

Prevalence and Correlates of Attention Deficit Hyperactivity Disorder among College Students in Jeddah, Saudi Arabia

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Abstract

Background: Childhood attention deficit hyperactivity disorder (ADHD) is commonly diagnosed in Saudi Arabia, but there is negligible evidence regarding adult ADHD in college students.

Objective: To determine the prevalence and correlates of ADHD among undergraduates at King Abdulaziz University, Jeddah, Saudi Arabia.

Methods: In this cross-sectional study, 2280 undergraduate students from 11 colleges at King Abdulaziz University, one of the largest university in Saudi Arabia, were approached in person with a questionnaire that elicited information regarding demographics, education, psychiatric history, health behaviors, and ADHD. A validated Arabic version of the Adult ADHD Self-Report Scale was used.

Results: A total of 2059 students (90%) completed the questionnaire (mean age: 21.2 years). Almost one-tenth (11.9%) of the sample met the criteria for adult ADHD; only 6.5% had been diagnosed with ADHD in childhood and <1% (0.8%) had taken medication for the same. Multivariate analyses revealed that high family income, low grade in the last semester, parental divorce, diagnosis of childhood ADHD, prior diagnosis of depression, greater severity of current depression and anxiety, and cigarette smoking increased the likelihood of adult ADHD.

Conclusion: A notable proportion of students in this study had suspected adult ADHD. Early evaluation of students with ADHD and identification of those at risk may potentially help in improving their academic performance and quality of life.

Keywords: Attention deficit hyperactivity disorder, mental disorders, risk assessment, Saudi Arabia, students, young adult

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Submitted: 14-Nov-2021 **Revised:** 16-Feb-2022 **Accepted:** 17-Mar-2022 **Published:** 28-Apr-2022

INTRODUCTION

Attention deficit hyperactivity disorder (ADHD) is a complex developmental disorder characterized by predominantly inattentive, disorganized, and/or hyperactive symptoms

that directly interfere with a person's functioning.^[1] The estimated global prevalence of childhood ADHD is about 7.2%.^[2] ADHD has a strong heritability component,^[3]

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How to cite this article: Alghamdi WA, Alzaben FN, Alhashmi HH, Shaaban SS, Fairaq KM, Alsuliamani AS, *et al.* Prevalence and correlates of attention deficit hyperactivity disorder among college students in Jeddah, Saudi Arabia. Saudi J Med Med Sci 2022;10:131-8.

Access this article online	
Quick Response Code:	Website: www.sjmms.net
	DOI: 10.4103/sjmms.sjmms_654_21

and may affect a child's life into adulthood, with adults experiencing similar symptomatology and disability.^[4] A large number of patients diagnosed with ADHD during childhood have persistent symptoms in adulthood that affect many areas of life.^[3] Adults with ADHD are at greater risk of developing social problems and exhibiting more delinquent and aggressive behavior. ADHD is also associated with depression, anxiety, substance use disorders, and poor academic performance.^[4-8] Other factors associated with ADHD symptoms is being male, having low family income, and divorced parents.^[9,10]

Several studies have recently investigated the prevalence of ADHD in college students, and found it to range from 3.5% in Chinese students to 27.2% in Japanese students.^[11,12] In Saudi Arabia, childhood ADHD is a commonly diagnosed disorder,^[13-15] but no longitudinal study has followed children with ADHD into adolescence or adulthood. In young adults, to the best of the authors knowledge, only one previous study from Saudi Arabia has reported the prevalence of ADHD in college students. This study found that the prevalence of ADHD was 10.9% among medical students in Riyadh and that history of ADHD in childhood and a medium-to-low grade-point average (GPA) were associated factors.^[16]

Determining the prevalence and correlates of adult ADHD among university students is important for developing strategies for early diagnosis and identification of students at-risk of ADHD, which in turn can help mitigate the associated challenges. Therefore, this study was conducted to determine the prevalence of adult ADHD among university-level college students at a leading public university of Saudi Arabia and identify the demographic, education-related, psychological, and behavioral risk factors for ADHD. It was hypothesized ADHD will be more common among male, younger students with lower family income, divorced parents, worse grades in college, a history of depression or anxiety, a childhood diagnosis of ADHD, and cigarette smoking.

METHODS

Study design, settings, and participants

This cross-sectional questionnaire study included students from King Abdulaziz University (KAU), Jeddah, Saudi Arabia, and was conducted between July 26, 2016, and May 1, 2018. This study was approved by the Institutional Review Board of King Abdulaziz University Hospital.

KAU is one of the largest teaching centers in Saudi Arabia, with 19 different colleges within the university. The

University has a student population of 30,000. The required sample size was calculated to be 2280 students based on the following: the prevalence of ADHD was assumed as 15%, a 2% margin of error with a confidence level of 99% was considered, and 15% were added to compensate for missing data and refusals to participate. The 15% assumed prevalence rate was reached by calculating the mean of the lowest (3.5%) and highest (27.2%) prevalence rates of adult ADHD found in the literature.^[11,12]

To have equal weight across colleges, gender, and year of education, 25 students were invited per strata, except for the Foundation Year, where 140 male and 140 female were invited (the Foundation Year is the first year of college following which students decide the college they intend to join). Study participants were recruited throughout the university campus using convenience sampling. The inclusion criteria were being an undergraduate student (Year 1 up to Year 6), currently enrolled at KAU, and attending the Foundation Year/college where both male and female students are enrolled (not all KAU colleges admit both genders).

Data collection

Five of the authors were tasked with approaching participants for the study. Eligible participants were approached in person, and purpose of the study was explained. Those interested were requested to read a paragraph at the beginning of the survey specifying that participation was voluntary, and that their response would be anonymized and maintained securely and confidentially. Completing and returning the four-page questionnaire was considered informed consent. Safeguards were placed to prevent participants from participating more than once, which included providing student identification number in the questionnaire, as well as carrying out data collection in a manner that focused on a single department at a time to limit re-exposures/duplication. All responses were anonymized before the data were extracted on datasheets, and the data were analyzed by an author not affiliated with KAU.

Study tool

ADHD was assessed using the self-rated Adult ADHD Self-Report Scale (ASRS) (version 1.1).^[17] The original ASRS is an 18-item scale, from which a World Health Organization (WHO)-approved 6-item screener was developed.^[17] This shortened screener has been shown to be useful in several studies,^[17-21] and has been translated by the WHO Composite International Diagnostic Interview Advisory Committee in several languages; the Arabic translation was used in this study. Responses

to each of the six questions were rated on a 5-point Likert (0 = never, 1 = rarely, 2 = sometimes, 3 = often, and 4 = very often). The maximum score was 24, and higher scores indicated more frequent and severe symptoms. The timeframe for symptoms was the past 12 months. Scores of ≥ 14 were considered as suspected adult ADHD.^[8,20] In addition to the ASRS, the distributed questionnaire elicited data regarding demographics, education-related characteristics, and psychological and behavioral variables.

Demographics

The following data were collected: age (years), nationality (Saudi/non-Saudi), sex, marital status (married/not married), number of siblings (1 = none, 2 = 1–3, 3 = 4–6, 4 = 7–10, 5 = >10 siblings), parental marital status (married/divorced), and family income (1 = <3,000 Saudi riyals [R], 2 = 3001–7000 R, 3 = 7001–15,000 R, 4 = >15,000 R; dichotomized for analysis as 1–3 vs. 4).

Education-related characteristics

The current educational year was categorized as 1 = first year (Foundation Year), 2 = second year, 3 = third year, and so forth, through 6 = sixth year (range 1–6). Of the 19 colleges at KAU, students from the following 11 eligible colleges were included: medicine, dentistry, applied medical sciences, pharmacy, economics and administration, computing and information technology, engineering, sciences, arts and humanities, law, and communication and media. For analysis, colleges were dichotomized into health sciences (medicine, dentistry, applied medical sciences, and pharmacy) versus others.

Regarding academic performance, participants were asked to provide their overall grade at the time of graduation from high school. Grading ranged from 0% to 100%, and was categorized as 1 = <70% (equivalent to C in the Western grading scale), 2 = 70%–80% (C to B), 3 = 80.1%–90% (B to A-), and 4 = more than 90% (A- or above). GPA during the last semester (for those beyond their Foundation Year) was categorized as 1 = GPA <2.5, 2 = 2.51–3.5, 3 = 3.51–4.0, 4 = 4.01–4.5, and 5 = >4.5. For those in their Foundation Year (categorized as 6) without the last semester grade, their overall grade in high school was substituted for the last semester grade. Participants were also asked about their parents' level of education. This variable, assessed for mother and father separately, was categorized as follows: 1 = no education, 2 = below secondary education, 3 = secondary education, 4 = bachelor's degree, and 5 = postgraduate degree.

Psychological and behavioral variables

Participants were asked if they had been previously diagnosed with ADHD during childhood, whether they had ever used ADHD medication, and whether their parents or siblings had been diagnosed with ADHD. In addition, they were asked if they had been previously diagnosed with depression or anxiety. Participants were also asked to rate the frequency of current depressive symptoms on a 0 to 10 scale (0 = never to 10 = constantly); the same was done for anxiety symptoms.

Statistical analysis

Descriptive statistics were presented as frequencies for categorical variables. For continuous variables and those with ≥ 5 ordered response options,^[22,23] parametric statistics were calculated and presented as means and standard deviations (SDs). In bivariate analyses, the Chi-square statistic was used to compare characteristics with dichotomized response options between participants with or without suspected ADHD. Student's *t*-test was used to compare means for characteristics measured as continuous variables between those with or without suspected ADHD.

In multivariate analyses, stepwise logistic regression was used to examine the correlates of suspected adult ADHD. Characteristics significant at the $P < 0.10$ level in bivariate analyses were entered into models, first examining demographic characteristics (Model 1), then education-related variables (Model 2), and then psychological/behavioral variables (Model 3). Characteristics significant at $P \leq 0.05$ were carried forward from one model to the next. The final model (Model 4) was arrived at after removing all variables in Model 3 not significant at $P \leq 0.05$ to arrive at the most parsimonious model. Note that a family history of ADHD was unknown in 347 participants, so this was not included in Model 3 or 4 to avoid loss of power. However, when added to Models 3 and 4, family history of ADHD was not a significant correlate.

RESULTS

A total of 2280 students were approached, of which 2059 (90%) completed the questionnaire. The mean age of the participants was 21.2 years (SD = 1.8); 55.5% were men, 95.1% were of Saudi nationality, 94.7% were not married, and 86.1% were in a college (i.e., beyond the Foundation Year). Regarding academic achievement, at the time of graduation from high school, 93.9% of the students had an overall GPA of >80% (high C or B). Nearly two-thirds (64.6%) reported a >4.0 (of 5.0) GPA score in the last semester of college. Regarding parents'

education level, 59% and 50.1% of the respondents' father and mother, respectively, had a bachelor's degree or higher.

Attention deficit hyperactivity disorder

With regards to previous diagnosis, 6.5% of the total respondents had been diagnosed with ADHD at childhood. Further, 0.8% had taken medication for ADHD and 6.3% had a family member diagnosed with ADHD. Based on the ASRS cutoff score, 11.9% of the participants were found to have a suspected diagnosis of adult ADHD.

Bivariate analyses

All variables between participants with or without suspected ADHD were compared [Table 1]. Among the sociodemographic characteristics, those who were older, having divorced parents, or reporting a higher family income were more likely to have ADHD. Among the educational characteristics, students who were in Year 2 and above (older age), in a college of health sciences, and had a low GPA in their last semester were more likely to report ADHD symptoms above the ASRS threshold.

Not surprisingly, among the psychological characteristics, those previously diagnosed with ADHD were more symptomatic and had a family history of ADHD. Interestingly, those with suspected adult ADHD reported more depressive and anxiety symptoms and were more

likely to have a previous diagnosis of depression but not of anxiety. Finally, those with suspected adult ADHD were more likely to smoke cigarettes than those without ADHD (22.1% vs. 13.4%, respectively).

Multivariate analyses

The stepwise logistic regression results indicated that older age, higher family income, and divorced parents remained significant in Model 1. However, once education-related factors were controlled (especially low GPA in the past semester) (Model 2), age was no longer a significant factor [Table 2]. Family income and parental divorce remained significant positive predictors of ADHD even after controlling for psychological and behavioral characteristics (Model 3). Among education-related characteristics, only having a low GPA in the last semester of the college remained a significant correlate of ADHD after controlling for family income and parental divorce (Model 2). Low GPA remained significant even after psychological and behavioral characteristics were controlled for in Models 3 and 4 [odds ratio = 1.65 (95% CI: 1.23–2.22) and 1.72 (1.29–2.30), respectively]. Among psychological characteristics, having a history of depression, reporting current depression, and especially indicating current anxiety symptoms were strong correlates of adult ADHD symptoms, even

Table 1: Characteristics of college students with suspected adult attention deficit hyperactivity disorder (bivariate analyses)

Characteristics	n (%) or mean (SD)		χ^2/T
	ADHD (n=245)	No ADHD (n=1814)	
Sociodemographic			
Age (years)	21.4 (1.8)	21.2 (1.8)	2.1*
Sex (females)	106 (43.3)	810 (44.7)	0.2
Nationality (Saudi)	234 (95.5)	1724 (95.0)	0.1
Marital status (married)	12 (4.9)	97 (5.3)	0.1
Parents divorced (yes)	31 (12.7)	115 (6.3)	12.***
Number of siblings (1-5)	2.9 (0.8)	2.9 (0.8)	0.3
Family income (>15,000 SR/month)	120 (48.9)	736 (40.5)	6.7**
Education-related			
Mean education level (1-6 years)	3.4 (1.4)	3.1 (1.4)	3.5***
Foundational year (yes)	25 (10.2)	261 (14.4)	3.2 [†]
College (health sciences)	117 (47.7)	701 (38.6)	5.0*
High school GPA (>80)	227 (92.6)	1699 (93.6)	0.4
Mean last semester GPA (1-5)	3.7 (1.1)	3.9 (1.1)	2.7**
Low GPA (% ≤4.0 out of 5)	108 (44.1)	625 (34.4)	8.7**
Father's education (1-5)	3.6 (1.0)	3.6 (1.0)	1.2
Mother's education (1-5)	3.3 (1.0)	3.3 (1.1)	0.5
Psychological and behavioral			
Current ADHD symptoms (0-24)	15.9 (2.2)	8.0 (3.2)	50.0****
ADHD during childhood (yes)	16 (6.5)	47 (2.6)	11.4****
Taken ADHD medication (yes)	5 (2.0)	12 (0.6)	5.0*
Family member with ADHD (yes)	20 (8.1)	87 (4.8)	6.8**
History of depression (yes)	34 (13.8)	92 (5.1)	29.1****
History of anxiety (yes)	20 (8.1)	108 (5.9)	1.9
Current depression level (0-10)	5.5 (3.0)	3.9 (2.9)	8.1****
Current anxiety level (0-10)	5.1 (3.3)	3.3 (3.0)	8.4****
Smoking (percentage yes)	54 (22)	242 (13.3)	13.4***

* $P \leq 0.05$, ** $P \leq 0.01$, *** $P \leq 0.001$, **** $P \leq 0.0001$. ADHD – Attention deficit and hyperactivity disorder; GPA – Grade-point average; SD – Standard deviation; T – Student's *t*-test; χ^2 – Chi-square test. [†]0.05 < P < 0.10

Table 2: Characteristics of college students with suspected adult attention deficit hyperactivity (stepwise logistic regression)

Characteristics	OR (95% CI)			
	Model 1	Model 2	Model 3	Model 4
Sociodemographic				
Age	1.09 (1.01–1.16)*	1.00 (0.89–1.10)	-	-
Family income	1.44 (1.10–1.89)**	1.42 (1.05–1.91)*	1.48 (1.11–1.96)**	1.48 (1.11–1.96)**
Parents divorced	2.16 (1.41–3.30)***	2.34 (1.49–3.66)***	1.89 (1.21–2.95)**	1.99 (1.28–3.09)**
Education-related				
Education level	-	1.13 (0.97–1.32)	-	-
Health sciences	-	1.33 (0.98–1.80) [†]	-	-
Low GPA	-	1.79 (1.33–2.42)****	1.65 (1.23–2.22)***	1.72 (1.29–2.30)***
Psychological and behavioral				
ADHD during childhood	-	-	1.94 (0.99–3.81)*	2.08 (1.11–3.90)*
Taken ADHD medication	-	-	1.60 (0.46–5.59)	-
History of depression	-	-	1.76 (1.11–2.79)*	1.84 (1.17–2.90)**
Current depression	-	-	1.10 (1.03–1.17)**	1.10 (1.03–1.17)**
Current anxiety	-	-	1.11 (1.04–1.18)***	1.11 (1.05–1.18)***
Smoking	-	-	1.41 (0.99–2.02) [†]	-
Likelihood ratio χ^2 (df)	22.9 (3)****	41.0 (6)****	121.2 (9)****	116.6 (7)****
Sample size (n)	2019	1741	2011	2014

* $P \leq 0.05$, ** $P \leq 0.01$, *** $P \leq 0.001$, **** $P \leq 0.0001$. ADHD – Attention deficit and hyperactivity disorder; CI – Confidence interval; GPA – Grade-point average; OR – Odds ratio; χ^2 – Chi-square. [†] $0.05 < P < 0.10$

stronger than having taken medication for ADHD in the past (Model 3) or having a history of childhood ADHD (Models 3 and 4).

DISCUSSION

This study examined the prevalence and correlates of suspected adult ADHD among university students at KAU, Saudi Arabia, and included both gender students aged in their early 20s. Approximately one-tenth (11.9%) of the respondents scored above the cutoff on our ADHD screening measure.^[20] Characteristics more common in students with suspected adult ADHD were having higher family income, lower academic performance (as reflected by their past semester grades), a history of ADHD as a child, and especially, a history of depression and current symptoms of depression and anxiety. Those with suspected adult ADHD were also more likely to smoke.

The prevalence of adult ADHD in our sample was higher than that in college students from China (3.5%),^[11] and Korea (7.6%),^[7] but lower than that reported in India (15.9%),^[24] Kenya (21.8%),^[25] and Japan (27.2%).^[12] Within Saudi Arabia, our results were similar to those of a recent study that reported a 10.9% prevalence of ADHD among medical students in Riyadh.^[16] The higher prevalence of suspected adult ADHD in our cohort could be because of several factors such as this study used a self-completed questionnaire, so the findings may be less reliable than those obtained from structured psychiatric interviews administered by trained interviewers. In addition, the use of multiple diagnostic instruments and criteria could explain the high prevalence of adult ADHD in our sample.

The ratio of childhood ADHD has been shown to be skewed toward males compared with females in a ratio of 2:1.^[9] In adults, both Adler *et al.*^[26] and Ebejer *et al.*^[27] reported that males have a higher prevalence of ADHD than females. However, no gender-wise significant difference was noted in the current study, which is similar to the findings of Das *et al.*^[28] and Kwak *et al.*^[7]

ADHD is known to have a strong genetic basis.^[3] While the bivariate analysis in the current study did find that participants with ADHD were more likely to have a family history of the same, this association was not replicated in the multivariate analyses. This could also likely be because about 15% of the respondents were unaware of a family history of ADHD. In terms of socio-economic factors, Estévez *et al.* (2014)^[8] and Shen *et al.* (2018)^[11] indicated that a low level of maternal education predicted an increased prevalence of adult ADHD in offspring. Interestingly, in the current study, while parental education was not found to be a significant predictor of ADHD, higher family income was. This is in contrast to the findings of several studies showing that low family income increased the risk of ADHD.^[10,29] It was beyond the scope of the current study to determine the reason for this difference in findings, but social/societal/cultural factors may have played a role, and further studies are required to determine the exact factors.

No association was found between high school grades and ADHD symptoms in college, in contrast to the results reported by Ebejer *et al.*,^[27] who found that adults with low grades in high school reported more ADHD symptoms as adults. Likewise, Kwak *et al.*^[7] found a positive correlation between ADHD and students with below-average grades

in high school. The present study did, however, find a very strong association between suspected adult ADHD and low GPA scores in the last semester of college, even when controlled for demographic, education-related, and psychological and behavioral factors. This is indicative of ADHD having a detrimental effect on education.

The positive association between students' ADHD symptoms and having divorced parents was significant in our study, which concurs with the findings of Kessler *et al.*^[30] Similarly, Shen *et al.*^[11] have shown a positive association between a poor relationship with parents and having ADHD. Regarding substance use, bivariate analyses revealed a strong correlation between smoking status and adult ADHD symptoms: smoking was nearly two-thirds more frequent in those with threshold ADHD symptoms. However, this association weakened significantly after controlling for psychological/behavioral variables. Here, it should be considered that in general, the prevalence of smoking in Saudi Arabia is high.^[31] In the literature, while ADHD and smoking/nicotine dependence have commonly been shown to have an association,^[11,32] contrasting findings have also been found.^[7]

Among the 245 students with suspected adult ADHD in this study, only 16 (6.5%) had been diagnosed with the disorder in childhood. This signifies that either low diagnosis of childhood ADHD or that ADHD were developed at a later age, considering that older age was a factor in the bivariate analysis. A longitudinal study that follows the profiles of students from schools to college would provide a deeper understanding regarding these factors. Similar to our study, a study from Riyadh showed a positive association between history of ADHD and currently experiencing ADHD symptoms.^[16]

ADHD is also known to be associated with multiple comorbidities,^[33] such as depression and anxiety, as was also found in this study. A history of depression or current symptoms of depression/anxiety were strongly related to threshold ADHD symptoms in the present study. These findings are similar to those of Shen *et al.* (2018),^[11] who reported that adult ADHD in college students was strongly correlated with depression. Kwak *et al.* (2015)^[7] also reported a strong association between depression and ADHD.

Limitations

This study has several limitations. First, the measure used to diagnose suspected adult ADHD was not a structured psychiatric interview, but rather a screening tool designed to identify those at an increased risk

for the disorder; no clinical assessment was done to confirm the diagnosis. However, the ASRS has been shown to be a valid and reliable screening tool for adult ADHD that allows the estimation of the prevalence of ADHD in adults.^[17,20] Second, the present study was conducted among college students at of a single university and not all colleges were included, thereby limiting its generalizability across all colleges at of this university as well as to other universities in Saudi Arabia, especially considering that KAU is a top ranked university of Saudi Arabia that likely admits students with higher GPAs. Third, data regarding alcohol and drug use, which are common among those with adult ADHD, were not collected, as these substances are stringently prohibited in the country. Fourth, this was a cross-sectional study that does not allow for causal inferences from the associations, and thus conducting a longitudinal study or randomized controlled trial in the future would help establish causality. Finally, medication and medical history were not taken, except for a history of depression, anxiety, and childhood ADHD, and even these were only self-reported and not identified using a standard diagnostic method. For example, use of single variables assessing current anxiety and current depression each on a 0–10 scale was a study weakness; future research should use multi-item measures of these constructs. Thus, ADHD symptoms in some cases might have been explained by other psychiatric illnesses, medical conditions, or medication-related side effects.

CONCLUSION

A notable proportion of students in our study were found to have suspected adult ADHD based on the shortened ASRS. Factors found to increase the risk of the suspected ADHD included older age, high family income, divorced parents, lower academic performance, history of ADHD during childhood, history of depression, and current symptoms of either depression or anxiety. Students who smoke may also be at greater risk. Notably, childhood diagnosis of ADHD appears to be low, as only 6.5% of those with suspected ADHD had been diagnosed previously. This study highlights the need to identify students with, and at risk of, ADHD at earlier stages to enable appropriate treatment that can potentially help them improve academic performance, quality of life, and relationships with other students.

Ethical considerations

This study was approved by the Institutional Review Board of King Abdulaziz University Hospital (approval number: 290-16), Jeddah, Saudi Arabia, in July 2016. The study

followed the principles outlined by the Declaration of Helsinki, 2013. Completion of the survey was considered informed consent.

Data availability statement

The datasets generated during and/or analyzed during the current study are not publicly available, but are available from the corresponding author on reasonable request.

Peer review

This article was peer-reviewed by two independent and anonymous reviewers.

Acknowledgement

The authors would like to acknowledge Dr. Sara F. Alnajjar, Department of Medicine, King Abdulaziz University, Jeddah, Kingdom of Saudi Arabia, for her assistance with the data collection process.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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