Original Article

Factors Associated with Treatment Adherence in Children with Attention Deficit Hyperactivity Disorder

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ABSTRACT

Background: Attention deficit/hyperactivity disorder (ADHD) is a common psychiatric disorder in children. The aim of this study was to investigate factors related to treatment adherence in children with ADHD. **Methods:** This cross-sectional study was done in 118 children (aged 6–12 years) with ADHD who have been on medications for at least 6 months. The patients were selected based on the convenience sampling method from those who were referred to child psychiatry clinic. Medication Adherence Report Scale, Belief about Medicines Questionnaire specific version, and Children Symptom Inventory-4 were completed by parents and teachers. **Findings:** Medication adherence had significant negative correlation with inattention scores on teacher-report forms (r = -0.27, P = 0.003) and poor economic status (P = 0.03). There was a positive correlation between medication adherence and history of psychopharmacological treatment in the family (P = 0.01), and father's education level (P = 0.001). Treatment adherence had no significant correlation with age, gender, comorbid disorders, mother's education, family history of ADHD, medication side effects, or parental concerns and beliefs about the necessity of drug use. **Conclusion:** The factors found to have a correlation with adherence should be taken in to account by clinicians so that adherence can be improved in their patients.

Key words: *Attention deficit/hyperactivity disorder, children, treatment adherence*

Key message: *In children with ADHD, adherence to medications is positively correlated with history of psychopharmacological treatment in the family and father's education level and negatively correlated with inattention scores on teacher-report forms and poor economic status.*

Children with ADHD often are diagnosed in primary school age. It is estimated that in as many as half of the affected children, the disorder persists beyond adolescence and throughout adulthood.[1] The severity of symptoms and treatment in childhood can predict a persistence of symptoms.[2] Appropriate treatment may improve quality of life significantly.[3] Medication treatment is the cornerstone of treatment in ADHD,

Access this article online	
Website: www.ijpm.info	Quick Response Code
DOI: 10.4103/IJPSYM.IJPSYM_456_18	

How to cite this article: Safavi P, Saberzadeh M, Tehrani AM. Factors associated with treatment adherence in children with attention deficit hyperactivity disorder. Indian J Psychol Med 2019;41:252-7.

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Received: 12th November, 2018, **Accepted:** 27th April, 2019

so medication nonadherence is an important dilemma in the treatment of children with ADHD. Adherence has an important role in achieving treatment effects.[4] For instance, students with high adherence to ADHD medication gain higher academic grades.[5]

Treatment adherence is defined by the extent to which a patient's behaviors correspond to the recommendations of the healthcare providers.[4] Varying definitions and methodological heterogeneity cause a wide range of outcomes on measurements of adherence to ADHD medications.[6] There is no definite method to measure treatment adherence in patients on medication treatment, and investigators have used the information on refill intervals or pill counts, patient/caregiver surveys, and semistructured interviews to measure adherence.[7-10] A variety of factors related to the patient, condition, therapy, healthcare system, and socioeconomic circumstances have been detected to affect treatment adherence in different studies.[4] Factors such as type of medication (short-acting or long-acting),[11] length of treatment,[12] medication side effects,[13,14] gender and age of the patient,[15] existence of comorbidity, and type of medical center (governmental or private)[16] have been reported to affect adherence of patients to treatment directions. Ferrin *et al*.[17] and Charach *et al*.[18] reported that adolescents' beliefs and attitudes about the medication have a higher impact on medication use than the real benefits and risks. The belief that medication is effective, in addition to the minimal experience of adverse effects, has been shown to increase willingness to use ADHD medication by adolescents.[19]

A previous study by the first author showed that 21% of primary school children suspected of having ADHD were on medication treatment.[20] A significant number of ADHD patients and their families do not have compliance to recommendations about drug use. Various factors may affect adherence to medical treatments in populations with different sociocultural backgrounds. So, recognition of these factors in different geographic areas can increase our knowledge in this regard, and using the results can help to implement practical approaches to increase adherence to treatment, thus improving the patient outcomes and decreasing treatment costs.

The aim of this study was to investigate factors related to treatment adherence in children with ADHD because we found no study addressing this issue in Iran. The factors considered included age and gender of the child, academic achievement, severity of ADHD symptoms, presence of comorbid disorders, type of insurance, economic status of the family, site of residence, parent's education, family history of ADHD, history of psychopharmacological treatment in the family, type of medication, medication side effects, and parent attitudes about psychopharmacology of ADHD. These factors were selected based on previous studies[11-19] and the clinical experience of the authors.

METHODS

This was a cross-sectional study. The study population was children with ADHD referred to child psychiatry clinic of University of Shhrekord, Iran in 2018. Inclusion criteria were 6- to 12-year-old children diagnosed with ADHD who were on medication treatment for at least 6 months. Children with seizures or neurodevelopmental disorders such as mental retardation or autism spectrum disorder were excluded. Participants were selected based on the convenience sampling method. The sample size was calculated by using appropriate formula based on a similar study.[12] A total of 118 children with ADHD entered the study. Cases were diagnosed by a child psychiatrist, using clinical interview based on Diagnostic and Statistical Manual of Mental Disorders version 5 (DSM 5) criteria. The comorbidity of oppositional defiant disorder and conduct disorder was assessed by clinical interview. The study was approved by the ethics committee of Shahrekord University of Medical Sciences.

Data were collected using demographic and clinical data questionnaire, Medication Adherence Report Scale (MARS), Belief about Medicines Questionnaire specific version (BMQ-specific), and Children Symptom Inventory-4 (CSI-4).

Demographic and clinical data questionnaire included age and gender of the child, academic achievement, education of father and mother, type of insurance, economic status of the family (good, average, poor), family history of ADHD, family history of psychopharmacological treatment, and type of medication of the child.

MARS is a self-report questionnaire which covers five common patterns of nonadherent behavior, scored on a five-point Likert scale (1 = always, 2 = often, 3 = sometimes, 4 = rarely, and 5 = never). The first statement of the MARS-5 is about unintentional nonadherence ("I forget to take my medication"), whereas the other four statements assess intentional nonadherence (e.g., ",I change the dosage of my medication"). Total scores range from 5 to 25, with higher scores indicating higher adherence. A score of 23 or more was defined as high adherence.[6] The Persian translation of this questionnaire has been used in Iran,[21] and its reliability is good (Cronbach's alpha = 0.94).[22] As children who are 6–12 years old usually use medications

with the supervision of the parents; in this study, the questionnaire was filled by the parents.

BMQ-specific is an 11-item questionnaire assessing the beliefs and concerns of patients about medication treatment.[23] It has three subscales. The first, necessity (five items), investigates patients' beliefs about the necessity of prescribed medication. The second, concern (five items), assesses their concerns about potential adverse outcomes from medication use. The third subscale is one item that addresses side effects, "I get unpleasant side effects from my ADHD medicines." This item was analyzed separately due to the known role of side effects of ADHD medication in nonadherence. The total score of this scale was not calculated because each subscale measures a different entity. Each item is scored from 1 (strongly disagree) to 5 (strongly agree). The Persian translation of this scale has been used in a study and its reliability was good (Cronbach's alpha = 0.71).[24] In this study, the parents completed the questionnaire about their beliefs regarding medication treatment of their children.

The CSI-4 is a commonly used behavior rating scale for children, whose items correspond to the symptoms of disorders defined by the Diagnostic and Statistical Manual of Mental Disorders 4th edition. It consists of parent forms and teacher forms. In the present study, we used the scales for ADHD (18 items; nine items for inattention subscale and nine for hyperactivity/impulsivity subscale), oppositional defiant disorder (ODD, eight items), and conduct disorder (CD, 10 items). Each item is scored from 0 (never) to 3 (frequently) and assesses the severity of the symptoms quantitatively. The validity and reliability of Persian translation have been approved.[25]

Parents completed the questionnaires in the clinic and took the teacher form of the questionnaires to school, which was completed by the teacher and returned to the clinic. Data were entered to the Statistical Package for the Social Sciences (SPSS) software, version 22.0. We used descriptive statistics, *t*-test, Mann–Whitney test, Kruskal–Wallis test, Chi-square test, Pearson or Spearman correlation coefficient, analysis of variance, and linear regression to analyze the data.

RESULTS

A total of 118 children with ADHD were included in the study. The mean (±SD) age of participants was 8.89 ± 1.9 years, and 98 (82.4%) were boys. The mean score of medication adherence was 19.53 ± 3.2 and 25 patients (21.2%) had high adherence to treatment (score of 23 or higher). Most of the patient received methylphenidate alone (51.7%) or methylphenidate in combination (39.8%) with risperidone, atomoxetine, or clonidine. Because of few number of patients on medicines other than methylphenidate, we did not conduct statistical analysis as the results were not generable. The most frequently reported side effect was decreased appetite (19.5%). A total of 18 had comorbidity with ODD and 100 had no comorbidity.

Based on the results of Spearman' test, there was no significant correlation between age (r = -0.11, P = 0.21) and adherence to treatment, but there was a significant inverse correlation between inattention scores based on teacher report and adherence to treatment (r = -0.29, P = 0.001). In addition, the relationship between adherence to treatment and gender, academic grade, insurance status, comorbidity, family history of ADHD, and family history of drug treatment for mental disorders were evaluated [Table 1]. Table 1 shows that there was no significant relationship between having comorbidity and adherence to treatment (P = 0.55). Also, there was no significant relationship between having a family history of ADHD and adherence to treatment (P = 0.58), but there was a significant positive relationship between having a family history of psychopharmacological treatment and adherence to treatment (P = 0.01).

The results also showed that there was a significant relationship between poor economic status and lower adherence to treatment compared to average economic status (P = 0.03). There was no significant difference between average and good or between good and poor economic status regarding adherence to treatment (P = 0.85 and P = 0.35, respectively) [Table 2 and Figure 1].

Table 1: Correlation between sociodemographic variables and adherence to treatment

Variable		MARS score (mean±SD)	*P*
Gender	Girl (*n*=20)	19.50±3.21	0.74*
	Boy (*n*=98)	19.70±3.72	
Academic achievement	Good (*n*=39)	19.25±3.50	0.17¶
	Fair (*n*=60)	20.05±3.14	
	Poor (*n*=19)	18.47±2.71	
Insurance	No insurance (*n*=3)	21.33±0.57	0.38¶
	Social security (*n*=89)	19.61±3.10	
	Health (*n*=12)	19.83±3.80	
	Other (*n*=14)	18.35±4.18	
Comorbidity	Yes (*n*=18)	20.05±3.31	0.55*
	No (*n*=100)	19.44±3.29	
Family history of ADHD	Yes (*n*=84)	19.42±3.47	0.58*
	No (*n*=34)	19.79±3.34	
Family history of drug treatment	Yes (*n*=41)	20.65±2.89	0.01*
	No (*n*=77)	18.93±3.40	

*Based on Mann-Whitney test, ¶Based on Kruskal-Wallis test.
MARS: Medication Adherence Report Scale, ADHD: Attention Deficit Hyperactivity Disorder

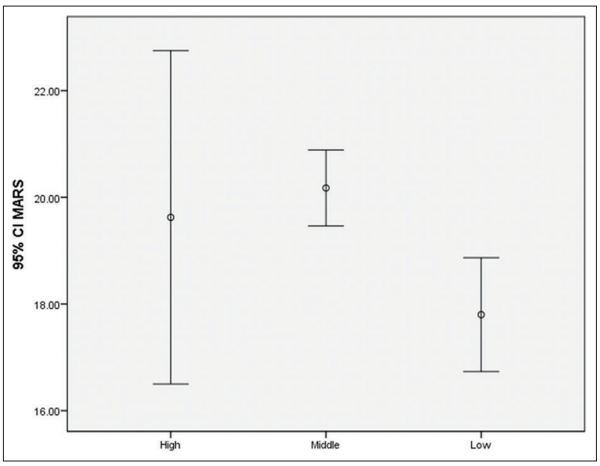

Figure 1: Medication Adherence Report Scale scores in economic status groups

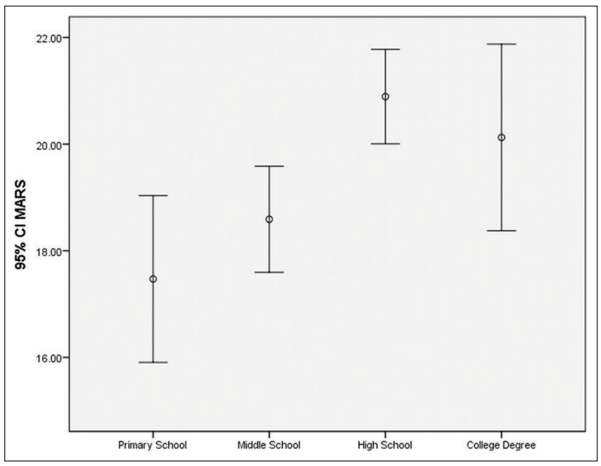

Figure 2: Correlation between father education and treatment adherence. MARS: Medication Adherence Report Scale

Analysis of variance showed that there was a significant correlation between father education and treatment adherence ($P = 0.001$); in families with fathers who had graduated from high school, there was higher treatment adherence compared to other educational levels [Figure 2].

Table 3 shows that there was no significant correlation between BMQ necessity scores or BMQ side effect scores and treatment adherence $P = 0.15$ and $P = 0.96$, respectively, but there was a significant correlation between BMQ concern scores and treatment adherence ($P = 0.03$) [Figure 2].

Linear regression was used to evaluate the relationship between different variables and treatment adherence. Those variables whose relationship with adherence had a *P* value less than 0.1 were entered in the analysis. The analysis showed that the father's education ($P < 0.001$), insurance type ($P = 0.009$), history of psychopharmacologic treatment in family ($P = 0.016$), and the inattention scores from the teacher ($P = 0.04$) had a statistically significant relationship with treatment adherence (MARS score). The relation between BMQ concern and adherence was not significant ($P = 0.07$) [Table 4].

DISCUSSION

Results of the present study showed that only 21.2% of participants had high treatment adherence (92–100% of maximal MARS scores). A similar study in Sweden showed high adherence behavior in 46.5% of cases.[6] Treatment adherence was similar in boys and girls, as in the results of the study of Hwang and Lee done in Korea.[16] Also, there was a negative correlation between inattention scores based on teacher forms and treatment adherence, which may be indicating that inattention in the classroom is more frequent in children with irregular drug use.

Table 2: Correlation between economic state and adherence to treatment

Economic state	MARS score	Comparisons¶ Between Socieconomic Groups	*P*
Good (*n*=8)	19.62±3.67	Good with average	0.85
Average (*n*=80)	20.17±3.19	Good with poor	0.35
Poor (*n*=30)	17.80±2.85	Average with poor	0.03*

¶Comparison of groups with Dunn's test, *Statistically significant. MARS: Medication Adherence Report Scale, ADHD: Attention-deficit hyperactivity disorder

Table 3: Correlation between BMQ subscale scores and treatment adherence

Variables	Mean±SD MARS score	Correlation coefficient	*P*
BMQ necessity score	15.19±5.24	-0.13	0.15
BMQ side effect score	3.15±1.22	0.005	0.96
BMQ concern score	18.00±3.61	-0.20	0.02*

*Statistically significant. MARS: Medication Adherence Report Scale, BMQ: Belief about Medicines Questionnaire

In this study, unlike in the study of Hwang and Lee, treatment adherence was correlated with the type of insurance.[16] Also, results showed that families with poor economic status had lower treatment adherence compared to other economic groups. These results suggest that economic factors have an important role in drug adherence in Iran.

There was a significant positive correlation between the history of psychotropic medication use in the family and higher adherence to treatment. This may be related to higher knowledge or less concern about possible harms of psychotropic medicines in these families. Also, the results showed that there was no significant correlation between parental concerns and beliefs about the necessity of medication use and treatment adherence. But Charach and Fernandez in their study about factors affecting the improvement of treatment compliance reported that increasing the knowledge of patients and families leads to improved treatment adherence.[13]

Table 4: The relationship among MARS score and different variables

	Standardized Coefficients	*P*	95% Confidence Interval for B	
	Beta		Lower Bound	Upper Bound
Insurance	-0.238	0.009*	-1.924	-0.275
Comorbidity	0.055	0.539	-1.111	2.115
Academic achievement	0.155	0.113	-0.231	1.579
father.education	0.344	<0.0001*	0.246	1.875
family.history	0.020	0.813	-1.088	1.384
Inattention (teacher score)	-0.232	0.041*	-0.234	-0.005
Conduct disorder (mother score)	0.149	0.200	-0.038	0.179
Conduct disorder (teacher score)	-0.157	0.130	-0.237	0.031
BMQ concern score	-0.122	0.227	-0.291	0.070
BMQ side effect score	0.044	0.842	-0.194	0.079
Family history of drug therapy	-0.212	0.016*	-2.635	-0.205

*$P < 0.05$. MARS: Medication Adherence Report Scale; BMQ: Belief about Medicines Questionnaire

Results showed a positive correlation between fathers' education and treatment adherence; children of high school graduated fathers had more treatment adherence compared to other educational groups. This correlation did not exist for mothers' education. This finding may show the important role of fathers in treatment adherence of their children in the region of the study.

In this study, the correlation between the side effect of medicines and treatment adherence was not significant. This was unlike the results of the study of Charach *et al*. which reported that many patients discontinue their medication in adolescence because of medication side effects.[18] Also, Ferrin *et al*.[17] and Charach *et al*.[18] reported that adolescents' beliefs and attitudes about drugs for ADHD have a higher impact on medication use than the real benefits and risks. The difference may be due to the younger age group of the patients in our study, which usually consume drugs under the supervision of their parents.

Limitations

This study was conducted on a population of children with ADHD attending a child psychiatry clinic, so its results may not be generalizable to families who have completely discontinued their child`s medications and have not returned to the psychiatry clinic. Also, adherence in this study was measured by a self-report questionnaire which may not be as accurate as direct measurement. These limitations should be considered in the interpretation of the results.

CONCLUSION

A variety of sociodemographic factors may affect parental compliance with medical treatment in children with ADHD. These factors should be considered to improve treatment adherence in children with ADHD. It is suggested that socioeconomic factors and father's education have an important role in ADHD medication adherence in Iran.

Financial support and sponsorship

This study was supported by Shahrekord University of Medical Sciences (Grant No. 2731).

Conflicts of interest

There are no conflicts of interest.

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