Shades of gray:
Controversies at the limits of viability

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April 26, 2018

Disclosures

I have nothing to disclose.
Definition of viability

- Able to work as intended or to succeed
- Ability to continue to exist or develop as a living being

https://dictionary.cambridge.org/us/dictionary/english/viability

Raju TNK, et al. AJOG 2014

• Broadly defines viability as 20 0/7 weeks to 25 6/7 weeks
• 0.4-0.5% of all births are ≤ 27 weeks and comprise 40% of infant death
• Summary of obstetric practices, antenatal counseling, neonatal resuscitation practices, and recommendations for research and education

Raju TNK, et al. AJOG 2014
Born before 22 weeks, 'most premature' baby is now thriving

- Born at 21 weeks and 4 days
- 15 ounces
- Now 3 years old

Views On Viability Differ Around The World

- International Perinatal Collegium – 42 members, 14 countries
- Survey was carried out regarding antenatal counseling in 4 different scenarios:
  - Female infant whose mother had received steroids
  - Male infant whose mother had not received steroids
  - Premature infant who was active and crying with a HR of 130 bpm
  - Non-reactive infant with poor tone and a heart rate of 60
- Answers were to be given for 22, 23, and 24 weeks and were to be one of the following:
  - Start resuscitation with full care
  - Start pulmonary resuscitation only
  - Comfort care only
  - Other

Views On Viability Differ Around The World

Norway –
- Little resuscitation < 23 weeks, 23-24 weeks controversial, > 24 weeks viable

France –
- Infants < 23 weeks should not be resuscitated because of “unreasonable obstinacy,” 23 - 25 weeks “grey zone”

Israel –
- Infants > 24 weeks “full resuscitation,” 22-24 weeks “gray zone”

Sweden –
- Infants 22-23 weeks controversial, > 23 weeks mostly resuscitated

Canada –
- Infants 22-24 weeks resuscitation should be tailored to the individual

What should the limit of viability be?

- 21 weeks?
- 22 weeks?
- 23 weeks?
- 24 weeks?
- 25 weeks?
Without a consensus on the limit of viability what do we do?

Optimize care

Cohesive OB/Neo planning

Cohesive OB/Neonatal Planning

Determine the accuracy of gestational age assessment

- Gold standard: IVF or ovulation induction
- First trimester ultrasound (up to 13 6/7 weeks)
  - accurate ± 5 - 7 days
- Second trimester ultrasound (14 0/7 – 27 6/7 weeks)
  - accurate ± 14 days
- Consistent with the last menstrual period?

Cohesive OB/Neonatal Planning

• Establish clear communication with the obstetric and maternal-fetal team
  • Determine any maternal factors that may affect outcomes
  • Determine any fetal factors that may affect outcomes

http://ampsinc.net/

Cohesive OB/Neonatal Planning

• Ideally, planned deliveries would be discussed in a care conference

• Determine the obstetric plan for monitoring and delivery

• Consider ways to optimize neonatal outcomes
Cohesive OB/Neonatal planning: Modifiable practices

<table>
<thead>
<tr>
<th>Variable</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gestational age assessment</td>
<td>IVF dating, dating by ultrasound</td>
</tr>
<tr>
<td>Non-modifiable risk factors</td>
<td>Race and ethnicity, plurality, infant sex, birthweight, gestational age</td>
</tr>
<tr>
<td>Modifiable obstetric practices</td>
<td>Antenatal interventions (corticosteroids, tocolysis, antibiotics for premature rupture, magnesium) and site and mode of delivery</td>
</tr>
<tr>
<td>Modifiable neonatal practices</td>
<td>Initial resuscitation and subsequent care</td>
</tr>
<tr>
<td>Approaches to comfort care</td>
<td>Institutional and physician philosophies, parental wishes, and religious convictions</td>
</tr>
<tr>
<td>Regional/hospital legal and practice guidelines</td>
<td>Policies concerning neonatal resuscitation</td>
</tr>
</tbody>
</table>


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Cohesive OB/Neonatal planning: Antenatal steroids

- Neonates 400 – 1000 grams, 22 – 27 weeks
- Excluded infants who died within 12 hours of birth
- Exposure: No, partial, or complete antenatal steroids
- Outcome: Neurodevelopmental disability at 18 – 22 months
- 4284 infants (90% with followup data)

Cohesive OB/Neonatal planning: Antenatal steroids

### Variable

<table>
<thead>
<tr>
<th>Variable</th>
<th>No ANS</th>
<th>Partial ANS</th>
<th>Complete ANS</th>
</tr>
</thead>
<tbody>
<tr>
<td>22 weeks*</td>
<td>N = 51</td>
<td>N = 14</td>
<td>N = 12</td>
</tr>
<tr>
<td>Death/NDI</td>
<td>92%</td>
<td>84% Adj OR 0.69 (95% CI 0.06-7.73)</td>
<td>75% Adj OR 0.03 (95% CI 0.002-0.59)</td>
</tr>
<tr>
<td>Death</td>
<td>73%</td>
<td>61% Adj OR 0.60 (95% CI 0.14-2.48)</td>
<td>67% Adj OR 0.48 (95% CI 0.09-2.53)</td>
</tr>
<tr>
<td>23 weeks</td>
<td>N = 215</td>
<td>N = 201</td>
<td>N = 275</td>
</tr>
<tr>
<td>Death/NDI</td>
<td>87%</td>
<td>77% Adj OR 0.50 (95% CI 0.29-0.89)</td>
<td>72% Adj OR 0.37 (95% CI 0.22-0.63)</td>
</tr>
<tr>
<td>Death</td>
<td>73%</td>
<td>61% Adj OR 0.58 (95% CI 0.36 – 0.92)</td>
<td>58% Adj OR 0.51 (95% CI 0.32 – 0.79)</td>
</tr>
</tbody>
</table>

*Very small numbers, OR relative to no ANS

Cohesive OB/Neonatal planning: Antenatal steroids

- Infants born between 1993 – 2005
- 22 – 25 week gestation
- 23 Neonatal Research Network Centers
- Infants who did not receive resuscitation were not included
- Outcome: Death or severe neurodevelopmental impairment by 18 – 22 months

Carlo, WA et al. JAMA 2013

<table>
<thead>
<tr>
<th>Gestational Ages</th>
<th>Adjusted Odds Ratios</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Death or Neurodevelopmental Impairment</td>
<td></td>
</tr>
<tr>
<td>All infants</td>
<td>0.60</td>
<td>0.53 – 0.69</td>
</tr>
<tr>
<td>22 week</td>
<td>0.80</td>
<td>0.29 – 2.21</td>
</tr>
<tr>
<td>23 week</td>
<td>0.58</td>
<td>0.42 – 0.80</td>
</tr>
<tr>
<td>24 week</td>
<td>0.62</td>
<td>0.49 – 0.78</td>
</tr>
<tr>
<td>25 week</td>
<td>0.61</td>
<td>0.50 – 0.74</td>
</tr>
</tbody>
</table>

Carlo, WA et al. JAMA 2013
Cohesive OB/Neonatal planning:
Antenatal steroids

- Neocosur Centers 2001 – 2011
- 4386 infants 24-30 weeks
- Model 2: 24-25 week subgroup adjusted for gender, Apgar scores, early onset sepsis, SGA, PPROM < 18 hours
- Exposure: antenatal steroids and mode of delivery
- Outcome: Survival to hospital discharge

Cohesive OB/Neonatal planning:
Antenatal steroids and mode of delivery

<table>
<thead>
<tr>
<th>Table 2. Multivariate logistic regression for survival and sIVH-free survival, Neocosur Network, 2001-2011</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Table Image" /></td>
</tr>
</tbody>
</table>

Hubner, ME et al. J Peri 2016
Cohesive OB/Neonatal planning:
Other therapies

- Meta-analyses of magnesium sulfate given to mothers at risk of preterm birth
  - Reduced risk of cerebral palsy (RR 0.68 95% CI 0.54 – 0.87)
  - Reduction in the rate of gross motor dysfunction (RR 0.61 95% CI 0.44 – 0.85)
  - No difference in mortality

- Consider antibiotics to prolong latency in the setting of premature rupture of membranes
  - 24 weeks and beyond?

- Tocolysis
  - May delay delivery 48 – 72 hours after 26 weeks

Doyle, LW et al. Cochrane Reviews 2009; Obstetric Care Consensus, 2017

Cohesive OB/Neonatal planning

- Establish clear communication

- Optimize modifiable OB Care

- What if the family elects to provide comfort care?
Qualitative interviews of nurses and physicians
• 24 nurses/14 physicians

• Neonates between 22 0/7 weeks and 23 6/7 weeks, other neonates with complex chronic conditions

• Half had no signs of distress
• Most common symptoms were
  • Respiratory – Hypopnea, Apnea, Gasping, Dyspnea
  • Tachycardia or bradycardia
  • Vocal expressions such as crying or whining

Cohesive OB/Neonatal planning: Comfort Care

Treatment of symptoms

• External warmth and skin contact

• Pharmacological pain management
  • Should not accelerate or extend the dying process
  • Easy to apply
  • Should not disturb the parent-child interaction

Caregiver stress: 50% of participants reported high degrees of emotional stress

- Being insecure how to communicate with parents

- Especially when parent’s wishes were difficult to accept or to put in place by the DR team

- Shortage of staff

- Lack of appropriate family-centered rooms

Factors that enabled staff to cope with stress

- Personal exchange with family and friends

- Keep a professional distance

- Good and harmonious interaction between parents and the dying newborn

- Structured exchange and education

Cohesive OB/Neonatal planning: Comfort Care

Ensure your team can cope with comfort care

• Obstetric team, Labor and Delivery Nurses, Resuscitation Team, Neonatal providers
• Prepare the parents for what to expect
• Identify a point person to treat the patient and attend to the family
• Identify a place where the family may go and be undisturbed
• Offer to gather any family or religious support

Engage in a debriefing session with providers

Cohesive OB/Neonatal planning

• Establishment of communication and management plan
• Determination of non-modifiable risk factors
• Optimization of modifiable factors
• Establish guidelines for comfort care
• Establish structured de-briefing for staff caring for the dying newborn
Individualize antenatal counseling: shared decision-making

“The goal of this process is for parents to feel like parents and to feel like they are good parents, before birth, at birth and after, either in the NICU or until the death of their child.”

Hayward, MF et al. Clin Perinatol 2017
Individualize antenatal counseling: shared decision-making

Transfer of information without exploration of values may be inadequate

• Gestational-age based information may not take into account differences in active treatment

• Gestational-age based counseling may not take into account differences in parental values

Hayward, MF et al. Clin Perinatol 2017

Individualize antenatal counseling: Parental perceptions

• Qualitative analyses of 46 interviews among 54 parents

• 3 sites in the Midwestern US (40 pregnancies)

• 40 pregnancies were between 22-25 weeks gestation

• 85% of the participants reported that physicians provided morbidity and mortality data based on gestational age; “brain damage” “disability” “handicap”

Individualize antenatal counseling: Parental perceptions

- Almost 30% of those parents involved in treatment decisions based their decision on giving their infant a “fighting chance”

- Parents who had a child born preterm or knew others with a preterm child were more likely to request resuscitation

- Others explained their decisions were based on wanting what was “best for their infant,” desiring a “healthy infant,” or concerns about infant suffering

- Views towards disability varied

- Views on a higher power were important


Individualize antenatal counseling: Parental perceptions

- Qualitative study in England 2011

- Parents of babies born < 32 weeks (range 24 – 32 weeks)

- 32 mother and 7 fathers

Sawyer, A et al. BJOG 2013
Individualize antenatal counseling: Parental perceptions

Factors associated with parents’ experiences of care

**Staff professionalism**
- Information and explanation (85%)
- Staff calm in a crisis (49%)
- Confident and in control
- Negative: Staff not listening (18%)

Sawyer, A et al. BJOG 2013

Individualize antenatal counseling: Parental perceptions

**Staff empathy**
- Caring and emotional support (54%)
- Encouragement and reassurance (59%)

**Involvement of the father**

**Birth environment**
- Radio playing
- Windows in the room

Sawyer, A et al. BJOG 2013
Individualize antenatal counseling:
Provide multidisciplinary support

- Provide consistent information

- Encourage staff to recognize the degree of stress
  - Be polite and professional
  - Be kind and calm

- Offer time between counseling sessions
  - Support system – father or other family
  - Time to reflect and think of questions or concerns

- Interpretation services for non-English speaking patients

- Religious providers

“Controlled-improvised agenda” vs. a physician-driven agenda

- S – Situation –
  - All providers deliver the same message of the situation, “trust”
- O – Opinions
  - Opinions and biases should be recognized by providers
- B – Basic politeness
  - Avoid distractions (phone/pager); consider a consultation team
- P – Parents
  - Determine parental concerns
- I – Information
  - Provide information
- E – Emotions
  - Address emotions, avoid pessimism
Provide information:
Gestational age guided decision-making

- May be guided by your hospital or employer guidelines
- Consider gestational-age based outcomes
- Consider other factors that affect neonatal outcomes

Stokes, TA et al Clin Perinatol 2017
Infants 22 0/7 – 28 6/7 weeks: greatest overall decline in mortality from 2004 – 2007 and 2008 – 2011 of 9.6%

- More than half of the reduction in mortality due to decreased RDS and BPD
- Deaths due to NEC increased from 2000 – 2003 to 2008 – 2011

From 2000 - 2011

- Increased prenatal care
- Increased Cesarean section
- Increased ANS
- Decreased prenatal antibiotic use
Provide Information:
Gestational age based survival/Infants surviving > 12 hours

Table 3. Cause of Death According to Gestational Age.

<table>
<thead>
<tr>
<th>Cause of Death</th>
<th>22 Wk</th>
<th>23 Wk</th>
<th>24 Wk</th>
<th>25 Wk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total deaths†</td>
<td>97 (2.7)</td>
<td>650 (18.0)</td>
<td>986 (27.2)</td>
<td>729 (20.1)</td>
</tr>
<tr>
<td>Cause</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Congenital anomalies</td>
<td>0</td>
<td>2 (0.3)</td>
<td>8 (0.8)</td>
<td>16 (3.2)</td>
</tr>
<tr>
<td>Respiratory distress syndrome</td>
<td>28 (28.3)</td>
<td>271 (41.7)</td>
<td>360 (36.6)</td>
<td>242 (33.2)</td>
</tr>
<tr>
<td>Bronchopulmonary dysplasia</td>
<td>3 (3.1)</td>
<td>40 (6.2)</td>
<td>100 (10.1)</td>
<td>76 (20.4)</td>
</tr>
<tr>
<td>Infection</td>
<td>12 (12.4)</td>
<td>65 (10.0)</td>
<td>112 (11.4)</td>
<td>78 (10.7)</td>
</tr>
<tr>
<td>Necrotizing enterocolitis</td>
<td>5 (5.2)</td>
<td>67 (10.3)</td>
<td>136 (13.8)</td>
<td>122 (16.7)</td>
</tr>
<tr>
<td>CNS injury</td>
<td>3 (3.1)</td>
<td>38 (5.8)</td>
<td>73 (7.4)</td>
<td>42 (5.8)</td>
</tr>
<tr>
<td>Immaturity</td>
<td>36 (37.1)</td>
<td>96 (14.8)</td>
<td>46 (4.7)</td>
<td>20 (2.7)</td>
</tr>
<tr>
<td>Other</td>
<td>10 (10.3)</td>
<td>66 (10.2)</td>
<td>147 (14.9)</td>
<td>126 (17.3)</td>
</tr>
<tr>
<td>Unknown</td>
<td>0</td>
<td>5 (0.8)</td>
<td>4 (0.4)</td>
<td>7 (1.0)</td>
</tr>
</tbody>
</table>

* Percentages in this row are percentages of all deaths.
† Percentages in this row are percentages of all deaths after 12 hr.

Patel, RM et al NEJM 2015

Provide Information:
Gestational age based survival and neurodevelopmental outcomes

- 4274 infants in the Neonatal Research Network
  - 18% 22 weeks
  - 34% 23 weeks
  - 49% 24 weeks

- 2000 – 2011
  - Across 3 Epochs

- Outcomes at 18 – 22 months:
  - Survival without neurodevelopmental impairment
  - Survival with neurodevelopmental impairment
  - Death

Younge, N et al NEJM 2017
Provide Information:
Gestational age based Outcomes

Survival without NDI/Survival with NDI
Infants 2008-2011 compared with 2000-2003

Adjusted for completed wks GA, multiple gestation, sex, race, SGA, and birth center
* Confidence interval does not span 1

Younge, N et al NEJM 2017
Provide Information:
Gestational age based Longer-term Outcomes

- Meta – analysis of 9 studies
  - Cohort studies
  - Prospective Data Collection
  - > 65% follow-up at 4 -8 years

- Outcomes were
  - Severe NDI – IQ < 3 SD below mean, non-ambulent CP, no useful vision or hearing
  - Moderate NDI – IQ 2-3 SD below mean, ambulent CP, little useful vision, hearing restored with amplification

Moore, GP et al. JAMA Ped 2013

Moderate – Severe NDI decreased 6% with each increasing gestational age week (95% CI 1.7 – 10.3)

<table>
<thead>
<tr>
<th>Gestational Age</th>
<th>Mean</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>22 weeks</td>
<td>43%</td>
<td>21% - 69%</td>
</tr>
<tr>
<td>23 weeks</td>
<td>40%</td>
<td>27% - 54%</td>
</tr>
<tr>
<td>24 weeks</td>
<td>28%</td>
<td>18% – 41%</td>
</tr>
<tr>
<td>25 weeks</td>
<td>24%</td>
<td>17% – 32%</td>
</tr>
</tbody>
</table>

Moore, GP et al. JAMA Ped 2013
Provide Information:  
Other factors that affect outcomes

Growth restriction
• Infants who were small for gestational age had over a 2-fold increased adjusted risk for neonatal death and severe BPD (EPIPAGE 2)

Preterm prolonged rupture of membranes
• Infants whose mothers had ROM < 25 weeks had higher rates of most neonatal morbidities and neurodevelopmental outcome at 2 years, when compared with PPROM 25 – 32 weeks

Anomalies or aneuploidy
• Infants with critical congenital heart disease have higher rates of NEC, ROP, severe IVH, BPD, and PVL if they are born at less than 29 weeks gestation

Plurality
• Population-based studies (CDC) show high rates of neonatal mortality and morbidity in twin births at periviable gestations

Summary: Provide information

- Survival for infants > 23 weeks is improving over the past decades although mortality remains high

- Rates of moderate and severe neurodevelopmental disability are high but more infants born at 23 and 24 weeks are surviving without neurodevelopmental disability in recent years

- Information for infants born at 22 weeks is limited

- Other maternal or fetal factors may influence neonatal outcomes besides gestational age
Active treatment: Variation in outcomes

- 2006 – 2011
- Neonatal Research Network
- Active treatment: Surfactant therapy, Tracheal intubation, Ventilatory support (CPAP), parenteral nutrition, epinephrine, or chest compressions
- Outcomes: Survival, survival without severe impairment, survival without moderate or severe impairment

Rysavy, M et al. NEJM 2015

### Table 3. Relationship between Hospital Rates of Active Treatment and Variation in Outcomes by Gestational Age at Birth.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Model Not Including Hospital Rate of Active Treatment ICC (95% CI)</th>
<th>Model Including Hospital Rate of Active Treatment ICC (95% CI)</th>
<th>Proportion of Variation in Outcomes Attributable to Hospital Rate of Active Treatment %</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>22 or 23 Wks of gestation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survival</td>
<td>0.13 (0.05-0.29)</td>
<td>0.03 (0.01-0.15)</td>
<td>78</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Survival without severe impairment</td>
<td>0.07 (0.02-0.24)</td>
<td>0.02 (0.01-0.23)</td>
<td>75</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Survival without moderate or severe impairment</td>
<td>0.06 (0.01-0.25)</td>
<td>0.04 (0.01-0.22)</td>
<td>41</td>
<td>0.02</td>
</tr>
<tr>
<td>24 Wks of gestation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survival</td>
<td>0.08 (0.03-0.16)</td>
<td>0.06 (0.02-0.13)</td>
<td>22</td>
<td>0.01</td>
</tr>
<tr>
<td>Survival without severe impairment</td>
<td>0.07 (0.02-0.14)</td>
<td>0.03 (0.02-0.13)</td>
<td>16</td>
<td>0.02</td>
</tr>
<tr>
<td>Survival without moderate or severe impairment</td>
<td>0.05 (0.02-0.13)</td>
<td>0.04 (0.01-0.12)</td>
<td>15</td>
<td>0.08</td>
</tr>
<tr>
<td>25 Wks of gestation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survival</td>
<td>0.03 (0.01-0.11)</td>
<td>0.01 (0.00-0.10)</td>
<td>1</td>
<td>0.26</td>
</tr>
<tr>
<td>Survival without severe impairment</td>
<td>0.01 (0.00-0.09)</td>
<td>0.00 (0.00-0.09)</td>
<td>0</td>
<td>0.74</td>
</tr>
<tr>
<td>Survival without moderate or severe impairment</td>
<td>0.05 (0.02-0.12)</td>
<td>0.03 (0.00-0.12)</td>
<td>1</td>
<td>0.31</td>
</tr>
</tbody>
</table>

Rysavy, M et al. NEJM 2015
Active treatment: Variation in outcomes

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>22 weeks Active tx</th>
<th>22 weeks No active tx</th>
<th>23 weeks Active tx</th>
<th>23 weeks No active tx</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>70 (20%)</td>
<td>278 (79%)</td>
<td>542 (72%)</td>
<td>213 (28%)</td>
</tr>
<tr>
<td>Death before discharge</td>
<td>76 %</td>
<td>100%</td>
<td>63 %</td>
<td>100%</td>
</tr>
<tr>
<td>Survival at 18-22 mo</td>
<td>23 %</td>
<td>—</td>
<td>33%</td>
<td>—</td>
</tr>
<tr>
<td>Survival w/o severe NDI at 18-22 mo</td>
<td>15 %</td>
<td>—</td>
<td>25%</td>
<td>—</td>
</tr>
</tbody>
</table>

* Most infants at 24 weeks and beyond received active treatment
Rysavy, M et al. NEJM 2015

Active treatment: EXPRESS

- 2004 - 2007
- Population-based observations study in Sweden
- < 27 weeks gestation
- 94% received antenatal steroids
- 70% of infants overall survival with active treatment to one-year of age

EXPRESS, Acta Ped, 2010
Active treatment: EXPRESS

45% survived without major neonatal morbidity at one year (BPD, severe ROP, cystic PVL, NEC, > grade 3 IVH)

One year survival by gestational age:

• 22 week survival 5/19 (26%)
• 23 week survival 53/81 (65%)
• 24 week survival 96/132 (73%)

EXPRESS, Acta Ped, 2010

Active treatment: Thermoregulation

<table>
<thead>
<tr>
<th></th>
<th>Normothermia (N = 79)</th>
<th>Mild hypothermia (N = 100)</th>
<th>Moderate hypothermia (N = 162)</th>
<th>P valuea</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDS required surfactant</td>
<td>31 (39.2%)</td>
<td>47 (47.0%)</td>
<td>54 (58.0%)</td>
<td>0.006</td>
</tr>
<tr>
<td>IVH grade III–IV</td>
<td>2 (2.5%)</td>
<td>3 (3.0%)</td>
<td>8 (4.9%)</td>
<td>0.56</td>
</tr>
<tr>
<td>NEC ≥ Stage II</td>
<td>0 (0%)</td>
<td>1 (1.0%)</td>
<td>4 (2.5%)</td>
<td>0.29</td>
</tr>
<tr>
<td>Late-onset sepsis</td>
<td>12 (15.2%)</td>
<td>10 (10.0%)</td>
<td>27 (16.7%)</td>
<td>0.54</td>
</tr>
<tr>
<td>PDA required treatment</td>
<td>21 (26.6%)</td>
<td>29 (29.0%)</td>
<td>37 (22.8%)</td>
<td>0.49</td>
</tr>
<tr>
<td>ROP required therapyb</td>
<td>5 (6.6%)</td>
<td>7 (7.9%)</td>
<td>13 (8.8%)</td>
<td>0.63</td>
</tr>
<tr>
<td>Oxygen at 36 wkc</td>
<td>23 (30.7%)</td>
<td>24 (27.0%)</td>
<td>43 (32.6%)</td>
<td>0.81</td>
</tr>
<tr>
<td>cPVLd</td>
<td>1 (1.3%)</td>
<td>2/89 (2.2%)</td>
<td>5 (3.8%)</td>
<td>0.42</td>
</tr>
<tr>
<td>Mortality</td>
<td>4 (5.1%)</td>
<td>11 (11.0%)</td>
<td>30 (18.5%)</td>
<td>0.005</td>
</tr>
</tbody>
</table>

• Very low birth infants / Outcome mortality before hospital discharge
• Normothermia 36.5 – 37.5 °C
• Mild hypothermia 36 – 36.4 °C
• Moderate hypothermia 32 – 35.9 °C

Chang, HY et al. PLOSone, 2015
Active treatment: Thermoregulation and polyurethane bags

Meta-analyses of infants < 29 weeks at birth
21 – 46 % decrease in the risk of hypothermia
No reduction in mortality/ inadequate power?

Oatley, HK et al. J Peri 2016

Active treatment: Summary

• Some of the variation in survival of periviable infants between centers may be secondary to rates of active treatment

• For infants who receive active treatment, survival is improving over the past decade

• Thermoregulation is important in preventing neonatal morbidities and possibly also mortality

• For families that elect for resuscitation, providing active treatment may improve survival and outcomes
Provide information

Individualize Antenatal Counseling

Cohesive OB/ Neo planning

Active treatment for those seeking resuscitation

Optimize care

Thank you!