OUTLINE

• Survival
• Long-term Outcomes
  – Neurodevelopmental Impairment
  – Perceptions of outcomes
Definitions

• Birth Weight
  – LOW BW (LBW) ≤ 2500 grams
  – VERY LOW BW (VLBW) ≤ 1500 grams
  – EXTREMELY LOW BW (ELBW) ≤ 1000 grams

• Gestational Age
  – TERM ≥ 37 weeks
  – PRETERM < 37 weeks
  – “Extremely Low GA” ≤ 28 weeks
Borderline Viability

- Edge of viability
- Threshold of viability
  - 22 to 25 completed weeks of gestation
    - 22 and 0/7 weeks
    - 25 and 6/7 weeks
Borderline Viability

• American Academy of Pediatrics (AAP) and the International Liaison Committee on Resuscitation (ILCOR): NRP
  – Individualized decision-making
  – Parent’s views
  – Resuscitation is not indicated GA < 23 weeks or BW < 400 grams
International Guidelines for Resuscitation

- Each institution caring for women at risk should have consistent guidelines
- Certainty vs. Uncertainty
We all know...

• The younger GA, the worse the prognosis
  – Death
  – Morbidity
  – Disability
MORTALITY
## Survival

<table>
<thead>
<tr>
<th></th>
<th>POPULATION Studies</th>
<th>SINGLE CENTER or NETWORK Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>22 weeks</td>
<td>0 – 3%</td>
<td>1 – 21%</td>
</tr>
<tr>
<td>23 weeks</td>
<td>0 – 41%</td>
<td>17 – 66%</td>
</tr>
<tr>
<td>24 weeks</td>
<td>16 – 70%</td>
<td>44 – 81%</td>
</tr>
<tr>
<td>25 weeks</td>
<td>44 – 85%</td>
<td>68 – 85%</td>
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</tbody>
</table>

Ho (2005) *NeoReviews*
Survival

• Graphic for parents

Guillen (2012) *JPeds*
Improved VLBW Survival

Birth-Weight Specific VLBW SURVIVAL from NICHD: 1988-2002

PERCENTAGE

YEAR


0 10 20 30 40 50 60 70 80 90 100

501 - 750 g

751 - 1000 g

1001 - 1250 g

1251 - 1500 g

VLBW
Factors Contributing to Mortality

• Obstetric

• Neonatal
  – Decision not to treat or resuscitate
  – Not transferred to tertiary center
  – Discontinuation of intensive care

• Perceptions and knowledge of neonatal mortality and morbidity can influence OB and Neonatal decisions
Early Factors Influencing Survival

• GA
  – Inversely related

• Birthweight
  – SGA disadvantage

• Gender
  – ↑ female survival

• Antenatal Steroids
  – Higher survival; disability same

• Multiple births
  – ↓ survival, ↑ morbidity

• Delivery location
  – ↑ survival in tertiary care center

• Surfactant therapy
  – Increased survival; disability same
Moving Beyond Gestational Age

- Limits in the estimation of GA
  - GA
  - BW
  - Sex
  - Antenatal steroids
  - Singleton vs multiples

Each associated with benefits similar to ↑GA of 1 week
Race or ethnic group had no significant association with outcome.

Tyson (2008) NEJM
NICHD Neonatal Calculator


<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Outcomes for All Infants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survival</td>
<td>85%</td>
</tr>
<tr>
<td>Survival Without Profound Neurodevelopmental Impairment</td>
<td>74%</td>
</tr>
<tr>
<td>Survival Without Moderate to Severe Neurodevelopmental Impairment</td>
<td>60%</td>
</tr>
<tr>
<td>Death</td>
<td>15%</td>
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<tr>
<td>Death or Profound Neurodevelopmental Impairment</td>
<td>26%</td>
</tr>
<tr>
<td>Death or Moderate to Severe Neurodevelopmental Impairment</td>
<td>40%</td>
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</table>

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Outcomes for All Infants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survival</td>
<td>5%</td>
</tr>
<tr>
<td>Survival Without Profound Neurodevelopmental Impairment</td>
<td>3%</td>
</tr>
<tr>
<td>Survival Without Moderate to Severe Neurodevelopmental Impairment</td>
<td>1%</td>
</tr>
<tr>
<td>Death</td>
<td>95%</td>
</tr>
<tr>
<td>Death or Profound Neurodevelopmental Impairment</td>
<td>97%</td>
</tr>
<tr>
<td>Death or Moderate to Severe Neurodevelopmental Impairment</td>
<td>99%</td>
</tr>
</tbody>
</table>

25wks, 750 grams, Female, Singleton, (+) Antenatal Steroids

23wks, 401 grams, Male, Multiple, (-) Antenatal Steroids
Moving Beyond GA

- **Antenatal Steroids**

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Outcomes for All Infants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survival</td>
<td>54%</td>
</tr>
<tr>
<td>Survival Without Profound Neurodevelopmental Impairment</td>
<td>40%</td>
</tr>
<tr>
<td>Survival Without Moderate to Severe Neurodevelopmental Impairment</td>
<td>27%</td>
</tr>
<tr>
<td>Death</td>
<td>46%</td>
</tr>
<tr>
<td>Death or Profound Neurodevelopmental Impairment</td>
<td>60%</td>
</tr>
<tr>
<td>Death or Moderate to Severe Neurodevelopmental Impairment</td>
<td>73%</td>
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</table>

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Outcomes for All Infants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survival</td>
<td>54%</td>
</tr>
<tr>
<td>Survival Without Profound Neurodevelopmental Impairment</td>
<td>38%</td>
</tr>
<tr>
<td>Survival Without Moderate to Severe Neurodevelopmental Impairment</td>
<td>25%</td>
</tr>
<tr>
<td>Death</td>
<td>46%</td>
</tr>
<tr>
<td>Death or Profound Neurodevelopmental Impairment</td>
<td>62%</td>
</tr>
<tr>
<td>Death or Moderate to Severe Neurodevelopmental Impairment</td>
<td>75%</td>
</tr>
</tbody>
</table>

- 24 wks, 700 g, Female, Singleton, (-) Steroids
- 23 wk, 700 g, Female, Singleton, (+) Steroids
A Tale of Two Preemies

G2: 23wk, Male, BW 625 grams, Singleton, (+) Steroids
- Born OSH
- Died at DOL 2 (severe IVH, multi organ failure)

G3: 24wk, Male, BW 730 grams, Singleton, (+) Steroids
- Born UAMS
- Surgical NEC, low grade IVH
A Tale of Two Preemies
EARLY OUTCOMES
Neonatal Morbidity

• Chronic lung disease
  – 13 – 74% for survivors ≤ 25wks
  – 86 – 100% for survivors ≤ 23 wks

• Severe IVH/Periventricular leukomalacia
  – 17 – 21% for survivors ≤ 25wks
  – Up to 42 % ≤ 23wks

• Severe ROP (Stage 3 or 4)
  – 14 – 32% for survivors ≤ 25wks

• 23 – 41% of ≤ 25wks were free of major neonatal morbidities

Ho (2005) NeoReviews
Neurodevelopmental Morbidity

• Varying definitions of impairment
• Varying denominators

• Cerebral Palsy
• Blindness
• Deafness
• Cognitive Deficits
• Developmental delay without defined impairment
Outcomes at 30 months

- Among those discharged from the NICU
Noah

• 23-2/7 weeks, EFW 583 grams, Male, Singleton, (+) Steroids

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Outcomes for All Infants</th>
<th>Outcomes for Mechanically Ventilated Infants</th>
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<tbody>
<tr>
<td>Survival</td>
<td>28%</td>
<td>38%</td>
</tr>
<tr>
<td>Survival Without Profound Neurodevelopmental Impairment</td>
<td>16%</td>
<td>22%</td>
</tr>
<tr>
<td>Survival Without Moderate to Severe Neurodevelopmental Impairment</td>
<td>8%</td>
<td>11%</td>
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<tr>
<td>Death</td>
<td>72%</td>
<td>62%</td>
</tr>
<tr>
<td>Death or Profound Neurodevelopmental Impairment</td>
<td></td>
<td></td>
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<tr>
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</table>
LONG(ER) TERM OUTCOMES
Early vs. Late Outcomes

- Severity of disability at 30mo vs. 6 years corrected for GA
Disability Among Survivors

Disability at Age 6 among 22-25wk GA

- None: 20%
- Severe Disability: 22%
- Mild Disability: 34%
- Moderate Disability: 24%
## Disability Among Survivors

<table>
<thead>
<tr>
<th>OUTCOME</th>
<th>22 wk (N=138)</th>
<th>23wk (N=241)</th>
<th>24wk (N=382)</th>
<th>25wk (N=424)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survived to Discharge</td>
<td>1%</td>
<td>11%</td>
<td>26%</td>
<td>44%</td>
</tr>
<tr>
<td>Disability at Age 6y</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Severe</td>
<td>(1) 0.7%</td>
<td>2%</td>
<td>5%</td>
<td>6%</td>
</tr>
<tr>
<td>- Moderate</td>
<td>0</td>
<td>4%</td>
<td>4%</td>
<td>8%</td>
</tr>
<tr>
<td>- Mild</td>
<td>(1) 0.7%</td>
<td>2%</td>
<td>7%</td>
<td>12%</td>
</tr>
<tr>
<td>Survived without Impairment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- As % of Live Births</td>
<td>0</td>
<td>1%</td>
<td>3%</td>
<td>8%</td>
</tr>
<tr>
<td>Survived without severe or moderate disability</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- As % of Live Births</td>
<td>(1) 0.7%</td>
<td>3%</td>
<td>9%</td>
<td>20%</td>
</tr>
</tbody>
</table>
Disability

• Graphic for parents

Long Term

Mental Disability
Range: 16-54%

Cerebral Palsy
Range: 6-38%

Blindness
Range: 1-15%

Deafness
Range: 1-9%

Things that affect a poor outcome
• BPD (lungs)  • IVH (brain)  • ROP (eyes)

©Guilien & Kirpalani, CHOP 2011
Cognition

• Cognitive scores of extremely preterm children vs. Term Controls
22 Weeks (n=12)

- N = 12 in this metaanalysis
- Moderate-Severe or Severe outcomes
- Wide confidence interval; heterogeneity
23 weeks (n=75)

- Severe: 17%
- Moderate-Severe: 40%
24 and 25 weeks

- **24wk**
  - 28%
  - 21%

- **25wk**
  - 24%
  - 14%
Risk of Death or Disability at Age 6

OUTCOMES 22-25 WKS

No Disability

Death Before DC

Severe Disability

Lost to F/U

Death After DC

Other Disability

SEVERE:
non-ambulatory CP, IQ>3SD below mean, profound sensorineural hearing loss, blindness
PERCEPTIONS OF OUTCOMES
Estimation of Neonatal Outcome

- Physicians underestimate survival and freedom from handicap in PTNB
- Restriction of use of interventions

Morse (2000) Pediatrics

Estimation of Rates of Freedom from Handicap
Differences in Preferences for Outcomes

• Parents of ELBW infants are more accepting of severely disabled outcomes

• Health professionals provide lower HRQL scores than ex-ELBW infants or their parents

Impact on Families

- By young adulthood of ELBWI
- Negative impact on parent’s jobs
- But: No difference in marital disharmony, family dysfunction, maternal health, social support …
What do the ex-ELBW Teens Think?

- IF in *mainstream* school
  - Most do not rate their health-related quality of life as significantly different from term-born subjects
  - i.e. Life is satisfactory
- IF those in *special schools* are included
  - Higher level of functional impairment (cognition, hearing, ambulation, dexterity)

What do the ex-ELBW Young Adults Think?

• Excluding those with Major disability
• Ex-preemie problems affect lifestyle and health but NOT perceived QOL
  – Preemies drank less alcohol, fewer illicit drugs
  – Shorter and less satisfied with appearance
  – Shorter education

Cooke (2004) ADC
1987: Sarah, 24 wk, 710 grams
1987: Sarah, 24 wk, 710 grams

- RDS
- Grade 1 IVH
- Pulmonary hemorrhage
- Yeast infection
- Chronic lung disease
1987: Sarah, 24 wk, 710 grams

- Two brief readmissions in infancy
- Frequent ear infections
- 17yo “slow processing”
- College: frequent bronchiolitis (PCP: smoker??)

Sarah’s Mom: “Overall, uneventful childhood considering your start”
2013: Sarah, 26yo, UAMS nurse
Summary

• Despite advances in perinatal and neonatal care, infants born <26wk GA have disproportionate contribution to mortality and disability

• But, there are long-term survivors with no or minimal disability
Summary

• Considerations for resuscitation
  – Survival is related to GA and other relevant factors
  – Center-specific guidelines
  – Individual decisions regarding resuscitation
  – Aim for delivery in a tertiary care center
Summary

• Difficult to be precise about predictions for any individual or family
  – Even with the best available data

• Perceptions of the effects of impairment vary between professionals and families

• Perceptions of those LIVING with impairment
Thank You!