

|   |
|---|
| Access this article online  |
| Quick Response Code:  |
|  |
| Website:<br>www.jehp.net  |
| DOI:<br>10.4103/jehp.jehp_46_21   |

# The prevalence of attention-deficit hyperactivity disorder and its related risk factors among children at elementary school in Shahroud

Azam Hamidzadeh, Mehrnaz Kharatha, Milad Bazghaleh, Hassan Basirinejad<sup>1</sup>, Nasrin Fadae Aghdam, Hossein Ebrahimi<sup>2</sup>

## Abstract:

**BACKGROUND:** Attention-deficit hyperactivity disorder (ADHD) is one of the most common reasons for visiting psychiatrists and psychologists. This study aimed to investigate the prevalence of ADHD and its related risk factors among children at elementary schools.

**MATERIALS AND METHODS:** This cross-sectional study focused on teachers and parents of 779 elementary students who were selected through stratified cluster random sampling; Conners Parent and Teacher Questionnaires were used to collecting data. The data were analyzed by the use of descriptive statistics (frequency and percentage), independent samples *t*-test, Chi-square, one-way ANOVA, and linear regression. The significant level was set at 0.05.

**Results:** According to teachers' responses, the prevalence of ADHD among students in elementary schools was 4.4%, whereas parents reported a prevalence of 0.5%. There was a significant relationship between childhood ADHD and marital status of parents, fathers' smoking habits, previous experience of living in rural areas, children's previous history of having diseases and using the medicine, previous history of ADHD, and psychological problems in the family.

**Conclusions:** According to the study, teachers and parents suffer from a lack of knowledge about ADHD. Thus, the educational workshops and programs should be held for teachers, parents, and counselors to inform them about the procedures for timely diagnosis and treatment of ADHD.

## Keywords:

Attention-deficit hyperactivity disorder, elementary school, prevalence, risk factors

## Introduction

Attention-deficit hyperactivity disorder (ADHD) is one of the most common reasons for visiting psychiatrists and psychologists.<sup>[1-3]</sup> It is a mental disorder of neurodevelopment type and is characterized by delay or disorder in acquiring motor, behavioral, social, and cognitive skills. ADHD is common among children and often continues into adulthood.<sup>[4,5]</sup> ADHD is divided into three different types: predominantly

inattentive type, predominantly hyperactive-impulsive type, and combination type. ADHD predominantly inattentive presentation with signs such as difficulty in sustaining attention and easily distracted and hyperactive-impulsive that explained by the difficulty in remaining seated and engaging in activities quietly. Diagnosis of this disorder is limited to the history and psychiatric examination have been met for the past 6 months, and the symptoms still result in impairment in social, academic, or occupational functioning.<sup>[6]</sup>

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow\_reprints@wolterskluwer.com

**How to cite this article:** Hamidzadeh A, Kharatha M, Bazghaleh M, Basirinejad H, Aghdam NF, Ebrahimi H. The prevalence of attention-deficit hyperactivity disorder and its related risk factors among children at elementary school in Shahroud. *J Edu Health Promot* 2021;10:341.

Department of Nursing,  
School of Nursing and  
Midwifery, Shahroud  
University of Medical  
Sciences, Shahroud,  
Iran, <sup>1</sup>Department of  
Epidemiology, School  
of Epidemiology and  
Biostatistics, Tehran  
University of Medical  
Sciences, Tehran, Iran,  
<sup>2</sup>Center for Health Related  
Social and Behavioral  
Sciences Research,  
Shahroud University  
of Medical Sciences,  
Shahroud, Iran

## Address for correspondence:

Dr. Hossein Ebrahimi,  
Center for Health Related  
Social and Behavioral  
Sciences Research,  
Shahroud University  
of Medical Sciences,  
Shahroud, Iran.  
E-mail: ebrahimi@shmu.  
ac.ir

Received: 20-01-2021  
Accepted: 17-03-2021  
Published: 30-09-2021

Five percent of children across the world suffer from ADHD.<sup>[7]</sup> A comprehensive review of studies related to ADHD indicates that a prevalence of 5.29% has been reported for this disorder in Northern America (6.1%), Southern America (12.3%), Africa (8.9%), Asia (4.2%), Australia (4.8%), and the Middle East (2.5%).<sup>[8]</sup> According to the results of studies conducted in different cities of Iran, the prevalence of ADHD has been reported between 3.2% and 23.6%.<sup>[9-17]</sup>

Children who suffer from ADHD are physically hyperactive, play games for shorter periods of time, have problems in terms of social skills, and show conflicting behaviors. Such children are easily distracted, have school-related problems, have little motivation for improvement, are rejected by their friends, and suffer from low self-confidence. These symptoms may change in the course of time.<sup>[18]</sup> ADHD occurs with many other mental disorders.<sup>[19]</sup> Research has clearly demonstrated that attention deficit in childhood is associated with low academic achievement, job-related disruptions, higher crime rates, drug abuse, interpersonal problems, and mental disorders (e.g., stress and mood disorder) in adolescence.<sup>[20]</sup> Young people with attention deficit may suffer from more severe mental and cognitive disorders compared to their healthy counterparts.<sup>[4]</sup> Around 30%–70% of children with ADHD experience the same problems in adolescence.<sup>[20]</sup> In children and young adults who suffer from ADHD, there is an association between socioeconomic problems and risk of ADHD.<sup>[21]</sup> Previous studies show that ADHD is associated with several risks and related factors. Some related factors including marital divorce,<sup>[22]</sup> living with single parents,<sup>[23]</sup> fathers' education,<sup>[24]</sup> family history, order of birth,<sup>[25]</sup> rural residency,<sup>[26]</sup> parental smoking,<sup>[21,27]</sup> childhood medical history, and some risk factors such as birth weight, maternal tobacco use,<sup>[28]</sup> and history of psychological problems in the family.<sup>[24,25,29]</sup>

Recent studies support the idea that ADHD is a family-based disorder. Two separate double-blind trials, which were conducted based on DSM-R–III and DSM–III definitions of ADHD, highlighted that this disorder is family-based. Nonetheless, many family-based disorders are rooted in environmental (not genetic) factors. More specifically, the results of different studies indicate that ADHD may be a genetic disorder; however, it should be noted that ADHD children are raised in disorganized families which have a history of psychological disorders. Such families provide an environment which is conducive to various types of disease.<sup>[30]</sup> Despite the fact that, over the past 25 years, various research projects have been carried out on family-related factors the cause ADHD, there is still little empirical evidence to make firm judgments on the role of family-based variables. Many questions in this regard have remained unanswered.<sup>[31]</sup> Malek *et al.* investigated the relationship

between children's diseases and parents' diseases, on the one hand, and ADHD, on the other hand. They reported that mothers' diseases significantly predict ADHD in children. They failed to establish any measurable connection between children's diseases and ADHD.<sup>[32]</sup>

Parents' divorce has negative impact on children's behaviors.<sup>[33]</sup> In addition, the prevalence of ADHD in children, who live with one parent, is more than those living with both parents.<sup>[23]</sup> Moreover, the result of scurvies showed that ADHD was significantly associated with marital status (never married and divorced) and rural residency. The probable cause for this issue is that rural families do not access the psychiatric services.<sup>[34]</sup>

Russell *et al.* reported that there is an association between fathers' educational level and child's risk for ADHD. Exposure to tobacco smoke may have numerous negative impacts on children's health. Research-based evidence shows that both genetic factors and environmental issues (e.g., exposure to tobacco smoke) influence cognitive-behavioral problems and developmental disorders of childhood.<sup>[35]</sup> There is a significant relationship between exposure to cigarette smoke in the prenatal period and neurobehavioral disorders in children.<sup>[36]</sup>

Despite the extensive studies carried out about ADHD and effective treatment plans that have been developed for this purpose, many people, especially parents and teachers who deal with these children, do not have a proper understanding of the characteristics of this disorder, resulting in misconceptions, and such behaviors are often attributed to other factors. Studies showed that higher levels of ADHD misconceptions were associated with lower acceptance of medication and higher acceptance of dietary interventions and this has a great impact on the quality of life and health promotion of children with ADHD. The prevalence of ADHD in Iran is very different in various studies that have been done (3.2%–23.6%), and the reasons of this difference refers to different tools used for diagnosis of ADHD, the discrepancy between parents' and teachers' views, and lack of any representative community sample being seen in Iranian studies.<sup>[9-17]</sup> Therefore, based on the above-mentioned reasons, this study was conducted with two aims: 1) to determine prevalence of hyperactivity from the perspective of teachers and parents 2) to determine the relation between prevalence of ADHD and risk factors such as demographics and familial factors.

## Materials and Methods

### Study design and setting

This cross-sectional study focused on teachers and parents of elementary students of Shahroud during the educational year of 2015–2016.

### Study participants and sampling

A total sample of 779 students of elementary school was selected through stratified cluster random sampling. More specifically, the city was first divided into six regions or clusters. Then, two schools (a public school and a private one) were randomly selected from each cluster. Depending on the population of each selected school, a number of students from grades 1 through 5 were randomly selected. The 779 questionnaires for parents (father or mother) and 779 questionnaires for teachers were filled.

### Data collection tool and technique

#### *Demographic questionnaire*

A demographic questionnaire was used to collect data about students' age, school types, gender, birth order, season of birth, socioeconomic status, parents' kinship, family member, live with parents, marital divorce, family history of ADHD, family history of mental illness, parents' job, parents' education, past location, duration of pregnancy, birth weight, delivery method, feeding in infancy, medical history of children, history of medicine use in children, history of smoking in parents, and history of opium use in father; this questionnaire has been completed by their parents.

#### *Conners parents questionnaire*

Conners Parents Questionnaire (which has 48 items and is the most widely used instrument to measure ADHD) was used to gain a perspective on children's behavior with regard to attention deficit, hyperactivity, and impulsivity. This instrument assesses five dimensions including conduct criteria, learning disorders, psychomotor, passive aggressive disorder, and hyperactive-impulsive. Respondents were requested to answer each item on a 4-point Likert scale (not at all = 0, just a little = 1, pretty much = 2, and very much = 3). A mean score of 1.5 was considered as the cutoff point, meaning that scores >1.5 indicated that the corresponding child suffered from ADHD (Conners, Sitarenios, Parker, and Epstein, 1998).

#### *Connors Teachers Questionnaire*

Connors Teachers Questionnaire (with 38 items) was also filled by the teachers. This instrument measures three areas of classroom behavior (21 items), group work (8 items), and attitude toward authorities (9 items). Each item should be answered based on a 4-point Likert scale (never = 0, occasionally = 1, often = 2, and very often = 3). The overall score in each area was calculated through summing up the respondents' answers to its corresponding items. In addition, the total score of the questionnaire was calculated through adding up the scores of the three areas. In both questionnaires (teachers and parents), the total scores were divided by the number of questions, so the average obtained will be between 0 and 3. An average score of 1.5 or more indicated that the

target student suffered from ADHD (Conners, Sitarenios, Parker, and Epstein, 1998).

#### *Validity and reliability*

Validity and reliability of the questionnaires were carried out using psychometric assessment tools and confirmed by Shahim.<sup>[37]</sup> It should be noted that according to the aforementioned study, the correlation coefficients ranged from 0.29 to 0.86, while the reliability was 0.76. Further, the concurrent criterion validity<sup>®</sup> was 0.84.<sup>[38]</sup> In this study, the total Cronbach's alpha for "Parents' Questionnaire" was 0.925 and for dimensions (conduct criteria = 0.823, learning disorders = 0.728, psychomotor = 0.711, passive aggressive disorder = 0.623, and hyperactive-impulsive = 0.735) was calculated. Further, the total Cronbach's alpha for "Teachers' Questionnaire" was 0.939 and for dimensions (classroom behavior = 0.920, team work = 0.893, and attitude toward authorities = 0.628) was calculated. Moreover, in this study, the Kaiser-Meyer-Olkin coefficient was 0.910 in the Parents' Questionnaire and 0.943 in the Teachers' Questionnaire.

### Data collection

The researcher proceeded to various elementary schools in Shahroud, after the research proposal was approved by the research council and ethical committee of the university. First, he/she provided some information about the purpose of the study and the procedure for completing the questionnaire. After obtaining informed consent from the participants, the demographic questionnaire and Conners Parents Questionnaire were given to students' parents. Connors' Teachers Questionnaire, on the other hand, was submitted to children's teachers. Both parents and teachers were assured that the information they provided would remain strictly confidential and would be used only for research purposes. The participants could also withdraw from the study at any stage they liked. In addition, the questionnaires that were not appropriately completed by parents and/or teachers were excluded from further analysis.

### Ethical consideration

This study was approved by the ethics committee of Shahroud University of Medical Sciences (ethics code: IR.SH.REC.1394.105).

### Data analyses

All statistical analyses were performed using SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp. using descriptive statistics, independent samples *t*-test, one-way ANOVA, and linear regression. In the univariate analysis, we analyze the relationship between 27 primary predictors with ADHD score as dependent variable separately. In this section, we selected the six

predictor variables with  $P < 0.20$  for entering a multiple regression analysis. In single-variable analysis, the simultaneous effect (interaction and confounding) of the variables may not be observed. In the single-variable analysis, the simultaneous effect (interaction and confounding) of the variables may not be observed. In multivariate analysis, the variables in the single-variable analysis with a  $P < 0.20$  are included to obtain more certainty in the model (Plichta and Elizabeth, 2012).

## Results

### Participant characteristics

A total number of 779 questionnaires were properly filled by parents and teachers in 17 elementary schools (9 girls' schools and 8 boys' schools).

### Attention-deficit hyperactivity disorder's mean scores

Based on the data obtained through parents' questionnaires, the mean score for hyperactivity was mean ( $M$ ) = 0.37, standard deviation ( $SD$ ) = 0.29, and through teachers' questionnaires, the mean score of hyperactivity was  $M = 0.53$ ,  $SD = 0.45$ . Conners Teacher Questionnaire measured three components of classroom behavior, group work, and attitude toward authorities. The mean scores of these three components, respectively, were  $M = 0.48$ ,  $SD = 0.50$ ;  $M = 0.42$ ,  $SD = 0.52$ ; and  $M = 0.72$ ,  $SD = 0.42$ . The prevalence of ADHD in teachers' questionnaire was 34 (4.4%), while the same value in parents' questionnaire was 4 (0.5%). Table 1 displays demographic features of the participating children. It is observed that, based on the scores obtained from Conners Questionnaire, there are significant differences among children in the light of season of birth, socioeconomic status, living with parents, marital discords in the family, history of hyperactivity and mental disorders in the family, fathers' educational level, previous residential area (urban vs. rural areas), children's medical history, children's medicine use history, and fathers' smoking status. It should be noted that there was a significant difference between hyperactivity scores and the scores of other variables [Table 2]. Table 3 demonstrates the statistical modeling of studied children's ADHD scores. Linear regression analysis revealed that factors such as marital divorce, previous cases of ADHD in the family (4.77), prior experience of living in rural areas (4.56), children's medical history (3.23), and fathers' smoking status (4.21) significantly were associated with ADHD scores.

As regression coefficients show, marital divorce has the strongest relationship with ADHD. More precisely, a coefficient of 9.1, assuming this is the unstandardized coefficient, suggests that the children of families with marital divorce score an average of 9.1 points higher

**Table 1: Distribution of the demographic characteristics of children based on the mean scores of the Conners Teacher Questionnaire**

| Variables              | n (%)      | Mean±SD   | P      |
|------------------------|------------|-----------|--------|
| SES                    |            |           |        |
| Good                   | 274 (35.2) | 17.4±11.4 | 0.010  |
| Average                | 431 (55.3) | 19.5±12.4 |        |
| Week                   | 52 (6.7)   | 22.2±14.8 |        |
| Live with parents      |            |           |        |
| Live with both of them | 741 (95)   | 18.7±12.1 | 0.030  |
| Live with one of them  | 36 (5)     | 23.2±15.4 |        |
| Marital divorce        |            |           |        |
| No                     | 727 (93.3) | 18.4±11.9 | <0.001 |
| Yes                    | 36 (4.6)   | 29.6±15.7 |        |
| FH of ADHD             |            |           |        |
| No                     | 705 (90.5) | 18.5±12.1 | 0.003  |
| Yes                    | 38 (4.9)   | 24.7±14.1 |        |
| FH of mental illness   |            |           |        |
| No                     | 748 (96)   | 18.6±12.1 | 0.010  |
| Yes                    | 15 (4)     | 26.8±15.5 |        |
| Father's education     |            |           |        |
| Up to primary          | 70 (10)    | 18.1±11.7 | 0.030  |
| High school            | 437 (56)   | 19.9±12.7 |        |
| University             | 266 (34)   | 17.4±11.5 |        |
| Past accommodation     |            |           |        |
| City                   | 707 (90.8) | 18.5±12.1 | 0.003  |
| Village                | 70 (9.2)   | 23.0±13.1 |        |
| MH of children         |            |           |        |
| No                     | 685 (89.2) | 18.4±12.0 | 0.008  |
| Yes                    | 84 (10.8)  | 22.7±14.1 |        |
| HMU in children        |            |           |        |
| No                     | 726 (94)   | 18.5±11.9 | 0.023  |
| Yes                    | 49 (6)     | 23.8±15.3 |        |
| HS in father           |            |           |        |
| No                     | 704 (90.6) | 18.5±12.3 | 0.001  |
| Yes                    | 73 (9.4)   | 23.4±11.6 |        |

SES=Socioeconomic status, ADHD=Attention-deficit hyperactivity disorder, FH=Family history, MH=Medical history, HS=History of smoking, SD=Standard deviation, HMU=History of medication use, HFA=History of food allergy,

than children of families without discord ( $P < 0.001$ ). The coefficient of determination of the model is 17.8% that means that approximately 18% of the variance of ADHD in viewpoint of teachers was explaining by the variables within the model.

## Discussion

The results indicate that, according to teachers' responses, the prevalence of ADHD among students of elementary schools in Shahroud was 34 (4.4%), whereas parents reported a prevalence of 4 (0.5%). Thus, teachers reported a higher prevalence for ADHD. In a systematic review, the prevalence of ADHD was investigated in Iran. In particular, they concentrated on methodological issues such as sample size, data source (e.g., parents, teachers, or children), response rate, and follow-up diagnostic interview schedules (DSMs) or lack thereof. They



**Table 2: Compare of distribution demographic characteristics of children based on the mean scores of the Conners Teacher and Parents Questionnaire**

| Variables              | ADHD according to parents' view (n) | P     | ADHD according to teachers' view (n) | P       |
|------------------------|-------------------------------------|-------|--------------------------------------|---------|
| School types           |                                     |       |                                      |         |
| Private                | 4                                   | 0.577 | 31                                   | 0.381*  |
| Public                 | 0                                   |       | 8                                    |         |
| Gender                 |                                     |       |                                      |         |
| Female                 | 2                                   | 1.00  | 23                                   | 0.500*  |
| Male                   | 2                                   |       | 16                                   |         |
| Birth order            |                                     |       |                                      |         |
| First                  | 2                                   | 0.673 | 19                                   | 0.232** |
| Second                 | 1                                   |       | 7                                    |         |
| Third                  | 1                                   |       | 6                                    |         |
| >4                     | 0                                   |       | 3                                    |         |
| Season of birth        |                                     |       |                                      |         |
| Spring                 | 1                                   | 0.698 | 10                                   | 0.027** |
| Summer                 | 1                                   |       | 6                                    |         |
| Autumn                 | 2                                   |       | 5                                    |         |
| Winter                 | 0                                   |       | 17                                   |         |
| SES                    |                                     |       |                                      |         |
| Good                   | 1                                   | 0.433 | 15                                   | 0.902** |
| Average                | 2                                   |       | 21                                   |         |
| Week                   | 1                                   |       | 2                                    |         |
| Parents kinship        |                                     |       |                                      |         |
| No                     | 2                                   | 1.00  | 31                                   | 0.940** |
| Yes                    | 2                                   |       | 8                                    |         |
| Family members         |                                     |       |                                      |         |
| Up to 4                | 3                                   | 1.00  | 28                                   | 0.447*  |
| >4                     | 1                                   |       | 10                                   |         |
| Live with parents      |                                     |       |                                      |         |
| Live with both of them | 2                                   | 0.323 | 28                                   | 0.559*  |
| Live with one of them  | 2                                   |       | 9                                    |         |
| Marital divorce        |                                     |       |                                      |         |
| No                     | 2                                   | 1.00  | 34                                   | 0.116** |
| Yes                    | 2                                   |       | 5                                    |         |
| FH of ADHD             |                                     |       |                                      |         |
| No                     | 3                                   | 0.182 | 35                                   | 0.162** |
| Yes                    | 1                                   |       | 4                                    |         |
| FH of mental illness   |                                     |       |                                      |         |
| No                     | 2                                   | 0.058 | 35                                   | 0.102** |
| Yes                    | 2                                   |       | 2                                    |         |
| Father's job status    |                                     |       |                                      |         |
| Employee               | 3                                   | 0.453 | 12                                   | 0.490*  |
| Worker                 | 0                                   |       | 4                                    |         |
| Self-employed          | 1                                   |       | 21                                   |         |
| Workless               | 0                                   |       | 4                                    |         |
| Mother's job status    |                                     |       |                                      |         |
| Employee               | 0                                   | 0.078 | 8                                    | 0.233** |
| Worker                 | 1                                   |       | 1                                    |         |
| Self-employed          | 0                                   |       | 4                                    |         |
| Housewife              | 3                                   |       | 29                                   |         |
| Father's education     |                                     |       |                                      |         |
| Up to primary          | 0                                   | 0.289 | 8                                    | 0.510*  |
| High school            | 4                                   |       | 20                                   |         |
| University             | 0                                   |       | 11                                   |         |
| Mother's education     |                                     |       |                                      |         |

*Contd...*

**Table 2: Contd...**

| Variables                     | ADHD according to parents' view (n) | P     | ADHD according to teachers' view (n) | P       |
|-------------------------------|-------------------------------------|-------|--------------------------------------|---------|
| Up to primary                 | 1                                   | 0.280 | 14                                   | 0.072** |
| High school                   | 3                                   |       | 12                                   |         |
| University                    | 0                                   |       | 13                                   |         |
| Past accommodation            |                                     |       |                                      |         |
| City                          | 3                                   | 0.314 | 33                                   | 0.128*  |
| Village                       | 1                                   |       | 6                                    |         |
| Duration of pregnancy (weeks) |                                     |       |                                      |         |
| <37                           | 1                                   | 0.186 | 2                                    | 0.096** |
| 37-40                         | 2                                   |       | 28                                   |         |
| >40                           | 1                                   |       | 5                                    |         |
| Birth weight (g)              |                                     |       |                                      |         |
| <2500                         | 0                                   | 0.028 | 1                                    | 0.476** |
| 2500-4000                     | 2                                   |       | 31                                   |         |
| >4000                         | 2                                   |       | 3                                    |         |
| Delivery of method            |                                     |       |                                      |         |
| Natural                       | 2                                   | 1.00  | 11                                   | 0.008** |
| Cesarean                      | 2                                   |       | 28                                   |         |
| Feeding in infancy            |                                     |       |                                      |         |
| Breastfeeding                 | 4                                   | 1.00  | 36                                   | 0.714** |
| Others                        | 0                                   |       | 3                                    |         |
| MH of children                |                                     |       |                                      |         |
| No                            | 2                                   | 0.065 | 36                                   | 0.801** |
| Yes                           | 2                                   |       | 3                                    |         |
| HMU in children               |                                     |       |                                      |         |
| No                            | 4                                   | 1.00  | 37                                   | 1.00**  |
| Yes                           | 0                                   |       | 2                                    |         |
| HS in father                  |                                     |       |                                      |         |
| No                            | 4                                   | 1.00  | 36                                   | 1.00**  |
| Yes                           | 0                                   |       | 3                                    |         |
| HOU in father                 |                                     |       |                                      |         |
| No                            | 4                                   | 1.00  | 38                                   | 0.565** |
| Yes                           | 0                                   |       | 1                                    |         |

\*Chi-square test, \*\*Fisher's exact test. SES=Socio economic status, FH=Family history, MH=Medical history, HS=History of smoking, ADHD=Attention deficit hyperactivity disorder.

**Table 3: The role of different independent variables on attention-deficit hyperactivity disorder score in multiple linear regression model**

| Factors                 | Children ADHD scores Coefficient (SE) | P      | 95% CI for coefficients |       |
|-------------------------|---------------------------------------|--------|-------------------------|-------|
|                         |                                       |        | Lower                   | Upper |
| Gender (female)         | 1.05 (0.9)                            | 0.242  | -0.71                   | 2.81  |
| Marital discord (yes)   | 9.10 (2.1)                            | <0.001 | 4.93                    | 13.27 |
| FH of ADHD (yes)        | 4.77 (2.0)                            | 0.018  | 0.83                    | 8.72  |
| Past location (village) | 4.56 (1.5)                            | 0.004  | 1.43                    | 7.70  |
| Children MH (yes)       | 3.23 (1.4)                            | 0.025  | 0.40                    | 6.05  |
| Fathers HS (yes)        | 4.12 (1.6)                            | 0.009  | 1.02                    | 7.21  |
| Constant                | 16.54 (0.7)                           | <0.001 | 15.25                   | 17.84 |

CI=Confidence interval, FH=Family History, MH=Medical history, HS=History of smoking, SE=Standard error, ADHD=Attention-deficit hyperactivity disorder

concluded that differences in ADHD prevalence reports could be attributed to various research methodologies. Iranian study also demonstrated that teachers reported a higher prevalence for ADHD compared to parents.<sup>[17]</sup> The results of this study are also in line with some others studies.<sup>[39,40]</sup> They believe that teachers' higher score

might be due to the fact that children spend a longer time with teachers at school; thus, teachers are more sensitive to their behaviors. On the other hand, since parents may not have enough information about ADHD, they might have difficulty diagnosing such a disorder. The results of this study differ from the ones obtained by previous studies who found no discrepancy between teachers' and parents' scores calculated through Conners Questionnaires.<sup>[41,42]</sup> Moreover, some studies showed that parents reported a higher prevalence of ADHD compared to teachers. They attributed parents' higher scores to stricter assessment of children's behavior, free atmosphere for children at home compared to school, parents' erroneous diagnosis of ADHD symptoms, and their larger number of false positive reports.<sup>[16,43,44]</sup>

The influence of marital discord on various dimensions (e.g., children's cognitive, social, educational, and psychological performance, their relationship with other children, and family's performance in different areas such as raising children) has been investigated.<sup>[37]</sup>

The results of the current study indicated that children who live in families with marital discord are 9 points higher than children who live in calm families at risk for ADHD. In fact, most of the studies on ADHD have reported frequent instances of marital discord in families of children with ADHD. The result of a study conducted in Iran indicated that, as a source of stress, marital discord can be a predictor of the rise of children's emotional and behavioral symptoms.<sup>[45]</sup> Parents who have children with ADHD unconsciously are under a lot of psychological pressure, feeling that they are not qualified parents. In these cases, usually, the mother is psychologically associated with more severely. The conflict that subsequently arises between parents reduces satisfaction with marital relations. On the other hand, researchers have displayed that children who are living in families with a lot of discords suffer from adaptability problems, suggesting a direct relationship between parental discord and children's health.<sup>[46]</sup> The results of this study showed that living with only one parent is another factor that contributes to ADHD. These findings are in line with the results obtained by previous studies.<sup>[47-49]</sup> The findings of this study further indicated that ADHD scores of children of fathers smoked were higher than to those of fathers did not smoke. Researchers have also observed the association between ADHD prevalence and exposure to cigarette smoke in the postnatal period<sup>[50]</sup>. Since researchers cannot make a clear distinction between the effect of smoke exposure in the pre- and postnatal periods, it is difficult to exactly measure the degree of the influence of exposure to cigarette smoke in the postnatal period. In addition, there are some other intervening variables (e.g., families' low academic degree and low socioeconomic status) that make it challenging to pinpoint the exact impact of exposure to cigarette smoke.<sup>[51]</sup>

The results of this study also revealed that the ADHD prevalence was higher among children who had experienced living in rural areas. More precisely, a coefficient of 4.56, assuming this is the unstandardized coefficient, suggests that the children living in rural area score an average of 4.56 points higher than children of living in urban area. Based on the results of a study, ADHD was more prevalent in urban areas compared to rural regions. This difference might be due to cultural discrepancies between cities and villages and the role of environmental factors.<sup>[51]</sup> In addition, according to the results of the present study, there is a significant relationship between the history of psychological problems in the family and ADHD. Similarly, two studies demonstrated that the existence of behavioral disorders and previous cases of ADHD in family significantly predicts ADHD in children.<sup>[24,52-53]</sup>

Finally, the results of this study revealed that having a history of medical treatment and using medicine by

children (consuming all medication for any chronic disease except for hyperactivity is desired) were influential in causing ADHD. The same association was also reported by an Iranian study.<sup>[29]</sup> Conversely, such a significant relationship was not observed in others study.<sup>[38]</sup> Researchers in Iran argued that there are few studies with conflicting findings documenting the relationship between childhood diseases and ADHD. This disorder has a complicated etiology and may have both genetic and environmental origins. Preventive and therapeutic interventions may not be sufficient as long as all factors that contribute to ADHD are not identified. It is therefore crucial to detect the causes of ADHD using various research methodologies.<sup>[32]</sup>

### Limitation and recommendation

The main limitation of the study is its almost low generalizability to other cities in the province and therefore to the country due to the great diversity of demographic and cultural variables in Iran. Due to the significant effects of this disorder on children's general health, it is necessary to conduct a national study on the prevalence, risk factors, signs and symptoms and finally the treatment of this disorder throughout the country to promote children's health.

The other limitation is concerns regarding the accuracy of parent- and teacher-reported diagnosis of ADHD that had no clinical confirmation, but parent- and teacher-reported ADHD has generally been found to be a reliable source of information. However, parent-reported ADHD diagnosis may include false positives, particularly, for mild, never treated cases.

The findings from the current study reinforce the important role of school nurses. To the best of our knowledge, the present study was the first attempt investigating the prevalence of ADHD in one city in Semnan province (Shahroud); one of the positive points of this study was the use of linear regression in analyzing the information. This data analysis procedure has been rarely used in ADHD-related studies.

### Conclusions

The findings of this study indicated that the knowledge of elementary school teachers in Shahroud regarding the ADHD disorder was not desirable. Teachers can use the results to understand about the signs and symptoms and risk factors of ADHD and manage the behavior of affected students and interact appropriately with them.

This study indicated the high prevalence of inadequate knowledge among parent, and it shows the necessity of giving more attention to this subject in health promotion

programs. To achieve this goal, some sectors like social and health political medias should pay more attention to the children's psychiatric disorders, because they are the most important and publican sources of appropriate information for parents to increase knowledge about children mental health problems.

### Implications

The findings from the current study showed that a large discrepancy between the teacher and parent reports that this indicates the need to strengthen the relationship between the teacher and the parents because Teacher–parent collaboration was identified as an important barrier and/or facilitator to intervention and the amelioration of ADHD symptoms, so policy and support to guide these interactions may be particularly influential.

Moreover, our findings reinforce the important role of school nurses for educating to parents and teachers to identify ADHD in children as soon as possible so that prospective damages will be prevented. Because Teachers learn how to treat a child with ADHD from their peers or professional workshops, not in their educational programs and from health professionals. Broad categories of interventions included allowing activity, assuring positive interactions, redirecting, communicating consequences, decreasing distractions, and utilizing multiple methods of instruction.

As a result, the researchers suggest that educational workshops and programs should be held for teachers, parents, and counselors to inform them about the procedures for diagnosing ADHD, and having more appropriated behavior with students, it should not be forgotten that students with ADHD were significantly more likely to have repeated a grade or failed to complete high school compared with participants without ADHD and this helps to have a brilliant future for these students.

### Acknowledgments

We sincerely thank the student research committee of Shahroud University of Medical Sciences for their kind cooperation. We are also indebted to school administrators, headmasters/headmistresses, teachers, and parents in Shahroud. This study was not possible without their participation.

### Financial support and sponsorship

The author(s) received financial support for the research via the student research committee of Shahroud University of Medical Sciences.

### Conflicts of interest

There are no conflicts of interest.

## References

1. Dobrosavljevic M, Solares C, Cortese S, Andershed H, Larsson H. Prevalence of attention-deficit/hyperactivity disorder in older adults: A systematic review and meta-analysis. *Neurosci Biobehav Rev* 2020;118:282-9.
2. Ayano G, Yohannes K, Abraha M. Epidemiology of attention-deficit/hyperactivity disorder (ADHD) in children and adolescents in Africa: A systematic review and meta-analysis. *Ann Gen Psychiatry* 2020;19:21.
3. Hankey JR, Liu YS, Chokka PR. Adult ADHD: Prevalence, comorbidities, and patient-reported dysfunction in a tertiary mental health clinic. *Psychiatry Clin Psychopharmacol* 2020;30:3-9.
4. LeGris J, Boylan K, Stead V, Beyfuss K, Chan A. Developmental risk relationships between ADHD and depressive disorders in childhood. *Curr Dev Dis Rep* 2016;3:25-32.
5. Melegari MG, Bruni O, Sacco R, Barni D, Sette S, Donfrancesco R. Comorbidity of attention deficit hyperactivity disorder and generalized anxiety disorder in children and adolescents. *Psychiatry Res* 2018;270:780-5.
6. Vitola E, Bau C, Salum G, Horta B, Quevedo L, Barros F, et al. Exploring DSM-5 ADHD criteria beyond young adulthood: Phenomenology, psychometric properties and prevalence in a large three-decade birth cohort. *Psychol Med* 2017;47:744.
7. Chang Z, Lichtenstein P, D'Onofrio BM, Almqvist C, Kuja-Halkola R, Sjölander A, et al. Maternal age at childbirth and risk for ADHD in offspring: A population-based cohort study. *Int J Epidemiol* 2014;43:1815-24.
8. Polanczyk G, de Lima MS, Horta BL, Biederman J, Rohde LA. The worldwide prevalence of ADHD: A systematic review and meta-regression analysis. *Am J Psychiatry* 2007;164:942-8.
9. Abdollahian A, Shakeri M, Vosogh A. Prevalence of attention deficit/hyperactivity disorder in pre-school children in Mashhad city in school year of 2002-2003. *J Med Sci Univ Mashhad* 2004;47:275-80.
10. Akhavan Karbasi S, Golestan M, Fallah R, Sadr Bafghi M. Prevalence of attention deficit hyperactivity disorder in 6 year olds of Yazd city. *JSSU* 2008;15:29-34.
11. Bahreynian AA, Bayat MR. Prevalence of ADHD in school-aged boys in Tehran. *Pejouhandeh* 2002;6:555-8.
12. Moayedi F, Moayedi A, Goli G, Hemedi Y. Prevalence of attention deficit hyperactivity disorder in Bandarabbas primary school students in 2010. *Bimonthly J Hormoz Univ Med Sci* 2013;17:241-7.
13. Moradi A, Khobazkhub M. Hyperactivity disorder (ADHD) among school children of Nishaboor - Iran during 2006. *J Gorgan Univ Med Sci* 2008;10:37-42.
14. Ghafari Nejad A. Prevalence of Social phobia disorder and related factors among high school students in Kerman. *Sci J Hamadan Univ Med Sci Health Serv* 1998;8:1-9.
15. Fallahzadeh M. P\*revalence of Attention Deficit Hyperactivity Disorder among School-Children in Karaj. *The Abstract Book of the 5<sup>th</sup> Congress on Hygienic and Mental Health in Children and Youth, Zanjan, Iran; 2000. p. 24.*
16. Mostafae MR, Shokati M, Sarchami R, Rafiei H. Prevalence of attention deficit hyperactivity disorder in elementary school students in Hamadan. *Int J Epidemiol Res* 2016;3:63-8.
17. Shabani M, Yadeghari A. Prevalence of attention deficit hyperactivity disorder (ADHD) in elementary school children in Zanjan, 2004-05. *J Zanjan Univ Med Sci Health Serv* 2005;51:48-2.
18. Starck M, Grünwald J, Schlarb AA. Occurrence of ADHD in parents of ADHD children in a clinical sample. *Neuropsychiatr Dis Treat* 2016;12:581-8.
19. Mulraney M, Schilpzand EJ, Hazell P, Nicholson JM, Anderson V, Efron D, et al. Comorbidity and correlates of disruptive mood dysregulation disorder in 6-8-year-old children with ADHD. *Eur*



- Child Adolesc Psychiatry 2016;25:321-30.
20. Cadman T, Findon J, Eklund H, Hayward H, Howley D, Cheung C, et al. Six-year follow-up study of combined type ADHD from childhood to young adulthood: Predictors of functional impairment and comorbid symptoms. *Eur Psychiatry* 2016;35:47-54.
  21. Russell AE, Ford T, Williams R, Russell G. The association between socioeconomic disadvantage and attention deficit/hyperactivity disorder (ADHD): A systematic review. *Child Psychiatry Hum Dev* 2016;47:440-58.
  22. Wymbys BT, Pelham WE Jr., Molina BS, Gnagy EM, Wilson TK, Greenhouse JB. Rate and predictors of divorce among parents of youths with ADHD. *J Consult Clin Psychol* 2008;76:735-44.
  23. Al Hamed JH, Taha AZ, Sabra AA, Bella H. Attention deficit hyperactivity disorder (ADHD) among male primary school children in Dammam, Saudi Arabia: Prevalence and associated factors. *J Egypt Public Health Assoc* 2008;83:165-82.
  24. Bayati A, Faghizadeh S, Rahgavi A. Aiding factors of attention-deficit disorder/hyperactivity among school age children in arak state primary schools. *J Rahavard Danesh* 2000;3:9-14.
  25. Khoushabi K, Setareh-Forouzan A, Moradi S, Mohammadkhani P. Risk factors of attention deficit hyperactivity disorder in children. *J Rehabil* 2006;7:6.
  26. de Zwaan M, Gruss B, Muller A, Graap H, Martin A, Glaesmer H, et al. The estimated prevalence and correlates of adult ADHD in a German community sample. *Eur Arch Psychiatry Clin Neurosci* 2012;262:79-86.
  27. Paraskevopoulou M, van Rooij D, Schene AH, Scheres AP, Buitelaar JK, Schellekens AF. Effects of substance misuse and family history of substance use disorder on delay discounting in adolescents and young adults with attention-deficit/hyperactivity disorder. *Eur Addict Res* 2020;26:295-305.
  28. Minatoya M, Araki A, Itoh S, Yamazaki K, Kobayashi S, Miyashita C, et al. Prenatal tobacco exposure and ADHD symptoms at pre-school age: The Hokkaido study on environment and children's health. *Environ Health Prevent Med* 2019;24:74.
  29. Kouchakzadeh Talami S, Namazi A, Zarkesh M. Symptoms related to attention deficit hyperactivity disorder among preschool children based on parents report. *Holistic Nurs Midwif J* 2015;25:35-44.
  30. Biederman J, Milberger S, Faraone SV, Kiely K, Guite J, Mick E, et al. Family-environment risk factors for attention-deficit hyperactivity disorder: A test of Rutter's indicators of adversity. *Arch Gen Psychiatry* 1995;52:464-70.
  31. Muñoz-Silva A, Lago-Urbano R, Sanchez-Garcia M. Family impact and parenting styles in families of children with ADHD. *J Child Fam Stud* 2017;26:2810-23.
  32. Malek A, Amiri S, Abdi S. Previous medical history of diseases in children with attention deficit hyperactivity disorder and their parents. *J Anal Res Clin Med* 2014;2:42-6.
  33. Yazdi, S.A.H., Mashhadi, A., Kimiaee, S.A. and Asemi, Z., Effectiveness of Children of Divorce Intervention Program (CODIP) on externalized and internalized problems in children of divorce. *Fam Psychol* 2015;2:3-14.
  34. Fayyad J, Sampson NA, Hwang J, Adamowski T, Aguilar-Gaxiola S, Al-Hamzawi A, et al. The descriptive epidemiology of DSM-IV Adult ADHD in the World Health Organization World Mental Health Surveys. *Atten Defic Hyperact Disord* 2017;9:47-65.
  35. Russell G, Ford T, Rosenberg R, Kelly S. The association of attention deficit hyperactivity disorder with socioeconomic disadvantage: Alternative explanations and evidence. *J Child Psychol Psychiatry* 2016;55:436-45.
  36. Joelsson P, Chudal R, Talati A, Suominen A, Brown AS, Sourander A. Prenatal smoking exposure and neuropsychiatric comorbidity of ADHD: A Finnish nationwide population-based cohort study. *BMC Psychiatry* 2016;16:306.
  37. Shahim, Sima, Leila Mehrangiz, and Farideh Yousefi. "Prevalence of attention deficit hyperactivity disorder in a group of elementary school children." *Iranian Journal of Pediatrics* 17.s2 (2007): 211-216
  38. Shooshtary MH, Chimeh N, Najafi M, Mohamadi MR, Yousefi-Nouraei R, Rahimi-Mvaghari A. The prevalence of attention deficit hyperactivity disorder in Iran: A systematic review. *Iran J Psychiatry* 2010;5:88-92.
  39. Venkata JA, Panicker AS. Prevalence of attention deficit hyperactivity disorder in primary school children. *Indian J Psychiatry* 2013;55:338-42.
  40. EL-Gendy SD, El-Bitar EA, El-Awady MA, Bayomy HE, Agwa EM. Attention-deficit/hyperactivity disorder: Prevalence and risk factors in Egyptian primary school children. *Egypt J Commun Med* 2017;35:1-16.
  41. Willcutt EG, Pennington BF. Comorbidity of reading disability and attention-deficit/hyperactivity disorder: Differences by gender and subtype. *J Learn Disabil* 2000;33:179-91.
  42. Pierrehumbert B, Bader M, Thévoz S, Kinal A, Halfon O. Hyperactivity and attention problems in a Swiss sample of school-aged children: Effects of school achievement, child gender, and informants. *J Atten Disord* 2006;10:65-76.
  43. Soma Y, Nakamura K, Oyama M, Tsuchiya Y, Yamamoto M. Prevalence of attention-deficit/hyperactivity disorder (ADHD) symptoms in preschool children: Discrepancy between parent and teacher evaluations. *Environ Health Prev Med* 2009;14:150-4.
  44. Meysamie A, Fard MD, Mohammadi MR. Prevalence of attention-deficit/hyperactivity disorder symptoms in preschool-aged Iranian children. *Iran J Pediatr* 2011;21:467-72.
  45. Arfaie A, Mohammadi A, Sohrabi R. Relationship between marital conflict and child affective-behavioral psychopathological symptoms. *Procedia Soc Behav Sci* 2013;84:1776-8.
  46. Taghaza M, Abolmaali K, Saberi H. Comparison of family emotional setting in hyperactive versus normal children. *J Behav Sci* 2012;4:9-26.
  47. DuPaul GJ, McGoey KE, Eckert TL, VanBrakle J. Preschool children with attention-deficit/hyperactivity disorder: Impairments in behavioral, social, and school functioning. *J Am Acad Child Adolesc Psychiatry* 2001;40:508-15.
  48. Counts CA, Nigg JT, Stawicki JA, Rappley MD, von Eye A. Family adversity in DSM-IV ADHD combined and inattentive subtypes and associated disruptive behavior problems. *J Am Acad Child Adolesc Psychiatry* 2005;44:690-8.
  49. Hurtig T, Ebeling H, Taanila A, Miettunen J, Smalley S, McGough J, et al. ADHD and comorbid disorders in relation to family environment and symptom severity. *Eur Child Adolesc Psychiatry* 2007;16:362-9.
  50. Gustavson K, Ystrom E, Stoltenberg C, Susser E, Surén P, Magnus P, Knudsen GP, Smith GD, Langley K, Rutter M, Aase H. Smoking in pregnancy and child ADHD. *Pediatrics*. 2017 Feb 1;139(2).
  51. Kabir Z, Connolly GN, Alpert HR. Secondhand smoke exposure and neurobehavioral disorders among children in the United States. *Pediatrics* 2011;128:263-70.
  52. Mohamed F, Syed H, Salah M. Prevalence of attention deficit hyperactivity disorder in children. *Sci J Public Health* 2015;3:274-80.
  53. Khoushabi K. Study of Prevalence of ADHD and Comorbid Disorders in Primary School Students of Tehran. Iran, Tehran: University of Welfare and Rehabilitation; 2002.