The Cognitive Profile of Preschoolers at Risk for Dyslexia and ADHD

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Abstract

Dyslexia and ADHD frequently co-occur, as approximately 15-40% of children with one diagnosis also have symptoms of the other. However, in prospective research, preschoolers at risk for dyslexia and ADHD are often neglected. Yet, insight into the cognitive profile of these at-risk children might enhance early identification and remediation. Therefore, overall, our study aimed to investigate the cognitive development of preschoolers at risk for dyslexia and/or ADHD and typically developing preschoolers, by following them up longitudinally from preschool (age 5) to third grade (age 8) (N = 178 in third grade). In this presentation, we specifically compared preschool risk status to cognitive deficits and investigated to what extent these preschool deficits were related to later formal diagnoses in third grade.

Prospectively, we examined the likelihood of working memory (WM), processing speed (PS), or inhibition deficits in specific risk groups through an individual deviance analysis. The results showed that when a WM, PS, or inhibition deficit was present in preschool, most children were simultaneously at risk for dyslexia, with or without ADHD.

Additionally, we retrospectively assessed the relation between these preschool deficits and the probability of a formal diagnosis of ADHD and/or dyslexia by the time they were in third grade. These specific preschool deficits were indeed associated with later difficulties, as preschool WM and PS deficits were related to the probability of a future diagnosis of ADHD and/or dyslexia. This study's results highlight the importance of cognition in identifying children with special educational needs and developing interventions for these children.

Summary

Developmental dyslexia (dyslexia) and attention-deficit hyperactivity disorder (ADHD) frequently co-occur, as approximately 15-40% of children with one diagnosis also have symptoms of the other (Willcutt et al., 2010). At a cognitive level, children with co-occurring dyslexia and ADHD show deficits related to dyslexia (i.e., phonological deficits), ADHD (i.e., executive deficits), and processing speed deficits (McGrath et al., 2011). Because of the increased risk of poor school performance, early identification of these disorders is essential (Willcutt et al., 2001).

The overall aim of this study was to compare the cognitive profile of preschoolers (M_{age} = 62.50 months) at risk for dyslexia and ADHD (n = 47) to preschoolers at risk for dyslexia (n = 49), preschoolers at risk for ADHD (n = 35), and to a group without risk (n = 47). At five years old, these children did not have formal diagnoses yet. However, we identified dyslexia and/or ADHD risk with a behavioral screening during this last year of preschool. In the case of dyslexia risk, children performed poorly on preliteracy measures (i.e., letter knowledge, rapid automatic naming, and phonological awareness). In the case of ADHD risk, these children scored clinically on a standardized questionnaire completed by their parents (Preschool Behavior Questionnaire (PBQ) (Smidts & Oosterlaan, 2014)). Children in the double-risk group performed poorly on the preliteracy measures and scored clinically on the PBQ, while controls did not. After selecting participants, we administered an extensive test battery to all children, measuring phonological skills, executive functioning, and processing speed, all related to co-occurring dyslexia and ADHD in older children. All four groups were followed longitudinally (from the final year of preschool (age 5) until the third grade of primary school (age 8).

In this presentation, we specifically compared preschool risk status to cognitive deficits and investigated to what extent these preschool deficits were related to formal diagnoses in third grade. From a prospective perspective, we performed an individual deviance analysis to assess the likelihood of preschool deficits in children depending on their risk status in preschool (Ramus et al., 2003). Since children were allocated to their risk group based on their performance on preliteracy measures, we only investigated executive functioning performance (working memory (WM), behavioral inhibition, and shifting) and processing speed (PS). Working memory was assessed with a backward digit span and Corsi block task, behavioral inhibition was calculated by the proportion of commission errors on a go/no go task, shifting was measured with an experimental task, and processing speed was investigated with the corresponding WPPSI-III-NL subtests. Individual deviance analyses revealed that 34.31% of all children showed a preschool WM deficit. Of those having a WM deficit, 85.10% came from the dyslexia (with or without ADHD) risk group (Table 1). A chi-

square test for association showed a moderately strong association between risk group and the presence of a WM deficit, χ^2 (3) = 24.59, p < .001, Cramer's V = .42. Preschool PS and inhibition deficits were present in 16.67% and 15.25% of all children, respectively. In both cases, most children (approximately 85%) with PS or inhibition deficits were from the dyslexia (with or without ADHD) risk group. There was a significant association between risk group and the presence of a PS deficit (Fisher's exact test, $p < 0.001$) but not between risk group and the presence of an inhibition deficit (Fisher's exact test, $p = 0.011$). Merely 6.17% of all children showed a shifting deficit, with an equal distribution over the four groups. There was no association between risk group and a shifting deficit (Fisher's exact test, $p = 0.086$).

Additionally, we retrospectively looked at the likelihood of preschool deficits in children with versus without an ADHD or dyslexia diagnosis by the time they were in third grade. These diagnoses were made externally to the study by a qualified multidisciplinary team that parents consulted. There was a moderately strong association between diagnosis in third grade and a preschool WM deficit, $\chi 2$ (1) = 10.56, $p = 0.001$, Cramer's V = .28, odds ratio 4.129, 95% CI [1.69, 10.08] (Table 1). There was also a small association between third-grade diagnosis and a preschool PS deficit, χ^2 (1) = 4.56, $p = 0.033$. Cramer's V = .17, odds ratio 2.59, 95% CI [1.06, 6.33]. However, there were no associations between third-grade diagnosis and an inhibition (Fisher's exact test, $p = .38$) or shifting deficit (Fisher's exact test, $p = 1$) in preschool.

To conclude, these results showed that when a WM, PS, or behavioral inhibition deficit was present in preschool, most children were simultaneously at risk for dyslexia, with or without ADHD. Furthermore, these vulnerabilities were associated with later difficulties, as preschool WM and PS deficits were related to the probability of a diagnosis of ADHD and/or dyslexia later in life. This study's results highlight the importance of cognition in identifying children with special educational needs and developing interventions for these children.

Table 1

Numbers of Children With and Without a Working Memory Deficit (N = 137)

		Risk status				
WM deficit	Diagnosis	ADHD risk	Dyslexia risk	Dyslexia + ADHD risk	No risk	Total by WM deficit
WM deficit	ADHD or dyslexia diagnosis	1	8	6	1	
	No diagnosis	1	16	10	4	
	Total by risk status	2 (4.26%)	24 (51.06%)	16 (34.04%)	5 (10.64%)	47 (34.31%)
No WM deficit	ADHD or dyslexia diagnosis	2	2	6	0	
	No diagnosis	13	18	11	38	
	Total by risk status	15 (16.67%)	20 (22.22%)	17 (18.89%)	38 (42.22%)	90 (65.69%)

Note. Risk status reflects the selection in preschool, while diagnosis is the current status in grade 3.

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