

# Prevalence of ADHD among 7-9-Year-Old Children in Israel. A Comparison between Jewish and Arab Populations

Asher Ornoy, MD,<sup>1</sup> Moran Ovadia, MSc,<sup>1</sup> Dori Rivkin, MA,<sup>2</sup> Ellen Milshtein, MA,<sup>2</sup> and Lital Barlev, MA<sup>2</sup>

<sup>1</sup> The Hebrew University Hadassah Medical School, Jerusalem, Israel

<sup>2</sup> Myers JDC Brookdale Institute, Jerusalem, Israel

## ABSTRACT

**Introduction:** The world prevalence of ADHD ranges between 5-10%. The prevalence in Israel was generally studied from prescriptions of methylphenidate and not from cohorts of children.

**Methods:** We assessed the prevalence of ADHD among a cohort of early school age children in the Jewish and Arab populations using DSM-IV criteria and evaluated the difference between teachers' and parental assessment. We also studied in the Jewish population the differences in several social-behavioral parameters between children with and without ADHD.

**Results:** The rate of ADHD among the Jewish children was 9.5% and among the Arab children it was significantly lower – 7.35%. Teachers' evaluation in the Jewish population was 2.3 times higher than parental evaluation but in the Arab population it was closer to that of the parents, being only 12% higher. In addition, there were more regulatory, behavioral and learning problems among the Jewish children with ADHD compared to children without ADHD.

**Conclusions:** The rates of ADHD in school age children among both Jews and Arabs fall within the average

rate in other countries. The high difference between teachers' and parental assessment of ADHD in the Jewish population emphasizes that ADHD diagnosis should rely on the joint behavioral assessment of both.

The prevalence of ADHD in Jewish early school age children is slightly higher than in Arab children and the inattentive type is the most common. There is a discrepancy between teachers' and parents' evaluation of children's behavior in the Jewish population, but this discrepancy is less in the Arab population.

## INTRODUCTION

Attention deficit hyperactivity disorder (ADHD) is a neurobehavioral disorder defined by the Diagnostic Statistical Manual 5 (DSM-5) as a “persistent disorder of inattention and/or hyperactivity-impulsivity that interferes with functioning or development” (1). ADHD is generally divided into the inattentive type, hyperactive type and combined type. However, these behavioral presentations in the child may change with time (1, 2). The diagnosis requires the symptoms to be present before the age of 12 years, and have various degrees of severity. In the DSM-IV the definition was similar but symptoms needed to be present before the age of 7 years (2). The prevalence of ADHD varies among populations and in school age children it ranges between 8-12% (3). The differences are explained by different genetic (ethnic) background and by different definitions of the disorder. During the last decade, the prevalence of ADHD has increased significantly, and in the U.S., for example,

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**Address for Correspondence:** ✉ Asher Ornoy, MD, The Hebrew University Hadassah Medical School, POB 12272, Jerusalem 91120, Israel

✉ ornoy@cc.huji.ac.il

it rose from 7.8% in 2003 to 9.5% in 2007 (4). In a most recent meta-analysis of 175 studies using DSM-III, DSM-III-R or DSM-IV (5) the world prevalence of ADHD was 7.2% (95% confidence interval 6.7-7.8) and it was similar by using either DSM-III or DSM-IV criteria (5).

There are relatively few studies on the prevalence of ADHD in Israel. In a study conducted on a population of 774 kindergarten children aged 4-6 years, the prevalence of ADHD as assessed from both kindergarten teachers and parental PBQ questionnaire, was 10.1% (78/774 children) (6). In these children, 47% had two or more additional neurodevelopmental deficits, especially lower scores in verbal intelligence, fine and gross motor abilities and sensory functioning. These comorbidities were different from those generally observed in school age children with ADHD (7).

Studies on the prevalence of ADHD in school age children in Israel were conducted from the examination of methylphenidate prescriptions (8-10). Examination of one year prevalence of children in the north of Israel insured by the Clalit Health Services who were prescribed methylphenidate showed that in 1999, 1.45% of children 5-18 years of age were prescribed the drug. The percent of Arab children prescribed methylphenidate was much lower than in the Jewish population (8). In a later study comparing the rate between 1999 to 2001 (9) the rate was 1% in 1999 and rose to 1.2% in 2001, with a much lower prescription rate among the Arab children (9). Thereafter, a study that compared the number of children prescribed methylphenidate in 2007 and those in 2011, all living in the central regions of Israel, the prevalence increased from 4.2% to 7.5%, with four times more prescriptions among Jewish children compared to Arab children (10). However, the number of prescriptions given to children is not an accurate indication for the rate of ADHD since even children prescribed only a few tablets (i.e., for the performance of CPT) are enrolled. Moreover, not all children with ADHD are prescribed methylphenidate. Also, as observed in other studies, over one third of children with ADHD do not use stimulants and about a third of children prescribed methylphenidate are not diagnosed with ADHD (11, 12).

In a survey carried out on 284,419 children enrolled at Maccabi Healthcare Services in Israel, the prevalence of ADHD was found to be 12.6% (11), with 75% males. The authors observed a constant rise in ADHD with age, ranging from 3.7% at 6 years of age to 17.1% at 13 years. In this study, stimulants were prescribed to 8.5% of the children, but only 4.8% of children (58%) used stimulants regularly.

A much lower rate of ADHD was found among adolescents. In a relatively recent study by Farbstein et al. (12) the rate of ADHD among adolescents aged 14-17 years, from a cross-sectional representative sample, was found to be only 3%, with 3.9% in boys and only 2.0% in girls. In this study too, the rate among Jewish adolescents was more than three times higher compared to Arabs and Druze (3.6% vs. 1.0%). All these children met the DSM-IV criteria for the diagnosis of ADHD. This rate was relatively lower than the observed prevalence in other countries.

ADHD is usually diagnosed by the use of a variety of behavioral questionnaires (scales assessing ADHD), many of them are based on DSM-IV criteria (12). Behavior is recorded in at least two settings, and for school age children it is at school and at home (13-19). However, concordance between school teachers and parents is generally low, although it improves in children with additional neurobehavioral problems. For example in autism spectrum disorder concordance is high (17).

The socioeconomic status (SES) of the family is considered to have a significant influence on the prevalence of ADHD. The prevalence is higher in families with socioeconomic disadvantage, in association with low family income, low parental education, lone parenthood and young mother (20).

The purpose of our study was to assess the prevalence of ADHD among early school age children in a representative Jewish population in Jerusalem in comparison to a population of Arab children of similar age living in the Arab town of Kafr Kana in Israel, by using the DSM-IV criteria for ADHD. In addition, we studied the concordance between teacher's and parental assessments in both populations.

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## SUBJECTS AND METHODS

**The Jewish population:** This consisted of children at the age of 7-8 years who attended first and second grade in 35 schools in Jerusalem representing the secular and orthodox population but not the ultra-orthodox children, as there was no permission for these schools to participate. The initial information from the teachers was collected during February-June 2012, and the information from the parents several months later. We purposefully chose the end of the school year to enable the teachers to better know their students. An informed consent to participate in the study was given by 1,129 parents. The teachers of these children filled out the DSM-IV ADHD questionnaire. Following the evaluation of the teachers' DSM-IV questionnaire,

248 children (22%) were found to present with typical symptoms of ADHD. A DSM-IV questionnaire was filled out by the parents by a direct telephone interview for 213 (86%) of these 248 children. From the 881 children that were not found on teachers' DSM-IV questionnaire to have ADHD symptoms, parents of 248 children were randomly selected as controls and 240 of their parents (97%) were interviewed by telephone to fill out the DSM-IV questionnaire. Children were diagnosed as having ADHD only if they fulfilled criteria according to both the teachers' and parental DSM-IV questionnaire. The study was approved by the ethics committee of the Hebrew University Hadassah Medical Center.

The Jewish children also participated in an expanded study where, in addition to the DSM-IV questionnaire, we performed a parental telephone interview that also included a detailed questionnaire relating to the following topics: child's general behavior and behavior at school, child's learning ability at school, child's delay in developmental milestones, learning ability and difficulties, additional health problems, pregnancy and delivery complications, gestational age at birth, birth weight, mode of delivery, maternal smoking over 10 cigarettes/day and alcohol consumption during pregnancy, parental education and income. In addition we collected data on regulatory problems that were based on the average score from 1-10 on a 3-item scale (frequent temper tantrums, failure to obey adults, and frequent fights or bullying with other children). We also collected information about siblings at home with ADHD. All data were collected by a detailed telephone interview performed by the same very experienced interviewer from the Myers JDC Brookdale Institute in Jerusalem. The results were compared between children with and without ADHD.

In order to find out whether the children are a representative sample of Israeli children or only of non-ultra-orthodox Jerusalem children, we performed a comparison in the following parameters between these children and the families with children aged 6-17 in Jerusalem and in the general Israeli population (Table 1): Paternal and maternal country of birth, years of schooling, employment, religiosity - whether secular or observant (but not ultra-orthodox), and family income. The Jerusalem population is similar to the general Israeli population in income and employment, which are thought to be important factors affecting the rate of ADHD (20), but differs in the country of origin and education. The study sample is also similar in income and maternal employment. Hence, the children in the present study were

only partially representative of the Israeli children at the same age.

The Arab population: Children attended grades 2-4 of elementary school and were 7-9 years of age. DSM-IV questionnaire was filled out by the teachers at the end of the school year for 1,550 children from Kafr Kana that comprise in this Arab town almost all children studying in these classes. Of these, 132 children (8.5%) fulfilled the DSM-IV diagnostic criteria for ADHD. One hundred parents (75.8%) filled out the DSM-IV questionnaire. In contrast to the Jewish children in Jerusalem who participated in an additional study, where we collected data on their behavior and school performance, no other data were collected from the teachers or parents of these children as only the children in Jerusalem participated in the expanded study.

### STATISTICAL EVALUATION

Categorical data on children with and without ADHD symptoms were compared by chi square and are expressed as ratios or percentages. Continuous data on children with and without ADHD symptoms (in aggregated measures) were compared by t test for independent samples and are presented using mean  $\pm$ SD. Logistic regression was used to predict the presence of ADHD symptoms by variables that pre-exist the disorder. Significance was set at  $p < 0.05$ . Statistical calculations were done using SPSS Version 20.

## RESULTS

### JEWISH POPULATION (TABLE 2)

Of the 1,129 children screened in Jerusalem by their teachers, 248 (22%) fulfilled the DSM-IV criteria of ADHD. Of these, 92 children (40% concordance with teachers' questionnaire) met the diagnostic criteria of DSM-IV according to the teachers' and parents' and were therefore considered as having ADHD; of these 48 (52%) had mainly inattention, 19 (21%) had mainly hyperactivity and 25 (27%) had combined inattention and hyperactivity. Because we received answers from only 86% of the parents, the rate of ADHD was calculated only from a total number of 971 children (which are 86% of the entire sample), and was found to be 9.5% (Table 2). From the 881 children with negative teachers' questionnaire there were 13 children (1.5%) who were reported by parents as having been diagnosed with ADHD and whose parental DSM-IV was suggestive of ADHD. Of the children with ADHD identified by both parents and teachers, 46 (50%) were previously diagnosed and treated, while 46 (50%) were identified for the first time.

**Table 1.** Comparison of socio-demographic data between the study group, the population of Jerusalem and the Israeli population

		Israel population 1,567	Jerusalem population 103	Study sample 360	Study sample vs Israel population*	Study sample vs Jerusalem population*
Paternal country of birth	Israel	74.3	58.8	80.9	p<0.000	p<0.000
	Former Soviet Union	11.5	6.4	4.8		
	Europe and Americas	6.2	20.4	12.5		
	Asia and Africa	8.0	14.4	1.8		
Maternal country of birth	Israel	75.3	84.5	75.3	p<0.000	p=0.193
	Former Soviet Union	13.6	2.2	7.2		
	Europe and Americas	5.2	9.1	13.3		
	Asia and Africa	5.9	4.2	3.7		
Paternal education	Twelve years	18.7	15.3	22.0	p<0.000	p<0.01
	High school graduate	19.8	19.8	15.4		
	Fourteen years (college)	17.8	16.0	14.2		
	University graduate	33.4	40.5	46.3		
	None of the above	7.3	10.1	2.2		
Maternal education	Twelve years	17.4	26.5	12.4	p<0.000	p=0.000
	High school graduate	24.9	29.0	17.0		
	14 years (college)	16.9	14.7	11.2		
	University graduate	36.3	25.1	58.1		
	None of the above	4.5	4.6	1.3		
Paternal employment	employed	84.0	87.4	95.5	p<0.000	P=0.019
	unemployed	15.9	12.3	4.6		
Maternal employment	employed	82.2	82.7	82.5	p=0.523	p=0.571
	unemployed	17.7	17.3	17.6		
Religiosity	secular	45.2	22.2	36.7	p<0.000	p=0.021
	observant	31.4	41.7	28.9		
	religious	13.4	36.2	31.1		
Monthly household income	Low: <8000 NIS	17.8	22.6	19.9	p=0.627	P=0.362
	Intermediate 8000-10,000 NIS	13.5	18.3	13.6		
	High >10,000 NIS	68.6	59.1	66.5		

Data from Israel Central Bureau of Statistics social survey 2012 for similar population (Jewish, non-ultra-orthodox, parents of children ages 6-17) in Israel and in Jerusalem.

\*Chi square two-sided test

The sample is compared to similar population – Jewish, non-ultra-orthodox, with school age children.

Since the sample for the total population of Israel was much larger than the Jerusalem population samples, differences were more likely to be significant.

**Table 2.** Children with ADHD in a Jewish sample in Jerusalem as evidenced from 1,129 teachers and 437 parental questionnaires

	Number of questionnaires	No ADHD	ADHD	Inattention	Hyper-activity	combined
Children with teachers' questionnaires	1,129 (100%)	881 (78%)	248 (22%)			
Children with both teachers' and parents' DSM-IV questionnaire	213/248 (86%)	121 (57%)	92 (43%)			
Number and % of ADHD from Teachers and parents DSM-IV	437 (39%)		92/971* (9.5%)	48/92 (52%)	19/92 (21%)	25/92 (27%)

\*Because we received answers from only 86% of the parents, the rate of ADHD was calculated from a total number of 971 children (86% of the entire sample of 1,129),

**Table 3.** Children with ADHD in an Arab sample in Kafr Kana as evidenced

	Number of questionnaires	ADHD
Teachers	1,550	127 (8%)
Parents	100/127 (79%)	90 (90%)
Teachers and parents	100	90/1,225 (7.35%)

from 1,550 teachers and 100 parental questionnaires

**ARAB POPULATION (TABLE 3)**

Of 1,550 children evaluated in Kafr Kana by the teachers, 127 children (8.2%) met the diagnostic criteria of ADHD. Of these children, 100 parents (79%) filled out the DSM-IV questionnaire. Ninety of these parental questionnaires were positive. Hence, in the Arab population, the teachers and parental concordance was 90%. The rate of ADHD was therefore calculated from a total number of 1,225 children (79% of the entire sample) and was 7.35% (Table 3). This was significantly lower than in the Jewish population ( $p < 0.01$ ). As mentioned above, the Arab children did not participate in the expanded study and we therefore could not define the subtypes of ADHD among them or to find out from the parents of children who had “negative” teachers’ DSM-IV questionnaires and were not suspected to have ADHD whether they had been previously diagnosed.

**COMPARISON OF TEACHERS’ DSM-IV BETWEEN JEWISH AND ARAB SCHOOLS**

The comparison of “positive” DSM-IV teachers’ questionnaires between all Jewish and Arab schools in this study shows that the rate of positive questionnaires among Jewish teachers was more than twice that of the Arab teachers: 248/1,129 (22%) in the Jewish schools and only 127/1,550 (8.2%) in the Arab schools. Thus, the gap between Arab teachers’ evaluation of the children’s behavior and the children’s parents was much smaller (8.2% and 7.3%) than the gap between teachers and parents in the Jewish schools (22.0% and 9.5%).

**RESULTS OF THE TELEPHONE QUESTIONNAIRE: PRENATAL AND PERINATAL EVENTS, SOCIAL AND BEHAVIORAL CHANGES IN JEWISH CHILDREN WITH ADHD**

We carried out a detailed telephone parental interview in a total of 437 children. From the 105 children with ADHD (92 defined by positive teachers’ and parental DSM-IV and 13 diagnosed with ADHD, but had a negative teachers’ questionnaire) there were 34 children who received medical treatment for their ADHD. These children were considered for our comparative studies between the

children with and without ADHD only for background factors, and all other comparisons were therefore performed on 72 children with non-treated ADHD compared to 245 children without ADHD.

No differences between the children with and without ADHD were observed in background variables: cigarette smoking by the mother, pregnancy complications, perinatal complications, maternal and paternal education, parental employment, income or country of birth. The single difference was a higher rate of complications during delivery in the children with ADHD (17.1% vs 8.3% in controls).

In addition there were significantly more learning problems among the children with ADHD in comparison with children without ADHD (35.2% vs. 19.4%).

There was a significantly higher rate of regulatory problems among the children with ADHD. The average score for children with hyperactivity was the highest (4.90), followed by children with the combined type (4.17). Both were significantly higher ( $P < 0.001$ ) than controls (1.96). The average scores of children with inattentive type (2.83) were lower, and differed significantly from children with hyperactivity ( $p < 0.01$ ) but not from the combined type or controls.

Table 4 shows the differences in social and behavioral problems and in learning difficulties between the children with different types of ADHD and controls in the Jewish population. As observed, severe learning difficulties were present mainly in the children with the inattentive and

**Table 4.** Social, learning and behavioral problems among children with and without ADHD in a Jewish sample in Jerusalem

	Children with inattention (40)	Children with combined type (16)	Children with hyperactivity (16)	No ADHD (240)
Social problems	12.5%	25%	25%	13.3%
No learning difficulties	45%	25%	68.8%	77.7%
Slight learning difficulties	7.5%	12.5%	18.8%	8%
Severe learning difficulties	47.5%	62.5%	*12.5%	14.3%*
No behavioral difficulties	64.1%	43.8%	25%	82.5%
Slight behavioral difficulties	12.8%	0%	12.5%	10%
Severe behavioral difficulties	23.1%	56.2%	62.5%	7.5%**

\*Significantly lower than children with combined type or inattentive type  $p < 0.001$

\*\*Significantly lower in comparison to children with combined type or hyperactive type  $p < 0.0001$



combined type but not in the children with the hyperactive type. On the other hand, severe behavioral difficulties were observed mainly in the hyperactive and in the combined type.

## DISCUSSION

We found that 9.5% of the Jewish children in Jerusalem and 7.35% of the Arab children in Kafr Kana met the DSM-IV diagnostic criteria of ADHD as described by their parents and teachers. In addition, there were more regulatory, behavioral and learning problems among the Jewish children with ADHD compared to controls.

The differences between the Arab and Jewish children were significant, but in both groups of children the rates are high, within the range previously observed by us in 4-6 year old Jewish preschool children (5, 6) and in various countries using the DSM-IV criteria (2). It is also within the range described in most published reviews or meta-analyses (14-16). The difference in prevalence between the two ethnic groups is also not surprising as such differences were described in many studies, including significant differences between Europe and the U.S. (5). These differences, however, may also stem from differences in services and in awareness to ADHD (14-16), as both seem to be less developed in the Arab population with fewer neurodevelopmental services. On the other hand, there are some socio-economic factors that might increase the prevalence of ADHD in the Arab children. We did not study the SES of the Arab families but it is known that their income, education and employment rate are generally lower than that in the Jewish families (21). Hence, this is expected to increase the rate of ADHD.

Subtypes of ADHD were determined only in the Jewish population, and the highest rate was of the inattentive type, comprising 52% of the children with ADHD. Similar findings among school age children were observed by others in different countries and international surveys (15, 16).

The lack of concordance in the Jewish population between the teachers' and parental assessment is not surprising, since it was observed in many studies with the teachers often describing a higher rate of ADHD in comparison to the parents (16, 18, 19). For example, Willcutt (16), in his meta-analysis, found that based on teachers' rating of DSM-IV, 13.3% of children had ADHD while, if based on parental reports, it was only 8.5%. Mitsis et al. (18) and Wolraich et al. (19) also found high disagreement between teachers' and parental evaluation of the DSM-IV and conclude that diagnosis should be performed by both

teachers and parents and that diagnosing ADHD on the evaluation of a single informant is of questionable validity.

However, the large difference in the Jewish population between assessments, with teachers' assessment more than twice the parental rate, is high when compared to the observed differences in the literature. We have no explanation for this large gap, except the possible fact that our classes have a relatively large number of children, and teachers may be more affected by children's learning difficulties and behavior in class. It is, however, surprising that the teachers' assessment of the children in the Arab schools were much closer to the parental assessment, in spite of the fact that the number of children in class is similarly high. It may express a higher tolerability of the Arab teachers to children's behavior in class. Moreover, the differences might also be related to different life styles between these populations.

In evaluating the data on the two populations of children there are some weaknesses. These are relatively small cohorts and there is no data on the socio-demographic characteristics of the Arab population. The Jewish sample is only partially representative of the general Jewish population. We have no data to show that Kafr Kana properly represents the general Arab population in Israel. In addition, the children were not examined by any medical authority, but this is true with most studies on the prevalence of ADHD.

In summary, we found that the rate of ADHD among the Jewish and Arab population is within the range found in most western countries and that the rate in the Arab population increased markedly in comparison to the rate described in that population in earlier years. However, in the Jewish population the teachers' assessment of ADHD prevalence is very high, which stresses the fact that ADHD diagnosis should rely on the joint behavioral assessment of the teachers and parents. In addition, there were more regulatory, behavioral and learning problems among the children with ADHD compared to children without ADHD, as studied in the Jewish population.

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