Easy (?) as 1,2,3: Issues in Developmental Follow Up of NICU GRADS

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- Must Find Strong Coffee Soon.

- Neurodevelopmental impairment is often a primary outcome measure to evaluate efficacy or the iatrogenic impact of biomedical interventions in the care of high risk infants.

- During infancy, cognitive function has been typically measured with the Mental Development Index of the BSID or the BSID II, or more recently the Cognitive Composite score of the Bayley Scales of Infant and Toddler Development-Bayley III.

- Longitudinal follow up is the most costly component of outcome research projects.
- Pressure to obtain measures of cognitive function at the earliest age possible.
- Bayley often administered at 18 to 24 months and at 3 years.
- Data viewed as continuous or categorical (eg MDI<70 or MDI<85).

The Changing Yardstick in Measurement of Cognitive Abilities in Infancy – Aylward and Aylward

JDBP 32,6,465-468 July/August 011

Andrews et al, Poster at SDBP Annual Meeting 2011, San Antonio Texas

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Bayley Scales of Infant Development

- Bayley scales (BSID) -1969
- Bayley Scales II (BSID-II) – 1993

- Direct observational scales standardized tasks
  - Mental Development Index (MDI)
  - Psychomotor Development Index (PDI)

  Normed to give a standard score (mean 100, and SD 15).

Flynn Effect

- Overall mean test scores increase by 0.3 to 0.5 points per year (~5 points per decade)
- Due to greater cognitive stimulation or increased awareness of tasks in developmental tests or better nutrition (pre and post natal)

Flynn, JR. What is Intelligence? Beyond the Flynn effect 2007

Bayley III

- Bayley Scales of Infant and Toddler Development (Bayley-III)-2006
- Introduced the “cognitive composite” (CC)
  - 92 items vs 72 in MDI
  - Language items not included in CC, moved to separate Language composite

Comparisons

- BSID-II compared to BSID, both given to 200 children 1-42 months
- MDI was 12 pts (0.8 SD) lower and Psychomotor Development Index (PDI) 7 pts lower than on BSID
  - Bayley, The Psychological Corporation 1993

And yet,

- BSID II with Bayley III, comparison in 102 children 1-42 months
- Bayley III Cognitive Composite 6 points (0.4 SD) higher than BSIDII MDI
- Bayley –III PDI 8 points higher.
  - Bayley, Pearson 2006

Why?

- Changes in content, administration and scoring, item gradients, and the floors and ceilings also have an impact and produce more variability
BSID vs BSID II

- Kids born 1983-2003 @ < 800g compared in 5 year cohorts. 18 month BSID and BSID II as well as 3 different WPPSI versions.
- MDI scores 93, 91, 84, 85.
- MDI scores < 70 increased from 7% 14%/ 18%, 22%
- PDI scores 89, 86/82, 78. (despite CP decreasing from 20% to 12%).

Synnes et al, J. Peds 2010

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Mean MDI Scores by Cohort

BSID-II vs Bayley III

40 kids mean gest age 26 weeks mean bw 891 gm. All given both evaluations;


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BSID II MDI mean 89.4, 20% <70

Bayley III CC mean 96.5 0% <70
  - For those kids <70 on the BSID II, Bayley III 23 points higher

BSID II MDI correlated more closely with Bayley III Language composite 89.4/88

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Compared to what?

221 infants <1000g and <28 weeks gestation- 2 year (corrected) 220 controls.

Developmental delay decided by comparison to test norms or by comparison to controls who took the test.

- Anderson et al, Underestimation of developmental delay by the new Bayley III Arch Pediatr Adolesc Med 2010;164; 332-336
Bayley III Cognitive Composite

- In premies: 96.9 (average range)
- In controls: 108.9

Difference was 10 pts when adjusted for maternal education and family structure and 8.9 when add’tl adjustment for CP/deafness. This difference is 2/3 of a standard deviation.

Similar results for language composite.

Percent of Children identified as delayed, comparison to norms vs. Controls.

- Rates of developmental delay (mild, moderate, severe) for
  - Cognitive: 13%
  - Language: 21%
  - Motor: 16%

- Vs controls: 33% 43% 48%

M. Msall editorial: “using the Bayley III will underestimate problems and reduce eligibility for intervention services” Arch Ped and Adolesc. Med 2010

Also, this overestimation will reduce ability to compare to earlier studies with BSID and BSID II.

Learning Problems in Kindergarten Students with Preterm birth

- Cohort of 148 kids born between 1/1/2001 and 12/31 2003 <28 weeks gestation, +/- <1000g and 111 classmate controls born at term with normal birth weight.

- Outcome measures achievement tests, teacher ratings of learning progress, individual educational assistance.


- 117 different schools in 57 school districts in Cleveland area.
- Multiple assessments in one setting
- Achievement deficits noted in spelling and applied math (when a subgroup with neurosensory issues is removed, only deficits are in math).

Risk factors: >25 weeks, abnl US of head, BPD, and infection, Neurodevelopmental impairment at 20 months and lower. MANY DID NOT HAVE AN IEP.
Predictive Ability?
- 200 ELBW infants <1000 g from a cohort born 1992 to 1995
- BSID II @ 18-20 months CA
- KABC Mental Processing Composite@8 years
- PE both times
- Major Neurologic Abn. 19% at 20 mos. And 16% at 8 years.

Hack et al. Poor Predictive Ability of the BSID for Cognitive Function in ELBW children at School age Pediatrics August 2005

ELBW without Neurosensory Handicap:
- 20 months MDI 79.3 (16)
- 8 year MPC 92.3 (16)
- Classmate control 99.8 (15)

ELBW with Neurosensory Handicap
- 20 month MDI 63.2 (15)
- 8 year MPC 72.9 (2)

Handicap Identified by MDI vs MPC

Predictive value
For Neurosensory normal
- MDI <70 PPV 0.37 (0.27-0.49)
For Neurosensory abnormal
- MDI <70 PPV 0.61 (0.42-0.77)

Addressing counseling families
- “Based on our results and those of others, results of the Bayley Scales of Infant Development or similar cognitive assessments should not be used to make decisions about medical treatment or policy, especially those as important as the life and eath of ELBW infants.”
- Hack et al.

"We suggest that the data used for reporting early childhood outcomes of infants born at the limits of viability be based mainly on the rates of children with neurosensory impairment who also have cognitive deficits rather than on cognitive deficits per se”
Would their recommendation been any different if they had the Bayley III available? (fewer kids would have had Cognitive Composite <70)

Recommendations

- Comparison to norms and control groups

- Be aware of the “noise” that changes in test versions and variability in mean scores adds to the comparisons and further predictions.