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The effect of lowering school entry age on attention deficit hyperactivity disorder diagnosis

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Abstract

The school entry age was changed from 72 to 66 months in 2012 with a new education system adjustment in Turkey. The aim of the study was to investigate the effects of lowering school entry age on Attention Deficit Hyperactivity Disorder (ADHD) diagnosis and symptom severity. The records of children at first and second grade diagnosed with ADHD according to the DSM-IV diagnostic criteria in the Child Psychiatry outpatient clinic between January and July 2010 (when the old system was in use) and between January-July 2013 (when the new system was in use) were retrospectively screened to create the old-system and new system groups. Among the two groups, T-DSM-IV-S fulfilled by parents and teachers were used to assess symptom severity. The frequency of ADHD and ADHD predominantly inattentive subtype diagnosis we found to be significantly higher among the girls in the new system compared to old system (25.8%, 8.9%, p=0.027 - 56.3%, 0%, p=0.012). Additionally, mother's subscale scores of T-DSM-IV-S were lower among the children in the new system compared to the ones in the old system. By lowering school entry age due to the new education system, frequency of ADHD diagnosis increased while symptom severity rates decreased among the first-grade girls. Thus, it may be suggested that despite decreased symptom severity, the girls who started school with the new system were diagnosed with ADHD more frequently due to a marked disruption in academic, social, and behavioral functionality associated with insufficient neurodevelopmental maturity.

Keywords: Attention deficit hyperactivity disorder, ADHD, symptom severity, school entry age

1. Introduction

Attention deficit hyperactivity disorder (ADHD) is one of the most common psychiatric disorders in childhood, with a reported prevalence of about 5% in children (Association, 2013). ADHD is a neurodevelopmental disorder characterized by symptoms of inattention, hyperactivity, and impulsivity as well as impaired cognitive functions (Barkley and Poillion, 1994; Spetie and Arnold, 2007). The main reason for ADHD is believed to be a disruption in normal brain development resulting from genetic and neurological factors and their interactions with the environment (Barkley and Poillion, 1994). Although the signs of ADHD that manifest this disruption are usually present in early childhood, adverse effects on functioning are generally recognized by parents and educators after starting primary school (Association, 2013).

With the "12-year compulsory education system" implemented in the Turkish education system in 2012, the entry age of primary education was changed from 72 months to 66 months, which has been in force since the 2012-2013 academic year (Gazete, 2012). From a developmental perspective, children who start school earlier may experience difficulties due to underdeveloped coordination, fine motor skills, abstraction, and ability to focus, sustain attention, and regulate impulses and behavior. Besides, starting primary school before being ready can have mentally, physically, socially, and psychologically damaging effects that may lead to various psychological problems in children (Blair, 2002). Numerous studies have shown that starting school at an early age has a strong influence on ADHD diagnosis. In a study of children 6-12 years of age in British Columbia, Morrow and colleagues found that children born in December (who were youngest in their classes) had a higher risk of being diagnosed with ADHD (boys: relative risk [RR] 1.30, 95% confidence interval [CI] 1.23-1.37; girls: RR 1.70, 95% CI 1.53-1.88) and receiving medical treatment for ADHD (boys: RR 1.41, 95%

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CI 1.33-1.50; girls: RR 1.77, 95% CI 1.57-2.00) than those born in January (the relatively older students in each class) (Morrow et al., 2012). Elder determined that in areas where the cut-off date for kindergarten was December 1st, the prevalence of ADHD was 6.8% among children born in November, while this rate was only 1.9% among children born in December, who were approximately one year older when they started school (Elder, 2010). Layton and colleagues found that the rate of ADHD diagnosis and treatment among children in states with a September 1st cut-off were respectively 85.1 and 52.9 per 10,000 children (95% CI, 75.6 to 94.2 - 45.4 to 60.3) among those born in August, 63.6 and 40.4 per 10,000 children (95% CI, 55.4 to 71.9 - 33.8 to 47.1) among those born in September (Layton et al., 2018).

The present study aimed to investigate the effects of starting school at the age of 66 months instead of 72 months by comparing the diagnosis and symptom severity of ADHD before and after the new education system in Turkey. There are few studies on this subject, and it is also notable because ADHD diagnoses based on clinical evaluations performed by child psychiatrists.

2. Materials and methods

The study was approved by the Ondokuz Mayıs University Clinical Research Ethics Committee (approval number OMU KAEK 2015/479). The records of children diagnosed with ADHD for the first time according to the DSM-IV diagnostic criteria in the Kocaeli University School of Medicine, Child Psychiatry outpatient clinic between January and July 2010 were retrospectively screened to create the old-system group. Because the academic year begins in September, we included patients who presented between January and July in our analysis to allow for the adjustment period in grade 1 and for teachers to get to know the students. These students were in primary grades 1 and 2 who had started school according to the old system's school entry age of 72 months.

The records of children diagnosed with ADHD for the first time by the same child psychiatrist according to the DSM-IV diagnostic criteria in Kocaeli Derince Training and Research Hospital, Child and Adolescent Psychiatry outpatient clinic between January and July 2013 were retrospectively screened to create the new-system group. This group comprised children in grades 1 and 2 who had started school according to the new school entry age of 66 months. Data from grades 1 and 2 were compared between the old-system and new-system groups in terms of age at school entry, sociodemographic features (age, gender, number of siblings, occupation, and level of education of the parents), diagnosis and symptom severity of ADHD.

Exclusion criteria were presence of severe medical disabilities such as paralysis, blindness, or deafness; any organic disorders such as epilepsy which may cause symptoms of ADHD; and mental retardation (IQ<70) determined via the assessment of children with the Wechsler Intelligence Scale for Children-Revised. Previously ADHD diagnosed cases were excluded from the study because of the possible effect of treatment on symptom severity. Turgay DSM-IV-Based Child and Adolescent Behavior Disorders Screening and Rating Scale (T-DSM-IV-S) fulfilled by parents and teachers were used to assess symptom severity.

2.1. Turgay DSM-IV-based child and adolescent behavior disorders screening and rating scale (T-DSM-IV-S)

This inventory was developed based on DSM-IV diagnostic criteria and consists of a total of 41 items related with attention deficit (nine items), hyperactivity/impulsivity (nine items), opposition/defiance (eight items), and conduct disorder (15 items). Each item is scored as 0: no, 1: some, 2: quite a bit, or 3: a lot. The validity and reliability study of the Turkish version of the inventory was conducted by Ercan and colleagues (Ercan et al., 2001).

2.2. Statistical analysis

The data obtained from the study assessments were analyzed using the IBM SPSS Statistic Program (version 21.0). Numerical data with normal distribution were analyzed using the t-test, while those not conforming to a normal distribution were analyzed using the Mann-Whitney U test. The chi-square test was used for comparisons of categorical data. When the expected values in the contingency table were less than five in the chi-square test, the p-value was determined using Fisher's exact test. The statistical significance level was accepted as $p<0.05$ for all analyses

3. Results

The study included 74 children (16.2% girls, 83.8% boys) diagnosed with ADHD in the old-system group and 119 children (23.5% girls, 76.5% boys) diagnosed with ADHD in the new-system group. Sociodemographic characteristics of old and new system groups are shown in Table 1.

There were significant differences in terms of age at school entry for both grade 1 (6.18±0.30 - 5.96±0.28 p=0.000) and grade 2 children (6.06±0.46 - 5.86±0.47 p=0.025) among old and new system groups, respectively. For grade 1 children, the ratio of students started school before 73 months was lower among the old-system group (48.9%; 95% CI 48,7-49,1) compared to the one of the new-system group (72.6%; 95% CI 72,4-72,8; p=0.012), while no significant differences were found in grade 2. There was no significant difference between the old-system and new-system groups in terms of ADHD subtypes according to grade levels, whereas the difference between groups in terms of diagnostic distribution of predominantly inattentive subtype according to gender (Table 2) was significant. The frequency of combined subtype ADHD diagnosis was higher among the boys who started school before 73 months in the new-system group compared to the boys in the old-system group (46.3%- 69.5%, p=0.028).

T-DSM-IV-S subscale and total scores of old and new system groups are shown in Table 3. In both the old-system and the new-system groups, children who started school before the age of 73 months and started school after the age of 72 months had no significant difference in terms of ADHD symptom severity according to reports of fathers and teachers although most scores were appeared to be higher in the old-system group. But among the grade 1 children, the scores of inattentiveness, hyperactivity/impulsivity, opposite defiant disorder, conduct disorder subscales and total scores reported by mothers were significantly higher in old-system group compared to the new-system one.

Table 1. Sociodemographic characteristics of old and new system groups

			Old-system	New-system	p
Age (years), mean±SD		**Grade 1**	6.7±0.3	6.4±0.3	**0.000** [a]
		Grade 2	7.5 [7.3-7.8]	7.2 [6.8-7.7]	0.082 [b]
Gender, n (%)	**Grade 1**	**Girls**	4 (8.9)	16 (25.8)	**0.027** [c]
		Boys	41 (91.1)	46 (74.2)	
	Grade 2	**Girls**	8 (27.6)	12 (21.1)	0.498 [c]
		Boys	21 (72.4)	45 (78.9)	
Mother's age (years), mean±SD		**Grade 1**	32.6±5.6	32.7±4.7	0.916 [a]
		Grade 2	33.6±4.7	32.6±4.6	0.650 [a]
Mother's education, n (%)	**Grade 1**	**Primary**	27 (60.0)	28 (45.2)	0.130 [c]
		High school or university	18 (40.0)	34 (54.8)	
	Grade 2	**Primary**	16 (55.2)	37 (64.9)	0.380 [c]
		High school or university	13 (44.8)	20 (35.1)	
Father's age (years), mean±SD		**Grade 1**	36.0±5.3	36.0±4.5	0.973 [a]
		Grade 2	38.3±6.0	37.9±5.7	0.741 [a]
Father's education, n (%)	**Grade 1**	**Primary**	19 (42.2)	22 (35.5)	0.479 [c]
		High school or university	26 (57.8)	40 (64.5)	
	Grade 2	**Primary**	15 (51.7)	23 (40.4)	0.315 [c]
		High school or university	14(48.3)	34 (59.6)	

[a]: Independent Samples t-test, Values were given as mean±SD, [c]: Chi-square, Values were given as numbers (%)
[b]: Mann Whitney U test, Values were given as median [IQR] SD: Standard Deviation, IQR: Interquartile Range

Table 2. The percentage of ADHD subtypes among girls and boys in old and new system groups

		ADHD-I			ADHD-C			ADHD-H		
		Old-system	New-system	p	Old-system	New-system	p	Old-system	New-system	p
Grade 1 n (%)	Girls	0	9 (56.3)	0.014[b]	4 (100)	7 (43.7)	0.520[a]	0	0	-
	Boys	14 (34.1)	15 (32.6)		26 (63.4)	27 (58.7)		1 (2.4)	4 (8.7)	
Grade 2 n (%)	Girls	6 (75.00)	9 (75.0)	0.277[b]	2 (25.0)	3 (25.0)	1000[b]	-	-	-
	Boys	5 (23.8)	19 (42.2)		16 (76.2)	26 (57.8)		-	-	

[a]: Chi-square, [b]: Fisher's exact test, Values were given as numbers (%)
ADHD: Attention Deficit Hyperactivity Disorder, I: Inattentiveness Subtype, C: Combined Subtype, H: Hyperactivity Subtype

4. Discussion

Although there is no absolute consensus on the optimal age for entering primary school, it requires a certain level of mental, physical, emotional, and social maturity, and most countries accept 72 months as the age of school entry (Sharp, 2002; Yavuzer, 2013; Statistics, 2016). School maturity can vary from child to child; however, academic sources indicate that starting school at the age of 6 years or older is most appropriate (Blair, 2002; Binbaşıoğlu, 2004; Oktay, 2010; Yavuzer, 2013). In our country, the mandatory age which was 72 months for school entry, had changed into 66 months in 2012. According to a study assessing the school maturity levels of children after the implementation of this new education system, mean metropolitan maturity test scores were significantly lower among children 60-66 months and 66-72 months of age compared to children 72-84 months of age; the authors also found that school maturity and literacy skill improvement levels increased with older age (Gündüz and Çalışkan, 2013). It is conceivable that children entering school at a younger age due to this change in the education system may experience difficulties related to underdeveloped coordination, fine motor skills, abstraction, and ability to focus, maintain attention, and regulate impulse and behavior (Blair, 2002). In the present study, we investigated the effect of starting school at a younger age on the clinical manifestation of ADHD among children who already had underdeveloped attention, impulse, and behavior regulation skills due to ADHD.

Our finding that children in the new-system group were significantly younger than those in the old-system group is an expected outcome of lowered school entry age. In addition, the mean school entry age was also lower in the new-system

group. The rate of school entry age before 73 months of grade 1 children with ADHD in the new-system group was higher than the old-system group. Numerous studies have reported that the prevalence of ADHD diagnosis and treatment were higher among children born before the school eligibility cut-off date (Evans et al., 2010; Morrow et al., 2012; Chen et al., 2016; Layton et al., 2018). In these studies, it was asserted that children who started school before the eligibility cut-off age were more likely to be diagnosed with ADHD than their classmates due to educational and behavioral problems. On the other hand, two studies performed in Denmark revealed no significant differences in the rates of ADHD and the use of medical treatment between children who started school earlier or later than the school eligibility cut-off age (Dalsgaard et al., 2012; Pottegård et al., 2014). This may be due to the fact that the school entry age in Denmark is seven years, meaning that even if children were born before the cut-off date, they were still sufficiently mature when they started school and thus did not have a higher diagnosis rate.

The frequency of ADHD among girls in grade 1 increased significantly from 8.9% to 25.8% when the school entry was earlier. Morrow and colleagues reported that the relative age effect resulted in 70% more ADHD diagnoses in girls and 30% more in boys (Morrow et al., 2012). These data suggest a more considerable increase in diagnoses for girls when the age of school entry is younger.

According to ADHD subtypes comparison, all girls in the old-system group were diagnosed with combined ADHD subtype, whereas 56.3% of girls in the new-system group were diagnosed with the predominantly inattentive subtype. These results demonstrate that after redefining the school entry age, girls received significantly more ADHD diagnoses due to attention problems. Inattentive subtype of ADHD is known to be more frequent among girls compared to the other subtypes (Biederman et al., 2002), It is suggested that ADHD is more underdiagnosed among girls as hyperactivity and impulsivity are less common symptoms (Biederman et al., 2002; Gershon and Gershon, 2002), but academic problems related with early starting school may helped the parents recognize inattentiveness of girls and prompt them to seek professional help.

Table 3. The comparison of mean values of T-DSM-IV-S scores between old and new system groups

T-DSM-IV-S Subscales	Grade	Old-system	New-system	p
Mothers' I subscale	1	17.6±6.2	14.0±5.4	0.002 [a]
	2	17.0±6.1	17.4±5.8	0.771 [a]
Mothers' HI subscale	1	16.4±7.3	13.0±6.6	0.020 [a]
	2	13.3±6.4	15.3±7.5	0.247 [a]
Mothers' Total score of ADHD	1	34.0±11.7	27.6±9.8	0.005 [a]
	2	30.2±9.5	31.5±11.2	0.637 [a]
Mothers' ODD subscale	1	12.2±6.7	9.6±5.3	**0.037** [a]
	2	10.5±5.4	9.1±6.1	0.349 [a]
Mothers' CD subscale	1	2 [0-7.5]	1 [0-4]	**0.016** [b]
	2	2 [0-5]	1 [0-4]	0.883 [b]
Fathers' I subscale	1	15.6±6.0	15.1±5.0	0.644 [a]
	2	15.5±5.0	15.8±6.3	0.855 [a]
Fathers' HI subscale	1	14.3±7.2	13.2±5.9	0.465 [a]
	2	13.2±6.5	13.8±7.5	0.759 [a]
Fathers' Total score of ADHD	1	29.8±11.7	27.5±9.0	0.281 [a]
	2	28.8±9.1	28.6±12.1	0.947 [a]
Fathers' ODD subscale	1	11.9±6.6	10.1±4.7	0.136 [a]
	2	9.0±5.0	8.4±4.6	0.622 [a]
Fathers' CD subscale	1	2 [0-7]	2 [0-3.75]	0.597 [b]
	2	1 [0-4]	1 [0-2]	0.895 [b]
Teachers' I subscale	1	18.9±5.5	18.5±5.6	0.712 [a]
	2	17.5±6.4	18.5±3.9	0.443 [a]
Teachers' HI subscale	1	14.9±7.5	14.2±6.8	0.607 [a]
	2	12.2±7.4	13.1±7.5	0.619 [a]
Teachers' Total score of ADHD	1	33.8±10.1	32.5±8.1	0.458 [a]
	2	29.7±11.8	31.6±8.8	0.476 [a]
Teachers' ODD subscale	1	10.7±7.3	8.4±4.8	0.075 [a]
	2	9.1±6.9	7.6±5.8	0.380 [a]
Teachers' CD subscale	1	4 [1-10]	2 [0-4.5]	0.358 [b]
	2	1 [0-3.5]	1 [0-2]	0.985 [b]

Independent Samples t-test, Values were given as mean±SD [b]: Mann Whitney U test, Values were given as median [IQR] ADHD: Attention Deficit Hyperactivity Disorder, I: Inattentiveness, HI: Hyperactivity/impulsivity, ODD: Opposite Defiant Disorder, CD: Conduct Disorder, T-DSM-IV-S: Turgay DSM-IV-Based Child and Adolescent Behavior Disorders Screening and Rating Scale, SD: Standard Deviation, IQR: Interquartile Range

The frequency of combined subtype ADHD diagnosis was found significantly higher among the boys who started school before 73 months in the new-system group than the ones in old-system group. Considering the fact that the combined subtype of ADHD is more frequent among boys and the higher number of children in the new–system group, this increase can be expected.

It was found that for grade 1 children, the symptom severity reported by mothers was appeared to be milder in new-system group than that of old-system group. Previous studies have shown that children who started school before reaching a certain maturity level are more likely to be diagnosed with ADHD, receive medical treatment for ADHD, and have psychiatric and academic difficulties (Goodman et al., 2003; Bedard and Dhuey, 2006; Elder, 2010; Mühlenweg et al., 2012). In addition, Gökçe and colleagues reported that children started primary school before 72 months of age in the new system had lower academic, social and behavioral functioning (Gökçe et al., 2017). Although scores of scales related with symptom severity of grade 1 new-system group were lower differently from those studies mentioned, increased diagnosis of ADHD with milder symptoms may be a result of insufficient neurodevelopmental maturity causing a marked disruption of academic, social and behavioral functionality.

This can be attributed to the fact that children are entering school before reaching the level of neurodevelopmental maturity required and receive more ADHD diagnoses due to lack of adequate attention and behavior regulation skills. Therefore, lowering the school entry age has important implications both in terms of public health and educational policies, and delaying school entry for children who have not reached sufficient school maturity may prevent potential problems.

On the other hand, the study was conducted in a clinical sample and in two different hospitals, and the distribution of children before and after 72 months was not equal in the old and new system groups may be the methodological limitations of this study. Another limitation is the absence of a structured interview directly related with adaptation to the school settings and an assessment of effects of comorbid disorders on ADHD. Additionally, a control group comprised of children without ADHD is essential to compare the results of ADHD children. Therefore, further studies with larger samples and control group are warranted in this issue

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