Health Disparities, Prematurity, and Cerebral Palsy: Opportunities and Challenges

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University of Chicago Comer Children’s Hospital
Co-Director Kennedy Research Center on Intellectual and Developmental Disabilities

THE UNIVERSITY OF
CHICAGO
MEDICINE
Comer Children’s Hospital

IC 7 AACPDM San Diego CA 09.11.14
<table>
<thead>
<tr>
<th>Conflict of Interest Disclosures for</th>
<th>Michael E. Msall MD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grant/Research Support</strong></td>
<td>T73 MC11047  HRSA Leadership Education in Neurodevelopmental Disabilities (LEND); R01 NR003695 /NINR Risk and Protection in Trajectories of Preterm Infants: Birth to Adulthood R01 NS040069 NINDS Neonatal Biomarkers in Extremely Preterm Babies Predict Childhood Brain Disorders</td>
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<td>Speakers Bureau</td>
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<td>Nothing to disclose</td>
</tr>
<tr>
<td>Other (identify)</td>
<td>Nothing to disclose</td>
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</tbody>
</table>
BORN TOO SOON
The high-tech, high-risk drama of keeping the tiniest babies alive

Jason Michael Waldmann Jr., who weighed only 1.5 pounds at birth...
Myths versus Realities after Extreme Prematurity Pretest

1. A child is born weighing 900 grams at 27 weeks gestation. The chance that this child at age 4.5 years will walk, communicate basic needs, see, hear, understand requests, and learn in a group of peers is:

2. A child is born at 28 weeks gestation to a mother with household income of <$10,000 US. The chance that this child at age 4.5 years will have intellectual disability (IQ<70) is:

3. A child weighs 800 grams at birth after 26 weeks of gestation. Mother’s education is less than high school. The chance for early childhood education experiences prior to kindergarten is:

   1) 5%    2) 10%    3) 25%    4) 50%    5) 75%    6) >90%
Myths versus Realities after Extreme Prematurity Pretest

4. A child is born at 26 weeks gestation and weighs 750g. Both parents are lawyers. The chance that this child will meet criteria for an Autistic Spectrum Disorder at age 10 is:

5. A boy is born at term to a single mother who lives in a neighborhood of concentrated social disadvantage. The chance that he will graduate from college with a BA degree or an associate’s degree by age 25 is:

1) 5%  2) 10%  3) 25%  4) 50%  5) 75%  6) >90%
Epidemiology of Prematurity

n=4,100,000 USA

<table>
<thead>
<tr>
<th>Gestational Age (GA)</th>
<th>Prevalence</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 37 weeks</td>
<td>900 per 1000</td>
<td>5 per 1000</td>
</tr>
<tr>
<td>33-36</td>
<td>94 per 1000</td>
<td>15 per 1000</td>
</tr>
<tr>
<td>28-32</td>
<td>5 per 1000</td>
<td>50 per 1000</td>
</tr>
<tr>
<td>&lt;28</td>
<td>1 per 1000</td>
<td>100 per 1000</td>
</tr>
</tbody>
</table>
• Cerebral Palsy in Sweden

Himmelmann K1, Uvebrant P.
### Neurodevelopmental Disorders

(*# Children 0-5 Years, POP 20 Million*)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Rate Per 1,000</th>
<th># Children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cerebral Palsy</td>
<td>2.5</td>
<td>50,000</td>
</tr>
<tr>
<td>ID/MR (IQ &lt;50-55)</td>
<td>5</td>
<td>100,000</td>
</tr>
<tr>
<td>Communicative Dis.</td>
<td>5</td>
<td>100,000</td>
</tr>
<tr>
<td>Autism Spectrum</td>
<td>10</td>
<td>200,000</td>
</tr>
<tr>
<td>Hearing Loss (&gt;50db)</td>
<td>2</td>
<td>40,000</td>
</tr>
<tr>
<td>Visual Loss (&lt;20/200)</td>
<td>.5</td>
<td>10,000</td>
</tr>
<tr>
<td>Technology Dependent</td>
<td>1</td>
<td>20,000</td>
</tr>
<tr>
<td>Any ND Disorder</td>
<td>26</td>
<td>520,000</td>
</tr>
</tbody>
</table>
Epidemiology of Cerebral Palsy I

- Term: 1 per 1000
- Late Preterm 33-36 wks: 10 per 1000
- Very Preterm 28-32 wks: 70 per 1000
- Extreme preterm 23-27 wks: 100-160/1000

Prevalence of preterm birth: white vs black in 2010
- Late preterm: 78 vs 119 per 1000
- Early Preterm: 29 vs 61 per 1000
CP rates among infants of birthweight of 1000-1499g from nine European centers, 1980-96

When time is critical in severe neonatal RDS...

INFASURF effectively treats and prevents RDS¹⁻⁴

INFASURF contains an SP-B level close to that of natural surfactant

Infasurf®
(calfactant)
Intratracheal Suspension

For complete details about contraindications, warnings, precautions, adverse reactions, and dosage and administration, please see brief summary of prescribing information on last page of this advertisement.
Measuring Quality of Life in Child Neurodisability

Medical Management, Developmental Interventions, Family Supports

Family Values, Beliefs, Judgment

Health, Growth, Neurological Integrity

Developmental Skills
Functional Skills
Behavioral Competencies

Social Interactions and Community Participation

Educational and Vocational Successes

-Adapted from Spilker
Parental Concerns About Function

- Will my child be healthy?
- Will my child walk?
- Will my child talk?
- Will my child learn self care?
- Will my child learn at school?
1983-86 RCT + Open Infasurf®

24-28 weeks
n=194

50 Betamethasone
55 Neither
89 Surfactant

Demography

< High School 18%
< 20 Years Old 17%
Poverty 78%
Minority 40%

Neurodevelopmental morbidity among survivors (N=149). CP = cerebral palsy; ID = intellectual disability

Predictors of NDD

Cerebral Palsy:
- Ventriculomegaly RR 7 (3-18)
- IVH3/4 RR 5 (2-13)

Intellectual Disability:
- Ventriculomegaly RR 4 (2-10)
- Sepsis RR 4 (2-8)
- Seizures RR 3 (1.2-8)
- Minority RR 3 (1.3-6)

## Functional Status at Kindergarten Entry

<table>
<thead>
<tr>
<th>Activity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walks 150 Feet</td>
<td>97%</td>
</tr>
<tr>
<td>Talks in Sentences</td>
<td>97%</td>
</tr>
<tr>
<td>Toilets Self</td>
<td>96%</td>
</tr>
<tr>
<td>Self-Care/ADL</td>
<td>96%</td>
</tr>
</tbody>
</table>
# Functional Status and Neurodevelopmental Disability

<table>
<thead>
<tr>
<th>Activity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walks 150 Feet</td>
<td>87%</td>
</tr>
<tr>
<td>Talks in Sentences</td>
<td>84%</td>
</tr>
<tr>
<td>Toilets Self</td>
<td>81%</td>
</tr>
<tr>
<td>Self-Care/ ADL</td>
<td>81%</td>
</tr>
<tr>
<td>Understands Requests</td>
<td>94%</td>
</tr>
</tbody>
</table>

Requirements for special education resources among survivors of extreme prematurity (N=149)

Msall et al. AJDC 1992; 146:1371-1375
## Predictors of Special Education Resources at Kindergarten Entry

<table>
<thead>
<tr>
<th>Predictor</th>
<th>RR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poverty</td>
<td>7.3</td>
<td>2.5 – 21.4</td>
</tr>
<tr>
<td>Minority Status</td>
<td>2.5</td>
<td>1.2 – 5.3</td>
</tr>
<tr>
<td>Male Gender</td>
<td>2.4</td>
<td>1.1 – 5.0</td>
</tr>
</tbody>
</table>

Msall et al. AJDC 1992; 146:1371-1375
# Multicenter Model Extremely Low Birth Weight Short Term Outcomes Studies

<table>
<thead>
<tr>
<th>STUDY</th>
<th>SAMPLE</th>
<th>CP</th>
<th>DD</th>
<th>HI</th>
<th>VI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schmidt 1996-98</td>
<td>N=910 500-999 g</td>
<td>13%</td>
<td>26%</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>Whyte, Canada 1990-94</td>
<td>N=274 23-26 wks</td>
<td>15</td>
<td>26</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Vohr 1993-94</td>
<td>N=1151 400-999 g</td>
<td>17</td>
<td>37</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Wood 1995</td>
<td>N=283 22-25 wks</td>
<td>16</td>
<td>30</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Doyle 1997</td>
<td>N=233 500-999 g</td>
<td>11</td>
<td>22</td>
<td>2.4</td>
<td>1.5</td>
</tr>
</tbody>
</table>

CP=Cerebral Palsy  
DD=MDI/PDI <70  
HI=Hearing Impairment requiring aides  
VI=Visual Impairment worse than 20/200 corrected

Msall et al. AJDC 1992; 146:1371-1375
Predicting School-Readiness from Two Year Neurodevelopmental Assessments

Patrianakos Al, Msall ME, Marks JD et al.
Kindergarten Readiness

1. A multidimensional construct
2. Articulated by US Governors in 1989 - “all children will enter kindergarten ready to learn”
3. Kagan and colleagues operationalized components:
   - **Physical health**
     - Gross and fine motor skills
     - Language and communicational skills
     - Problem solving and conceptual skills
     - Social-emotional skills
     - Adaptive competencies
4. EMPHASIZED context of parents as first teachers, ready schools and ready communities
5. Msall NICHD/Casey Foundation 2001: “all children enter kindergarten healthy in physical and behavioral development and are supported in learning”
207 Infants in Original Cohort

168 Surviving Children
At 2 years (corrected)

138 Children Evaluated
At 2 years

121 Children Evaluated
At Both 2 years and 5 ½ years
(88%)

Patrianakos DMCN 2010;52:379
2 Year Outcomes

Normal
No Disability and
No Delay

Abnormal
Delay
No Disability and
MDI and/or PDI
<70
Disability
Cerebral Palsy
and/or
Bilateral
Blindness and/or
Bilateral Hearing Loss

Patrianakos DMCN 2010;52:379
5.5 Year Outcomes

School-Age Follow-Up*

School-Ready
- Level 1 = School Ready
  One domain 1-2 SDs below mean
- Level 2 = School-Ready, at risk for special ed
  Two domains 1-2 SDs below mean

Not School-Ready
- Level 3 = Not school-ready requiring some special education
  Three domains 1-2 SDs below mean
  Any domain > 2 SDs below mean
  - Visual impairment (sees letters/shapes)
  - Hearing impairment requiring aids (hears/understands verbal language)
  - GMFCS Level I-III
- Level 4 = Not school-ready requiring intense special education
  - Bracken < 50
  - Visual impairment (inability to see)
  - Hearing impairment (inability to talk)
  - GMFCS Level IV-V
  - Severe autism (CARS)

Patrianakos DMCN 2010;52:379
Disability at 2 Years is Associated with Lack of School-Readiness at 5 ½ Years

---

**2 Year Neurodevelopmental Outcomes**

<table>
<thead>
<tr>
<th>Condition</th>
<th>% of Children NOT School-Ready</th>
<th>RR</th>
<th>95% CI</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>10%</td>
<td>1.00</td>
<td></td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Delayed</td>
<td>50%</td>
<td>3.33</td>
<td>1.75-6.34</td>
<td></td>
</tr>
<tr>
<td>Disabled</td>
<td>92%</td>
<td>6.16</td>
<td>3.56-10.6</td>
<td></td>
</tr>
</tbody>
</table>

*Patrianakos DMCN 2010;52:379*
Low Score on MDI at 2 Years is Associated with Lack of School-Readiness at 5 ½ Years

- MDI Normal ≥85: n=65
  - % Children NOT School-Ready: 63%
  - RR=1.00

- MDI 70-84: n=24
  - % Children NOT School-Ready: 55%
  - RR=8.12 (3.3-20.0)

- MDI <70: n=31
  - % Children NOT School-Ready: 55%
  - RR=7.13 (2.89-17.6)

Patrianakos DMCN 2010;52:379
Poor Social Position Negatively Impacts School-Readiness

Hollingshead ISP

Patrianakos DMCN 2010;52:379
Lessons in RDS

• The neuroprotective effect of decreased bpd and parenchymal brain injury is associated with low levels of delays and disability at age 2 Y.
• This neuroprotective effect can be compromised by social disadvantage and lack of access to quality early childhood experiences.
• There are gaps in integrating health, community and early childhood services for vulnerable preterm survivors.
Missed Opportunities for Receiving Early Intervention Services After Neonatal Intensive Care

Michael E. Msall, Everett L Weiss, Lawrence A Gray, Carol Muhammad, Jennifer J Park, Bree Andrews, Jennifer L Liedel

America Academy of Pediatrics
Section on Community Health: Preventive Interventions
Hynes Convention Center Boston MA 10-12-2008
Results (N=557)

- 415 infants deemed not automatically eligible
  - 95% had child and family impairments (e.g. gastrostomy, feeding delays, income < $10K per year, parental mental or developmental disorder) that met EI criteria.

- 77 automatically eligible infants
  - 49% were referred to EI at discharge.

- Of the 34 submitted referrals,
  - 56% were received by Illinois regional EI centers despite 100% fax documentation.
  - 16 additional infants were referred by their medical home.
Community Supports After Surviving ELBW Extremely Preterm Birth

Hintz SR, Kendrick DE, Vohr BR,

Objective & Cohort

- To determine special outpatient services (SOS) use, need, associated factors, and neurodevelopmental and functional outcomes, for EP infants at 18-22mos CA
- Survivors <28wks GA,<1000g at NICHD Neonatal Research Network Center
- Born January 1, 1997-December 31, 2000, and received follow-up at 18-22mos
SOS

- Visiting nurse
- Occupational or physical therapy
- Speech or language therapy
- Early Intervention
- Social worker
- Any medical subspecialty or surgical subspecialty
- Neurodevelopmental or behavioral evaluations
Service use: D/C to 18-22 months

<table>
<thead>
<tr>
<th>Service Used</th>
<th>Estimated Gestational Age (wks)</th>
<th>% Total</th>
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<tr>
<td></td>
<td>&lt;24</td>
<td>25</td>
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<tr>
<td>Visiting nurse</td>
<td>64</td>
<td>58</td>
</tr>
<tr>
<td>Occupational/physical therapy</td>
<td>71</td>
<td>61</td>
</tr>
<tr>
<td>Speech/language</td>
<td>41</td>
<td>36</td>
</tr>
<tr>
<td>Early intervention</td>
<td>61</td>
<td>57</td>
</tr>
<tr>
<td>Social worker</td>
<td>31</td>
<td>24</td>
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<tr>
<td>Medical specialty</td>
<td>77</td>
<td>74</td>
</tr>
<tr>
<td>Neurodevelopmental and behavioral</td>
<td>73</td>
<td>72</td>
</tr>
</tbody>
</table>

Results

- 2315 infants,
  - 55% used more than 3 SOS by 18-22mos,
  - 19% used 6-7 SOS
  - Any SOS need was reported by 37%
- Predictors of neurodevelopment & >5SOS:
  - sepsis, postnatal steroids, BPD, cystic periventricular leukomalacia, grade 3/4 IVH
- Male sex associated with SOS need
- SOS need was common even among those with mild CP(42%) or DD(40%)

Functioning & Participation at 17 Y of Preterm Survivors with Diverse Neonatal Morbidities

Michael E. Msall¹, Robin J. Miller, PhD², Mary C. Sullivan, PhD³

¹ Developmental and Behavioral Pediatrics, Kennedy Research Center on Intellectual and Developmental Disability, Comer Children’s Hospital, University of Chicago, Chicago, IL; ² Brown Center for the Study of Children at Risk, Brown University, Providence, RI; and ³ College of Nursing, University of Rhode Island, Kingston, RI
Classification:

HP = healthy preterm infants without medical or neurological illness

MPT = medical preterm infants with clinical illness but without neurological abnormality

NPT = neurological preterm infants with hydrocephalus, IVH 3-4, and severe ROP

SGA PT = small-for-gestational-age preterm infants
<table>
<thead>
<tr>
<th>ICF Domain</th>
<th>Sub-components</th>
<th>Measures</th>
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<tbody>
<tr>
<td>Activities &amp; Participation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cognition &amp; learning</td>
<td>K-BIT</td>
</tr>
<tr>
<td></td>
<td>Decision making/executive function</td>
<td>WCST</td>
</tr>
<tr>
<td></td>
<td>Self-care &amp; personal living</td>
<td>SIB-R</td>
</tr>
<tr>
<td></td>
<td>Involvement with academics</td>
<td>K-TEA</td>
</tr>
<tr>
<td></td>
<td>Involvement with friends, groups, recreation</td>
<td>YSR-ASEBA</td>
</tr>
<tr>
<td>Environment</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>SES Educational supports</td>
<td>Hollingshead Index School records</td>
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<tr>
<td>Personal</td>
<td>Gender</td>
<td>Male or female</td>
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</table>
Table 2. Cognition, Learning, Self-Care & Personal Living, and Decision Making Outcomes by Neonatal Morbidity Group

<table>
<thead>
<tr>
<th>Measures</th>
<th>FT</th>
<th>HPT</th>
<th>MPT</th>
<th>NPT</th>
<th>SGA</th>
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<tbody>
<tr>
<td></td>
<td>N=45</td>
<td>N=26</td>
<td>N=48</td>
<td>N=31</td>
<td>N=30</td>
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<tr>
<td>K-BIT</td>
<td>101.30</td>
<td>99.44</td>
<td>99.83</td>
<td>96.89</td>
<td>98.79</td>
</tr>
<tr>
<td></td>
<td>(11.7)</td>
<td>(14.6)</td>
<td>(16.5)</td>
<td>(13.0)</td>
<td>(14.6)</td>
</tr>
<tr>
<td>SIB-R</td>
<td>98.04</td>
<td>92.04</td>
<td>96.43</td>
<td>87.37</td>
<td>103.76</td>
</tr>
<tr>
<td></td>
<td>(19.2)</td>
<td>(20.6)</td>
<td>(24.8)</td>
<td>(37.2)</td>
<td>(22.5)</td>
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<tr>
<td>WCST</td>
<td>103.07</td>
<td>98.28</td>
<td>103.74</td>
<td>92.31</td>
<td>98.97</td>
</tr>
<tr>
<td></td>
<td>(14.4)</td>
<td>(15.6)</td>
<td>(17.7)</td>
<td>(14.8)</td>
<td>(16.0)</td>
</tr>
<tr>
<td>K-TEA</td>
<td>100.91</td>
<td>95.60</td>
<td>101.15</td>
<td>96.37</td>
<td>99.34</td>
</tr>
<tr>
<td></td>
<td>(16.2)</td>
<td>(14.8)</td>
<td>(19.5)</td>
<td>(17.9)</td>
<td>(18.7)</td>
</tr>
</tbody>
</table>

Table 3. Cognitive (K-BIT) and Academic (K-TEA) by SES (SES: 1 = highest / 5 = lowest)

<table>
<thead>
<tr>
<th></th>
<th>SES Groups</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>K-BIT composite</td>
<td><strong>107.4±13</strong></td>
<td>102.6±13</td>
<td>100.3±11</td>
<td>94.2±12</td>
<td><strong>89.8±14</strong></td>
<td></td>
</tr>
<tr>
<td>K-BIT vocabulary</td>
<td>107.4±12</td>
<td>101.4±12</td>
<td>98.6±11</td>
<td>95.9±11</td>
<td>89.5±14</td>
<td></td>
</tr>
<tr>
<td>K-BIT matrices</td>
<td>105.6 ±15</td>
<td>103.7±12</td>
<td>102.0±12</td>
<td>95.3±16</td>
<td>92.1±15</td>
<td></td>
</tr>
<tr>
<td>K-TEA composite</td>
<td><strong>126.9±12</strong></td>
<td>117.7±17</td>
<td>112.2±17</td>
<td>109.4±16</td>
<td><strong>97.5±28</strong></td>
<td></td>
</tr>
<tr>
<td>K-TEA math</td>
<td>110.2±7</td>
<td>101.1±10</td>
<td>93.71±8</td>
<td>91.6±18</td>
<td>86.3±6.4</td>
<td></td>
</tr>
<tr>
<td>K-TEA reading</td>
<td>115.2±4</td>
<td>105.71±5</td>
<td>100.2±3</td>
<td>99.3±4</td>
<td>93.21±6</td>
<td></td>
</tr>
<tr>
<td>K-TEA spelling</td>
<td>114.4±14.8</td>
<td>105.91±4.4</td>
<td>103.2±7.</td>
<td>99.01±3.</td>
<td>94.1±2.8</td>
<td></td>
</tr>
<tr>
<td>P &lt; .001</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Whole Person Composite Functioning by Socioeconomic Status (n=180)

Chi Square (1,8)=16.8, p = .032

Msall et al. 2014
School Support Services at Age 17: Term vs. Preterm Groups by Gender

<table>
<thead>
<tr>
<th></th>
<th>Term-male (n=23)</th>
<th>Term-female (n=22)</th>
<th>PT-male (n=60)</th>
<th>PT-female (n=75)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular</td>
<td>78</td>
<td>82</td>
<td>58</td>
<td>79</td>
</tr>
<tr>
<td>Supportive</td>
<td>22</td>
<td>9</td>
<td>28</td>
<td>13</td>
</tr>
<tr>
<td>Intensive</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Drop</td>
<td>0</td>
<td>9</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Chi Square (1,4) = 6.18, p=.185
Note. 3 PT females were home schooled.

Msall et al. 2014
81% were in grades 11 or 12

<table>
<thead>
<tr>
<th>Grade</th>
<th>K-TEA SS (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 12</td>
<td>103.4 (15.7)</td>
</tr>
<tr>
<td>Grade 11</td>
<td>101.1 (18.6)</td>
</tr>
<tr>
<td>Grade 10</td>
<td>88.5 (18.8)</td>
</tr>
</tbody>
</table>
Table 4. ICF Measures Outcomes and SES

<table>
<thead>
<tr>
<th></th>
<th>Regular education</th>
<th>Some special education</th>
<th>Intense special education</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Highest SES</strong></td>
<td>78%</td>
<td>16%</td>
<td>3%</td>
</tr>
<tr>
<td><strong>Lowest SES</strong></td>
<td>58%</td>
<td>37%</td>
<td>5%</td>
</tr>
</tbody>
</table>

Conclusion

• The most common sequelae of prematurity is not intellectual disability (IQ < 70), but academic underachievement.

• Both IQ and academic challenges are determined by social disadvantage, not neonatal comorbidities.

• Though 6% of our cohort with severe neurodisability require intensive special education, many preterm infants are similar to their full term peers in functioning and participation.

• Females are better than males in participation.
Perry Preschool Program

- 3- to 4- year olds of low SES families
- Attended Perry Preschool or did not.
- Matched on IQ, gender, and average SES.
- 58 in preschool; 65 in non-preschool
- Group differences can be analyzed by effects of preschool participation
Perry Preschool Curriculum

- High/Scope curriculum based on Piaget’s interactional theory of child development
- Most children attended for 2 years
  - (ages 3 and 4)
- Program was in session 5 days a week, for 7 months a year
  - Home visits by teacher once a week
- Classroom teacher-child ratio was 1:5
Data from the Perry Program collected when individuals were 27 years old

Economic benefits and costs to Perry Preschool Program

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Childcare</td>
<td>$ 986</td>
</tr>
<tr>
<td>Earnings</td>
<td>$ 40,537</td>
</tr>
<tr>
<td>K-12</td>
<td>$ 9,184</td>
</tr>
<tr>
<td>College/adult</td>
<td>$ -782</td>
</tr>
<tr>
<td>Crime</td>
<td>$ 94,065</td>
</tr>
<tr>
<td>Welfare</td>
<td>$ 355</td>
</tr>
<tr>
<td>Abuse/neglect</td>
<td>$ 0</td>
</tr>
<tr>
<td>Total benefits</td>
<td>$ 144,345</td>
</tr>
<tr>
<td>Total costs</td>
<td>$ 16,514</td>
</tr>
<tr>
<td>Net present value</td>
<td>$ 127,831</td>
</tr>
<tr>
<td>Benefits to cost ratio</td>
<td>8.74</td>
</tr>
</tbody>
</table>

Heckman’s Model

Rates of return to human capital investment

- Preschool programs
- Schooling
- Job training

Rate of return to investment in human capital

Age

Preschool | School | Post-school

What does this tell us?

- Investing in vulnerable young children promotes fairness, social justice, productivity in the economy and society.
- Early intervention for disadvantaged children have higher returns than later interventions (e.g., reduced teacher-student ratio, public job training, convict rehabilitation programs, etc.)
- Our current early intervention and preschool systems are not reaching children at highest biological or social risks.

Reducing Risk & Optimizing Protective Factors

Age

Early Infancy

Late Infancy

Early Toddler

Late Toddler

Early Preschool

Late Preschool

6 mo 12 mo 18 mo 24 mo 3 yrs 5 yrs

Ready to learn

Poverty

Parent Ed./Emotional Health Lit

Reading to child

Appropriate Discipline

Health Services

Pre-school

Toxic Stress

Lack of health services

“Healthy” Trajectory

“At Risk” Trajectory

“Delayed/Disordered” Trajectory

Halfon 3.0
DBP Chicago Model

Examine sequential outcomes after implementing translational science and community interventions so that disability is prevented, function optimized, and we create systems of care that strive to eliminate health care disparities for vulnerable children.
Acknowledgement

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Implication
Myths versus Realities after Extreme Prematurity Pretest

1. A child is born weighing 900 grams at 27 weeks gestation. The chance that this child at age 4.5 years will walk, communicate basic needs, see, hear, understand requests, and learn in a group of peers is: 95%

2. A child is born at 28 weeks gestation to a mother with household income of <$10,000 US. The chance that this child at age 4.5 years will have intellectual disability (IQ<70) is: 25%

3. A child weighs 800 grams at birth after 26 weeks of gestation. Mother’s education is less than high school. The chance for early childhood education experiences prior to kindergarten is: 25%

1) 5%   2) 10%   3) 25%   4) 50%   5) 75%   6) >90%
Myths versus Realities after Extreme Prematurity Pretest

4. A child is born at 26 weeks gestation and weighs 750g. Both parents are lawyers. The chance that this child will meet criteria for an Autistic Spectrum Disorder at age 10 is: 12%  
5. A boy is born at term to a single mother who lives in a neighborhood of concentrated social disadvantage. The chance that he will graduate from college with a BA degree or an associate’s degree by age 25 is: 10%

1) 5%  2) 10%  3) 25%  4) 50%  5) 75%  6) >90%
# Mean Scores on Intelligence Testing

<table>
<thead>
<tr>
<th>Maternal Grade</th>
<th>Age (yr)</th>
<th>Birth Weight</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>≤ 3lb. 8oz</td>
<td>3lb.9oz-4lb.8oz</td>
</tr>
<tr>
<td>1 and 2: Middle class and superior working class</td>
<td>3</td>
<td>98</td>
<td>101</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>100</td>
<td>102</td>
</tr>
<tr>
<td></td>
<td>5+</td>
<td>104</td>
<td>112</td>
</tr>
<tr>
<td>3: Average working class</td>
<td>3</td>
<td>80</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>73</td>
<td>93</td>
</tr>
<tr>
<td></td>
<td>5+</td>
<td>74</td>
<td>93</td>
</tr>
<tr>
<td>4: Poor working class</td>
<td>3</td>
<td>66</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>64</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>5+</td>
<td>59</td>
<td>87</td>
</tr>
</tbody>
</table>


Drillen CM Arch Dis Child 36:233, 1961