Attention-Deficit/Hyperactivity Disorder (ADHD) and Reading Abilities: A Comprehensive Review

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Abstract

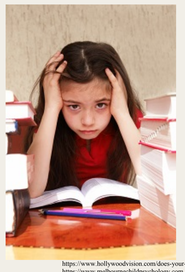
Attention-Deficit/Hyperactivity Disorder (ADHD), is a neurodevelopmental disorder that is characterized by "a consistent pattern of inattention and/or hyperactivity/impulsivity symptoms that interferes with functioning in at least two domains" (DSM-V, 2013). While most studies link reading impairments to attention symptoms, Kagan's (1965) seminal work documents a significant positive correlation between cognitive impulsivity and reading abilities in typically developing school-aged children (Kagan 1965). Moreover, extant research documents a relation between academic achievement impairments and ADHD-related cognitive impairments (i.e., executive functions). The purpose of this review is to examine ADHD-related reading abilities. We aim to outline the foundation for research on the relation between reading abilities and ADHD symptoms. We will examine both reading abilities broadly and examine specific reading-related processes (i.e., reading comprehension and reading decoding). Moreover, we will examine the relation between impulsivity and reading abilities in school-aged children diagnosed with ADHD. Our goal is to understand the etiology (i.e., root cause) of impaired reading abilities in school-aged children diagnosed with ADHD. Clinical and research implications will be discussed.

Introduction

- Approximately 5% of children are diagnosed with ADHD (Friedman & Rapport, 2015).
- Children with ADHD score 1-3 standard deviations lower than their typically-developing peers on standardized achievement tests (Barkley, 2006).
- 10-35% of children diagnosed with ADHD fail to complete high school (Barkley, 2006).
- ADHD is frequently co-morbid with reading problems (i.e, comorbidity rate for ADHD and reading disability is 15-40%; Rucklidge & Tannock, 2002).

	Controls (n=37)		ADHD (n=35)		ADHD+RD (n=24)		
Variable	Mean	SD	Mean	SD	Mean	SD	*F* (3,104)
Age	14.95	1.10	15.18	1.36	14.86	1.43	0.365
WISC-III							
Estimated FSIQ	111.03	13.15	102.20	8.73	101.13	12.06	5.105**
Vocabulary	11.77	2.68	10.29	2.09	8.54	2.23	9.811***
Block Design	12.06	3.35	10.49	1.88	11.54	3.98	1.672
K-SADS-In. Symptoms	1.19	0.70	6.60	2.00	6.96	1.12	156.927***
H/I Symptoms	0.22	0.53	2.54	2.17	3.21	2.48	18.611
CTRS (Tscores)							
DSM In.	41.92	13.17	66.66	17.61	68.04	17.97	18.701***
DSM H/I	42.81	13.58	65.71	20.03	63.45	20.81	11.927***
OCHSS ADHD Teacher Report	0.81	1.85	10.60	7.37	11.79	5.41	26.864***
Teacher Impairment	0.11	0.52	4.37	4.19	4.25	3.48	13.828***
WRAT3(SS) Reading	111.24	7.44	105.71	7.61	87.21	13.27	39.517***
WRMT-R (SS)							
Word-ID	106.14	5.56	103.94	7.86	85.96	13.41	36.521***
Word-Attack	103.97	6.74	102.00	5.91	87.08	8.21	42.513***

Table 1- Sample Characteristics: Means and SD



https://www.hollywoodvision.com/does-your-child-have-a-learning-related-problem/school-age-girl-reading-frustration_7246862-1/
https://www.melbournechildpsychology.com.au/blog/importance-of-early-intervention-for-learning-difficulties/

Sub-Test	Referral Question to Behavior	What it is measuring
Letter & Word Recognition (LWR)	Can the examinee recognize and pronounce the letter or word correctly?	Pronunciation of phoneme and response style (letter-by-letter, chucking, or whole word)
Reading Comprehension (RC)	Can the examinee read content and answer prompted questions accurately?	Accuracy on reading context and providing an oral response
Phonological Processing (PP)	Can the examinee listen to examiner and provide an accurate response within each section?	If the examinee can coordinate correct responses to phonological prompts (Blending, Rhyming, Sound Matching, Deleting Sounds, Segmenting)
Nonsense Word Decoding (NWD)	Can the examinee combine known reading tools to decode made-up words?	Examinee's can use known reading rules and accurately read an nonsense word.
Silent Reading Fluency (SRF)	Can the examinee read to his/herself silently and answer Yes/No questions under a time limit?	Examinee's reading and RC speed
Word Recognition Fluency (WRF)	How quickly can the examinee read in a limited time?	How many words can the examinee read in a word set in 15s?
Decoding Fluency (DF)	How quickly can the examinee read non-word in a limed time?	How many non-words can the examinee read in a set in 15s?
Reading Vocabulary (RV)	Can the examinee make an inference?	Examinee reads a sentence and has to select a word that responds to similar meaning in the question

Fig. 1- KTEA III Subtests

Literature Review

Inattention:

❖Greven et al. 2011 studied the genetic correlation between ADHD symptoms and reading difficulties.
- 6428 twin pairs, age 12, were administered tests of reading comprehension and decoding abilities.
- Data on ADHD symptomology was collected through parent report. Results found a high heritability rate of both ADHD (70%) and reading difficulties (45-65%) in the sample.
- A higher heritability correlation was found between reading difficulties and inattentiveness (r=-.31) than between reading difficulties and hyperactivity/impulsivity (r=-.16).
- The findings suggest a strong relationship between inattentiveness and reading abilities for children diagnosed with ADHD (Greven, Harlaar, Dale & Plomin, 2011).

❖Greven et al. conducted a 2012 longitudinal study evaluating the genetic influence on the association between ADHD symptoms and reading difficulties.
- Data from 7,000 twin pairs within two age groups 7-8 years and 11-12 years.
- ADHD symptoms were a stronger predictor of reading difficulties than contrariwise.
- Inattentive symptoms were found to be a stronger predictor of reading difficulties than hyperactivity/impulsivity symptoms in both age groups.
- The study implies children with ADHD are at risk of reading impairments (Greven, Rijsdijk, Asherson, & Plomin, 2012).

❖Pham's 2016 study divides the three core symptoms of ADHD: inattention, hyperactivity, and impulsivity, and attempted to find their unique contributions to reading abilities in school-aged children.
- The sample included 131 children all of which completed a battery of tests to measure reading comprehension and fluency abilities.
- Parent and teacher reports of ADHD symptoms were obtained.
- Results of the study found a significant correlation between inattentiveness and reading achievement with inattentiveness as a significant predictor.
- No significant correlations were found between reading achievement and both hyperactive and impulsive symptoms (Pham, 2016).

Impulsivity:

❖Kagan's 1965 research used a sample of typically-developing school-aged children attempts to find a link between cognitive impulsivity and reading abilities.
- Kagan administered measures to 130 children organizing them into two groups, impulsive and reflective, based on their response time and error scores on tasks measuring impulsivity.
- Kagan's research differentiates itself for two reasons. He measured cognitive impulsivity (i.e., commission errors) and reflection-impulsivity as opposed to behavioral impulsivity (i.e., verbal interruptions) and his sample consisted of school-aged children with no previous diagnosis of ADHD.
- While most studies link reading impairments to attention symptoms, Kagan's seminal work documents a significant positive correlation between cognitive impulsivity and reading abilities in typically developing school-aged children (Kagan, 1965).

Proposed Research Questions

My honors thesis will examine the following two questions:

1.Do cognitive impairments (i.e., executive functions, working memory) moderate the relation among ADHD symptoms (attention, hyperactivity/impulsivity) and reading problems (i.e. reading comprehension, fluency, decoding)?
2.Does cognitive impulsivity predict reading problems (i.e. reading comprehension, fluency, decoding) in a clinical ADHD sample of school-aged children? (This is a replication of Kagan's study with an ADHD sample)

Future research should examine the following questions:

1.What is the relation between cognitive impulsivity (or ADHD symptoms) and reading problems?
2.Do reading problems (i.e. fluency, decoding) predict cognitive impulsivity in a clinical ADHD sample of school-aged children?

Proposed Methods

❖The study will include children between ages 8-12 who were referred to a clinical research laboratory for attention and learning problems.
❖The children's reading performance will be correlated with their ADHD symptoms
❖The following measures will be included in the study:
- Kaufman Test of Educational Achievement – Third Edition (K-TEA-III)
- Matching Unfamiliar Figures (MUFTy; a measure of cognitive impulsivity)
- Continuous Performance Task (CPT) i.e. commission errors
- Teacher Report Form (TRF)

Preliminary Results

		Letter & Word Recognition Raw Score	Reading Comprehension Raw Score	Nonsense Word Decoding Raw Score	Word Recognition Fluency Raw Score	Decoding Fluency Raw Score	TRF ADHD Problems Raw Score
Letter & Word Recognition Raw Score	Pearson Correlation	1					.
Reading Comprehension Raw Score	Pearson Correlation	.499**					
Nonsense Word Decoding Raw Score	Pearson Correlation	.783**	0.319				
Word Recognition Fluency Raw Score	Pearson Correlation	.484*	0.24	.453*			
Decoding Fluency Raw Score	Pearson Correlation	.613**	0.333	.640**	.673**		
TRF ADHD Problems Raw Score	Pearson Correlation	0.033	-0.14	-0.027	-0.075	0.048	1
Means		67.79	36.41	29.07	38.26	24.88	10.79
SD		9.59	55.42	10.54	8.17	7.22	7.26

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 2- Correlations Among Study Variables

Goals for Future Research

1.We aim to inform the development of impairment specific reading interventions for children diagnosed with ADHD.
2.We seek to provide specific reading interventions to children diagnosed with ADHD whose reading may be impaired on a foundational level (i.e., decoding).

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References

- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing.
- Barkley, R. A. (2006). *Attention-Deficit Hyperactivity Disorder: A Handbook for Diagnosis and Treatment*. New York: Guilford Press.
- Friedman, L. A., & Rapport, J. L. (2015). Brain development in ADHD. Current Opinion in Neurobiology, 30, 106-111.
- Greven, C. U., Harlaar, N., Dale, P. S., & Plomin, R. (2011). Genetic overlap between ADHD symptoms and reading is largely driven by inattentiveness rather than hyperactivity-impulsivity. *Journal of the Canadian Academy of Child and Adolescent Psychiatry*, *20*(1), 6.
- Greven, C. U., Rijsdijk, F. V., Asherson, P., & Plomin, R. (2012). A longitudinal twin study on the association between ADHD symptoms and reading. *Journal of Child Psychology and Psychiatry*, *53*(3), 234-242.
- Kagan, J. (1965). Reflection-impulsivity and reading ability in primary grade children. *Child development*, 609-628.
- Kaufman, A.S., & Kaufman, N.L. (2014). Kaufman Brief Intelligence Test III. Circle Pines, MN: American Guidance Service.
- Pham, A. V. (2016). Differentiating behavioral ratings of inattention, impulsivity, and hyperactivity in children: effects on reading achievement. *Journal of Attention Disorders*, *20*(8), 674-683.
- Rucklidge, J. J., & Tannock, R. (2002, October 28). Neuropsychological profiles of adolescents with ADHD: Effects of reading difficulties and gender. Retrieved April 05, 2018, from http://onlinelibrary.wiley.com/doi/10.1111/1469-7610.00227/abstract.