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Review Article

Prevalence of attention deficit hyperactivity disorder among primary school children according to teachers and parents' report: Systematic review and meta-analysis study

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Abstract

Introduction: Attention deficit hyperactivity disorders (ADHD) is the most common psychiatric disorder diagnosed in primary school children's psychiatric outpatient clinics. Many researchers have used the data provided by parents and teachers in diagnosing children with ADHD. The aim of this meta-analysis study is to estimate of prevalence of ADHD through the perspective of teachers and parents in school children in Iran.

Materials and Methods: Overall 16 articles were extracted, by searching the databases: SID, Magiran, GoogleScholar and etc. in the years 1996 to 2011 in Iran. Data were analyzed by random effects model of meta-analysis. Study heterogeneity was assessed using the I2 index. To investigate the relationship between years of study and sample size, meta-regression was used. Data analysis was done with R and Stata software version 11.2.

Results: In 16 articles, in a total sample of 14,891 primary school children aged 7 to 12 years, the pooled prevalence ADHD by parents and teachers agreement was 8%, prevalence of ADHD was 20% according to parents and 20% according to teachers.

Conclusion: This study shows that the prevalence of ADHD is moderate. This issue indicated the necessity of students' mental health care as the future of the country, and the need to identify and treatment groups at risk by revealing and responsible institutions.

Keywords: Attention deficit hyperactivity disorder, Children, Prevalence

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Introduction

Health and disease of children are associated with the health and disease of tomorrow's society and later generations. Therefore, mental health and study of children adaptation help them infertility and growth in adult hood and lack of attention to the childhood developmental conditions will bring irreparable damages to mental health of the society (1).

Attention deficit hyperactivity disorder (ADHD) is the most common psychiatric disorder of preschool children diagnosed at psychiatric outpatient clinics. This is defined as a persistent pattern of attention deficit or active and impulsive behaviors which are more severe than what is usually seen in children of the same age and the similar level of growth (2). The onset of symptoms in children with ADHD is associated with hyperactivity inappropriate for developmental level, inattention, educational and impulsivity problems (5-3). Based on the symptoms, the disorder is divided into inattentive, hyperactive-impulsive and combined types. A child showing at least six signs of the 9 criteria of inattention or 6 signs of the 9 criteria of hyperactivity-impulsivity in at least two environments (home, school or other environments) is known to be suspected to the disorder (3). According to DSM-IV, each type of ADHD is diagnosed alone when criteria specific to

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that type of disorder are observed before the age of 6 years for a period of 6 months, but criteria of other types of the disorder are not observed for that period of time (4).

The signs affect cognitive, educational, behavioral, emotional and social functions of affected individuals. Affected children are at risk of academic failure, poor academic performance, grade repetition, school withdrawal, poor family relationships and friendships, anxiety, depression, aggression, violation, drug abuse at an early age, law-breaking and exclusion from peers. In addition, the disorder is at risk of associating with other disorders such as aggression in adolescence and defiant disorder (3,4). These children do not obey their parents at home, act impulsively, are emotionally destabilized and irritable; they are not able to perform their assignments at school requiring more attention from their teachers (2). Children with this disorder whose symptoms continue until adolescence are at higher risk of conduct disorder (3).

Attention deficit hyperactivity disorder is a multi-factorial disorder and its exact etiology is unknown, however the role of psychosocial, biological, genetic, environmental, nutritional factors, low birth weight, family, and tobacco use during pregnancy of mother, family history, and stress during pregnancy and minor injuries has been reported. Psychological and behavioral disorders such as dysfunction, urinary incontinence, obsessive-compulsive disorder and anxiety disorder may be accompanied by ADHD (2).

The level of activity and attention in the general population has a spectrum, the boundary between hyperactivity and normal high activity in different countries has been drawn with different diagnostic criteria. Strict diagnostic criteria have been used for hyperactivity in the UK that only measure severe cases of the disorder, based on which 0.1 percent of children are affected (6). In the United States, a broader set of diagnostic criteria have been used, by which attention deficit and hyperactivity disorder ranges from 2% to 20% in pre-school children, but the statistical value of 3 percent to 5 percent is more reliable among primary school children (7).

It is estimated that the disorder affects from 5 to 3.5% of children in the United States (8).

In fact, according to the Center for Disease Control in the United States, approximately 4.4 million children between the ages of 4 and 7 years have received diagnosis of the disorder (9). The prevalence varies among regions, countries and different ages. The global prevalence is estimated to be 5.29% (10). More recent studies in different regions of the world have reported different prevalence (11-14). The prevalence according to DSM-IV criteria for schoolchildren is 7.3%, and based on ICD10 criteria is 1.7% (15). Various reports have been presented in Iran and in the world and, in general, its prevalence is estimated to be 2-18%. The incidence in boys is more than in girls by a ratio from 2 to 1 to 9 to 1 (3). On the other hand, the parents diagnosed signs of ADHD in girls less than in boys (4). Distraction is the major sign in girls however boys are frequently referred for hyperactivity (2).

The common aspect of all these studies indicates the relatively high prevalence of ADHD in primary school children. Differences that have been reported in the rates of ADHD indifferent countries are probably due to different methods of diagnosis rather than difference in clinical manifestations or signs of the disorder (1). Research of the recent decades indicates that the disorder, especially the problem of inattention often continues to adulthood (16). Lara and et al. study showed that almost50% of children with attention deficit/hyperactivity show the full criteria of the disorder in adulthood (17).

Attention deficit/hyperactivity disorder, like other psychiatric conditions, is a clinical diagnosis without the use of objective laboratory tests, although continuous performance tests (computerized tools for the assessment of attention and impulsivity), have sometimes been used as part of the clinical evaluation of the disorder, they do not have sufficient sensitivity and specificity. Therefore, rating scales of teachers and parents or interview about children's behavior over the last six months, as an important diagnostic tool is available (18).

Researchers and clinicians in the diagnosis of this disorder often rely on reports from teachers, because they believed that they have a better understanding of the child's daily behavior. The reason why the information given by teachers is of greater value than that of parents in the diagnosis of the disorder is that teachers often have a better knowledge and understanding of the behaviors in relation to the developmental stages of children. However, social researchers believe that the report of teachers may be influenced by factors such as the number of classroom students, their teaching and experiences, and their disciplinary attitudes which can be conceptualized as "level of adaptation" between the child, teacher, environment and the family (18).

Children spend many hours at school and as the teacher gain significant information about the children's behavior through teaching; many

researchers have used teachers' information to identify children with attention deficit/hyperactivity in their research (4).

In general, epidemiology studies can determine the presence or absence of symptoms and injuries which explain diagnosis of attention deficit/hyperactivity disorder. However, numerous studies have been conducted on accompanied problems of the children that show the need for identifying and performing epidemiology studies to carry out interventions and prevention of secondary problems in the children. The awareness of the mental health of the students can play an important role in planning to reduce their disorder and promoting their mental health. Also the effects and consequences of the disorder can be avoided in students. Given the importance of the issue, it appears that for any plan in this regard we need information on its prevalence in the students. Thus, we decided in this study to perform a meta-analysis of the prevalence of attention deficit/ hyperactivity disorder in primary schoolchildren from the prospective of teachers and parents.

Materials and Methods

In this study, the paper published in national and international journals in databases including Magiran, Pubmed, Iranmedx, SID, Medlib, Sciencedirect were used. Article search was mainly performed through systematic search and valid keywords such as attention deficit, hyperactivity, prevalence, and Meta-analysis, Iranian both Persian and Latin.

First, a list of the topics and abstracts of all articles in the databases were prepared by the researcher and then they were studied to select relevant topics. Then, relevant articles were independently entered into the research process. First, a number of 43 articles were selected and studied of which 7 were repetitive and out of all studied 31 articles, 5 were excluded due to lack of compliance with the criteria of the study, in addition, 9 studies were deleted due to inaccessibility to their full text and lack of necessary data in the abstracts of the articles and a number of 6 articles were excluded due to the unavailability of the prevalence data (Figure 1). Finally a number of 16 appropriate articles were selected to enter into meta-analysis stage and all the information of studies was entered into a form designed and prepared for data extraction and then data were then entered into Excel software. Then the data was transferred from the Excel software to R and STATA software Version 11.2.

Given that the main indicator of the study was the prevalence, its variance was calculated using binomial distribution, and 95% confidence interval was calculated for comparison. To determine the combined prevalence rates of various studies, the mean weight was used. Every study were weighted inversely proportional to their variance. To assess the heterogeneity, Q test was used andI2indexwas tested at the level of α error of less than 10% for its significance. In cases where the results were heterogeneous, they were analyzed using meta-analysis (random effects model). For data analysis R and Stata softwareVersion11.2 was used.

Results

In this study to study the prevalence of attention deficit/hyperactivity in Iran, 16 articles, between the years 1996 and 2011 entered into analysis. Total sample consisted of 14,891 primary-school students aged from 7 to 12 years. In all studies, the number of boys and girls was not specified, thus the number and percentage of boys and girls are not specified in our results.Table1shows the specifications of the examined articles.

Table 1. General data of the selected studies for meta-analysis

Questionnaires Type	Prevalence according to the consensus of teachers Total Boy Girl	Prevalence according to the consensus of parents Total Boy Girl	Prevalence according to the consensus of parents and teachers Total Boy Girl	Total Boy Girl	Place of study	Published year	Year	Author name
Conners			4-12% 1-18% 6-7%	1089	Mashhad		1382	Abdollahian[37]
CSI- 4	4-11% 4-63% 6-36%	2-12% 3-66% 7-33%	5-9% 5-64% 5-35%	800 400 400	Bandar Abbas	1392	1388	Moayedi[3]
Conners	2-12%	1-9%	4-9%	428	Zanjan	1384	1383-84	Shabani[38]

Rutter	1-85%			840	Ilam	1387	1384-85	Ghiasi[39]
	1.02%			470				
	0-83%			370				
Rutter	7-32%	7-21%	2-8%	656	Sirjan	1383	1378-79	Ziauddini[40]
	8-37%	8-24%	6-8%	322				
	5-27%	5-18%	7-8%	334				
CSI- 4		5-17%		1205	Shiraz	1388	1384-85	Najafi[36]
				639				
				566				
CSI- 4(DSM-IV)	9-53%			2182	Shiraz	1382	1380	Alishahi[5]
				1083				
				1099				
CSI- 4		3-16%		400	Yazd	1386	1383-84	Akhavan Karbasi[2]
		5-19%		200				
		13%		200				
CSI- 4	48-75%	60%	4%	2000	Ilam	1380	1375-76	Solaiman Nigad[41]
			4-5%	1040				
			2-3%	960				
Conners			5-12%	722	Neishabour	1387	1385-86	Moradi[42]
			9-10%	402				
			3-14%	320				
Conners	4-14%	17-67%	7-7%	181	Rasht	1390	1386-87	Bakhshi[18]
			6-6%	91				
			8-8%	90				
SWAN(DSM-IV)		2-4%		450	Isfahan	1388	1385	Karimi[43]
				207				
				243				
Rutter	5-18%			1311	Shiraz	1386	1385	Shahim[4]
				644				
				667				
	3-43%			600	Abhar	1382	1380-81	Shams Esfandabad[44]
	7-44%			300				
	42%			300				
DSM-IV	17%	8-25%		1403	Tehran	1390	1388	Meysamie[45]
	2-23%	4-32%		727				
	2-10%	1-18%		676				
	9-19%			624	Tehran			Bahreinian[46]

To investigate the prevalence of attention deficit/hyperactivity based on the consensus of parents and teachers7studieswere analyzed, resulting in the prevalence of 8% (95% confidence interval: 5-11) (Table2-Figure2). Also to assess the prevalence of attention deficit/hyperactivity in boys, according to the consensus of parents and teachers, 5studies were examined that according to meta-analysis it was 19% (95% confidence interval: 3-35), and to assess the prevalence of attention deficit/hyperactivity in girls, according to the consensus of parents and teachers, 5studies were examined that according to meta-analysis it was 14% (95% confidence interval: 4-23).

In this study to assess the prevalence of attention deficit/hyperactivity disorder from the perspective of parents 9 studies were analyzed, yielding a prevalence of 20% (95% confidence interval: 7-33). To assess the prevalence of attention deficit/hyperactivity in boys from the perspective of parents 4 studies were analyzed that based on meta-analysis estimate it was 36% (95% confidence interval: 16-55) and to assess the prevalence of attention deficit/hyperactivity in girls from the perspective of parents, 4studies were analyzed that based on meta-analysis estimate it was 21% (95% confidence interval: 13-28) (Table3).

In this study to assess the prevalence of attention deficit/hyperactivity disorder from the perspective of teachers, 11 studies were analyzed, yielding a prevalence of 20% (95% confidence interval: 12-28). To assess the prevalence of attention deficit/hyperactivity in boys from the perspective of teachers, 5 studies were analyzed that based on meta-analysis estimate it was 34% (95% confidence interval: 10-58) and to assess the prevalence of attention deficit/hyperactivity in girls from the perspective of teachers, 5studies were analyzed that based on meta-analysis estimate it was 23% (95% confidence interval: 9-37).

Table 2. The prevalence of attention deficit/hyperactivity based on the consensus of parents and teachers

Prevalence (95% confidence interval)	The number of studies	The prevalence of attention deficit/hyperactivity in the perspective of teachers and parents
(5-11) 8%	7	Total

(3-35) 19%	5	Boy
(4-23) 14%	5	Girl

Table 3. The prevalence of attention deficit/hyperactivity in the perspective of teachers and parents

Prevalence (95% confidence interval)	The number of studies	The prevalence of attention deficit/hyperactivity in the perspective of parents
(7-33) 20%	9	Total
(16-55) 36%	4	Boy
(13-28) 21%	4	Girl
Prevalence (95% confidence interval)	The number of Studies	The prevalence of attention deficit/hyperactivity in the perspective of teachers
(12-28) 20%	11	Total
(10-58) 34%	5	Boy
(9-37) 23%	5	Girl

Discussion

This study was conducted to perform a meta-analysis of the prevalence of attention deficit hyperactivity disorder in primary school children in 2013. The results of this study showed that the prevalence, according to teachers, parents and both was 20%, 20% and 8%, respectively. Our results are nearly close to the results of the study by Bener in Qatar (19) with a prevalence of 9.4% and a study among1077 primary school students in an area of Germany (20) with a prevalence of approximately 9.6%.

The results of other studies conducted by Al-Hamed (11) in Saudi Arabia, with a prevalence of 16.4% and Fontana (12) in Brazil, with a prevalence of 13%, compared to our study had a higher prevalence which are different from our results. Also this study showed prevalence higher than those of the study by Huss (13) in Germany, with a prevalence of 5.3% and the study by Rohde in Brazil (6) with a prevalence of 5.8%. If the prevalence of ADHD is considered between 5.8 and 19.9% according to different studies, this study shows that the prevalence of ADHD is moderate by parents' agreement. The World Health Organization estimates the prevalence of ADHD in the primary schoolchildren to be from 2 to 8% which is consistent with the results of our study (9). Despite the common use of Conners parents and teachers questionnaire in most of these studies, there are still contradictory results. However, the worldwide studies have reported conflicting results: prevalence of ADHD in suburbs of America was 3.4% (21), in North Carolina 16% (22), in Colombia 16.4% (23), in Brazil (26%) (24) and in India (25). The study conducted on 718 primary school children in Hong Kong (26), has reported the prevalence of the disorder as 1%. In a study on 232 students in Italy (27) to evaluate signs of attention deficit and hyperactivity disorder, 3.9 percent of students had at least 8 signs. In another study in Italy (28) the prevalence of the disorder was 1.7 percent. McGuy, Eckhart and DePaul (29) have estimated the prevalence of attention deficit/hyperactivity disorder as 3-8%.

It should be noted that the disease definition, sample size, diagnosis tools of the study, methods of validation and confirmation of the diagnosis are different in different studies, that this would be the reason for differences in reported numbers.

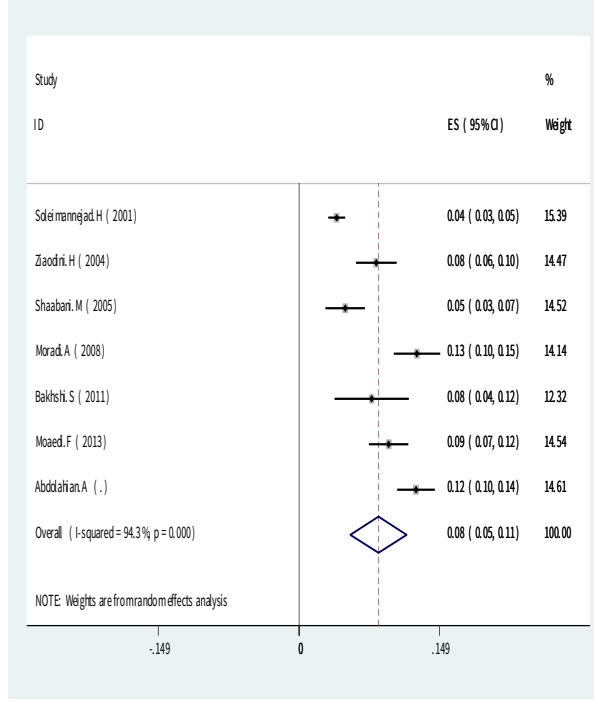

Figure 2. The prevalence of attention deficit/hyperactivity based on the consensus of parents and teachers in general and at a confidence interval of 95% in conducted studies by the author's name and year of the study.

The midpoint of each segment shows the estimated prevalence in the study. Diamond signs show the prevalence rate in the country for the all studies.

The differences can be explained also according to the role of genetic factors in this disorder and given the differences between the ethnic structures of individuals and different geographical, social, economic and cultural factors in the studied societies. Higher percentages are associated with urban areas than rural areas, as well as Western cultures than eastern cultures. The common aspect

of all these studies indicates the relatively high prevalence of ADHD in school-aged children.

In this study, the prevalence of ADHD was equal in the eyes of parents and teachers. Pierrehumbert et al (30) reported that there was not a significant difference in the prevalence of ADHD in Swiss primary school children between the perspectives of parents (8%) and teachers (9.6%). Also Ersan et al (31) reported no significant differences in the prevalence of ADHD in primary school children in Turkey the basis of parents (9.6%) and teachers (7.3 percent), which is almost consistent with the results of our study. These results are contrary to some studies, for example, in a meta-analysis study on ADHD epidemiological studies published in the past decade, the prevalence of ADHD signs was found in the eyes of parents in 24 studies and in the eyes of teachers in 10 studies as the overall prevalence were 3.5% and 10.3%, respectively; and there was a significant difference between the two views (32), also in a study, the prevalence of ADHD was 31.1% in the eyes of parents while it was estimated as 4.3 percent in the eyes of the teachers which were different from the results of our study (33).

But in fact, the highest prevalence in the present study is related to the reports by both parents and teachers. Researchers and clinicians often rely on teachers' report in the diagnosis of this disorder. The reason is that teachers have a better understanding of the child's daily behavior. The reason why the information of teachers is of greater value than that of the parents in the diagnosis of this disorder is that teachers often have better knowledge and understanding of the behaviors in relation to the developmental period of the children. However, there are factors that may affect emphasis on teachers' views. As social scientists have pointed out, these factors include the number of classroom students, disciplinary practices and attitudes of teachers and their teaching and experiences. In the current situation of the society, these factors may have a more positive effect on teachers, because in the current schools class size is relatively in a good condition and teachers are provided with good information about the problems of children which, in turn, puts a positive effect on their attitude. In some studies, the prevalence was higher in the questionnaires of teachers than in that of parents that could be for the following reasons:

1. Parents discount signs of their children or relate them to the child's age, and do not consider them abnormal.

2. Sometimes teacher's stimulation threshold is low, because if a teacher has personal problems, such as job dissatisfaction, overwork, boredom and less time may make negative judgments about the children with a slightly abnormal behavior.

In some studies, the prevalence of the disorder from the perspective of parents is more than that of teachers that is different from the results of this study. The higher prevalence in the eyes of parents compared to teachers can be attributed to lifestyle changes in society. These changes (smaller living area such as an apartment), have led to make changes in parents' expectations which are not consistent with the age of the child and therefore, even normal activities of children seem excessive. Also, as mentioned above, according to experts, the views of teachers on the disorder, because of having information on children's development are more important and they believe teachers' views should be set as criteria. This study showed that the prevalence of ADHD based on the views of teachers, parents, and both is higher in boys than girls but there is no significant difference between genders in the prevalence and this finding is inconsistent with the results of other studies, such as Pineda et al (23), and Vasconcelos et al (24). The aforementioned studies have concluded that the disorder is significantly more prevalent in boys than girls. Also our results was different from the results of the studies by Fontana (12) (with a ratio of approximately 2: 1) and Skouni (14) (with a ratio of approximately 2: 1), Byner (19) (with a ratio of approximately 3: 1) and Huss (13) (with a ratio of approximately 4: 1). The current study is consistent with some studies in which the prevalence in girls considered to be close to that in boys (34). Gomez et al in the diagnosis of attention deficit hyperactivity disorder reported that the disorder is more common in boys than girls (35). The above study is consistent with our study. Reference books and studies conducted in Brazil, India, Australia, America, and Colombia indicate a higher incidence of ADHD in boys.

According to studies carried out in Iran compared to studies that have been done in other parts of the world, the prevalence of ADHD in boys has lower percentage than in girls. So that even in some Iranian cities, the difference was not statistically significant or had a ratio f 2:1, which it shows differences with other countries. The reason why behavioral disorders such as ADHD are more common in boys may be due to the fact that generally boys are more biologically vulnerable than girls. Mortality rate is higher among boys than girls since the embryonic period and it seems that serious diseases, nutrition and poverty affect them more.

However, differences in the breeding of these groups in the society are not ineffective on the differences related to gender; for example, no doubt that aggression can be accepted more easily in boys than in girls. However, there is evidence showing that the higher prevalence of behavioral disorders among boys may be the result of this fact that violations of boys are heard more. Mothers expect problems of boys to be longer than girls. Teachers and Parents have less tolerance against excessive mobility, instability, distraction, hypocrisy and failure of boys. At the same time, lower tolerance of adults against the boys may be because the boys can be managed more difficultly since their birth and it is likely that biological factors are combined with the culture and social expectations. As a result, one can consider them as transient crisis of growing. This conclusion is reinforced when we see that many of the problems of childhood sit down without treatment (36). It is also believed that hormonal effects and the role of the family in terms of giving more freedom to boys and at the same time putting more limitations for girls, affect the increasing prevalence of ADHD in boys. With regard to the consequences of the disorder on quality of life in children and its unintended effects in directing the personal and social life of the individuals, it is necessary to perform screening for school children and make efforts to prevent and treat them. Also regarding the relationship between this disorder and other psychiatric disorders and poor school performance status, consultation with children for diagnosis and treatment of these disorders is necessary.

Conclusion

This study shows that the prevalence of ADHD according to parents and teachers is moderate. Therefore the need for mental healthcare of students as the future of the country, the need to identify, treat and follow up relevant groups at risk by the relevant and concerned institutions is clear.

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