

Prevalence of Attention-Deficit/Hyperactivity Disorder Symptoms in Preschool-aged Iranian Children

Alipasha Meysamie*¹, MD, MPH; Maryam Daneshvar Fard¹, MD, and Mohammad Reza Mohammadi², MD

1. Department of Community Medicine, Tehran University of Medical Sciences, Tehran, Iran
2. Psychiatry and Psychology Research Center, Tehran University of Medical Sciences, Tehran, Iran

Received: Jul 31, 2010; Final Revision: Feb 17, 2011; Accepted: Jun 22, 2011

Abstract

Objective: The aim of this study was to determine the prevalence of attention-deficit/hyperactivity disorder (ADHD) symptoms in Iranian preschool children based on evaluations by parents and teachers because a thorough understanding of epidemiologic features of ADHD symptoms in preschool children is important for prevention and management.

Methods: Children between the ages of three and six attending kindergarten participated in this study. For the survey, 37 kindergartens were selected by multistage (stratified cluster random) sampling, consisting of 2213 children with a design effect equal to 1.5. A 19-item observer-rating questionnaire was generated to assess ADHD symptoms in children within the last 6 months. This questionnaire was used by both teachers and parents to assess ADHD behavior in participating children.

Findings: Of 1403 children aged 3-6 years, 362 were classified as having ADHD symptoms according to their parent evaluation [25.8% (23.6-28.1%)] and 239 according to their teachers evaluation [17% (14.1-20.4%)]. Child rank among siblings, mother's education level, and interest in aggressive television programs were all independent explanatory variables according to parents' evaluation. Gender, parent education, child rank, single parent and interest in aggressive television programs were all independent explanatory variables according to teachers' evaluation.

Conclusion: Our findings reveal a large discrepancy in the prevalence of ADHD symptoms in preschool children based on evaluation by parents and teachers. Thus, it seems that the ADHD screening should be performed in multiple settings in order to identify children who need further investigations.

Iranian Journal of Pediatrics, Volume 21(Number 4),December 2011, Pages: 467-472

Key Words: Attention deficit hyperactivity disorder; Preschool age; Iranian Children

Introduction

Attention-deficit/hyperactivity disorder (ADHD) in children is a rising public health concern, which

is characterized by inappropriate levels of inattention, impulsiveness, and hyperactivity [1]. The ADHD worldwide-pooled prevalence has been

* Corresponding Author;

Address: خیابان ولیعصر، تهران، ایران
E-mail: meysamie@tums.ac.ir

estimated to be 5.29% (95% CI: 5.01–5.56) in an extensive review of the literature on the prevalence of ADHD in relevant articles from North America, South America, Europe, Africa, Asia, Oceania, and the Middle East [2]. However variations in prevalence figures occur both within and between countries depending on a number of factors, including the diagnostic criteria used, age and gender of the population, socioeconomic status and urban living. One of the population-based epidemiological studies in Iran found that 15% of preschool children evaluated by their parents and teachers had ADHD symptoms [3]. Another study revealed that the prevalence of ADHD in preschool-age children in North-East Iran was 12.3% (95%CI: 10.3–14.2%) [4]. Children with ADHD, because of disruptive, noncompliant behavior in preschool-age are at-risk for expulsion from preschool settings, and will have less exposure to pre-academic instruction, socialization opportunities, and the structure of classrooms. These may limit the child's development in different contexts [5]. Besides, children with ADHD symptoms are more likely to have sleep problems [6].

Diagnosis requires evidence of developmentally-inappropriate hyperactive-impulsive or inattentive behaviors that lead to functional impairment by 7 years of age [7]. Environmental stressors like immigration can cause some psychological problems like ADHD in children [8]. Many ADHD symptoms are stable throughout adolescence, and they persist into adulthood and a significant component of diagnosis of ADHD during early childhood is parental complaint of children's behavior [9,10]. One study in Chicago and Pittsburgh recruited preschool and primary school children in consecutive years and assessed attention-deficit/hyperactivity disorder annually over 8 years. It was found that the number of children who met criteria for ADHD declined over time, but not significantly [11].

The aim of this study was to determine the prevalence of ADHD symptoms in Iranian preschool children based on evaluations by parents and teachers because a thorough understanding of epidemiologic features of ADHD symptoms in preschool children is important for prevention and management of the disorder.

Subjects and Methods

Study design

Questionnaire survey was performed to estimate prevalence of ADHD symptoms in Iranian preschool children. The survey, conducted in 2009, evaluated children for ADHD symptoms by school teachers and parents. The study protocol was approved by the Ethics Committee of Tehran University of Medical Sciences.

Study population

Children aged three to six attending kindergartens in Tehran City participated in the study. For the survey, 37 kindergartens were selected by multistage (stratified cluster random) sampling. We assumed a 95% confidence level and one percent margin of error considering the estimated prevalence in European countries, the result was 4% in a total of 2213 children with a design effect equal to 1.5. Of these, 1403 parents and teachers agreed to participate (participation rate 63%).

Outcome and explanatory variables

A 19-item observer-rating questionnaire was generated to assess ADHD symptoms in children within the last 6 months. The questionnaire was based on preschool behavior [12]. Reliability was established using a pilot study by collecting data from 30 subjects. Data collected from pilot test was analyzed using SPSS; the reliability coefficient (Cronbach's alpha) was measured 0.79 that was acceptable. The validity of the questionnaire was established by expert's opinion. The three possible responses to each item were "rarely or none," "sometimes," and "always," coded as 1, 2 and 3 for the analysis. The score related to ADHD symptoms was calculated from 5 questions so the minimum and the maximum quantities for these could be between 5 and 15. We selected 50% of this value as cutoff point to determine if there are hyperactivity symptoms in a child. Children with a score of 10 or higher were classified as having significant ADHD symptoms, simply worded in the following texts as having ADHD symptoms. This questionnaire was used by both teachers and parents simultaneously to assess ADHD behavior of participating children. In addition, the gender, age, occupation and level of education of parents, history of smoking in mother during pregnancy,

number of siblings, living with one or both parents and death of child relatives was recorded.

Statistical analyses

The prevalence of ADHD symptoms was calculated for both parent and teacher assessments.

Statistical analysis was performed by complex sample survey analysis and chi-square test and t test were used for assessment of the relationship between the outcome and independent categorical and numeric variables, respectively. Multiple logistic regression analysis was used to test main effect and confounding effects (for a linear trend in the prevalence) across explanatory variables and to determine adjusted odds ratios. We used the SPSS statistical package (v16). *P*-values less than 0.05 were considered statistically significant.

Findings

The sample consisted totally of 1403 subjects. Of all examinees, 727 (52%) were boys and 459 (33%) were five years old. Distribution of examinees according to birth year, parents' education and some independent variables are depicted in Table 1.

Of 1403 children aged between 3 and 6, 362 [25.8% (95%CI: 23.6-28.1%)] according to their parent's evaluation and 239 [17% (95%CI: 14.1-20.4%)] according to their teacher's evaluation were classified as having ADHD symptoms. The prevalence of ADHD symptoms according to gender is shown in Table 2. The overall and gender-specific prevalences in the parent evaluation were higher than those in the teacher's. The difference in prevalence of symptoms between boys and girls was statistically significant in both assessments ($P<0.001$).

Parental education level, interest to aggressive television programs, age of mother during pregnancy, existence of chronic disease in a relative of the child, child rank and single parenting were related with ADHD symptoms by parent report ($P<0.05$) (Table 2). There were no significant differences found for number of siblings, history of smoking in mother, death of one of relatives, parent's occupation and existence of physical illness in child on prevalence of ADHD symptoms.

Results from the multiple logistic regression analysis indicated that child rank among siblings, mother education level, and interest to aggressive television programs were all independent explanatory variables according to parent evaluation and gender, parent's level of education,

Table 1: Frequency of independent variables in examinees

Variables	Subgroup	Number (%)
Sex	female	674 (48.1)
	male	727 (51.8)
Age (years)	3	234 (16.7)
	4	355 (25.3)
	5	459 (32.7)
	6	253 (18.0)
Mothers' education	up to 12 years	109 (7.7)
	12 to 16	1112 (79.3)
	more than 16 years	101 (7.2)
Fathers' education	up to 12 years	104 (7.4)
	12 to 16	956 (68.2)
	more than 16 years	217 (15.4)
First child		870 (62.0)
Single child		726 (51.8)
Ill child		62 (4.4)
Single parent		47 (3.3)
Age of mother (<18 or >35)*		160 (11.4)
Interest in aggressive tv program		387 (27.6)

Up to 12 years: School, High school diploma; 12 to 16 : BSc; more than 16 years: MSc or PhD

* High risk pregnancy

Table 2: Prevalence of ADHD symptoms by explanatory variables according to parent and teacher assessment

Variables	Parent evaluation			Teacher evaluation		
	Prevalence (95% CI)	OR (95% CI)	P-value	Prevalence (95% CI)	OR (95% CI)	P-value
Sex	male	32.4 (28.8-36.2)	2.16 (1.65-2.82)	23.2 (20-27)	2.67 (1.87-3.80)	<0.001
	female	18.1 (15.3-21.3)				
Interest*	yes	45.3 (41.3-49.3)	3.96 (3.31-4.76)	25.9 (21.1-31.4)	2.26 (1.72-2.98)	<0.001
	no	17.2 (15.4-19.2)				
Rank †	first	29.1 (25.7-32.8)	1.74 (1.34-2.27)	19.9 (16.5-23.8)	1.81 (1.24-2.66)	0.004
	others	19.1 (16.5-22)				
Age of mother	18-35	26.6 (23.9-29.5)	1.65 (1.03-2.66)	26.9 (16.7-40.3)	1.86 (1-3.44)	0.04
	<18, >35	17.9 (12.6-25)				
Single parent	yes	41.5 (30.6-53.4)	2.13 (1.33-3.42)	16.5 (13.8-19.5)	1.86 (1-3.44)	0.003
	No	25.0 (22.6-27.5)				
Chronic disease ‡	yes	36.3 (25.5-48.7)	1.70 (1.05-2.76)	21.2 (17.4-25.5)	1.71 (1.18-2.48)	0.03
	No	25.1 (22.8-27.5)				
Education of mother	<univ.	43.2 (33.4-53.4)	2.38 (1.44-3.95)	22.1 (17.9-26.9)	1.90 (1.27-2.83)	0.002
	other	24.1 (21.5-26.9)				
Education of father	≤BSc	27.2 (24.5-30.2)	1.73 (1.27-2.36)	13.0 (9.6-17.3)	1.90 (1.27-2.83)	0.001
	other	17.7 (14-22.2)				

* Interest for aggressive TV programs in child; † child rank among siblings; ‡ existence of chronic disease in one of the family
ADHD: Attention-deficit/hyperactivity disorder; CI: Confidence Interval; NS: Not significant

child rank, single parent and interest to aggressive television programs were all independent explanatory variables according to teacher evaluation (Table 3).

Discussion

The results of our study suggest that the prevalence of ADHD symptoms is high in preschool-aged children. Based on a systematic review conducted around the world the ADHD/HD worldwide-pooled prevalence was 5.29%. Although this estimate was associated with significant variability depending on the diagnostic

criteria, source of information, requirement of impairment for diagnosis, and geographic origin of the studies, but since questionnaire used in our study was primarily a screening device, it seems that what eventually will be compared is the percentage of children at risk whose diagnosis shall be confirmed by a psychiatrist interview [2]. In two different places of Iran, North-East and some parts of Tehran the prevalence of hyperactivity and attention and concentration deficit was estimated to be 12.3% and 11% respectively[3,4]. The perceived difference in our results can be related to different tools we used in the research.

We found a marked difference in the prevalence of ADHD symptoms when the evaluation was performed by parents compared to teachers. The

Table 3: Predictors of ADHD-related behavior: Multivariate Logic Model

Parameter	Parent evaluation		Teacher evaluation	
	Exp (B)	95% CI	Exp (B)	95% CI
Father's education (<BSc)	NS	---	1.7	1.1-2.4
Mother's education (<high school diploma)	2.9	1.7-4.8	2.3	1.3-3.8
Child rank (first)	1.8	1.3-2.6	1.7	1.1-2.6
Sex (male)	NS	---	2.2	1.5-3.4
Single parent	NS	---	2.0	1.0-3.8
Interest to aggressive TV programs	3.5	2.6-4.7	1.5	1.1-2.0

ADHD: Attention-deficit/hyperactivity disorder; CI: Confidence Interval

prevalence was consistently higher in the parent evaluation. This finding is consistent with some researches, for example a study on Japanese school children in which the mean scores for the Child Behavior Checklist (assesses behavioral and emotional problems) were higher in parents evaluation than that of teachers [13]. In another study the prevalence of ADHD symptoms was 31.1% in the parent survey and 4.3% in the teacher survey, with a prevalence ratio of 7.2 [1]. One explanation for this discrepancy is that parents may evaluate their children's behavior more strictly. Another explanation may be that, their diagnosis of an abnormal child's behavior is difficult, thus resulting in more false positives in the parent assessment. Finally, it seems that children behave more freely at home than in school, which may lead observers to conclude children are more symptomatic of ADHD.

While some studies have shown that the prevalence of ADHD can be affected by the observer, Pierrehumbert et al reported no difference in the prevalence of ADHD symptoms in school-aged Swiss children between parent (8.0%) and teacher (9.6%) evaluations [14]. Ersan et al found no significant difference in ADHD symptoms of school-aged Turkish children, using DSM-IV criteria, based on parent (9.6%) and teacher (7.3%) evaluations [15].

Even in a meta-analysis of epidemiological studies on ADHD published in the last decade the prevalence of ADHD symptoms was evaluated by parents in 24 studies and by teachers in 10 studies, with a median prevalence of 5.3 and 10.3%, respectively [16]. Thus, our findings are not consistent with these studies that can be affected by cultural differences and age groups in our study that were young (preschool children). Timimi and Taylor in their paper named "ADHD is best understood as a cultural construct" mention that considering interaction between the child and the expectations of the adult is very important in making a decision about diagnosis than just accepting a rating from a parent or teacher [17].

Our data suggest that teachers and parents reported younger children to have higher scores on Problem Behaviors but the differences between age groups were not statistically significant in both assessments. Kanbayashi et al reported that the prevalence of ADHD symptoms in boys and

girls, based on evaluation by parents using DSM-III-R criteria, were 12.6 and 10.1% in preschool children (4–6 years old) respectively [18]. Furthermore, they suggested that the gender difference in prevalence from the parent evaluation was small, which is in discordance with our findings. We found a significant difference in prevalence of ADHD symptoms in boys and girls.

The results from our study indicate that children living in a single parent home were more symptomatic based on evaluation by teachers. One explanation may be that being single parent has a negative effect in teacher perception of child's behavior. Also there is the possibility that in such families there is a lack of adequate emotional support that leads to behavior abnormalities in children.

We found that low level of parental education is a predictor variable for ADHD symptoms. In other studies authors see education as a predictor of divorce in the family of probands [19]. A study in a Colombian community indicated that higher prevalence of attention deficit disorder was found in low socioeconomic strata that can be in accordance with our results because of relation between level of education and socioeconomic status in our population [20]. Another study reported that parents of preschool children with ADHD, rated themselves as less competent parents, and as experiencing a restricted parenting role [21].

Limitations: Another key limitation of this work was the use of special study population, i.e., kindergarten's children.

There were some constraints in the process of data collection. We had a rather large number of families and teachers did not wish to participate in the project. As a result, generalization of our data may be limited and may not be reflective of the broader preschool population.

Further studies: Further studies should be conducted to generalize our results to the entire population of preschool children, but it will be more difficult and need more support to perform because that voluntary program participation leads to low response rate. Perhaps to ensure parents of the existence of advisory services for children at risk will be useful in attracting their participation.

Conclusion

Our findings suggest a large discrepancy in the prevalence of ADHD symptoms in preschool children based on evaluation by parents or teachers. Thus, it seems that the diagnosis of ADHD symptoms only by using parents may be inappropriate for ADHD screening, and it should be performed in multiple settings.

Acknowledgment

We would like to thank Tehran University of Medical Sciences for project grant and all participating teachers and parents too for their assistance with data collection.

Conflict of Interest: None

References

1. Soma Y, Nakamura K, Oyama M, et al. Prevalence of attention-deficit/hyperactivity disorder (ADHD) symptoms in preschool children: discrepancy between parent and teacher evaluations. *Environ Health Prev Med* 2009;14(2):150-4.
2. Polanczyk G, Lima MS, Horta BL, et al. The worldwide prevalence of ADHD: a systematic review and meta-regression analysis. *Am J Psychiatry* 2007;164(6):942-8.
3. Ardalan G, Farhud D, Shahmohammadi D. Hyperactivity, attention and concentration deficit in preschool children. *Iran J Pediatr* 2002;12(4): 53-6. (In Persian)
4. Hebrani P, Abdollahian E, Behdani F, et al. The prevalence of attention deficit hyperactivity disorder in preschool-age children in Mashhad, North-East of Iran. *Arch Iran Med* 2007;10(2): 147-51.
5. McGoey KE, Eckert TL, Dupaul GJ. Early intervention for preschool-age children with ADHD. *J Emotional Behav Disor* 2002;10(1):14-28.
6. Goodlin-Jones BL, Waters S, Anders TF. Objective sleep measurement in typically and atypically developing preschool children with ADHD-like profiles. *Child Psychiatry Hum Dev* 2009;40(2): 257-68.
7. Reiff MI. Attention-deficit/hyperactivity disorder. In: Berman S (editor). *Pediatric Decision Making*. 4th ed. Philadelphia: Mosby. 2003; P:66.
8. Mohammadi MR, Taylor E, Fombone E. Prevalence of psychological problems amongst Iranian immigrant children and adolescents in UK. *Iran J Psychiatry* 2006;1(1):12-18.
9. Fischer M, Barkley RA, Smallish L, et al. Executive functioning in hyperactive children as young adults: attention, inhibition, response perseveration, and the impact of comorbidity. *Dev Neuropsychol* 2005;27(1):107-33.
10. National Center on Birth Defects and Developmental Disabilities. *Healthy people 2010*. Chap 6, vision for the decade: Proceedings and Recommendations of a Symposium. Centers for Disease Control and Prevention, Atlanta GA: CDC, December 2001. Available at: www.cdc.gov/ncbddd/dh. Access date: Apr, 2009.
11. Lahey BB, Pelham WE, Loney J, et al. Instability of the DSM-IV subtypes of ADHD from preschool through elementary school. *Arch Gen Psychiatry* 2005;62(8):896-902.
12. Behar L, Springfield S. A behavior rating scale for the preschool child. *Developm Psychol* 1974; 10(5):601-10.
13. Satake H, Yoshida K, Yamashita H, et al. Agreement between parents and teachers on behavioral/emotional problems in Japanese school children using the child behavior checklist. *Child Psychiatry Hum Dev* 2003;34(2):111-26.
14. Pierrehumbert B, Bader M, Thevoz S, et al. Hyperactivity and attention problems in a Swiss sample of school-aged children: effects of school achievement, child gender, and informants. *J Atten Disord* 2006;10(1):65-76.
15. Ersan EE, Doğan O, Doğan S, et al. The distribution of symptoms of attention-deficit/hyperactivity disorder and oppositional defiant disorder in school age children in Turkey. *Eur Child Adolesc Psychiatry* 2004;13(6):354-61.
16. Polanczyk G, Jensen P. Epidemiologic considerations in attention deficit hyperactivity disorder: a review and update. *Child Adolesc Psychiatr Clin N Am* 2008;17(2):245-60.
17. Timimi S, Taylor E. ADHD is best understood as a cultural construct. *Br J Psychiatry* 2004;184:8-9.
18. Kanbayashi Y, Nakata Y, Fujii K, et al. ADHD-related behavior among non-referred children: parents' ratings of DSM-III-R symptoms. *Child Psychiatry Hum Dev* 1994;25(1):13-29.
19. Wymbs BT, Pelham WE. Rate and predictors of divorce among parents of youth with ADHD. *J Consult Clin Psychol* 2008;76(5):735-44.
20. Pineda DA, Lopera F, Henao GC, et al. Confirmation of the high prevalence of attention deficit disorder in a Colombian community. *Rev Neurol* 2001;32(3):229-31.
21. DeWolfe NA, Byrne JM, Bawden HN. ADHD in preschool children: parent-rated psychosocial correlates. *Developm Med Child Neurol* 2000; 42(12):825-830.