Effects of combined pharmacological and academic intervention for children with ADHD & comorbid dyslexia

Rosemary Tannock, PhD
Canada Research Chair in Special Education & Adaptive Technology, Professor of Special Education & Psychiatry, University of Toronto; & Senior Scientist, The Hospital for Sick Children, CANADA

with

Maureen Lovett, PhD., Rhonda Martinussen, PhD., Abel Ickowicz, MD., Alison McInnes PhD., Nancy Benson, PhD (deceased)
ADHD+RD: Clinical Characteristics & Outcome

- Early manifestation of delayed language & inattention
Intervention needs for ADHD+RD: critical points

Treatment will need to take into account:

- deficits in executive function
- Slower processing speed
- Problems in language comprehension as well as
- Phonological processing
- Core ADHD behavioral symptoms

which might otherwise compromise expected effects of treatment
Limitations of current ADHD treatment for ADHD+RD

Behavioral/psychosocial treatment

- Limited evidence of effectiveness for ADHD symptoms, alone or in combination with pharmacological treatment (e.g., MTA Study)

Psychopharmacological

- Striking improvements in ADHD symptoms and academic productivity
- No effects on phonological processing, reading rate, accuracy,
- Little effect on comprehension

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Current Intervention for RD

Specific Instruction

- **direct instruction**
  - focused, systematic, explicit instruction in letter-sound association skills, phonological analysis & blending

- **strategy instruction**
  - dialogue-based method to teach & facilitate child’s self-monitoring and use of metacognitive strategies for decoding unfamiliar words
Limitations of RD intervention for ADHD+RD

- Phonologically-based reading remediation is necessary for children with RD, but direct instruction alone is insufficient.
  - does not address transfer-of-learning or comprehension

- Combined approach produces best outcomes
  - particularly when outcomes include text-based reading

- No evidence that intervention for RD has any influence on behavioral or cognitive problems associated with ADHD
Published RCTs for ADHD+RD (n=2)

Richardson et al., 1988

- Combined MPH & specific reading remediation (n=42)
  - 24 weekly individual sessions with teacher, plus daily home practice with parents
  - Treatment effects on reading were indirect and mediated through behavioral control &
  - MPH had only modest direct effects of on word recognition (involving verbal retrieval), short-term memory and paired-associate learning,
    - but no effects on the core phonological processing deficits in these children.

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Existing RCTs for ADHD+RD cont.

- **Aro et al., 1999**
  - Investigated how ADHD symptoms influenced treatment outcome for LD (33% had ADHD+LD)
  - Neurocognitive training versus homework assistance & reading exercises
    - 76 hrs (2-hr group sessions 1/week for 9 mos)
  - **Results**
    - Both groups improved in reading
    - Improvements in inattention in the ADHD+LD group were related to improvements in reading and writing
    - high initial level of hyperactivity associated with treatment-induced improvements in mathematics (but not in reading).
Rabiner et al., 2004: Impact of tutoring on reading in children with & without inattention

- 581 children (Fast-Track program)
  - RD, INATT, INATT+RD
- Grade 1: 3 x 30 min/week instruction
  - phonics-based, mastery approach
- Results
  - Inattention predicted reading achievement at end Gr 1, even after controlling for IQ, early reading skills
  - RD: substantial gains
  - INATT: modest gains
  - INATT+RD: NO gains
Current intervention approaches for ADHD+RD

- Treatment-outcome research has begun to delineate effective treatment for ADHD or RD alone, but no credible evidence of effective treatment for ADHD+RD.

- Children with ADHD+RD at risk for being treated ineffectively even by best available treatments for separate conditions of ADHD+RD...

- Interventions for the separate disorders (ADHD, RD) typically provided independently and in disjointed manner by health & education agencies, respectively.

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Toronto: ADHD-READ STUDY
Study Objectives

1. Determine relative efficacy of:

   reading instruction *versus* social/cognitive strategy training, for reading & behavioral difficulties in children with ADHD+RD

2. Determine whether adjunctive stimulant medication is necessary and potentiates the effects of the academic instruction
READ STUDY DESIGN

RANDOMIZATION

MPH
- PHAB
- WI ST
- CSS

PLACEBO
- PHAB
- WI ST
- CSS
READ STUDY PROCEDURES

- Diagnostic Assessment
- Matching & Random Assignment
- Dose Adjustment Phase
- Combined Treatment Phase (35 1-hr-sessions)
  - Methylphenidate +
    - PHAB
    - WIST
    - CSS
  - Placebo +
    - PHAB
    - WIST
    - CSS

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Instruction in a small classroom in local elementary schools (K-5)

35 hours of instruction in total, 1 hour per day for approximately 10 weeks

1:4 student/teacher ratio

Children assessed pre and post program
Reading Remedial Programs

Goal: to enable children to acquire reliable and efficient word identification skills and expanded reading vocabulary

- **PHAB/DI**: Phonological Analysis and Blending Program
- **WIST**: Word Identification Strategy Training
PHAB/DI

- Focuses on teaching explicit letter-sound instruction in the context of intensive training in phonological analysis and blending skills.

- Uses the direct instruction program: Reading Mastery Fast Cycle (Engleman & Bruner, 1988)

- Sounding out (say it slowly: say it fast)
  strand: \(sss + t + rrr + aaa + nnn + d\)
WIST

- Instructs children in the acquisition, use and monitoring of four specific word identification strategies
  - Rhyming (Compare/Contrast) (based on Benchmark Word Identification program)
  - Vowel Alert
  - I Spy
  - Peeling-Off
Examples of WIST strategies

- **Rhyming**
  - example, using words that I know to figure out words that I don’t know
  - If I know “cat” then I know “flat”.
  - Limerick: *(him)*(her)*(kick)*

- **Vowel Alert**
  - Vowels are tricky because they make more than one sound (*head*, *bead*, *break*).
  - I stop. I have to be careful. First I try “i” like in “it” then I try “i” like in “kite”
I Spy

- I look for little words that I know.
- Dogmatic: *dog* – *mat* – *ic*

Peeling-Off

- Students learn affixes and how to identify in words
- Then they learn how to use that knowledge to decode words
- E.g., unexceptionally unrelenting
Social and Cognitive Remediation (CSS) – nonprint program

- Goals are to teach children:
  - to be independent & effective learners by facilitating their ability to use language to solve problems
  - a set of metacognitive & cognitive strategies to utilize across multiple settings (social and academic)

- Teacher facilitates the full participation of the students in the thinking/learning process by providing appropriate instructional scaffolds
## Four Components of CSS

<table>
<thead>
<tr>
<th>Academic skills</th>
<th>IDEAS</th>
<th>Getting Along Together</th>
<th>Being a Detective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporal Skills</td>
<td>Think Aloud/Ideas</td>
<td>Promoting self-esteem</td>
<td>Direct instruction in cognitive strategies</td>
</tr>
<tr>
<td>Instructional Language</td>
<td>Verbal mediation lessons</td>
<td>Emotion/Anger Management</td>
<td>E.g., tangrams, scientific methods</td>
</tr>
<tr>
<td>Organization, study strategies,</td>
<td>Explicit modelling of</td>
<td>Social Skills/Problem solving</td>
<td>Attribute blocks, mazes, pentominoes</td>
</tr>
<tr>
<td>listening</td>
<td>application to cognitive and social problem solving</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Key Instructional Strategies

- Integrated teaching of skills and strategies within and across each section
- Explicit instruction in the language of the classroom
- Delivery is modified (multiple tasks, cumulative review, visual supports, pacing, etc.)
- Children are taught when, where, and how to use verbal mediation to self-regulate, and solve both social and cognitive problems
Example of Metacognitive Strategies Used in SCORE with primary students

- Think Aloud (Camp & Bash, 1985)
  - Students’ thinking is guided by 4 questions
  - What am I supposed to do?
  - What are some plans?
  - How is my plan working?
  - How did I do?
I.D.E.A.S.

- Metacognitive dialogue sued with children in grades 4-6
- I - state my problem.
- D - develop some plans
- E - explore the plans
- A - ask myself how my plan is working
- S- see if I was successful
# Referrals, eligibility, exclusion

<table>
<thead>
<tr>
<th>Number of children</th>
<th>Telephone Screen</th>
<th>Behavior Rating Screen</th>
<th>Reading Assessment</th>
<th>DSM-IV ADHD assessment</th>
<th>Consent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>221</td>
<td>183</td>
<td>156</td>
<td>133</td>
<td>65</td>
</tr>
<tr>
<td>% excluded at each stage</td>
<td>18%</td>
<td>15%</td>
<td>15%</td>
<td>53%</td>
<td>8%</td>
</tr>
</tbody>
</table>

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## Sample characteristics (n=65)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Age</td>
<td>8.5 (1.4)</td>
</tr>
<tr>
<td>Girls (%)</td>
<td>16 (25%)</td>
</tr>
<tr>
<td>WISC-III FSIQ</td>
<td></td>
</tr>
<tr>
<td>Verbal IQ</td>
<td>91.5 (10.6)</td>
</tr>
<tr>
<td>Performance IQ</td>
<td>91.1 (11.2)</td>
</tr>
<tr>
<td></td>
<td>94.1 (13.2)</td>
</tr>
<tr>
<td>CELF : Receptive Lang.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>87.0 (15.5)</td>
</tr>
<tr>
<td>Expressive Lang.</td>
<td>92.0 (16.0)</td>
</tr>
<tr>
<td>ADHD symptoms</td>
<td></td>
</tr>
<tr>
<td>Parent Interview</td>
<td>Inattention</td>
</tr>
<tr>
<td></td>
<td>5.1 (2.1)</td>
</tr>
<tr>
<td>Teacher Interview</td>
<td>Hyp/Imp</td>
</tr>
<tr>
<td></td>
<td>6.0 (1.5)</td>
</tr>
<tr>
<td></td>
<td>4.4 (2.4)</td>
</tr>
<tr>
<td>Comorbidity (%)</td>
<td></td>
</tr>
<tr>
<td>ODD</td>
<td>29%</td>
</tr>
<tr>
<td>CD</td>
<td>8%</td>
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</tbody>
</table>

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A linguistic analysis confirms program integrity: 80% - 90% time spent in academic instruction & academic engagement.
Compliance & Issues

- **Academic programs:**
  - 100% completion of 35 hrs instruction

- **Medication:**
  - 20% requested cross-over to “other pills” within the dose-adjustment phase
    - 8 PL > MPH
    - 5 MPH > PL

- **Issue for Intent-to-Treat Analysis**
Sample: as-treated

<table>
<thead>
<tr>
<th>MPH</th>
<th>PLACEBO</th>
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</thead>
<tbody>
<tr>
<td>PHAB/DI</td>
<td>WI ST</td>
</tr>
<tr>
<td>CSS</td>
<td>PHAB/DI</td>
</tr>
<tr>
<td>N=18</td>
<td>N=12</td>
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<td>N=9</td>
<td>N=10</td>
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<tr>
<td>N=10</td>
<td>N=11</td>
</tr>
<tr>
<td>N=5</td>
<td></td>
</tr>
</tbody>
</table>

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Statistical Approach

- As-treated (not ITT as planned)
- MANOVA:
  - Posttest score adjusted for pretest score
  - Focused orthogonal contrasts
    - Reading program (PHAB/DI, WIST) vs CSS
    - PHAB/DI vs. WIST
    - MPH vs PL
No effects on parent ratings of ADHD symptoms

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Effects of programs on ADHD symptoms (collapsed across meds)

Lower scores indicate fewer ADHD symptoms

No effects of programs on teacher ratings of ADHD symptoms

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Effects on letter-sound mapping by program & medication condition

Higher scores indicate better performance on the reading test.
Effects on reading measures: medication x program interaction

Higher scores indicate better performance on the reading test
Medication x program interactions

Higher scores indicate better performance on the reading test

WRMT Pass. Comp.

WRAT-III Arithmetic

medication condition

placebo

MPH

reading program

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Generalization of intervention effects

Higher scores indicate better performance on the reading test.
Take Home Messages!

- Children with ADHD plus comorbid RD need specific treatment for each component of this comorbid condition.

- Combined treatment approach (reading instruction + stimulant medication) may be effective for children with ADHD+RD.
  - Stimulant medication improves behavioral symptoms of ADHD but has no effect on phonological processing.
  - Specific, focused, individualized, and intense reading instruction improves phonological processing abilities.
READ STUDY: Acknowledgements

Investigative Team

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