Optimal Outcome in Children with Autism

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Background (see Helt et al, 2008 review in Neuropsychology Review)

• Most longitudinal studies report 3-25% no longer meet criteria for autism on follow-up

• Most individuals no longer meeting criteria for ASD still show significant impairment in social and/or language functioning (e.g., Piven, 1996; Turner and Stone, 2007)
Lovaas, 1987

- 9/19 in the experimental group (40 hours a week Applied Behavior Analysis - ABA) successfully completed regular first grade in a public school and had an average or better score on IQ tests

- Attempts at replication generally report some children reaching this outcome, but not as many as Lovaas.
Mundy (1993) pointed out that normal IQ and functioning in regular education is possible in high-functioning autism and does not by itself constitute losing the diagnosis.
Purpose of our “optimal outcome” studies

• To document the phenomenon in which children with a clear history of ASD no longer meet criteria for ASD, and in whom there are no significant social or language problems

• To explore residual problems that may illuminate core deficits or suggest additional remediation or support needed

• To explore mechanisms of “optimal outcome” by tracking intervention and structural and functional imaging differences
Background

- 73 children dx’d with ASD at age 2 followed to age 4
- 13 (18%) lost dx
DSM-Symptoms

- ASD-to-NON
- ASD-to-ASD
- NON-to-NON

DSM Symptoms Time 1 vs DSM Symptoms Time 2
Vineland Communication

![Graph showing communication development with labels for asd to non asd, asd to asd, and non asd to non asd.]
Vineland Motor

The graph shows the comparison of different motor types over different values.

- **Vineland Motor 1 (VINEMOTOR1)**
- **Vineland Motor 2 (VINEMOTOR2)**

**Lines Represent:**
- Blue line: asd to non asd
- Pink line: asd to asd
- Yellow line: non asd to non asd

**Values:**
- 50, 55, 60, 65, 70, 75, 80, 85, 90, 95

The graph visually demonstrates the performance or characteristics of the motors under different conditions.
Can Head Circumference predict?


We predicted that the optimal outcome children would have more typical head circumference findings.
Figure 2. Mean HC z-scores for ASD-S, ASD-OO, and control groups
Current Study: Acknowledgements

• Funding: NIMH (NIH R01 MH076189)
• Collaborators:
  – Bob Schultz, Children’s Hosp. of Philadelphia
  – Mike Stevens, Institute of Living, Hartford
  – Letty Naigles, Marianne Barton, Inge-Marie Eigsti, University of Connecticut
• Recruitment: Lynn Brennan, Harriet Levin
• Graduate students: Dr. Mike Rosenthal, Katherine Tyson, Eva Troyb, Alyssa Orinstein, Molly Helt
Inclusion criteria

• All subjects:
  – Verbal, nonverbal, and full-scale IQ standard scores greater than 77
  – No major psychopathology (e.g., active psychotic disorder) that would impede full participation
  – No severe visual or hearing impairments
  – No seizure disorder
  – No Fragile X syndrome
  – no significant head trauma with loss of consciousness
Inclusion criteria for OO s’s

- Participants had a documented ASD diagnosis made by a physician or psychologist specializing in autism before the age of 5
- Early language delay (no words by 18 months or no phrases by 24 months)
- Report (without information on diagnosis, summary, and recommendations) was reviewed by clinician blind to group, mixed in with foils
- No current ASD as per ADOS and expert clinical judgment
- Vineland Communication and Socialization >77
- Full inclusion in regular education with no aide, no social skills services
Inclusion criteria for HFA

- participants had to meet criteria for ASD on the ADOS (both Social and Communication domains and total score) and according to best estimate clinical judgment.
Inclusion criteria for TD

• No ASD at any point in their development, by parent report
• No first-degree relative with an ASD diagnosis
• No current diagnostic criteria for an ASD on the ADOS, or by clinical judgment
• Vineland Communication and Socialization domains >77
Domains of Data Collection

- Cognitive functioning
- Social functioning
- Executive functioning
- Language functioning
- Academic functioning
- Psychiatric functioning
- Intervention, medical, developmental history
- Structural and functional imaging
- 4 experimental tasks (top-down processing, categorical induction, tone discrimination, dual task performance)
<table>
<thead>
<tr>
<th></th>
<th>HFA (n=44)</th>
<th>OO (n=34)</th>
<th>TD (n=34)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>40 M; 4 F</td>
<td>27 M; 7 F</td>
<td>31 M; 3 F</td>
<td>.23</td>
</tr>
<tr>
<td>Age</td>
<td>13.9 (2.7)</td>
<td>12.8 (3.5)</td>
<td>13.9 (2.6)</td>
<td>.20</td>
</tr>
<tr>
<td>VIQ</td>
<td>105.4 (14.4)</td>
<td>112.7 (13.7)</td>
<td>112.0 (11.2)</td>
<td>.03</td>
</tr>
<tr>
<td>NVIQ</td>
<td>110.2 (12.8)</td>
<td>110.3 (15.1)</td>
<td>112.8 (11.3)</td>
<td>.64</td>
</tr>
</tbody>
</table>
ADOS Algorithm Totals

Mean Score

- Communication: 3.50
- Social: 6.77

**HFA**

- Communication: 0.47
- Social: 0.50

**OO**

- Communication: 0.41
- Social: 1.09

**TD**

- Communication: 1.09
- Social: 1.00
# Social Communication Questionnaire (Lifetime)

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Score Mean</th>
<th>Std Dev</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>HFA</td>
<td>34</td>
<td>22.65</td>
<td>6.15</td>
<td></td>
</tr>
<tr>
<td>OO</td>
<td>30</td>
<td>17.10</td>
<td>6.68</td>
<td>&lt;.001 HFA &gt; OO</td>
</tr>
<tr>
<td>TD</td>
<td>32</td>
<td>1.50</td>
<td>1.24</td>
<td>&gt; TD</td>
</tr>
</tbody>
</table>

Note: The table compares the scores of different groups on the Social Communication Questionnaire (Lifetime), with higher scores indicating greater social communication difficulties. The p-value of <.001 suggests a statistically significant difference between the HFA and OO groups, with HFA scoring significantly higher.
## ADI-R Lifetime

<table>
<thead>
<tr>
<th>Category</th>
<th>HFA</th>
<th>OO</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socialization</td>
<td>20.30</td>
<td>15.24</td>
<td>14.05</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>(5.33)</td>
<td>(6.43)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication</td>
<td>15.51</td>
<td>14.30</td>
<td>1.12</td>
<td>.29</td>
</tr>
<tr>
<td></td>
<td>(5.07)</td>
<td>(4.73)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repetitive Behaviors</td>
<td>6.19</td>
<td>5.85</td>
<td>0.40</td>
<td>.53</td>
</tr>
<tr>
<td></td>
<td>(2.30)</td>
<td>(2.33)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Vineland Adaptive Behavior

<table>
<thead>
<tr>
<th></th>
<th>HFA</th>
<th>OO</th>
<th>TD</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Commun.</strong></td>
<td>82.70</td>
<td>98.30</td>
<td>93.44</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>(13.86)</td>
<td>(12.66)</td>
<td>(9.12)</td>
<td></td>
</tr>
<tr>
<td><strong>Socializ.</strong></td>
<td>75.51</td>
<td>102.03</td>
<td>101.74</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>(16.02)</td>
<td>(8.44)</td>
<td>(8.56)</td>
<td></td>
</tr>
<tr>
<td><strong>Daily Living</strong></td>
<td>75.40</td>
<td>92.30</td>
<td>88.76</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>(14.26)</td>
<td>(15.88)</td>
<td>(9.26)</td>
<td></td>
</tr>
</tbody>
</table>

For all comparisons, OO, TD > HFA
## Benton Face Recognition

<table>
<thead>
<tr>
<th></th>
<th>HFA</th>
<th>OO</th>
<th>TD</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>40</td>
<td>33</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Benton z-score</td>
<td>$z = -0.49$ (1.25)</td>
<td>$z = -0.02$ (1.19)</td>
<td>$z = 0.27$ (0.79)</td>
<td>0.01 TD&gt;HFA</td>
</tr>
</tbody>
</table>
Academic Skills (Troyb et al, in press, Autism: The International Journal)

• Measures of decoding, passage comprehension, written expression, and math problem solving
• All three groups performed in the average range on all subtests
• No significant differences between OO and TD groups. The HFA group scored significantly lower on reading comprehension and math problem solving.
Psychiatric Co-Morbidity

• Most common co-morbidities reported for ASD:
  – Anxiety (esp. specific and social phobias)
  – OCD
  – Tics
  – Depression
  – ADHD
  – ODD

• As much as 70% of ASD individuals have one co-morbid condition and 41% have 2 (Simons et al, 2008)
% with Current Psychiatric Disorders
(Tyson et al IMFAR 2010)

<table>
<thead>
<tr>
<th>Disorder</th>
<th>TD</th>
<th>HFA</th>
<th>Optimal outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific phobia</td>
<td>0</td>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td>ADHD</td>
<td>0</td>
<td>40</td>
<td>21</td>
</tr>
<tr>
<td>Tics</td>
<td>0</td>
<td>20</td>
<td>7</td>
</tr>
</tbody>
</table>
Summary

• OO group show no obvious social, language or cognitive difference from TD group
• Predictors of OO are similar to predictors of good outcome in general (higher cognitive and motor functioning, milder social symptoms)
• High rates of repetitive behavior do not preclude OO
• OO group does not show head circumference growth different from persisting ASD
• Above average IQ in OO group
• Residual deficits or vulnerabilities in the OO group (anxiety, attention)
Some Open Questions

- What percent of ASD children can reach this outcome?
- Is behavioral intervention necessary to produce this outcome?
- Do the children with OO potential have a distinctive set of etiologies?
- Are the OO participants arriving at overt behavior through different means (fMRI may illuminate)
Possible Mechanisms of Loss of Symptoms and Diagnosis

- The early clinical picture represented a transient developmental delay
- Behavioral intervention bypasses intrinsic motivation
- Neurologically based deficit in social orienting is prevented from disrupting further neurological development (Mundy & Crosson)
• Pairing social contact with primary reinforcers results in social contact developing secondary reinforcing value (Dawson) (but how does the connection become autonomous?)

• Suppressing interfering behaviors, especially stimulatory and repetitive behaviors

• Forcing attention to the environment rather than the internal world

• Teaching alternative routes to the same skills (fMRI may illuminate)
Future Directions

• Increase geographic and demographic diversity
• Adult outcome
• Biological differences between ASD-stable and Optimal Outcome individuals:
  – Genetic findings
  – Family history
  – Early growth parameters
  – Imaging findings
• Long term follow-up of children we diagnosed at age 2 to estimate % Optimal Outcome and identify predictors
• Follow children moving into OO to track reduction in symptoms
• Intervention histories
Setting the record straight...

- Children do not generally ‘grow out of’ autism

- These findings are not an argument for less early detection and intervention, but for more
Thank you
Predictors of Better Outcome

- higher initial IQ
- better receptive language
- imitation
- better motor skills*
- better pretend play
- less repetitive behavior
- milder overall severity
- better overall adaptive skills
- earlier diagnosis
- earlier treatment
- diagnosis of PDD-NOS rather than Autistic Disorder
Background

• Piven et al (1996) followed 38 high-IQ individuals with ASD from age 5 to age 13-28
• Majority showed improvement in social behavior and communication, but only half in repetitive behaviors
• 5 lost the ASD diagnosis, but all had persistent significant impairments in social interaction and/or repetitive behavior
• 18 children lost the diagnosis
  – milder social symptoms
  – higher cognitive functioning
  – were younger at initial diagnosis
  – tended to have persisting language problems
Specific Phobias

• HFA: crowds, babies, dogs,
• OO: dark, stink bugs, ants and bees, loud noises, crowds, elevators, ketchup, germs, dogs, crying, boats/water, heights
• TD: dogs, forests, snakes
Interpretations of the autistic to ADHD clinical picture

• Comorbid ASD/ADHD; autism resolves, leaving the ADHD clinical picture

• The children are a severe subtype of ADHD that presents as autism in the early years

• Attention impairment is part of ASD; when social, behavioral, and communication impairments subside, attention impairments remain
Mechanisms of Co-Morbidity

- Reactive disorder because of stress
- Overlapping symptoms with different causes
- Common underlying pathophysiology
- Misdiagnosis (avoidant anxious children may meet ADOS criteria for ASD)
- Subtypes of ASD that include other symptoms