

Prevalence of attention deficit hyperactivity disorder and comorbid psychiatric and behavioral problems among primary school students in western Saudi Arabia

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ABSTRACT

الأهداف: لتحديد مدى انتشار اضطراب نقص الانتباه مع فرط النشاط (ADHD)، والأنواع الفرعية من ADHD، والأمراض النفسية والأكاديمية والاعتلال السلوكي المشتركة في طلاب المدارس الإبتدائية العامة في جدة، المملكة العربية السعودية.

الطريقة: أجريت هذه الدراسة المستعرضة. وتم تحديد عينة عشوائية بسيطة من 6 مدارس حكومية إبتدائية في جدة بالمملكة العربية السعودية (3 ذكور، 3 نسائية)، وتم اختيار عينة عشوائية من الفصول في كل من الصفوف 1-6 خلال الفترة من يوليو ونوفمبر 2016، طلب من المعلمين في هذه الصفوف إكمال مقاييس فدربريلت أدهد على جميع الطلاب في فصولهم الدراسية.

النتائج: تم فحص ما مجموعه 929 طالباً. كان معدل انتشار اضطراب نقص الانتباه مع فرط النشاط 5% (5.3% لدى الفتيات، 4.7% لدى الأولاد). النوع الفرعي الأكثر انتشاراً هو ADHD (2.7%)، تليها فرط النشاط (1.2%). ونوع عدم التركيز (1.1%). كان معدل انتشار اضطراب فرط الحركة ونقص الانتباه عاليًا عموماً في الصف الثالث (7.1%) وأدنى معدل انتشار في الصف السادس (3.4%). من بين الطلاب مع DHD، انتشرت المشاكل المشتركة النفسية، والأكاديمية، والسلوكية (56.5%) من اضطراب العناد الشارد / اضطراب السلوك، 54.4% ضعف التحصيل الأكاديمي والأداء، 44.4% المشاكل السلوكية للفصول الدراسية، 41.3% الالكتياب / القلق). وكانت المشاكل المرضية منتشرة في النوع الفرعي من اضطراب فرط الحركة ونقص الانتباه في الأولاد.

الخاتمة: أن اضطراب نقص الانتباه مع فرط النشاط أمر شائع لدى أطفال المدارس الإبتدائية في جدة، وويرتبط بشكل واسع مع الأمراض النفسية، والأكاديمية، والمشاكل السلوكية، وخاصة في الفتيان. هذه النتائج لها آثار على التشخيص وعلاج هذا الاضطراب العصبي السلبي الخطير.

Objectives: To determine the prevalence of attention deficit hyperactivity disorder (ADHD), subtypes of ADHD, and psychiatric, academic, and behavioral comorbidity in public primary school students in Jeddah, Saudi Arabia.

Methods: This is a cross-sectional study. A simple random sample of 6 primary government schools in Jeddah, Saudi Arabia, was identified (3 male, 3 female), and a random sample of classes in each of grades 1-6 were selected. Between July and November 2016, teachers in these classes were asked to complete the Vanderbilt ADHD scale on all students in their classes.

Results: A total of 929 students were screened. The overall prevalence of ADHD was 5% (5.3% in girls, 4.7% in boys). The most prevalent subtype of ADHD was combined type (2.7%), followed by hyperactive type (1.2%), and inattentive type (1.1%). The highest prevalence of ADHD overall was in grade 3 (7.1%) and the lowest prevalence in grade 6 (3.4%). Among students with ADHD, prevalence of comorbid psychiatric, academic, and behavioral problems was widespread (56.5% oppositional defiant disorder/conduct disorder, 54.4% impaired academic performance, 44.4% classroom behavioral problems, 41.3% depression/anxiety). Comorbid problems were especially prevalent in combined ADHD subtype and in boys.

Conclusions: Attention deficit hyperactivity disorder is common in primary school children in Jeddah, and is associated with widespread psychiatric, academic, and behavioral problems, especially in boys. These findings have implications for the diagnosis and treatment of this serious neurobehavioral disorder.

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Attention deficit hyperactivity disorder (ADHD) is the most common neurobehavioral diagnosis affecting children in the world today.¹ In the United States in 2011, the prevalence of lifetime ADHD diagnosis among children ages 4 to 17 years was 11%, with 8.8% having a current diagnosis.² However, while rates are high in the United States, ADHD is not uncommon in other parts of the world. In the first worldwide review on the prevalence of ADHD conducted in 2014 involving 135 studies from around the world, a prevalence of between 6% and 7% was reported.³ The most recent meta-analysis of 179 studies indicated a point prevalence of 7.2% (95% CI= 6.7-7.8%).⁴ When compared with North America, the prevalence of ADHD in the Middle East was found to be higher (univariate coefficient= +4%). Children with ADHD have higher rates of comorbid psychiatric disorders, are hospitalized more often, and incur higher overall medical costs compared to those without ADHD.⁵ Those with ADHD are also more likely to drop out of school, infrequently complete college, have fewer friends, and are engaged in more antisocial activities than children without ADHD.⁶ As children with ADHD move into adulthood, they experience more difficulties obtaining employment, have higher rates of psychiatric disorder (such as depression, personality disorder, substance abuse, and so forth), have more auto accidents, and are more likely to contract sexually transmitted diseases compared to adults without childhood ADHD.⁷ Attention deficit hyperactivity disorder, then, is a serious disorder that is associated with multiple social, academic, and psychiatric problems during both childhood and adulthood. Among studies in the Middle East, a recent review by Alkhateeb and Alhadidi⁸ identified 26 ADHD prevalence studies in Arab countries that assessed a total of 35,798 children and adolescents over the past 25 years. The prevalence ranged from 1.3% to 34.5% (no average given). The low figure (1.3%) was for 1007 Yemeni school children ages 7-10 years old,⁹ who were assessed for all psychiatric disorders using a 2-stage screening process that involved non-clinicians interviewing parents. The high figure (34.5%) was for

1000 Palestinian school children age 12 to 16 years, where diagnoses were made by interviews with teachers using DSM-IV criteria, but without a psychometrically validated measure. A slightly earlier systematic review of 22 Arab studies reported the average prevalence from 17 studies in primary school students was 5.5% with a range from 0.5% to 11.1% depending on measure and geographical location.¹⁰ Relatively little research has systematically examined ADHD among primary school students in the Kingdom of Saudi Arabia (KSA). We were able to locate only 5 such studies that used psychometrically valid measures.¹¹⁻¹⁵ Depending on method of assessment and location of study, the prevalence of ADHD (all subtypes) in KSA ranged from 2.7% (DSM-IV-TR criteria¹¹) to 16.4% (Attention Deficit Disorders Evaluation Scale school and parent version¹⁵), averaging 9.2% overall. This figure is well above the average rate reported for Arab countries (5.5%) and worldwide (5.3-7.2%). Even fewer studies have examined the comorbidity present in primary school children with ADHD. Of the five Saudi studies above, only one assessed psychiatric, academic and behavioral comorbidity.¹⁶ In that study of primary school children grades 1 to 3 from the Assir region southeast of Jeddah near Yemen, more than half of those with ADHD had oppositional defiant disorder (ODD)/conduct disorder (CD), more than one-third had anxiety/depression, nearly two-thirds had impairment of academic achievement, and over 90% had problems with classroom behavioral performance.

Thus, the prevalence of ADHD and psychiatric comorbidity among primary school children in KSA remains unclear, affecting efforts to screen for these disorders and policy makers decisions regarding need for psychiatric services. The objectives of the present study were to determine the prevalence of ADHD, ADHD subtypes, and comorbidity psychiatric, academic, and behavioral problems in public primary students based on teacher ratings.

Methods. Related studies were identified by an exhaustive search of the literature using PubMed, Google Scholar, and other academic search engines as needed with the Medical Subject Headings (MeSH) terms “attention deficit and hyperactivity disorder,” “primary grade school,” “Middle East,” and “Saudi Arabia.” The reference lists at the end of retrieved articles were then searched for related research until no further studies could be located.

A simple random sample was identified of 3 male and 3 female public primary grade schools in Jeddah, western Saudi Arabia, the second largest city (3.5 million

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people) and largest seaport on the Red Sea. These were identified out of a total of 416 governmental primary schools (216 male and 200 female schools). By simple random sample, this means that each school among the entire sample of primary schools in Jeddah had an equal probability of being chosen. In those schools, a simple random sample of 6 classes one for each grade was chosen. Each class size ranged from 30-35 for boys and 25-30 for girls. Inclusion criteria were: 1) Teachers and students in grades 1-6 at 3 male and 3 female public primary grade schools in Jeddah, and 2) teachers and mothers of students agreeing to participate in the study. Exclusion criteria were: 1) Teachers and students in grades other than 1-6 at public primary grade schools, 2) teachers and students at private grade schools, all grades, 3) teachers or mothers not willing to give consent to participate, and 4) students not meeting criteria for ADHD, except for control students without ADHD chosen to compare with students who met ADHD criteria in order to identify risk factors for ADHD (reported elsewhere).¹⁷

Between July 1 and November 1, 2016, medical interns and 6th year medical students, who received extensive training by one of the authors (MGS), approached the primary teacher in each class and asked them to complete the scale on each of their students. All teachers (100%) who were asked to participate agreed (36 of 36). Medical interns and students then trained the teachers how to rate the VADTRS (administration of the VADTRS requires this training). Teachers then completed the scale on each of the students in their classes (89% of boys and 80% of girls in participating classes). The goal was to screen approximately 1000 students during the study period. Written informed consent was obtained from all teachers before completing the VADTRS on students. No information was collected on students except those who met criteria for ADHD and a similar number of control students without ADHD, whose mothers were later approached for an interview (from whom written informed consent was also obtained). All mothers who were approached agreed to participate (100%). The study was approved by the King Abdulaziz University Institutional Review Board and permission was obtained from the Saudi Ministry of Education to approach teachers. The study was performed according to principles of the Helsinki Declaration.

The primary teacher in each class was asked to complete the Arabic version of the Vanderbilt ADHD Diagnostic Teacher Rating Scale (VADTRS) in order to screen children for ADHD.¹⁸⁻²⁰ The VADTRS identifies 3 types of ADHD: hyperactive (ADHD-H), inattentive

(ADHD-I), and combined (ADHD-C). The VADTRS has been shown to have solid construct and convergent validity and acceptable reliability in community samples of children, which supports its utility as a screening tool for ADHD.^{21,22} The reason for choosing the VADTRS for this study was that: 1) it directly follows the DSM-IV-TR criteria, 2) the psychometrics have been well-established, and 3) Arabic versions of the scale exist.^{11,23,24} The VADTRS measure also has scales to screen for co-morbid psychiatric conditions (ODD/CD, anxiety and depression). The VADTRS consists of 43 questions, including 18 items that assess for ADHD subtypes, 10 items that assess for ODD/CD, 7 items that assess for anxiety and depression, 3 items that assess academic performance (reading, mathematics, written expression), and 5 items that assess classroom behavioral performance (relationship with peers, following directions, disrupting class, assignment completion, organizational skills). The VADTRS takes about 10 minutes to complete for each student.

Algorithm. For the inattentive type, 6 or more "often" or "very often" behaviors from questions 1-9 on the VADTRS were required; for the hyperactive type, 6 or more often/very often behaviors from questions 10-18 were necessary; and for the combined type, 6 or more often/very often behaviors each on both the inattentive and hyperactive dimensions were required. With regard to comorbidity, ODD/CD was identified if 3 or more often/very often behaviors from questions 19-28 were specified; for anxiety/depression, 3 or more often/very often behaviors from questions 29-35 were required; for impaired academic performance, ratings of 1 or 2 (problematic) on one or more of 3 academic performance items were required; and for impairment of classroom behavioral performance, ratings of problematic on one or more of 5 items were necessary.

Statistical analyses. The prevalence of total ADHD and ADHD subtypes (inattentive, hyperactive, combined) were calculated using the standard VADTRS algorithm described above. Percentages, means and standard deviations (SD) were calculated for demographics and for percentages of psychiatric and academic comorbidities across ADHD and ADHD subtypes using SAS (version 9.3; SAS Institute Inc., Cary, North Carolina).

Results. Teachers completed the VADTRS on 929 students (42.6% female, 57.4% male) in grades 1-6, age range 6-12 years. A total of 46 children were diagnosed with ADHD; demographic characteristics were 54.4% male, average age 9.0 years (SD=1.6), average grade level 3.3 (SD=1.6), average number of 3.5 siblings (SD=2.1,

range 0 to 9), and 50% had a monthly family income of greater than 8000 SR. The overall prevalence of ADHD was 5%, with a similar prevalence in boys (4.7%) and girls (5.3%) (Table 1). With regard to subtypes of ADHD, the most prevalent was ADHD-C (combined, 2.7%), followed by ADHD-H (hyperactive, 1.2%) and ADHD-I (inattentive, 1.1%). There was little variation in subtypes between girls and boys, although boys were more likely to have the hyperactive subtype, while girls were more likely to have the other 2 subtypes. With regard to grade level (Table 2), the highest prevalence of ADHD overall was found in grade 3 (7.1%) and the lowest prevalence was in grade 6 (3.4%). Gender differences in prevalence were marked only for grade 5,

Table 1 - Prevalence of ADHD subtypes overall and by gender.

Variables	Hyperactive	Inattentive	Combined	Total
Overall (n=929)	11 (1.2)	10 (1.1)	25 (2.7)	46 (5.0)
Girls (n=396)	3 (0.8)	5 (1.3)	13 (3.3)	21 (5.3)
Boys (n=533)	8 (1.5)	5 (0.9)	12 (2.3)	25 (4.7)

Values are presented as number and percentage (%), ADHD - attention deficit hyperactivity disorder

Table 2 - Percentage of students with ADHD by grade level (overall and stratified by gender).

Variables	Total screened	With ADHD n (%)
Combined		
Grade 1	160	7 (4.4)
Grade 2	148	8 (5.4)
Grade 3	169	12 (7.1)
Grade 4	161	8 (5.0)
Grade 5	146	6 (4.1)
Grade 6	145	5 (3.4)
Girls		
Grade 1	72	3 (4.2)
Grade 2	68	3 (4.4)
Grade 3	78	6 (7.7)
Grade 4	66	2 (3.0)
Grade 5	54	5 (9.3)
Grade 6	58	2 (3.4)
Boys		
Grade 1	88	4 (4.5)
Grade 2	80	5 (6.3)
Grade 3	91	6 (6.6)
Grade 4	95	6 (6.3)
Grade 5	92	1 (1.1)
Grade 6	87	3 (3.4)

ADHD - attention deficit hyperactivity disorder

where the prevalence of ADHD was 9.3% in girls and 1.1% in boys. With regard to comorbid psychiatric, academic, and behavioral problems, ODD/CD was identified in 56.5% of students with ADHD, followed in frequency by impaired academic performance (54.4%), behavioral problems (44.4%), and anxiety/depression (41.3%) (Table 3). Oppositional defiant disorder/CD was most prevalent in students with ADHD-C (72%) and ADHD-H (63.6%). Significant anxiety/depression symptoms were present in about half of the students with ADHD-C and ADHD-H. Impaired academic performance was most common among students with ADHD-I (70%), followed closely by ADHD-C (60%). Finally, classroom behavioral problems were most prevalent in ADHD-I (70%). Students with ADHD-H had the lowest rates of impaired academic performance and behavioral problems. Boys with ADHD were more likely than girls to have ODD/CD (68% versus 42.9%), which was more common in boys with ADHD-H and ADHD-C, and behavioral problems in class were most prevalent in boys with ADHD-C (75%). For girls, although number of cases was small, anxiety/depression was most common among those with ADHD-H (66.7%), ODD/CD in those with ADHD-C (61.5%),

Table 3 - Comorbid psychiatric, academic, and behavioral problems in students with ADHD by subtype and gender.

Variables	Hyperactive	Inattentive	Combined	Total
Overall (n=46)				
Conduct disorder	7 (63.6)	1 (10.0)	18 (72.0)	26 (56.5)
Anxiety/depression symptoms	5 (45.5)	2 (20.0)	12 (18.0)	19 (41.30)
Impaired academic performance	3 (27.3)	7 (70.7)	15 (60.0)	25 (54.4)
Behavioral problems (n=45)	3 (27.3)	7 (70.7)	10 (41.7)	20 (44.4)
Girls (n=21)				
Conduct disorder	1 (33.3)	-	8 (61.5)	9 (42.9)
Anxiety/depression symptoms	2 (66.7)	-	5 (38.5)	7 (33.3)
Impaired academic performance	1 (33.3)	4 (80.0)	10 (76.9)	15 (71.4)
Behavioral problems (n=20)	0	4 (80.0)	1 (8.3)	5 (25.0)
Boys (n=25)				
Conduct disorder	6 (75.0)	1 (20.0)	10 (83.3)	17 (68.0)
Anxiety/depression symptoms	3 (37.5)	2 (40.0)	7 (58.3)	12 (48.0)
Impaired academic performance	2 (25.0)	3 (60.0)	5 (41.7)	10 (40.0)
Behavioral problems	3 (37.5)	3 (60.0)	9 (75.0)	15 (60.0)

Values are presented as number and percentage (%), ADHD - attention deficit hyperactivity disorder

and impaired academic performance and behavioral problems in those with ADHC-I (80% for each).

Discussion. Based on our comprehensive literature search, this is the first report on the prevalence of ADHD, ADHD subtypes, and comorbid psychiatric, academic, and behavioral problems among children attending government primary schools in Jeddah, a large metropolitan port city on the Red Sea. We found that the prevalence of ADHD was 5% overall, which is slightly lower than the worldwide prevalence of 5.3-7.2%, and nearly half the average rate previously reported in Saudi Arabia (9.2%). The prevalence found here is also less than half the 11.6% reported in the only other study to examine ADHD in Jeddah primary school students, which was conducted in 2010.¹² In that study, a different measure was used to assess ADHD, the 18-item ADHD scale developed by the study's senior author,²⁵ which was also administered to teachers. Thus, differences in methodology may help to explain the differences in rate reported here.

We also found a similar rate of ADHD in girls and boys, which is different from what has been reported in other reports from Saudi Arabia,¹³ from Arab countries more generally,¹⁰ and from studies worldwide,²⁶ where boy-girl ratio has varied from 2:1 to 9:1. While other Saudi studies including both girls and boys have consistently reported higher rates of ADHD in boys, the differences have not been that great (15% versus 12%;¹³ 5.9% versus 2.6%;¹¹ 7.4% versus 4.2%;¹²). Another possible explanation for the lack of gender differences in the present study can be found in the distribution of ADHD by grade level. Note that the largest gender difference was for grade 5 (average age 10.2 years), where the prevalence of ADHD in girls was 9.3% compared to 1.1% in boys, a difference that we cannot explain. However, if the students in grade 5 are dropped from the sample, the ADHD prevalence changes to 4% in girls and 4.5% in boys, closer to the difference found in other studies. The lack of gender difference could also not be explained by distribution of ADHD subtypes. Although ADHD-H was nearly twice as common in boys as girls (1.5% versus 0.8%), the inattentive and combined subtypes were about one-third higher in girls than boys (1.3% versus 0.9% and 3.3% versus 2.3%, respectively).

Finally, it is unlikely that our screening method for identifying ADHD played a role. We used the Vanderbilt ADHD Diagnostic Teacher Rating scale, which is one of the most widely used measures of ADHD in the world today.²¹ However, in another Saudi study that used the Vanderbilt scale, the investigator also found higher

rates of ADHD in boys.¹¹ That study was conducted approximately 10 years ago in 2007. One remote possibility is that with the increase in social media in Saudi Arabia over the past decade (particularly among young girls) may have resulted in an increase in ADHD incidence in girls, especially in a cosmopolitan port city like Jeddah. Research indicates that the increasing use of social media may place children at greater risk for psychiatric problems and suicide; young girls, because of their social nature, may be at particular high risk.^{27,28} Future research, however, is needed to confirm such speculations. Until then, a similar rate of ADHD in boys and girls in the present study remains unexplained.

One finding here that is consistent with other reports in the literature is that comorbid psychiatric, academic, and classroom behavioral problems were widespread in students with ADHD. The overall prevalence of such problems ranged from 41.3% for anxiety/depression to 56.5% for ODD/CD. This was particularly true for boys where ODD/CD was present in 68% and behavioral problems in 60%. In girls with ADHD, the most prevalent comorbid problem was impaired academic performance in 71.4%. While these rates did not exceed the 75% prevalence originally hypothesized, they were nevertheless widespread. As noted earlier, Aliqahtani reported even high rates of ODD/CD (73%), impairments in academic achievement (63%), and classroom behavioral problems (90%) among the 5% of his students who met DSM-IV-TR criteria for ADHD based on the Vanderbilt scale.¹¹

With regard to comorbid problems by ADHD subtype, not surprisingly it was the combined subtype that had the highest rates of comorbidity, particularly ODD/CD (72%) and impaired academic performance (60%). Among boys in the study, ODD/CD was most prevalent in those with hyperactive (75%) and combined types (83.3%). For girls, impaired academic performance and classroom behavioral problems were most common (both 80%) in the inattentive ADHD type, and for impaired academic performance, in the combined type (76.9%). Although Aliqahtani did not examine comorbidity by gender, a study of primary school students in Italy also found that academic performance problems were more prevalent among girls with ADHD.²⁹ This finding may be explained by the fact that girls tend to do better academically in grade school than do boys, perhaps raising teacher expectations for girls.³⁰

Given the effects that such comorbid problems may have on the education, quality of life, and future productivity of these young persons, and the demonstrated efficacy of treatments for ADHD

that include medication, parent training, and other behavioral interventions,³¹⁻³³ clinicians (particularly generalist physicians and pediatricians) need to be on high alert for children with ADHD symptoms and promptly initiate therapy or make referrals to someone who can.

Study limitations. The study has several limitations that may influence the interpretation and generalizability of the findings. First, the relatively small number of students diagnosed with ADHD may affect the stability of percentages provided here, particularly for subgroup analyses by gender. Second, no information from parents was obtained to corroborate the ratings provided by teachers. Third, no information was collected on the personal attributes of teachers who performed the student ratings, which may have helped explain some of the findings. Finally, the unique characteristics of Jeddah city may have influenced rates reported here, given this locale's increasingly diverse population and greater exposure of youth to the world compared to other parts of Saudi Arabia. Nevertheless, the study also has a number of strengths, including the random sampling method to identify public schools throughout Jeddah and to choose classes from which to select students; the high cooperation received from teachers (almost 100%), and the use of state-of-the-art methods of identifying ADHD, its subtypes, and comorbidity (Vanderbilt scale). Future research should include both teacher and parent interviews to confirm the presence of ADHD, and longitudinal studies are needed to determine whether psychiatric, academic, and behavioral problems follow or precede the diagnosis of ADHD.

In conclusions, this study adds to what is known about the prevalence of ADHD/subtypes and associated psychiatric, academic, and behavioral comorbidities in public primary school students in western Saudi Arabia. The overall prevalence of ADHD was 5%, with a similar prevalence in girls and boys. Serious comorbid psychiatric, academic, and behavioral were present in the majority of students with ADHD. Such problems are likely to interfere with these students' education, quality of life, and ability to be productive members of society as they grow older. After teachers, the most likely professional to encounter children with ADHD is the medical provider. This makes it incumbent upon clinicians to maintain a high index of suspicion for this condition when seeing primary school children in their practices and be prepared to manage it effectively.

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