

# **10 Years prospective follow up of children with ADHD in Varna region**

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## **SUMMARY**

Attention deficit with hyperactivity disorder (ADHD) is the most commonly diagnosed conduct disorder in children and one of the most common disorders of neuropsychological development in the pediatric population. It has been recognized as a disorder for over a century, while name of the disorder in scientific literature has changed and evolved over the years. ADHD is a heterogeneous disorder, whose etiology is not yet completely known, in which hyperactivity, attention deficits and impulsivity are observed in variable degree, as well as executive dysfunctions, lack of emotional self-regulation and motivation. According to a meta-analysis the presumed prevalence of the disorder worldwide under 18 years is 5.29% and the ratio boys/girls is 3:1 in the general population. A considerable number of affected children continue to exhibit symptoms of the disorder in late adolescent and adult age. It is thought that in 60-70% of childhood ADHD cases symptoms persist in adult age, and even if there is symptom reduction the impairments associated with the disorder remains.

The estimated prevalence of ADHD in adult age is 2.5-4.9%. Clinical studies suggest that the leading manifestations of ADHD in adults differ to those in childhood, in such that adults show milder symptoms of hyperactivity and impulsivity, but more pronounced impairments in attention.

The number of scientific publications and studies, concerning the disorder has grown exponentially over the last years. In the last 4 decades it is assumed that this is the most studied syndrome in the field of child psychiatry in relation to its

etiology and pathogenesis, as well as treatment-wise, and it is also considered the most contradictory. This interest is related to the enormous social price of the disorder. The main symptoms present before school age and can persist throughout life, they affect the patient's relationships with family members, peers, learning abilities, emotional development and self-esteem, they often lead to disruption and disregards of social rules, norms and law, as well as a drastic reduction in quality of life. ADHD is a continuous disorder, which's persistence in the course of development leads to many negative outcomes.

Based on this the significance of ADHD can be considered in several aspects:

1. The persistence of hyperactivity/impulsivity and attention deficit symptoms.
  - Although there is a tendency for milder severity and less symptoms with age, there is still a great portion (between 50 and 70%) of children diagnosed with ADHD, who continue to meet the diagnostic criteria for the disorder even after adolescence. However, 30 years awareness of this fact has not led to a significant change in programs designed to care and treat adults with ADHD.
  - The evolution of various symptoms with increasing age is different, with hyperactivity symptoms marking a considerable reduction over time, while symptoms of impaired attention and impulsivity remain relatively more stable markers of the disorder in older age.
  - The presence of even some symptoms of ADHD in adult age leads to impairments in functioning. This increases the number of affected individuals several times compared to only childhood age, which also increases the social and health costs of the issue.
2. Medical, academic and social adverse outcomes associated with ADHD:
  - A child with ADHD is associated with significantly more medical risk, compared to a healthy child of the same age. These risks are related to consultations, treatment and medications for the disorder itself, as well as the more frequent injuries, fractures, unintentional poisonings with medication or other substances, participation in more accidents, etc. all these negative outcomes are closely related to the nature of the disorder itself and the hyperactive and impulsive behavior.

- Compared to the general population individuals suffering from ADHD more often change kindergartens and schools, they transfer to specialized schools or individual educational programs, drop out of school, rarely begin or graduate college or university.
- The incidence of pregnancy under the age of 20, involvement in traffic accidents and drug abuse are more common in patients with ADHD.
- Out of all disorder related long-term consequences the most impairing in adult age might be the disruption in interpersonal relationships. Individuals suffering from ADHD have few or no friends. Besides difficulties with tasks as work, there is a high risk of chronic conflicts with colleagues, which in the end leads to a high percentage of uneducated and unemployed individuals amongst ADHD patients. An added complication is the high risk of socially unacceptable behaviour, constant conflicts with partners and spouses and problems with the law.

### 3. Economic cost of the disorder:

- The direct cost is the price expression of the resources used to diagnose and treat a condition, which society pays. A child with ADHD has more medical expenses compared to a healthy child of the same age (hospitalizations, emergency room visits, consultations with different specialists, medications). These costs are covered by the patient and their families, but also by various institutions in the different countries.
- The indirect cost is related to dropping out of school, rare graduation from college or university, failing at work, participation in antisocial and criminal acts, pregnancy under 20 years, involvement in road accidents, drug abuse, comorbidity, etc. and it significantly exceeds the direct costs.
- Up to this point, even in developed countries, management and treatment programs that are compliant with the specific needs of adults with ADHD have not been developed, despite the National Institute for Health and Clinical Excellence (NICE; 2010) guideline,

the number of evidence for the persistence of the disorder in adolescence and adulthood and the clinical experience of child psychiatrist and pediatricians, suggesting that the symptoms of ADHD do not “disappear” in adulthood. This doesn't allow for the accurate estimation of the direct and indirect cost of the disorder in adult age.

#### 4. Comorbidity

ADHD is often comorbid with other psychiatric disorders. In children the most common comorbidity is with the diagnostic group Conduct disorders, and in adults it is with Personality disorders, taking into account the differences between the two classifications (DSM and ICD).

#### 5. Taking into account the continuous course of ADHD throughout time and the specific changes in symptoms over time, the quality of life of such patients is an important factor when evaluating the disorder significance. On the other hand, it is not possible to completely evaluate the isolation of children, adolescents or adults with the disorder, just by using scales.

The expected number of children with ADHD in the age group 7-14 is between 20 and 25 thousand, according to data from the National Statistical Institute based on the Bulgarian population, as well as our and other literature on the topic. When the number of adolescent and young adults (< 40yrs) with the disorder is added the total number of individuals with ADHD is 100 000.

The differences between the two classifications – ICD-10 and DSM V are considerable in relation to the criteria for the disorder, the clinical diagnosis and as a result the estimated prevalence of ADHD. Only a small number of the individuals, who have screened positive for the disorder, according to DSM-V criteria meet the ICD-10 criteria, but the whole group is at risk of developing conduct and other disorders and their early detection might be considered as prevention in this big group of disorders. For the first time the DSM-V attempts to introduce diagnostic criteria for ADHD in adults, even if a little literal by keeping the criteria for children (with some examples added for adult patients), but reducing the required number for a diagnosis. Nonetheless, this is an option for coding the disorder in adult age, which does not exist in the ICD up until now.

Based on the above mentioned information we conduct a study whose aim was: Evaluation of the dynamic of symptoms in patients diagnosed with ADHD in childhood and the detection of negative outcomes (impairments) related to the disorder in the course of a 10-year prospective follow-up.

Between 2006 and 2007 we carried out an epidemiological study to determine the prevalence of ADHD in Varna region, based on a population sample – children in grade 1 to grade 7. The sample was created by a one stage evaluation of cases, according to city and regional areas, which took place in state schools, where there is no selection of students and it consisted of 2000 children from both sees. In the current prospective follow-up study participated only subjects from the first study and based on the then received results were divided into three cohorts:

- 1) Target group – 113 children, all of which received a diagnosis of ADHD between 2006-2007 during the study. Evaluation is based on the data from two informants during the first study and the group has not been divided into subtypes of the disorder.
- 2) Control group 1- 50 children, which during the 2006-2007 study screened negative for the disorder according to the two informants. The control group consists of randomly selected subjects who participated in the first study, matched for age and sex to the target group.
- 3) Control group 2 (interest group) – 50 children, which during the 2006-2007 study received a very high score (measurable to the target group) from the teachers as informants, but did not meet the criteria for a screening positive subject and were not diagnosed with ADHD. Children were chosen at random from the children participants in the first study, who meet the requirements of an interest group and are matched for age and sex to the target group. This group presents an interest when assessing the validity of teacher responses when screening for the disorder in schools.

The same assessment instrument was used when assessing the dynamics of symptoms in the course of development during the current study as in the previous one – ADHD Rating scale IV (ADHD RS-IV Du Paul et al.), where next to each question in the scale a corresponding comment (example) from the new revision of DSM (the DSM 5) was added, whose purpose is to identify more precisely the 18 core symptoms of ADHD in adults. A self-rated version of the scale was used. The psychometric properties of the scale for Bulgarian population were assessed and published in 2015. All willing participants were also assessed by:

- Structured questionnaire with demographic information and included written informed consent to participate
- Questionnaire about negative outcomes (impairments) related to ADHD in the course of development

#### Results:

In the course of development, the Target group shows a reduction in the overall score of ADHD RS-IV. In the first study in 2006 the mean score for subjects in the target group was 31.98 for parents and for teachers 31.64, while the average score from informant in 2017 is 21.05. This is a 10-point reduction or more than 30 % from the total score. This reduction is not equally distributed between the two subscales of the assessment instrument. It is more pronounced in the subscale for evaluating hyperactivity/impulsivity and less marked in the Impaired attention subscale. Although there is a serious reduction in the 2017 study scores for Hyperactivity/Impulsivity subscale (assessed by the informant himself and average age of the group 21 years) these scores cannot reach the control group levels. With regard to the Impaired attention subscale in the ADHD RD-IV the change in scores is less marked over the course of development and therefore there is a considerable persistence of symptoms in young adulthood.

An assessment was done of the individual symptoms (diagnostic criteria) of ADHD, which persist over the course of development. The symptom that shows the greatest reduction is “Is often ‘on the go’, acting as if ‘driven by a motor’”, while the symptom that shows a marked endurance is “Often loses things necessary for tasks or activities”.

42.7% of the children diagnosed in 2006 continue to meet the DSM-5 diagnostic criteria for ADHD during their follow up in 2017, evaluated by the same criteria requirements for children – individuals have to meet 6 diagnostic symptoms in each subgroup Impaired attention and Hyperactivity/Impulsivity. If evaluated by the criteria for adults - reducing the number of required symptoms to 5, the data shows that 71.9% of the diagnosed in 2006 children still meet the DSM-5 diagnostic criteria for ADHD in 2017.

The received results in Control group 2 during the follow up study in 2017 do not differ significantly from the scores in the control group in the study. The high scores from teachers in the first study when scores from parents are in the range of normal have a negative predictive value and in the course of follow up the evaluation of symptoms of hyperactivity/impulsivity and inattention of these participants does not differ significantly from the scores of the control group.

Using ROC curve analysis for the assessment of answers from parents and teachers on the ADHD RS-IV in 2006 the subscale with the lowest sensitivity value was Hyperactivity/Impulsivity evaluated by teachers throughout the whole instrument. This makes the hypothesis that teachers are inclined to overvalue symptoms of hyperactivity/impulsivity more plausible and likely. It seems teachers have a lower tolerance for behaviors related to hyperactivity in children compared with parents. This fact is corrected when using the parents' score or when using two informants in screening (as it is required in the classifications), and this saves the general sensitivity of the instrument.

The evaluation of the negative outcomes (impairments), associated with ADHD was performed, according to the data gathered from the questionnaires, especially designed for the three groups in the study and their evaluation in 2017. The negative outcomes are related to physical health of the participants, decreased academic performance and achievements, social functioning and others.

From the results it is seen that the frequency of serious physical injuries is directly related with the disorder itself. The difference between the target group and the control group is more than 3 fold.

Many of the main symptoms of ADHD lead to impairments in abilities needed for the education (attention, concentration, memory). Studies following up the

development of patients with ADHD prospectively are consistent with regard to the low academic results, achieved by patients compared to controls.

The results in the current study outline on one hand the serious obstacles in the academic area of participant diagnosed with ADHD in childhood, such as changing school, fewer applications to universities, fewer graduations from universities (all of which have a significant difference to the control group). On the other hand, a few characteristics typical for our country are also outlined, which significantly differ to those in other literature. The switching of more than three schools before graduating high school is observed in almost half of the participants in the target group, compared to only 8% in the control group. Taking into account the very low scores regarding the repeating of a grade and the negligible data regarding the expulsion from school it seems the “universal solution” for dealing with children with educational difficulties, including those with ADHD, in our country is changing schools.

The disturbances in social functioning when following up children diagnosed with ADHD in adult age might be the most significant and important for the patients themselves and the most difficult to evaluate in their entirety. It is not possible to evaluate through scales the complete isolation of children, adolescents and adults suffering from the disorder.

When comparing the data regarding employment between the target group and the control group the result is much bigger in target group. If the percentage of those individuals still studying (higher education) at the time of evaluation is subtracted from the unemployed in both groups, the percentage of unemployed in the target group and the control group is 32.3% and 7%, respectively. The number of changed work places is another indicator, which considerably distinguishes the target and the control group. A more detailed analysis suggests that the change in place of work is related to the initial scores on the ADHD RS-IV in 2006, but not to the follow up evaluation in 2017. The accumulation of such results drives investigator to carry out studies. They are focused on the relationship between diagnosing ADHD in childhood and the occurrence of negative outcomes throughout development, which are no longer directly related to the severity of symptom perseverance of the disorder in adult age.

The development and maintenance of friendships is an important part of social functioning typical of our society and our way of life. In the results, received in

this study, the difference between the two groups (target and control) exceeds much more than the statistical significance of the data. Half of the participants diagnosed with ADHD as children, in young adult age declare they have no friends. In the control group this percentage is only 15%. The number of friends is also related to other social situations, occurring throughout the course of normal development. This is probably the reason why this indicator is related to the severity of persistence of ADHD symptom over time, and not just related to the diagnosis in childhood. From the analyses based on this hypothesis the correlation between number of friends and university attendance and graduation and employment status can be observed at the time of evaluation. The participation in more social situations after high school, such as attending university and beginning work, gives more opportunities for creating new friendships.

Based on the questionnaires, designed especially for the aims of this study, all discussed data, for the target and the control group, regarding sense of loneliness and feeling that others perceive them as different are significantly different and this completes the idea formed already by the work status and the presence of a friends. The difference in social functioning between participants diagnosed as children with ADHD and the controls applies to all aspects of functioning and is significantly different for each examined indicator.

The difference in participation between members of the target and the control group as drivers in road incidents is significant. It must be taken into account that the average age of the studied population is 21.59 year. That means participants in the study have had on average 3.5 years or less of ability to drive. In Bulgaria the right to drive a car is given after 18 years of age. In this short time every fifth participant, which had been diagnosed with ADHD as a child had been involved in a car accident as a driver.

In practice, the number of patients in our country, who receive consistent treatment for their ADHD is negligible. The whole financial weight of the treatment is at the expense of the families of the diagnosed with the disorder individuals. The current study is performed in a population of untreated patients. The data regarding the follow up of ADHD patients and the negative outcomes related to it in an untreated population are very limited world-wide.

The summary of all data shows that symptoms of ADHD persist throughout development and at least half of patients diagnosed with the disorder in childhood continue to present symptoms in adult age. The negative outcomes (impairments) related to ADHD do not always depend on the persistence of symptoms and treatment in the course of development. It is possible that the observed reduction of symptoms of hyperactivity, and to a lesser degree of impaired attention, is caused in large to the lack of specific criteria for diagnosing the disorder in adult age.