

Conduct Disorders in Seven-year-old Children – Results of ELSPAC Study –

1. Co-morbidity

Kukla L.¹⁾, Hrubá D.²⁾, Tyrlík M.³⁾, Matějová H.²⁾

¹⁾ Research Institute of Preventive and Social Pediatrics, Faculty of Medicine, MU Brno head of institute: ass.prof. MUDr. Lubomír Kukla, PhD. ²⁾ Department of Preventive Medicine, Faculty of Medicine, MU Brno head of department: prof. MUDr. Zuzana Brázdová, DrSc. ³⁾ Department of Psychology, Faculty of Arts, MU Brno, head of department: prof. PhDr. Mojmir Svoboda, PhD.

Abstract

Background. The interest of experts in conduct disorders (CD) research is growing during the last two decades. The research areas include the diagnostics, etiopathogenesis and treatment and also the comorbidity, especially with the hyperkinetic syndrome incidence (Attention Deficit Hyperactivity Disorder – ADHD). This paper intends to describe the conduct disorder occurrence and its other manifestations of divergence found during the investigation of children followed in the prospective longitudinal study ELSPAC in seven, respectively eight years of their age.

Methods and results. Data of 6100 seven-year-old children characterizing their behavior was collected from mothers and attending physicians. In the school year during which this investigation phase took place 2518 of the children reached eight years of age and their behavior, temperament and school results were also evaluated by their teachers. The children were divided into three groups according to the presence or absence of the symptoms, which characterize conduct disorders (found by physicians): „stubborn negativism“, „inability to pay attention“, „aggressiveness“ and „inadequate reactions“. The presence of two of these symptoms was found in 3%, presence of all four symptoms in additional 1,4% of children. Parents and teachers more often indicated various symptoms of hyperactivity in children with conduct disorders.

Conclusions. In almost 5% of the ELSPAC cohort children in seven years of their age those symptoms were diagnosed, which match the Conduct Disorder criteria and Attention Deficit Hyperactivity Disorder (ADHD) criteria. In agreement with similar studies these frequent comorbidities were found: sleep disorders, psychomotor development disorders and laterality changes. The cognitive abilities evaluated by mothers and also teachers based on schoolwork results were more often worsened in children with conduct disorders. Various data indicating their worse social adaptability (which significantly disturbed the class) occurred more frequently in these children.

Key words: Conduct Disorders, psychomotor development, ELSPAC, seven-year-old children, co-morbidity

In the last two decades the interest of specialists in the Conduct Disorders (CD) study is increasing – regarding their diagnostics, etiopathogenesis and treatment, as well as co-

morbidity, especially the ADHD (Attention Deficit Hyperactivity Disorder) – hyperkinetic syndrome occurrence. In the longitudinal studies the possible effect of Conduct Disorders in childhood on the situation in adulthood is studied, if they can be a predisposition factor for similar disorders or addictive substance abuse, eventually delinquency and criminality, even self-inflicted harm or suicides in adulthood.

The study in this field of research encounters a diagnostics methodology problem when it is important to establish a point beyond which the children's conduct is considered different or abnormal and can be a risk factor for the adolescent or adult risk behavior syndrome (1). In the beginning of Conduct Disorders research the parents' information was collected on frequent and intense displays of negative affections included in the term Lack of Control (1). Currently the reaction to serious stress and adaptation disorders (dg. F 43) and conduct disorders (dg. F 91 and F 92) are distinguished. Adaptability disorders are considered a maladaptation syndrome in which a long-term fixation of reaction and specific status appears which in the normal population only occur as immediate and imminent reactions. Conduct Disorders denote the recurring up to permanent occurrence of dis-social, aggressive and defiant behavior which conflicts with the social expectancy appropriate to the child's or adolescent's age (3). The low level of self-control and conduct disorders are also one of the hyperkinetic disorder attributes; also a significantly impaired attention concentration (especially the long-term part) and hyperactivity are attributed to this disorder (4).

The prospective European Longitudinal Study of Pregnancy and Childhood (ELSPAC) was initiated in the beginning of the 1990's by the expert research team from Bristol, Athens and Moscow and the intent was supported by the World Health Organization. A number of European countries entered the study, which is currently investigated in 6 countries – Great Britain, the Isle of Man, the Czech Republic, the Slovak Republic, Russia and Ukraine. The Czech Republic participates with a parent and child cohort from Brno and Znojmo, who were drafted for the study during the years 1990-1991 in the period of the 18th to 20th week of pregnancy. The coordinating center expert team prepares for each investigation phase unified questionnaires and examination protocols which are mandatory for each participating country and besides that each country can add further questions or whole sections which would focus on recording the national specifics. The questionnaires cover a wide range of personal history data about both biological parents (family and personal medical history, living conditions and life-style in the childhood, before and during pregnancy and after delivery), information about the child provided by the mother, attending physician, later also teacher, and a more detailed examination of a randomly selected sub-sample from the studied cohort, performed according to a unified protocol by the investigation team. During early childhood the intervals between individual phases were short (in the middle of pregnancy, at delivery, at age of 6 and 18 months and 3 years), then they settled at a 2-year period (at the age of five and seven years) with further extension after this time. According to original plans the investigation should continue until at least 19 years of age.

Among many indicators of the living conditions and health status also other information is pursued, which allow the study, among others, of conduct disorders occurrence in children, its trends in various investigation phases and some possible causal relationships. The objective of the first part of the paper is to describe the conduct disorders and other displays of behavior divergences occurrence found at the investigation of children at 7, respectively 8 years of age.

Children study sample and methods used

The children were divided into 3 groups, according to the presence or absence of indicators, which characterize the conduct disorders, as reviewed by the physician at the investigation at 7 years of age for the age period between the child's 5 and 7 years of age. From the 12 monitored markers of divergent behavior assessed by the physician from the mother's

statements as well as from eventual specialized examinations or from the child's manifestation at the two-year periodical investigation, there were 4 markers selected to create the groups with different conduct: "stubborn negativism", "inability to concentrate", "aggressiveness", "inadequate reactions". The groups were composed of these children:

1. with absence of conduct disorder (none of the above stated markers was present)
2. with presence of one or two of the selected markers
3. with presence of three or four selected markers

A frequency of other behavioral or psychomotor development divergences (recorded by the physicians and mothers during the last two years) was analyzed within the groups.

Some of the data is obtained through repeated questions in various questionnaires while the parents are instructed in the methodical recommendation not to search for their previous answers.

In a part of the sample of children investigated during this phase, who reached 8 years of age during the school year also a questionnaire investigation by their teachers was performed.

The differences in marker occurrence frequency were in both groups of afflicted children compared with the group of children without any behavior divergences. The statistical program SPSS was used to statistically test the differences (the tests used: Pearson χ^2 , linear associations, probability ratio, ANOVA).

Results

The information given by parents and attending physicians was collected for 6100 seven-year-olds, the majority of whom (5825 = 93,6 %) had, according to physician's exam, no significant behavior divergences. In 187 children (3,0 %) there were 1-2 divergences found and in 88 children (1,4 %) 3 to 4 divergences were found.

In all of the attributes used in the unified physical examination methodical procedure which in detail characterize the child's behavior and the circumstances at the beginning of school attendance, there were highly significant differences between the children without conduct disorders and those who had conduct disorders present (Table 1), with more frequent sleep disorders, pronounced mood sways and neurotic symptoms. Psychomotor development disorder was diagnosed more often in children with conduct disorder, requiring specialized care (neurological, psychological, rehabilitation). The children with no markers of conduct disorder preferred significantly more often the right hand and there was also a higher number of children with total dominance of the right (and eventually left) hand which they use to perform all evaluated activities (writing, drawing, sports etc.).

There were no differences among the children in the frequency of speech disorders (stuttering, lisp speech, incorrect phonemic articulation), but they were significantly different in the occurrence of worse expression abilities and inadequate vocabulary. The children with conduct disorders more often had delayed school attendance beginning, either on recommendation from attending physician, or as a result of a pedagogic finding on school matriculation. At school they had more frequent problems, because of a worse school adaptation they were in specialized care or they attended special schools.

In the subject period between the fifth and seventh year of age the children with conduct disorder were more often away from home for a longer period of time, mostly in a health-care or rehabilitation facility; the stays in children's homes or social care institutions, however, were rare.

The psychomotor development of the seven-year-olds was also evaluated by the mothers with use of several features, of which we selected such ones that complemented the data provided by the physical examination (Table 2). It had showed explicitly that the children without a significantly divergent behavior are less often afflicted with psychic development retardation, evaluated by verbal communication and basic pre-school reading and algebraic skills. These

children only seldom in the last two years had problems with the motor system, on the contrary to the children with diagnosed divergences. More detailed specialized examination (dyslexia, dyscalculia or dysgraphia) was in the ELSPEC child cohort performed between the eighth and ninth year of age and then at the age of eleven: differences with more pronounced significance have shown only in the dysorthographia frequency; it is not, however, an area covered in the first grade of elementary school education.

The questions about the child's conduct disorders were responded to by the mothers in two separate questionnaires: while in the first case the personal history period regarded the phase between the fifth and seventh year of age, in the other the questions regarded the past six months (Table 3). It is interesting that even the mothers of children without medical evidence of behavior divergent from normal (as found by the attending physicians) stated rather high frequency of repeated temper tantrums, hyperactivity, absent-mindedness, although a lot less than the mothers with children with record of divergent behavior. 209 mothers in total have positively responded to the question if there has been anybody who has queried the conduct or the properties of their child in such manner, that she paid great attention to such notice. Most mothers set up a specialized examination of the child, but still worry about the future conduct development of their child: also in these indicators the frequency of children with behavior divergences was significantly higher.

The teacher's statements were collected for 2518 eight-year-olds from this cohort. From the whole sample of children who participated in the investigation at seven years of age therefore 41,3 % of children also had records of the teacher's opinions: the data was obtained for 42 % of children without divergences, for 29 % of children with minor divergences and for almost 22 % of children with pronounced behavior divergences. In this sub-sample the representation of children with diagnosed behavior divergences was therefore lower: 54 (2,1 %) with minor and 19 (0,8 %) with pronounced divergences of behavior. The teachers were not in any way informed about the previous evaluation of children by their attending physicians and parents. In the first part of the questionnaire the teachers were to express, if the stated conduct disorder characteristics is not at all relevant to the child or if they are true description of the child, and if only on separate occasions or is completely true (Table 4). In case of all stated conduct disorder indicators in the group without diagnosed divergences, the significantly more frequent answer was that the given characteristic does not apply to the child and on the contrary the least frequent was the answer that the characteristic is completely true of the child.

The behavior markers which have relationship to the working conditions during the education process were evaluated by the teacher in a separate section: similarly to the previous evaluation, the conduct disorders occurred often in the larger number of children classified in the group with divergent behavior.

An interesting comparison came out of the evaluation of the same behavioral aspects by the mother and the teacher: information about the hyperactivity and lack of attention was given twice as often in the mothers' evaluation than the teachers', in all groups of children (Tables 3 and 4). Another reduction in the frequency of these features was observed when the teachers evaluated the same children, in the question whether these disorders occur often (Table 5).

In almost a half of all children evaluated by the teachers it was stated that they have difficulties in the area of emotional experiencing or attention and concentration, conduct and interpersonal relationships: the surprising part is, that according to the teachers the frequency of these difficulties is not significantly different in the individual groups of children as divided according to the physicians (Table 6). Nevertheless, the intensity of these difficulties is probably lower in the children from the first group because according to the teachers' opinion they only interrupt the teacher's and class work in a minor way and in a minor way they interfere with the interpersonal relationships and are a cause of the psychological

imbalance of the children when compared to the problems caused by the children from the two other groups where the behavior divergences were diagnosed by the physician. The differences between the individual groups of children have also manifested when evaluating their skills in the individual fields of schoolwork: in the group of children without behavior divergences there was always the highest frequency of very good classifications (in the school grading scale by the grades 1 or 2), on the contrary the children with conduct disorders were more often classified poorly (grades 4; grade 5 is not used in the first class of elementary school) (Table 7). The highest occurrence of poor classification was recorded in all groups of children in the subject of writing, which could suggest certain problems in hand motor coordination. This is however in contrast in low frequency of poor grades in manual skills. According to teachers' opinions very many children would need a special pedagogical care, up to one fifth of the group of children where the physicians didn't find any behavior divergences.

Discussion

Conduct Disorders are not the exclusive domain of psychopathology, because various elements usually denoted as asocial penetrate the conduct of people considered "normal". Basically we are dealing with a continuous transition between maladaptation manifestations and conduct disorders in which the longevity of the divergence presence is decisive. Conduct Disorders are an important part of illnesses classified as hyperkinetic disorders (according to the 10th revision of the International Classification of Diseases ICD-10) or Attention Deficit Hyperactivity Disorder (ADHD according to the American Medical Association DSM-IV). In both evaluation systems 4 criteria were established to diagnose these illnesses:

- often there is lack of concentration during play or task fulfilling, age-adequate tasks are not finished, often refused;
- frequent forgetting, losing utensils necessary to fulfill tasks;
- concentration is easily distracted by external stimuli
- loudness, decreased ability to be quiet, still;
- jumping out of chair, running around;
- constant activity without an acceptable cause or context;
- the symptoms must occur at least in two different environments (e.g. at home and at school)
- their beginning is placed in the pre-school age period
- they last over six months
- they are not related to the development level;
- they significantly disturb social or professional activities (5).

ADHD is now considered owing to the wide symptomatology, to be a clinically heterogeneous unit which the experts usually divide into three subtypes: distracted, hyperactive-impulsive and combined (6).

The most recent expert perspectives alert about the continuing lack of objective diagnostic methods in assessing conduct disorders as well as in diagnosing hyperkinetic syndrome with attention disorders (ADHD). In the subjective approach the physician's experience with child behavior, what he/she feels is still normal and what he/she considers to be an abnormal reaction makes an important difference. In individual cases it is important how well he knows the evaluated child in order to assess his/her behavior not only during the examination but also in different situations (5). It is very possible that considering the subjective nature of current diagnostics any child experiencing immediate problems in the school system or with parents will be classified by physicians among patients with psychiatric diagnosis often based only on a short examination (duration of several minutes). The diagnostic model doesn't include the investigation of the social, educational and other external factors which have a

relation to the problem behavior. A child classified with a diagnose of risk behavior or ADHD can become less acceptable up to unacceptable for the parents and teachers. His/hers efforts are not evaluated as successful, he/she is denied a chance to make independent decisions. The scarcity and lack of prospective longitudinal well controlled studies on the results of the long-term medicament treatment of ADHD leaves, unfortunately, room for the possibility that the treatment can rather have detrimental effects (can cause depressions) especially when amphetamine-type medication is administered (7). That is why the estimates on incidence of these disorders are contradictory, recently it is estimated that it is from 5-10 % with higher incidence in boys (8).

The legitimate objections to the older studies from the end of the last and the beginning of this century led to the development of more objective diagnostic criteria: listing questionnaires came to use (e.g. Achenbach's , Conners's, Rutter's, Barkley's (9) and various cognitive performance tests (Continuous Performance Tests – CPTs), more recently the Test of Variables Attention – TOVA) which allows to record even sub-clinical problem behavior forms (10). Diagnosing hyperactivity and conduct disorders is complicated and should include:

- interview of the physician with the parents (examining the child's development, the family history, current problems' symptomatology in the sense of diagnostic criteria);
- discussions with the teacher, obtaining systematic information from all areas of diagnostic criteria;
- using recent specialized questionnaires;
- examining the child to exclude the somatic causes of conduct disorders, attention, activity;
- using cognitive tests can be used as an auxiliary examination (9).

The features which express the temperament and character find in the afflicted children higher and more frequent emotional instability, negative affects, mood sways, excitability and impulsiveness, distractibility, social difficulties with the peers, parents and educators (11).

Also this area of psychological manifestations of children is covered by a criteria set: the JTCI model (Junior Temperament and Character Inventory) (12) includes 4 temperament dimensions (novelty seeking, evading danger, dependence on reward and perseverance) and 3 character dimensions (self conduct, the ability to cooperate, the ability to excel). A study focusing on standardized temperament and character assessment has found out that the "novelty seeking" feature is strongly associated with these conduct disorder types: problems with attention, more frequent aggressive to delinquent behavior, social problems. These characteristics were more often found in the children diagnosed with hyperactive syndromes and who at the same time had lower self-regulation and cooperation ability scores (6). The temperament characterized by the marker "novelty seeking" is typical for hyperactive persons not only in childhood, but also in pre-pubertal and adult age (13, 14). The pronounce described temperament manifestations have not only shown in children with ADHD syndrome but also (similarly as in the ELSPAC study) in children with conduct disorders (15).

To support the Conduct Disorder and ADHD diagnoses also objective observation results were published which document certain development disorders (changes in white matter density) in certain areas of the brain (especially prefrontal lobes), which are important for motor skills, cognitive abilities, emotiveness and memory (16). The development in the genetics field enabled the detection of over 30 dopaminergic, serotonergic and noradrenergic gene: many of them show genetic variations which affect the behavior via their effect on neurotransmitter system. Until this point the research has brought consistent results which support the hereditary conditionality of ADHD: DRD3, DRD4, DRD5 dopamine receptor genes polymorphisms, DAT dopamine transport gene polymorphisms and the gene

which influences dopamine beta hydroxylase DBH polymorphisms are considered confirmed (16). DRD3 and DAT gene polymorphisms also have relation to the incidence of the important temperament marker “novelty seeking” (17).

In agreement with the hypothesis of serotonergic dysfunction as one possible cause these genetic polymorphisms have been researched and eventually differences have been found in genes HTR1B (serotonin receptors), 5HTT (serotonin transport genes), SNAP25 (influences a synapse protein 25) (18) or TPH 2, which regulates the tryptofan hydroxylase enzyme which intervenes in serotonin syntesis in the brain (19).

Although the search for the biochemical markers which would correlate with the clinical symptomatology of Conduct Disorders and hyperkinetic syndrome is to some extent limited by ethical limitation (especially cerebrospinal liquid examination), currently there a variety of studies which agree in finding e.g. higher noradrenaline and glycol 3-methoxy-4-hydroxyphenyl serum levels in patients with conduct disorders and dyslexia (20), lower serotonin and homovaniline acid levels in persons with hyperkinetic syndrome (21).

The ELSPAC study which in the Czech Republic began in the years 1990-1991 used in the methodology for pre-school and young school children behavior characteristics the markers usual for the period 10 years ago: from data acquired during physical examination it is not possible to deduce, which children manifested the symptom complex typical for ADHD diagnose. Especially the assessment of remarkable unrest, hyperactivity was not methodically required from the physicians therefore in the results of ELSPAC this symptom appears as a conduct disorder co-morbidity as stated by the mothers and teachers.

Since then the diagnostic criteria has been refined and the expert community level of knowledge in this area has increased. In the ELSPAC study the physicians, while diagnosing divergent to defective behavior, have not taken into account the teacher evaluation of children and their school performance; these were evaluated a year later. They certainly did proceed from the parents' statements and confronted the information with their examination. The mothers' statements on significantly different behavior were evaluated more critically by the physicians, they more often evaluated abnormalities as normal manifestations. Therefore also positive accounts from the mothers and later the teachers were also recorded on wide variety of conduct disorder symptoms in the group of children which was later classified by the physicians as no-problem.

In the literature, on the contrary, the divergent up to disturbed behavior is stated as a ADHD co-morbidity: it appears in 50-80 % of children with ADHD (22). The data about learning disorders are also frequent (20-25 %). In this aspect the ELSPAC results confirmed the existing knowledge.

During a certain period of time also excessive movements in sleep, pronounced tiredness and sleep disorders were included in the ADHD diagnostic criteria, although later they were eliminated from the diagnostic criteria as non-specific symptoms. There is much evidence for the statement that insufficient sleep causes behavior regulation disorders, influences cognitive functions (especially attention and memory, controlled from the prefrontal brain core area) and also has a direct influence on mood and affective syndromes increase (23).

Some researchers not only confirmed the high correlation between sleep disorders occurrence and problems with attention, learning and behavior in the child population, they even supplied the background for a premise that at least in part of the children the sleep disorders were the primary cause for later appearing conduct disorders (24). The syndrome of obstructive sleep apnoe and sleep breathing disorders (frequent snoring) are considered to be the main internal cause of sleep disorders: in such afflicted children hyperactivity occurred 2,4 times more often, attention disorders 4 times as often, problematic relationships with peers 9,7 times more often (25). Children with sleep disorders had motor function and memory disorders and worse school performance (26). Conduct disorders in the sense of mood sways, anxiety and

hyperactivity had closer relation to the sleep disorders than in the case of children with ADHD (27). The increased incidence of sleep disorders in children with conduct disorder was confirmed also in the ELSPAC sample.

Many studies investigated the cognitive performance of children with conduct disorders, however with inconclusive results. The more detailed description of the cognitive abilities assessment conditions has shown, that the results are related to the methodology used. Excited problem children can better fulfill those tasks, which have caught their attention in some manner (28). When various psychological tests are used, a lot of emphasis is usually put on the exact rule explanation, instruction repetition and repeated encouragement: all this can maximize also the performance of the children with conduct disorders (29). That is the main difference between the psychologists' and teachers' assessment conditions. The teachers evaluate the children based on common schoolwork, the same as in the ELSPAC study methodology. The results of the studies which evaluate memory deficit are also varied: the earlier works described higher incidence in children with conduct disorders (e.g. 30), while others didn't find any differences (31). It is possible that the results were affected by the type of memory evaluated – short-memory (repeating information) or long-term (visual memory tests). In the ELSPAC sample the information about worse school-work performance was more frequent (with high significance) in children with conduct disorders, based both on the information given by parents as well as by the teacher.

Some studies report motor skills and abilities disorders in up to a half of the children with conduct disorders (32, 33): the authors suppose that it is a consequence of the attention deficit, worse sensory perception which impair the ability to control the motor system. Also the necessity of longer time-span to perform a movement was denoted as characteristic for the children with conduct disorders and hyperactivity (34). Psychomotor development disorders were in the ELSPAC sample diagnosed by a physician almost in a half of the children with minor and almost in two thirds of children with more pronounced conduct disorders.

According to the data from the mothers and teachers the occurrence of decreased manual skills was higher in the children with problem behavior, but the frequency, however, was much scarcer in all groups. It is obvious that the specialized physician's assessment is performed under stricter criteria which are not taken into account by the non-specialists. The more frequent laterality changes in the sense of left hand preference and ambivalent use of both limbs in children with conduct disorder and hyperactivity syndrome are described by various studies (e.g. 35-38). Also in the ELSPAC study children significant relationships have been found. Laterality changes are considered to be a possible marker of prenatal brain development defect, influenced by an exposure to chemical substances, mothers' psychological distress in pregnancy (39).

Conclusion

Although the methodology of conduct disorder, temperament and character investigation did not correspond to more detailed recommendations during the investigation of the seven-year-old children in the Czech ELSPAC cohort, it can be stated that the symptoms corresponding to the Conduct Disorder and ADHD criteria were diagnosed in almost 5 % of children. In accordance with similar studies the frequent co-morbidities were the sleep and psychomotor disorders and laterality changes. The cognitive abilities evaluated by the mothers and also teachers according to school-work results were more often worse in children with conduct disorders. Various indications of their worse social adaptability, which significantly disrupted the education process, were more frequent in the children with these disorders.

The longitudinal behavior development and the occurrence of possible risk factors which could have affected the conduct disorders are analyzed in following papers.

Abbreviations

- ADHD - Attention Deficit Hyperactivity Disorder
- CD - Conduct Disorders
- CPTs - Continuous Performance Tests
- DAT - Dopamine Transporter Gene
- DBH - Dopamine-beta Hydrolase enzyme
- DRDs - Dopamine receptor genes
- DSM-IV - Diagnostic and Statistical Manual of Mental Disorders
- ELSPAC - European Longitudinal Study of Pregnancy and Childhood
- HTR1B - Serotonin receptors
- 5 HTT - Serotonin transporter genes
- ICD-10 - International Statistical Classification of Diseases and Related Health Problems – 10th Revision
- JTCI - Junior Temperament and Character Inventory
- SNAP 25 - Synaptosomal-associated Protein 25
- TOVA - Test of Variable Attention
- TPH - Tryptofan hydrolase enzyme regulation gene

Literature

1. Paclt, I., Zvolský, P., Florián, J.: Developmental Aspects of Child and Adolescent Conduct Disorders (in Czech). *Čs Pediat*, 1999, 54, 5, s. 237-240.
2. Malá, E.: Conduct Disorder Diagnostics According to ICD-1 (in Czech). *Čes Slov Psychiat*, 1994, 90, s. 262-268.
3. Hamanová, J., Hellerová, P.: Risk Behavior Syndrome in Adolescence, part 1 (in Czech). *Čes.-slov. Pediat*, 2000, 35, 6, s. 380-387.
4. Paclt, I., Florián, J.: Hyperactive Disorder (ADHD): Progress in the Cognitive, Neurobiological and Genetic Research (in Czech). *Čs Pediat*, 1999, 54, 9, s. 503-508.
5. Williams, Ch., Wright, J.B., Partridge, I.: Attention deficit hyperactivity disorders – a review. *Br J Gen Practice* 1999, 49, p. 563-571.
6. Yoo, H.J., Kim, M., Ha, J.H. et al.: Biogenetic temperament and character and attention deficit hyperactivity disorder in Korean children. *Psychopatology*, 2006, 39, p. 25-31.
7. Kean, B.: The risk society and Attention deficit hyperactivity disorder (ADHD): A critical social research analysis concerning the development and social impact of the ADHD diagnosis. *Ethical Hum Psychol Psychiat*, 2005, 7, 2, p. 131-142.
8. Scabill, I., Schwab-Stone, M.: Epidemiology of ADHD in school-age children. *Child Adolesc Clin North Am*, 2000, 9, p. 541-555.
9. Williams, Ch., Wright, J.B., Smith, R.: CHEAF – a multidisciplinary Pow Wow for children. *Psychiatric Bull*, 1999, 23, p. 104-106.

10. Preston, A.S., Fennell, E.B., Bussing, R.: Utility of a CPT in diagnosis ADHD among a representative sample of high-risk children: A cautionary study. *Child Neuropsychology* 2005, 11, 5, p. 459-469.
11. Shea, T., Fisher, B.E.: Self ratings of mood levels and mood variability as predictor of Junior 1-6 impulsivity and ADHD classroom behaviors. *Pers Individ Diff*, 1996, 20, p. 209-214.
12. Luby, J.L., Svakic, D.M., McCallum, K. et al.: The junior temperament and character inventory: preliminary validation of a child self-reported measure. *Psychol Rep*, 1999, 84. p. 1127-1138.
13. Tillman, R., Geller, B., Crany, J.L. et al.: Temperament and character in a prepubertal and early adolescent bipolar disorder phenotype compared to attention deficit hyperactive and normal controls. *J Child Adolesc Psychopharmacol*, 2003, 13, p. 531-543.
14. Downey, K.K., Stelson, F.W., Pomerlau, O.F., Giordani, B.: Personality differences related to smoking and adult attention deficit hyperactivity disorder. *J Subst Abuse*, 1996, 8, p. 129-135.
15. Schmeck, K., Poustka, F.: Temperament and disruptive behavior disorders. *Psychopathology*, 2001, 34, p.159-163.
16. Barnea-Goraly, N., Menon, V., Eckert, M. et al.: White matter development during childhood and adolescence: A cross-sectional diffusion tensor imaging study. *Cerebral Cortex* 2005, 15, 12, p. 1848-1854.
17. Bussing, R., Gary, F.A., Masob, D.M. et al.: Child temperament, ADHD, and caregiver strain: exploring relationships in an epidemiological sample. *J Am Acad Child Adolesc Psychiatry*, 2003, 42, p. 184-192.
18. Paclt, I., Koudelová, J., Křepelová, A. et al.: Biochemical markers and genetic research of ADHD. *Neuroendocrinol Lett*, 2005, 26 4, p. 423-430.
19. Walitza, S., Renner, T.J., Dempfle, A. et al.: Transmission disequilibrium of polymorphic variants in the tryptophan hydroxylase-2 gene in attention deficit/hyperactivity disorder. *Mol Psychiat*, 2005, 10, 12, p. 1126-1132.
20. Halperin, J.M., Newcorn, J.H., Koda, V.H. et al.: Noradrenergic mechanisms in ADHD children with and without reading disabilities: a replication and extension. *J Am Acad Child Adolesc Psychiatry*, 1997, 36, 12, p. 1688-1697.
21. Castellanos, F.X., Ella, J., Kruesi, M.J. et al.: Cerebrospinal monoamine metabolites in boys with attention – deficit hyperactivity disorder. *Psychiatry Res*, 1994, 52, 3, p. 305-316.
22. Jensen, P.S., Martin, B.A., Cantwell, D.P.: Comorbidity in ADHD: Implications for research, practice and DSM-IV. *J Amer Acad Child Adolesc Psychiat*, 1997, 36, p. 1065-1079.

23. Fallone, G., Owens, J., Deane, J.: Sleepiness in children and adolescents: clinical implications. *Sleep Med Rev*, 2002, 6, p. 287-306.
24. Smedje, H., Broman, J.E., Hetta, J.: Associations between disturbed sleep and behavioral difficulties in 635 children aged 6-16 years: a study based on parent's perception. *Eur Child Adolesc Psychiatry*, 2001, 10, p. 1-9.
25. Urschitz, M.S., Eitner, S., Guenther, A. et al.: Habitual snoring, intermittent hypoxia, and impaired behavior in primary school children. *Pediatrics*, 2004, 114, p. 1041-1048.
26. Gozal, D., Pope, D.: Snoring during early childhood and academic performance at ages thirteen to fourteen years. *Pediatrics*, 2001, 107, p. 1394-1399.
27. McLaughlin Grabtree, V., Ivanenko, A., Gozal, D.: Clinical and parental assessment of sleep in children with attention-deficit/hyperactivity disorders referred to a Pediatric Sleep Medicine Center. *Clin Pediatr*, 2003, 42, p. 807-813.
28. Barkley, R.A., Grodzinsky, G., DuPaul, D.J.: Frontal lobe functions in attention deficit/hyperactivity disorders: A review and research report. *J Abnorm Child Psychol*, 1992, 20, p. 163-188.
29. Barkley, R.A.: Issues in the diagnosis of attention deficit/hyperactivity disorder in children. *Brain Dev*, 2003, 25, p. 77-83.
30. Pennington, B.F., Ozonoff, S.: Executive function and developmental psychopathology. *J Child Psychol Psychiatry*, 1996, 37, p. 51-87.
31. Kashala, E., Elgen, I., Sommerfelt, K. et al.: Cognition in African children with attention deficit hyperactivity disorder. *Pediatr Neurol*, 2005, 33, p. 357-364.
32. Landgren, M., Kjellman, B., Gillberg, C.: Attention deficit disorder with developmental coordination disorders. *Arch Dis Child*, 1998, 79, p. 207 – 212.
33. Kadesjo, B., Gillbert, C.: Attention deficit and clumsiness in Swedish 7-year-old children. *Dev Med Child Neurol*, 1998, 40, p. 796-804.
34. Burger, N., van der Meere, J.: Visual behavior of ADHD children during an attention test: An almost forgotten variable ADHD. *J Child Psychol Psychiatry*, 2000, 41, p. 525-532.
35. Alonso, S.J., Navarro, E., Santana, C., Rodriguez, M.: Motor lateralization, behavioral despair, and dopaminergic brain asymmetry after prenatal stress. *Pharmacol Biochem Behav*, 1997, 58, p. 443-448.
36. Castellanos, F.X., Giedd, J.N., Marsh, W.L. et al.: Quantitative brain magnetic resonance imaging in attention-deficit hyperactivity disorder. *Arch Gen Psychiatry*, 1996, 53, p. 607-616.
37. Fride, W., Weinstock, M.: Prenatal stress increases anxiety related behavior and alters cerebral lateralization of dopamine activity. *Life Sci*, 1988, 42, p. 1059-1065.

38. Reid, H.M., Norvilitis, J.M.: Evidence for anomalous lateralization across domain in ADHD children as well as adults identified with the Wender Utah rating scale. *J Psychiatr Res*, 2000, 84, p. 311-316.

39. Obel, C., Hedegaard, M., Henriksen, T.B. et al,: Psychological factors in pregnancy and mixed-handedness in the offspring. *Develop Med Child Neurol*, 2003, 45, p. 557-561.

This study was supported by an IGA of MH CR grant n. NR 8791-2/2006.

Table 1: Differences in psychomotor development of children with different behavior (according to physician - %)

MARKER	GROUPS
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	1	2	3
Sleep disorders	0,6***	4,9	12,8
Mood sways	0,2***	14,1	41,0
Some neurotic manifestations	1,6***	20,7	47,6
Diagnosed psychomotor development disorder	3,5***	47,6	63,2
The child is a right-hander	95,0	86,6***	91,5**
Uses one hand for all activities	98,6***	95,4	93,1
Expression skills are not adequate to age	1,2***	24,9	31,0
Vocabulary is not adequate to age	1,1***	24,0	29,9
The child spends time alone regularly away from the family	6,4***	13,7	25,6
The child's school attendance start is postponed	18,1***	77,1	57,0
The child attends a special school	0,9***	16,1	24,1
The child didn't adapt well to school	1,4***	22,8	43,1
The child is having/has had problems at school	3,2***	23,1	46,9

Statistic significance: ** = $p < 0,01$, *** = $p < 0,001$

Table 2: Psychomotor development disorder frequencies according to mothers' information (%)

MARKER	Groups			
	1	2	3	
Speech problems in the last 2 years	34,6***	72,1	52,0	
Present speech problems	28,8**	53,2	38,5	
Clumsiness, mobility, coordination problems	1,5***	11,9	16,0	
Reading simple words	Can't read simple words	11,3***	51,5	40,0
	Reads well simple words	80,5***	34,8	44,0
Reading a 10 word story	Can't read a 10 word story	20,3***	49,2	56,5
	Reads well a 10 word story	69,5***	25,4	34,8
Counting to 20	Can't count to 20	1,5***	7,6	24,0
	Counts well to 20	94,0***	75,8	68,0
Counting to 100	Can't count to 100	17,8***	38,1	37,5
	Counts well to 100	57,6**	41,3	50,0

Statistic significance: ** = $p < 0,01$, *** = $p < 0,001$

Table 3: Conduct disorder frequency according to mother's information (%)

MARTIN	GROUPS		
	1	2	3

Temper tantrums	daily, most days	6,9***	19,4	24,0
	never	33,6***	22,4	16,0
	in the last six months	42,9***	60,0	68,0
Disquiet, hyperactivity in the last six months		49,6***	66,7	76,0
Can't sit still, constant fidgeting		61,8	80,3***	64,0
Distractedness, oscillating concentration		49,4***	69,7	68,0
People wondered at the child's behavior		6,6***	23,4	36,0
The child was examined by a specialist because of behavior)*		44,9***	80,0	88,9
Behavior problems persist)*		72,2	66,7	88,9
The mother is concerned with the child's behavior development)*		6,7***	18,2	44,0

Statistic significance: *** = $p < 0,001$

Note: in markers indicated by)* the frequency only referred to those children, whose mother confirmed that someone wondered at the child's inadequate behavior

Table 4: Characteristics of the child according to teachers' statements (%)

MARKER		Groups		
		1	2	3
The child is restless, hyperactive	not true	57,8***	31,5	31,6
	definitely true	15,0	33,3***	36,8***
The child has frequent mood sways, is irritable	not true	73,8***	50,0	57,9
	definitely true	6,6	11,1*	36,8***
The child keeps fidgeting, shuffling	not true	57,8***	35,2	36,8
	definitely true	14,2	27,8**	36,8**
Fights often, is rude to other children	not true	71,4***	59,3	42,1
	definitely true	7,5	11,1	31,6**
The child is easily distracted, doesn't pay attention	not true	43,5***	18,5	15,8
	definitely true	17,7	38,9**	42,1***
The child is nervous, unsure	not true	43,2	20,4**	42,1
	definitely true	13,5	16,7	31,6**
Takes (steals) things at school, at home, somewhere else	not true	95,6	96,3	89,5*
	definitely true	1,2	1,9	10,5*
The child is mischievous, hurts other children	not true	81,8	75,9	63,2*
	definitely true	3,2	3,7	15,8*

Statistic significance: * = $p < 0,05$, ** = $p < 0,01$, *** = $p < 0,001$

Table 5: Detailed description of the child's behavior according to the teacher (%)

MARKER	GROUP		
	1	2	3

Has problems to keep concentrating on a task	never	36,9***	14,8	10,5
	often	8,5	18,5**	21,1**
Is easily distracted	never	23,5***	3,7	10,5
	often	13,7	33,3**	36,8**
Performs purposeless, spontaneous movements	never	61,5***	25,9	47,4
	often	9,1	22,2**	15,8*
Gets up from chair without reason when supposed to be seated	never	72,4***	46,3	47,4
	often	4,1	11,1*	15,8**
Can't be calmed down in situations when it is distracting	never	78,2***	55,6	47,4
	often	2,9	9,3**	5,3
Acts hastily, is hyperactive	never	70,0***	46,3	47,4
	often	5,2	9,3*	21,1**

Statistic significance: * = $p < 0,05$, ** = $p < 0,01$, *** = $p < 0,001$

Table 6: Children with problems in the area of emotive experience, attention and concentration, behavior and interpersonal relationships – according to teacher's evaluation

MARKER	GROUPS		
	1	2	3
Number of children with mentioned problems	1184	35	13
From the whole study sample (%)	48,4	64,8	68,4
The child doesn't sorrow over his/her problems	26,1	31,4	7,7**
The child sorrows much over his/her problems	17,5	22,9	61,6**
The child's problems don't affect personal relationships	28,1	16,7	7,7**
The child's problems strongly affect personal relationships	21,1	41,7*	61,6**
The child's problems don't disrupt the class-work	20,7	8,3**	7,7**
The child's problems strongly disrupt the class-work	28,5	55,6**	69,3***
The child's problems are not a stress for the teacher	35,4	19,4*	23,1*
The child's problems present a significant stress for the teacher	17,0	41,7**	46,2**
The child's problems are not a stress for the class	46,1	25,0*	23,1*
The child's problems present a significant stress for the class	14,9	33,3**	46,2**

Statistic significance: * = $p < 0,05$, ** = $p < 0,01$, *** = $p < 0,001$

Table 7: Evaluation of the children's skills in various fields of school education (% of children)

MARKER	CLASSIFICATION	GROUPS		
		1	2	3
Reading	Very good	43,8**	37,7	15,8
	Poor	2,7	7,5*	15,8**
Writing	Very good	38,7***	16,7	15,8
	Poor	4,4	7,4	26,5***
Mathematics	Very good	54,4**	31,5	31,6
	Poor	1,2	3,7	10,5***
General knowledge	Very good	43,2**	29,6	21,1
	Poor	1,2	7,4**	5,3*
Motor skills	Very good	56,0	38,9*	55,6
	Poor	1,9	7,4*	5,6*
Manual dexterity and creativity	Very good	47,8***	18,5	22,2
	Poor	1,5	5,6*	5,6*
A need for special pedagogic care found		18,4	38,9***	47,4***

Statistic significance: * = $p < 0,05$, ** = $p < 0,01$, *** = $p < 0,001$