 TEENAGE PREGNANCY AND MICRONUTRIENT STATUS: A STUDY OF 500 PREGNANT TEENAGERS FROM TWO UK INNER CITY POPULATIONS (THE ATE STUDY)

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Aims: Pregnancy outcome was assessed prospectively in a cohort of UK pregnant teenagers and associations with nutritional status investigated. 500 pregnant teenagers were recruited from two inner-city populations in the United Kingdom.
Methods: Nutritional status was assessed by dietary 24-h recall interviews and measurement of relevant indices in blood samples obtained in the third trimester. Associations with pregnancy outcome were explored using univariate and multiple regression analysis.
Results: 17.6% of babies were born small-for-gestational age (SGA) as assessed by customised birthweight centiles (<10th centile). 9.0% of infants were born preterm. Maternal iron deficiency anaemia in late pregnancy was highly prevalent (52.1%) and 30.4% of participants had 25-hydroxyvitamin D concentrations <25 nmol/l indicating vitamin D insufficiency. Univariate logistic regression identified several predictors of SGA birth, including low folate status (red cell folate, $p = 0.003$; serum folate, $p = 0.016$; serum total homocysteine, $p = 0.025$) as well as folate dietary intake and raised serum ferritin. Maternal smoking, higher maternal age, low BMI, low gestational weight gain, high BMI at booking were also predictive of SGA birth. Serum total homocysteine was a predictor of preterm birth.
Conclusions: This study suggests that dietary factors may play an important role in poor pregnancy outcome in teenagers from inner-city UK populations. Dietary interventions that increase folate and vitamin D intake in pregnant teenagers should be evaluated in prospective studies.

6.4 MATERNAL OBESITY AND THE RISK OF STILLBIRTH IN SMALL-FOR-GESTATIONAL AGE BABIES IDENTIFIED BY CUSTOMISED BIRTHWEIGHT CENTILES

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Background: Maternal obesity is a risk factor for adverse pregnancy outcome. It is also considered to "protect" against the delivery of a small-for-gestational age (SGA) baby.[1] We wanted to examine this claim by using a customised weight standard.
Methods: The cohort consisted of a comprehensive database of 326 377 routine ultrasound-dated Swedish pregnancies. SGA was defined by two methods: (1) 10th centile based on the Swedish population standard (SGApop); (2) 10th centile customised for maternal height, weight, parity, ethnic origin and baby's sex. Maternal obesity was defined as BMI ⩾30. Outcome was assessed by rates of stillbirth.
Results: 22 083 mothers had a BMI ⩾30 (6.8%) and this group had a significantly elevated risk of stillbirth compared with the non-obese population (odds ratio (OR) 1.99, CI 1.62 to 2.43). This risk was still elevated when babies that were SGA by either method were excluded (OR 1.48, CI 1.16 to 1.88). Being small by both methods (SGApop and SGAcust) resulted in a higher risk of stillbirth (n = 1342; OR 6.06, CI 3.87 to 9.48). However, a similar number of cases was additionally identified by SGAcust and these also had an elevated risk of stillbirth: n = 1332; OR 5.49, CI 3.43 to 8.78.
Conclusions: Maternal obesity represents an increased risk factor for stillbirth, which is much higher when the fetus is SGA. Obesity does not "protect" against SGA, but in fact hides a substantial proportion of babies that can be identified as SGA by a customised standard. These previously unrecognised SGA babies of obese mothers have a high risk of intrauterine death.

1. **Cnattingius S**, Bergstrom R, Lipworth L, *et al*. Prepregnancy weight and the risk of adverse pregnancy outcomes. *N Engl J Med* 1998;**338**:147–52.

6.5 MATERNAL AND OBSTETRIC ASSOCIATES OF BEING IN GOOD CONDITION FOLLOWING SINGLETON EXTREMELY PRETERM BIRTH

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Background: A heart rate >100 bpm 5 minutes after birth (HR >100/5 min) is independently associated with survival to discharge

Abstract 6.5 Statistically significant associations from the logistic regression analysis for the outcome livebirth with HR >100/5 min

Item	OR (95% CI)	p Value
PPROM	0.74 (0.55 to 0.99)	0.04
Abruption	0.43 (0.27 to 0.68)	<0.001
Any antenatal steroid	2.09 (1.51 to 2.89)	<0.001
GA per week	1.96 (1.77 to 2.22)	<0.001
Birthweight for GA per 100 g	1.44 (1.26 to 1.64)	<0.001
Cephalic presentation	2.36 (1.80 to 3.09)	<0.001
Vaginal delivery	0.58 (0.39 to 0.86)	0.01
Presence of any paediatric staff	2.64 (1.92 to 3.63)	<0.001

GA, gestational age; HR >100/5 min, heart rate >100 bpm 5 minutes after birth; OR, odds ratio; PPROM, prolonged pre-labour rupture of membranes.

for extremely preterm livebirths in the national datasets collected for the EPICure studies in both 1995 and 2006.
Objective: To identify predictors of favourable neonatal outcome (HR >100/5 min) following extremely preterm birth.
Methods: An extensive dataset of maternal demographic, obstetric and neonatal factors was collected for all births 22 + 0 to 26 + 6 weeks in all English hospitals in 2006. Gestational age was validated using a hierarchical classification of scan dates, certain last menstrual period and working gestation.
Results: Data were collected for 1590 singleton births either born by Caesarean section or alive at the onset of labour of whom 1049 (66%) were liveborn with HR >100/5 (see table).
Conclusions: The only intervention highly associated with a favourable outcome for extremely preterm babies is the administration of antenatal steroids. Babies with placental abruption were much less likely to have HR >100/5 min. The incorporation of this information into clinical decision making remains a challenge for both obstetricians and neonatalogists.

Session 6B BAPM/NNS: Lungs and Infection

6.6 A RANDOMISED COMPARISON OF WIDE VERSUS NARROW SATURATION MONITOR ALARM LIMITS FOR CONTROLLING OXYGEN THERAPY IN PRETERM INFANTS

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Background: Saturation monitoring is used widely to guide oxygen therapy. The optimal target ranges are unknown. There is a general aim to minimise hyperoxia, hypoxia and variability. Chosen alarm limits may influence stability because alarm soundings prompt alterations to oxygen therapy.
Aim: To determine whether the width of the alarm limits influences the stability of oxygenation in oxygen-dependent preterm infants.
Methods: Infants born at <29 weeks' gestation and receiving supplemental oxygen were studied between days 3 and 14. Each infant was studied for two consecutive 3-h periods allocated in random order. During one period the alarm limits were set at 80–94% and during the other at 86–94%. Saturation values were downloaded to a PC every second. For each period the percentage of time spent with saturation >94%, <86%, <80% and saturation variability (standard deviation) were calculated. Differences within babies between the two periods were analyzed by by Wilcoxon test.
Results: See table.
Conclusions: When wider saturation alarm limits were used, babies spent less time with high saturations but no more time with low saturations. These results will facilitate improved oxygen saturation targeting.

Abstract 6.6

	Wide (80–94%)	Narrow (86–94%)	Median difference
Mean Spo_2 (%)	89.3 (88.1 to 90.5)	89.0 (88.6 to 91.8)	0 (−1.9 to 1.7)
% Time Spo_2 >94%	8.8 (5.3 to 20.4)	12.9 (6.3 to 31.0)	3.8 (−0.9 to 10.2)*
% Time Spo_2 <86%	16.0 (5.8 to 24.7)	14.4 (9.1 to 24.3)	0 (−8.4 to 6.9)
% Time Spo_2 <80%	3.8 (0.5 to 7.9)	4.2 (2.0 to 11.8)	0.5 (−1.0 to 6.2)
Spo_2 variability	5.0 (3.3 to 7.3)	6.2 (4.2 to 10.7)	0.7 (−0.4 to 3.8)*

Spo_2, oxygen saturation.
Data are median (interquartile range). *p<0.05.

6.7 COMPARISON OF LEFT AND RIGHT VENTRICULAR FUNCTION IN TERM AND PRETERM NEONATES USING TISSUE DOPPLER IMAGING

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Background: Tissue Doppler imaging (TDI) enables the measurement of myocardial velocities and calculation of the myocardial performance index.[12] Preterm infants are at risk of cardiac dysfunction but the aetiology and most effective treatments are not clear. This is the first study comparing TDI data from preterm and term neonates.
Methods: 30 neonates (25–41 weeks' gestation) were scanned by a single investigator (RN) on day one of life. TDI waveforms were acquired from an apical four-chamber view using a Doppler pulse-wave sample gate at the lateral tricuspid (right ventricular) and mitral (left ventricular) annuli. Peak systolic, early diastolic and late diastolic velocities were measured. Pulse-wave Doppler data of tricuspid, mitral and left ventricular outflow were obtained from an apical view. Right ventricular outflow was assessed from a parasternal view. Average readings were taken from three to five cardiac cycles. South Birmingham REC gave ethical approval.
Results: Patient data were compared from three gestational groups (n = 10 in each). Myocardial velocities decreased and the derived myocardial performance index increased with decreasing gestation (see table).
Conclusions: TDI enables the quantification of neonatal myocardial function. Velocities from term babies are consistent with published data[13] and this study provides evidence of relative myocardial dysfunction in preterm infants.

1. **Mori K,** *et al*. *Heart* 2004;**90**:175–80.
2. **Roberson DA,** Cui W. *J Am Soc Echocardiogr* 2006;**19**:1438–45.
3. **Ekici, *et al***. *Echocardiography* 2007;**24**:61–7.

Abstract 6.7

	Tricuspid annulus velocity (mean, SD) (cm/s)			Mitral annulus velocity (mean, SD) (cm/s		
	S	E	A	S	E	A
Term	6.7 (1.2)	7.2 (1.2)	7.9 (1.7)	5.0 (1.2)	6.2 (1.0)	7.6 (2.5)
32–36 weeks	6.0 (0.9)	6.2 (0.9)	7.9 (1.6)	4.4 (0.7)	5.8 (1.6)	6.2 (2.1)
<30 weeks	4.8 (0.6)	4.0 (1.1)	7.4 (1.6)	3.7 (0.6)	4.3 (0.8)	5.4 (2.5)

6.8 LOW CORD BLOOD MONOCYTES MHC CLASS II EXPRESSION IS ASSOCIATED WITH SEPSIS IN TERM AND PRETERM NEONATES

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Hypothesis: MHC class II expression on monocytes is necessary for immune competence and can be downregulated after an inflammatory stimulus. We hypothesised that MHC class II expression would be decreased in preterm neonates and that low expression would increase the risk of subsequent sepsis.