



Predictors of Intervention Response by Children with ADHD and Reading Difficulties: Contributions of ADHD Symptoms and Sluggish Cognitive Tempo

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The I-CARD Study: Interventions for Children with Attention and Reading Disorders

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ADHD and RD

- Distinct disorders
- Frequently overlap
- Between 25% and 40% of students with RD also have ADHD
- More severe academic and social problems and than awareness and executive functions than RD alone or ADHD alone
- More severe deficits in phonological awareness and executive functions than RD alone or ADHD alone

Participants

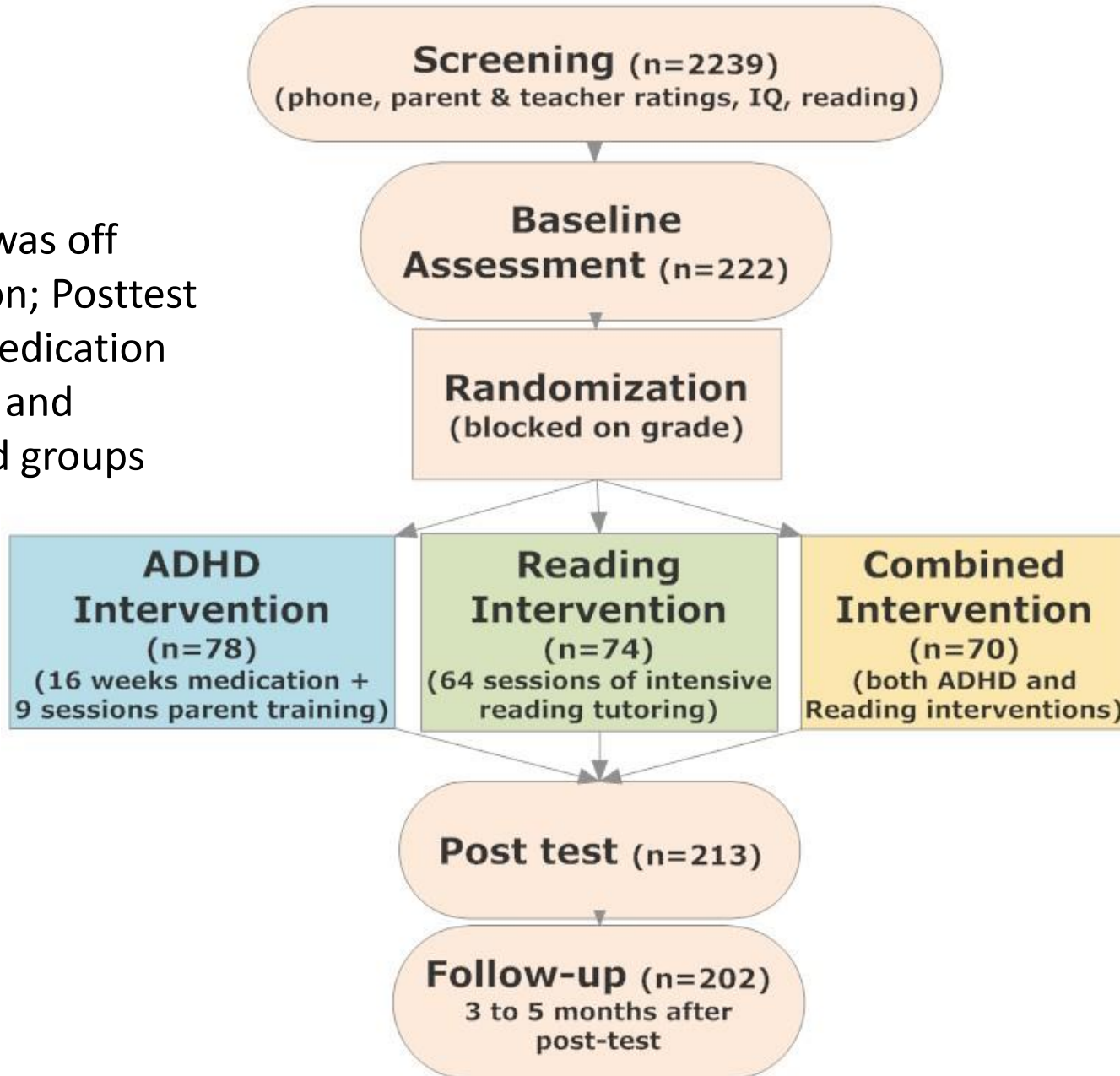
- $n = 216$ in grades 2-5
- Met DSM-IV criteria for ADHD (combined or inattentive type) and had WJ-III Letter-Word Identification or Word Attack < 90
- Severely impaired readers: Pretest *M* WIAT Basic Reading composite, TOWRE fluency composite, and WIAT Reading Comprehension in the 4th, 5th, and 10th percentiles
- Most recruited through schools (22 districts; 73 schools), some from clinics and community; in Houston and Cincinnati areas
- Replicated with 7 cohorts over 5 years

Demographics

	Reading (n=73)	ADHD (n=77)	Combined (n=66)
Percent Male*	67.1%	67.5%	47%
Percent Hispanic	7.8%	10.5%	18.3%
Caucasian	17.8%	18.2%	22.7%
African American	76.7%	71.4%	68.2%
Biracial	5.5%	9.1%	4.5%
Other	0%	1.3%	4.5%
Grade 2	30.6%	28.9%	30.8%
3	26.4%	25.0%	24.6%
4	25.0%	25.0%	23.1%
5	18.1%	21.1%	21.5%
ADHD Combined Type	58.3%	57.9%	45.5%
Econ. Disadvantaged	77.7%	77.9%	72.7%
Full Scale IQ	86.2	86.8	86.7

*significant group difference on gender

ICARD Study Design



*Pretest was off medication; Posttest was on medication for ADHD and Combined groups

16 Weeks

ADHD Treatment: Carefully Managed Medication + Parent Training

- Most started on extended release methylphenidate (Concerta), some switched to mixed salt amphetamine (Adderall) or a non-stimulant due to weak response or side effects
- Weekly MD visits during titration phase
- Ratings of symptoms and side effects collected weekly from parents and teachers to inform titration
- Monthly MD visits during maintenance phase

Parent Training Sessions

Session	Content
1	Overview of ADHD, introduction to treatment
2	Behavior modification principles
3	Compliance training
4	Token economies/point systems
5	Daily report cards
6	Response cost
7	Time out
8	Managing homework
9	General review and generalization

Reading Intervention

- 1:1 or 1:2; tutors hired by the researchers; 45 min, 4 days/week, during school (64 sessions)
- Individualized lessons in word study (phonics, word reading, spelling), fluency, and comprehension
- Primary emphasis on word study: explicit, systematic instruction
- Fidelity of implementation averaged 95% ($SD = .03$)

Primary Findings: Significant Group Differences at Posttest (Intent-to-Treat Analysis)

	Measure	Results
ADHD Symptoms, both Parent and Teacher ratings	SNAP-IV	ADHD = Combined < Reading (lower is better)
Untimed Word Reading & Phonemic Decoding	WIAT-3	Reading = Combined > ADHD
Phonemic Decoding Efficiency	TOWRE	Reading > Combined > ADHD
Reading Comprehension	WIAT-3	ADHD > Reading = Combined

Tamm, Denton, et al. (2017) *Journal of Consulting and Clinical Psychology* and Denton et al. (manuscript in preparation)

Predictors of Intervention Response

Do ADHD symptoms or symptoms of Sluggish Cognitive Tempo add to the prediction of posttest scores on WIAT Basic Reading Skills and WIAT Reading Comprehension after controlling for pretest scores, phonemic awareness, rapid letter naming, and verbal and nonverbal IQ?

Sluggish Cognitive Tempo (SCT)

- Symptoms: low energy, daydreaming, sleepiness, staring, mental fogginess/confusion, underactive, slow-moving/sluggish
- Symptoms appear to be distinct but overlapping with those of ADHD; does not seem to be a subtype of ADHD
- SCT has been identified in research but is not a recognized diagnostic category of mental disorder
- Strong evidence for association of SCT with social impairment, some evidence of association with academic difficulties
- Willcutt et al. (2014) found association of both ADHD-I and SCT symptoms with word reading and reading comprehension difficulties, but only SCT was associated with writing difficulties

Barkley, R.A. (2015). *Attention-Deficit Hyperactivity Disorder: A handbook for diagnosis and treatment* (4th Ed.), pp. 435-452. New York: Guilford.

Willcutt et al. (2014). The internal and external validity of SCT and its relation with DSM-IV ADHD. *J Abnormal Psychology, 42*, 21-35.

Approach

- Hierarchical multiple regression
- Predicting posttest WIAT-3 Basic Reading Skills (Word Reading & Phonemic Decoding) and WIAT-3 Reading Comprehension
- Conducted separately for each treatment condition

Predictor Variables

Variables	Measures
Pretest Scores	WIAT-3 Basic Reading Skills WIAT-3 Reading Comprehension
Phonemic Awareness and RAN Letters	CTOPP Elision CTOPP Rapid Letter Naming
Verbal and Nonverbal IQ	KBIT-2 Verbal and Nonverbal IQ Estimates
Inattention and Hyperactivity/Impulsivity	SNAP-IV Parent and Teacher Ratings
Sluggish Cognitive Tempo Symptoms	Child Behavior Checklist (Parent) Teacher's Report Form (Teacher)

SCT Symptom Ratings

- Child Behavior Checklist (parents) and Teacher's Report Form (teachers); Achenbach, 2007
 - Confused or seems to be in a fog
 - Daydreams or gets lost in his/her thoughts
 - Apathetic or unmotivated (teacher form only)
 - Stares blankly
 - Underactive, slow-moving, or lacks energy

Results: Reading Intervention Only (n=68)

Basic Reading Skills: Model $R^2 = .66$

Significant Predictors	R^2 Change	<i>Sig. F Change</i>
Basic Reading Skills Pretest	0.60	.000
Phonemic Awareness	0.03	.020
Teacher Inattention	0.02	.049

Reading Comprehension: Model $R^2 = .63$

Significant Predictors	R^2 Change	<i>Sig. F Change</i>
Comprehension Pretest	0.57	.000
Teacher Hyperactivity/ Impulsivity	0.06	.002

Results: ADHD Treatment Only (n=65)

Basic Reading Skills : Model $R^2 = .70$

Significant Predictors	R^2 Change	<i>Sig. F Change</i>
Basic Reading Skills Pretest	0.64	.000
Parent Inattention	0.03	.015
Parent Sluggish Cognitive Tempo	0.03	.013

Comprehension : Model $R^2 = .64$

Significant Predictors	R^2 Change	<i>Sig. F Change</i>
Comprehension Pretest	0.56	.000
Verbal IQ	0.05	.005
Nonverbal IQ	0.03	.040

Results: Combined Treatment^a (n=57)

Basic Reading Skills : Model $R^2 = .58$

Significant Predictors	R ² Change	Sig. F Change
Pretest	0.58	.000

Comprehension : Model $R^2 = .60$

Significant Predictors	R ² Change	Sig. F Change
Pretest	0.54	.000
Verbal IQ	0.06	.007

^aTeacher H/I excluded for this group due to multicollinearity

Conclusions and Implications

- Predictors of response vary among students who receive reading intervention only, ADHD treatment only, and their combination.
- Found little evidence that symptoms of SCT impact response to intensive reading intervention when other factors are controlled, but they may impact the progress of students receiving ADHD treatment (medication, parent training) without reading intervention.
- Characteristics of students with ADHD-I and SCT should be considered in the development of interventions for students with ADHD + RD.

Limitations

- All students had ADHD Inattentive or Combined Type; did not examine impact of SCT in those without ADHD
- The Child Behavior Checklist (parent form) included only 4 symptoms of SCT and the teacher version included only 5 symptoms

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