Objectives

• Overview of neonatal intensive care
• Outcomes of NICU infants plus resource
• Australia and New Zealand Neonatal Network
• Role of ANZNN
• Quality improvement
The NICU and the Australian Neonatal Network

MONASH NEWBORN NICU
Neonates needing intensive care at Monash NICU

- Babies born at 32 - 44 weeks gestation
- Babies born at less than 32 weeks gestation
Premature infants

http://mimr-phi.org/infant-and-child-health

http://www.cuh.org.uk/rosie/services/neonatal/nicu/how_we_care/vital_needs.html

Victorian NICU trend in ventilation

Figure 2. Changes over time in consumption of nursery resources (mean equivalent days of assisted ventilation) and survival rates to 2 years of age in each era, for infants of birth-weight 500–999 g, and in 250 g birth-weight subgroups. Redrawn from Doyle et al...

Cost of NICU care – preterms rates of childhood disability

Figure 2

Distribution of Canadian live births across disability levels for preterm infants by gestational age.

Healthcare utilisation – preterm infants

Figure 3

Resource use per individual in the Québec cohort from birth to age ten.
Surgical and cardiac infants

Neonates needing surgery

Congenital heart disease

Therapeutic hypothermia


<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Hypothermia</th>
<th>Standard care</th>
<th>Risk Ratio</th>
<th>Weight</th>
<th>Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sildenafil-head cooling with mild systemic hypothermia</td>
<td>31/100</td>
<td>46/100</td>
<td>1.0</td>
<td>1.5</td>
<td>5a(0.01)</td>
</tr>
<tr>
<td>Cool-Cap Study 2005</td>
<td>39/110</td>
<td>73/110</td>
<td>1.1</td>
<td>1.4</td>
<td>8a(0.10)</td>
</tr>
<tr>
<td>Zhou 2012</td>
<td>31/100</td>
<td>46/100</td>
<td>1.0</td>
<td>1.5</td>
<td>5a(0.01)</td>
</tr>
<tr>
<td>Whole-body cooling</td>
<td>14/27</td>
<td>21/23</td>
<td>0.7</td>
<td>0.7</td>
<td>0.01(0.01)</td>
</tr>
<tr>
<td>NICHD Study 2005</td>
<td>45/102</td>
<td>64/103</td>
<td>0.5</td>
<td>0.5</td>
<td>0.01(0.01)</td>
</tr>
<tr>
<td>TCEO Study 2009</td>
<td>74/133</td>
<td>80/142</td>
<td>1.1</td>
<td>1.3</td>
<td>0.09(0.10)</td>
</tr>
<tr>
<td>NICHD Study 2010</td>
<td>27/53</td>
<td>48/58</td>
<td>1.1</td>
<td>1.2</td>
<td>0.09(0.10)</td>
</tr>
<tr>
<td>EC Study 2011</td>
<td>58/107</td>
<td>67/103</td>
<td>1.0</td>
<td>1.0</td>
<td>0.01(0.01)</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>67/8</td>
<td>66/66</td>
<td>100.0</td>
<td>0.75</td>
<td>0.88</td>
</tr>
</tbody>
</table>

- Standard error
- Standard error
- Standard error

Additional notes:
- 3a: 0.01
- 2a: 0.01
- 1a: 0.01

Heterogeneity: CI = 4.0, df = 1.7 (P = 0.01) (2008)
Test for funnel effect 2 = 1.3 (P = 0.00)
Test for funnel shape: CI = 4.0, df = 1.7 (P = 0.01) (2008)
Complications from neonatal intensive care

INTENSIVE OXYGEN THERAPY AS A POSSIBLE CAUSE OF RETROLENTAL FIBROPLASIA: A CLINICAL APPROACH.

By Kate Campbell, Melbourne.

The fetus in the uterus is cyanosed. This is partly due to the fact that none of the arteries in his body carries pure arterial blood, even the head being supplied with mixed arterial and venous blood. Also, the oxygen conditions of the fetus are poorer than those in extraterrestrial life. It has been shown (Smith, 1946) that the oxygen content of the blood in the umbilical vein is lower than that of the arterial blood of extraterrestrial life. At birth.

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Hypothermia</th>
<th>Normothermia</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Events</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td>29</td>
<td>116</td>
</tr>
<tr>
<td></td>
<td>32</td>
<td>102</td>
</tr>
<tr>
<td></td>
<td>71</td>
<td>163</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>132</td>
<td>381</td>
</tr>
</tbody>
</table>

Risk ratio (95% CI): 22.9 (0.89 to 2.45) for CoolCap, 24.9 (0.94 to 2.42) for NICHD, 52.2 (1.16 to 2.12) for TOBY.

Favours normothermia, favours hypothermia.

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History of oxygen use in preterm neonates

- **early 1950s**: unrestricted, high \( O_2 \), subsequent huge increase in RLF (severe ROP)

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Retinopathy of prematurity – worldwide cases

- \(<8/1000\): Low risk of ROP blindness – good neonatal care and screening
- \(9-45/1,000\): High risk of ROP blindness – neonatal care and screening not always adequate
- \(≥61/1,000\): Low risk of ROP – neonatal care not well developed
The Australian Neonatal Network

ANZNN

The establishment of the Australian and New Zealand Neonatal Network

Evaluate health problem
Incidence, risk factors, care and prognosis
- audit and observational research

Implement and evaluate practice

Clear clinical question?

Effective care available?

Systematic review

Yes

Develop clinical practice guidelines

No

Randomised controlled trial or other appropriate research
Australia and New Zealand Neonatal Network

• In 1993 NHMRC Expert Panel on Perinatal Morbidity recommended that “The Australian Institute of Health and Welfare National Perinatal Statistics Unit”
  – a national minimum data set and implement a data collection to monitor mortality and morbidity of infants admitted to such [perinatal] units
• Data collection – Jan 1995 all level III NICUs in both Australia and New Zealand contributed to the audit
  – In 1998, all level II NICUs in NZ joined as did the one level II NICU from Tasmania in 1999
• Until 2008 hosted by Centre for Perinatal Health Services Research at the University of Sydney
• In 2008, the Network moved to the Perinatal and Reproductive Epidemiology Research Unit (PRERU) at UNSW

Eligible babies from:

Royal Darwin
Alice Springs
Children’s at Westmead
Liverpool
Nepean
Royal Hospital for Women
Royal North Shore
Sydney Children’s
Westmead
RPA Women and Babies
Women’s & Children’s
Flinders Medical Centre
Mercy Women’s
Monash Medical Centre
Launceston
Royal Hobart

Canberra
Northshore
Waitakere
Middlemore
Tauranga
Whakatane
Rotorua
Auckland City
Auckland
Gisborne
Hastings
Palmerston North
Nelson
Wairau
Timaru
Southland
Dunedin
Wellington Women’s
Christchurch Women’s
Schematic flow of ANZNN

Management Group

Chairman

Operations Manager

ANZNN Coordinator
ANZNN registration criteria

All babies admitted to a level III NICU at less than 28 days (during their first admission) who:
- < 32 completed weeks’ gestation or
- < 1500 grams birthweight or
- receive assisted ventilation for 4 or more hrs. or
- receive major surgery
- Therapeutic hypothermia

The registration unit is the first level III nursery that the baby remains in for 4 or more hours.
If retrieved, a baby is deemed to be in the care of the next hospital when a specialist team arrives.

ANZNN Minimum dataset

- Large dataset required
- Antenatal treatment
- Maternal conditions
- Delivery details
- Care delivered (ventilation)
- Mortality
- Morbidity (intracranial haemorrhage, chronic lung disease, retinopathy)
- 2 year outcomes (from 2012 report)
Purpose of ANZNN annual report

• Providing a core data
• Monitoring the clinical indicators for perinatal care
• Improving clinical practice while maintaining national standards
• Monitoring the use of new technologies
• Consistency in national data collections

• Follow-up data (2 year) available from 2012 report
• Available online


Individual Unit Feedback

• Provided to medical directors of NICU
• Confidential, password protected
• Benchmarked against NICU network
• Process of care, clinical outcomes, morbidity etc.
• Non-risk adjusted data
  – Illness severity e.g.
    CRIB-II and SNAPPE-II
ANZNN - Individual unit feedback for babies born in 2005

Days to go home

Gestational age (weeks)

ANZNN clinical indicators

- Cranial ultrasound
- Eye examination
- Chronic lung disease
- Use of exogenous surfactant for HMD
- Late onset sepsis

Days to go home

Inter quartile range
Median
your unit
Role of neonatal networks

- Randomised control trials
- Observational studies
- Quality improvement
- Advocacy

ANZNN Working groups

- Cranial ultrasounds
- Common parenteral nutrition formulations
- Chronic lung disease
- Clinical Practice Improvement
Quality Improvement

BENCHMARKING

Institute of Medicine's six domains of quality.

Quality improvement and benchmarking

“So how do we set realistic targets for improvement? In health care, as in many other fields, we often look around us to see what others have achieved. The theory being that if they can do it, so can we.”

Benchmarking for Improvement: Reducing Health Disparities
Blog Jacob Lippa MPH – www.ihi.org
Nosocomial infection

• Average length of stay – time to reach EDD + 2 weeks
• High risk of nosocomial infection or hospital acquired infection (HAI)
  – Immature immune function
  – Permeability of skin barrier
  – Instrumentation (IV lines, blood tests, ventilation)
EPIC-I Results: Group A (NIT)

Lee et al. CMAJ 2009 181:469-76
EPIC-I Results: Group B (CLD)

Lee et al. CMAJ 2009 181:469-76

International Networks

VON Vermont Oxford Network

NIH Eunice Kennedy Shriver National Institute of Child Health and Human Development

The Canadian Neonatal Network™
ANZNN and other networks

http://www.canadianneonatalnetwork.org/portal

International Neonatal Network comparisons

Table 4. Multiple logistic regression models showing adjusted odds ratio and 95% CI of adverse outcome (ANZNN vs. CNN)

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Overall</th>
<th>&lt;25</th>
<th>25-26</th>
<th>27-28</th>
<th>29-31</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality</td>
<td>1.01 (0.88, 1.16)</td>
<td>0.98 (0.75, 1.27)</td>
<td>0.90 (0.74, 1.10)</td>
<td>1.14 (0.96, 1.35)</td>
<td>1.08 (0.79, 1.48)</td>
</tr>
<tr>
<td>Low Apgar</td>
<td>0.67 (0.62, 0.73)</td>
<td>1.18 (0.94, 1.52)</td>
<td>0.72 (0.62, 0.83)</td>
<td>0.63 (0.54, 0.73)</td>
<td>0.63 (0.54, 0.73)</td>
</tr>
<tr>
<td>Severe neurological injury</td>
<td>0.98 (0.59, 0.78)</td>
<td>1.02 (0.71, 1.43)</td>
<td>0.72 (0.57, 0.92)</td>
<td>0.60 (0.45, 0.79)</td>
<td>0.45 (0.33, 0.64)</td>
</tr>
<tr>
<td>Severe ROP</td>
<td>0.71 (0.61, 0.83)</td>
<td>0.70 (0.52, 0.92)</td>
<td>0.64 (0.51, 0.80)</td>
<td>0.75 (0.51, 1.10)</td>
<td>1.65 (0.83, 3.3)</td>
</tr>
<tr>
<td>NEC &gt; stage 2</td>
<td>0.65 (0.50, 0.86)</td>
<td>1.36 (0.95, 2.03)</td>
<td>0.73 (0.55, 0.96)</td>
<td>0.67 (0.48, 0.90)</td>
<td>0.30 (0.22, 0.41)</td>
</tr>
<tr>
<td>Early-onset sepsis</td>
<td>1.33 (1.02, 1.74)</td>
<td>0.68 (0.52, 1.47)</td>
<td>1.26 (0.75, 2.10)</td>
<td>1.70 (0.71, 3.95)</td>
<td>1.40 (0.52, 2.27)</td>
</tr>
<tr>
<td>Late-onset sepsis</td>
<td>0.03 (0.07, 0.91)</td>
<td>0.00 (0.00, 1.16)</td>
<td>0.76 (0.64, 0.90)</td>
<td>0.81 (0.65, 0.96)</td>
<td>0.88 (0.75, 1.01)</td>
</tr>
<tr>
<td>Air leak</td>
<td>1.20 (1.01, 1.42)</td>
<td>1.06 (0.70, 1.59)</td>
<td>0.96 (0.62, 1.50)</td>
<td>1.40 (0.93, 2.10)</td>
<td>1.40 (1.10, 2.1)</td>
</tr>
</tbody>
</table>

*Indicates statistically significant, AOR and 95% CI exclude 1.00. The reported AORs (ANZNN vs. CNN) were based on multiple logistic regression models, adjusted for gestational age group, gender, SGA, Apgar score at 5 min less than 7, outcome status, maternal age, antenatal maternal smoking, mode of delivery (cesarean section or normal delivery), multiple births and maternal hypertension using a stepwise entry or removal selection process. Neonatal injury defined as the presence of severe (grade 3 or 4) intraventricular/periventricular hemorrhage and/or persistent pulmonary hypertension. ANZNN, Australian and New Zealand Neonatal Network; AOR, adjusted odds ratio; CI, confidence interval; CLD, chronic lung disease; CNN, Canadian Neonatal Network; NEC, necrotizing enterocolitis; ROP, retinopathy of prematurity.

AHHH

Comparison of mortality and major morbidity of very preterm neonates using data from 8 national neonatal databases: The international network for evaluation of outcomes (INEO).


CNIO, Toronto, Canada; *ANZNN, Sydney, Australia; *SAQ, Uppeala, Sweden; *BHN, Tel Hashomer, Israel; *IKNK, Tokyo, Japan; *SwissNeonics, Zurich, Switzerland; *AHRF-15000, Bamahala, Spain; *UKNC, London, United Kingdom. Email: k.jin@unsw.edu.au

<table>
<thead>
<tr>
<th></th>
<th>AUS/NZ</th>
<th>Canada</th>
<th>Israel</th>
<th>Japan</th>
<th>Sweden</th>
<th>Switzerland</th>
<th>Spain</th>
<th>UKNC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observed (%)</td>
<td>3191 (34.4)</td>
<td>3139 (40.1)</td>
<td>1462 (33.2)</td>
<td>4575 (36.6)</td>
<td>663 (30.4)</td>
<td>532 (26.5)</td>
<td>2877 (37.5)</td>
<td>4241 (42.3)</td>
</tr>
<tr>
<td>SR (95% CI)</td>
<td>0.93 (0.90, 0.96)</td>
<td>1.04 (1.00, 1.08)</td>
<td>1.00 (0.95, 1.05)</td>
<td>0.89 (0.87, 0.92)</td>
<td>0.81 (0.71, 0.94)</td>
<td>0.87 (0.71, 0.94)</td>
<td>1.09 (1.05, 1.13)</td>
<td>1.16 (1.13, 1.20)</td>
</tr>
</tbody>
</table>
Summary

• Overview of the NICU clinical environment
• Organisation and aims of ANZNN
• Benchmarking activities in Australian NICU
• Future directions in ANZNN

Acknowledgements

• Assoc Prof Ross Haslam, Chairman ANZNN
• Assoc Prof Kei Lui, Operations Manager ANZNN
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