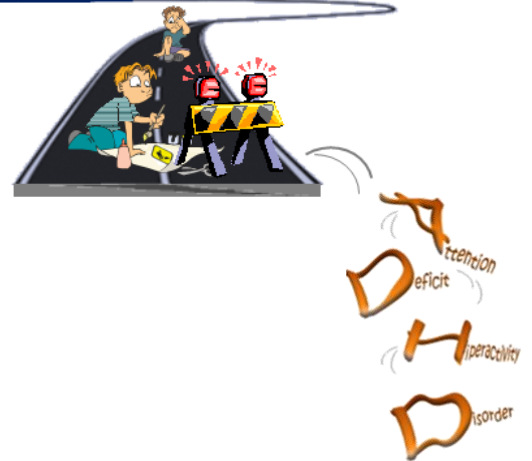




NEWSLETTER



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BIBLIOGRAFIA ADHD FEBBRAIO 2017

Afr J Psychiatry (South Africa). 2016;22.

THE FUNCTIONING AND BEHAVIOUR OF BIOLOGICAL PARENTS OF CHILDREN DIAGNOSED WITH ATTENTION-DEFICIT/HYPERACTIVITY DISORDER, ATTENDING THE OUTPATIENT DEPARTMENT AT WESKOPPIES HOSPITAL, PRETORIA.

Sundarlall R, der Westhuizen DV, Fletcher L.

Background: ADHD (attention-deficit/hyperactivity disorder) is gradually being acknowledged as a functionally impairing disorder across the lifespan, underscored by heritability. Nonetheless, lack of ADHD (adult attention-deficit/hyperactivity disorder) data from South Africa is alarming which could be due to either the unawareness of ADHD symptoms or underutilisation of available screening measures. Undiagnosed ADHD may influence family- and working lives unpleasantly. Parenting a child with ADHD may intensify parental stress through functional impairment notwithstanding the diagnosis of ADHD.

Methods: Eighty-one biological parents of children diagnosed with attention-deficit/ hyperactivity disorder were screened using self-reporting measurements. ADHD self-report scale (ASRS-V 1.1) identified either positive or negative subgroups; the Weiss functional impairment rating scale (WFIR-S) for functional impairment and the Jerome driving questionnaire (JDQ) for risk-taking behaviour specifically driving.

Results: Of the 39 (48%) parents who experienced impairment in all seven areas of functioning, 23 (59%) screened negative for ADHD, while 16 (41%) screened positive. A significant association was found between parents who screened either positive or negative for ADHD and functional impairment across five of the seven individual categories namely family, work, self-concept, life-skills and social functioning.

Conclusion: This study emphasised the high incidence of functional impairment in parents of ADHD children. Although a substantial number of parents screened negative for ADHD, they still reported impairment in functioning; probably due to undiagnosed ADHD with comorbid psychiatric disorders, and/or parental stress due to the complex behaviour of the child. Parents of children diagnosed with ADHD should be screened for functional impairment followed by referral for psychiatric assessment and parent management training to achieve better clinical outcomes

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Per la ricerca degli articoli pubblicati nella letteratura scientifica nel mese in esame sono state consultate le banche dati Medline, Embase, PsycINFO e PsycArticle utilizzando le seguenti parole chiave (o i loro sinonimi): 'Attention deficit disorder', 'Attention deficit hyperactivity disorder', 'Infant', 'Child', 'Adolescent', 'Human'. Sono qui riportate le referenze considerate rilevanti e pertinenti.

American Journal of Managed Care. 2017;23:e1-e9.

AN ASSESSMENT OF THE CHIP/MEDICAID QUALITY MEASURE FOR ADHD.

Blackburn J, Becker DJ, Morrisey MA, et al.

Objectives: We analyzed a standard children's quality measure for attention-deficit/hyperactivity disorder (ADHD) using data from a single state to understand the characteristics of those meeting the measure, potential barriers to meeting the measure, and how meeting the measure affected outcomes.

Study Design: Retrospective study using claims from Alabama's Children's Health Insurance Program from 1999 to 2012.

Methods: We calculated the quality measure for ADHD care, as specified within CMS' Child Core Set and with an expanded denominator. We described the eligible population meeting the measure, assessed potential barriers, and measured the association with health expenditures using logit regressions and log-Poisson models.

Results: Among those receiving ADHD medication, 11% of enrollees were eligible for annual measure calculation during our study period. Calculated as specified by CMS, 38% of enrollees met the measure. Using an expanded denominator of 7615 eligible medication episodes, 14% met all aspects of the measure. Primary reasons for failing to meet the measure were lacking medication coverage (64%) and lacking a follow-up visit within 30 days (62%). The rate of meeting the measure decreased with age and was lower for black enrollees. Health service utilization and costs were greater among children meeting the measure.

Conclusions: Too few children are eligible for inclusion, and systematic differences exist among those who meet the measure. The measure may be sensitive to arbitrary criteria while missing potentially relevant clinical care. Refinements to the measure should be considered to improve generalizability to all children with ADHD and improve clinical relevance. States must consider additional analyses to direct quality improvement

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Auris Nasus Larynx. 2017.

PRELIMINARY EVIDENCE OF IMPROVED COGNITIVE PERFORMANCE FOLLOWING VESTIBULAR REHABILITATION IN CHILDREN WITH COMBINED ADHD (cADHD) AND CONCURRENT VESTIBULAR IMPAIRMENT.

Lotfi Y, Rezazadeh N, Moossavi A, et al.

Objective: Balance function has been reported to be worse in ADHD children than in their normal peers. The present study hypothesized that an improvement in balance could result in better cognitive performance in children with ADHD and concurrent vestibular impairment. This study was designed to evaluate the effects of comprehensive vestibular rehabilitation therapy on the cognitive performance of children with combined ADHD and concurrent vestibular impairment.

Methods: Subject were 54 children with combined ADHD. Those with severe vestibular impairment (n = 33) were randomly assigned to two groups that were matched for age. A rehabilitation program comprising overall balance and gait, postural stability, and eye movement exercises was assigned to the intervention group. Subjects in the control group received no intervention for the same time period. Intervention was administered twice weekly for 12 weeks. Choice reaction time (CRT) and spatial working memory (SWM) subtypes of the Cambridge Neuropsychological Test Automated Battery (CANTAB) were completed pre- and post-intervention to determine the effects of vestibular rehabilitation on the cognitive performance of the subjects with ADHD and concurrent vestibular impairment. ANCOVA was used to compare the test results of the intervention and control group post-test.

Results: The percentage of correct trial scores for the CRT achieved by the intervention group post-test increased significantly compared to those of the control group (p = 0.029). The CRT mean latency scores were significantly prolonged in the intervention group following intervention (p = 0.007) compared to the control group. No significant change was found in spatial functioning of the subjects with ADHD following 12 weeks of intervention (p. >. 0.05).

Conclusion: The study highlights the effect of vestibular rehabilitation on the cognitive performance of children with combined ADHD and concurrent vestibular disorder. The findings indicate that attention can be affected by early vestibular rehabilitation, which is a basic program for improving memory function in such children. Appropriate vestibular rehabilitation programs based on the type of vestibular impairment of children can improve their cognitive ability to some extent in children with ADHD and concurrent vestibular impairment (p. > . 0.05)

Basic and Clinical Pharmacology and Toxicology. 2017.

UTILIZATION OF STIMULANTS AND ATOMOXETINE FOR ATTENTION-DEFICIT/HYPERACTIVITY DISORDER AMONG 5.4 MILLION CHILDREN USING POPULATION-BASED LONGITUDINAL DATA.

Furu K, Karlstad +, Zoega H, et al.

Use of stimulants to treat attention-deficit/hyperactivity disorder (ADHD) has increased over the past two decades and varies substantially between countries. The objective of this multinational population-based study was to examine utilization of ADHD drugs (stimulants and atomoxetine) including comedication with other psychotropic drugs in the entire child population in the five Nordic countries. We included longitudinal data on dispensed ADHD drugs from five Nordic prescription registers during 2008-2012, which in 2012 comprised 48,296 individuals among 5.42 million inhabitants aged 0-17 years. Prevalence of filling 1 prescriptions of ADHD drugs among children aged 6-17 years increased during 2008-2012 from 5.9 to 11.2 and 19.4 to 31.0 per 1000 girls and boys, respectively. Prevalence by country showed that Iceland, Finland and Sweden had a steady increase during the study period, while in Norway the prevalence was quite stable and in Denmark it levelled off from 2010. Use in preschoolers (aged 0-5 years) was rare. Iceland had much higher prevalence and incidence than the other Nordic countries. The incidence of ADHD drug use increased during the study period, from 4.0 to 4.9 and from 1.5 to 2.3 per 1000 boys and girls, respectively. The increasing number of new users levelled off somewhat after 2010. Comedication with other psychotropic drugs was more common among girls (33.9%) than boys (27.0%) and was mainly melatonin, followed by antidepressants and antipsychotics. Overall prevalence of ADHD drug use increased among Nordic girls and boys aged 6-17 years, whereas the incidence increased slightly during 2008-2010 but levelled off through 2012. The substantial differences in ADHD drug use across the Nordic countries and high degree of comedication with other psychotropic drugs underscore the importance of close monitoring of treatment for ADHD among children

Behav Genet. 2017;1-12.

ATTENTION DEFICIT HYPERACTIVITY DISORDER SYMPTOMS AND LOW EDUCATIONAL ACHIEVEMENT: EVIDENCE SUPPORTING A CAUSAL HYPOTHESIS.

De Zeeuw EL, Van Beijsterveldt CEM, Ehlis EA, et al.

Attention Deficit Hyperactivity Disorder (ADHD) and educational achievement are negatively associated in children. Here we test the hypothesis that there is a direct causal effect of ADHD on educational achievement. The causal effect is tested in a genetically sensitive design to exclude the possibility of confounding by a third factor (e.g. genetic pleiotropy) and by comparing educational achievement and secondary school career in children with ADHD who take or do not take methylphenidate. Data on ADHD symptoms, educational achievement and methylphenidate usage were available in a primary school sample of ~10,000 12-year-old twins from the Netherlands Twin Register. A substantial group also had longitudinal data at ages 7-12 years. ADHD symptoms were cross-sectionally and longitudinally, associated with lower educational achievement at age 12. More ADHD symptoms predicted a lower-level future secondary school career at age 14-16. In both the cross-sectional and longitudinal analyses, testing the direct causal effect of ADHD on educational achievement, while controlling for genetic and environmental factors, revealed an association between ADHD symptoms and educational achievement independent of genetic and environmental pleiotropy. These findings were confirmed in MZ twin intra-pair differences models, twins with more ADHD symptoms scored lower on educational achievement than their co-twins. Furthermore, children with ADHD

medication, scored significantly higher on the educational achievement test than children with ADHD who did not use medication. Taken together, the results are consistent with a direct causal effect of ADHD on educational achievement

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Biol Psychiatry. 2017.

INATTENTION AND REACTION TIME VARIABILITY ARE LINKED TO VENTROMEDIAL PREFRONTAL VOLUME IN ADOLESCENTS.

Albaugh MD, Orr C, Chaarani B, et al.

Background: Neuroimaging studies of attention-deficit/hyperactivity disorder (ADHD) have most commonly reported volumetric abnormalities in the basal ganglia, cerebellum, and prefrontal cortices. Few studies have examined the relationship between ADHD symptomatology and brain structure in population-based samples. We investigated the relationship between dimensional measures of ADHD symptomatology, brain structure, and reaction time variability—an index of lapses in attention. We also tested for associations between brain structural correlates of ADHD symptomatology and maps of dopaminergic gene expression.

Methods: Psychopathology and imaging data were available for 1538 youths. Parent ratings of ADHD symptoms were obtained using the Development and Well-Being Assessment and the Strengths and Difficulties Questionnaire (SDQ). Self-reports of ADHD symptoms were assessed using the youth version of the SDQ. Reaction time variability was available in a subset of participants. For each measure, whole-brain voxelwise regressions with gray matter volume were calculated.

Results: Parent ratings of ADHD symptoms (Development and Well-Being Assessment and SDQ), adolescent self-reports of ADHD symptoms on the SDQ, and reaction time variability were each negatively associated with gray matter volume in an overlapping region of the ventromedial prefrontal cortex. Maps of DRD1 and DRD2 gene expression were associated with brain structural correlates of ADHD symptomatology.

Conclusions: This is the first study to reveal relationships between ventromedial prefrontal cortex structure and multi-informant measures of ADHD symptoms in a large population-based sample of adolescents. Our results indicate that ventromedial prefrontal cortex structure is a biomarker for ADHD symptomatology. These findings extend previous research implicating the default mode network and dopaminergic dysfunction in ADHD

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Biol Psychol. 2017;124:11-20.

SUSTAINED ATTENTION AND HEART RATE VARIABILITY IN CHILDREN AND ADOLESCENTS WITH ADHD.

Griffiths KR, Quintana DS, Hermens DF, et al.

The autonomic nervous system (ANS) plays an important role in attention and self-regulation by modulating physiological arousal to meet environmental demands. Core symptoms of ADHD such as inattention and behavioral disinhibition may be related to dysregulation of the ANS, however previous findings have been equivocal. We examined autonomic activity and reactivity by assessing heart rate variability (HRV) in a large sample of un-medicated children and adolescents (6–19 years) with ADHD (n = 229) compared to typically-developing controls (n = 244) during rest and sustained attention. Four heart rate variability measures were extracted: Root mean square of successive differences between inter-beat-intervals (rMSSD), absolute high frequency (HFA) power, absolute low frequency (LFA) power and ratio of low frequency power to high frequency power (LF/HF). There were no group differences in HFA or rMSSD, even when assessing across child and adolescent groups separately, by gender or ADHD subtype. LF/HF however was higher in ADHD during both rest and sustained attention conditions, particularly in male children. Sustained attention was impaired in ADHD relative to controls, and a higher LF/HF ratio during sustained attention was associated with poorer performance in both groups. Lower rMSSD and HFA were associated with higher anxiety, oppositional behaviors and social problems, supporting prevailing theories that these measures index emotion regulation and adaptive social behavior. Different measures of heart rate variability provide important

insights into the sustained attention and emotional and behavioral regulation impairments observed in ADHD and may aid in delineating ADHD pathophysiology

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Biol Psychol. 2017 Feb;123:196-204.

MEMORY CONSOLIDATION OF SOCIALLY RELEVANT STIMULI DURING SLEEP IN HEALTHY CHILDREN AND CHILDREN WITH ATTENTION-DEFICIT/HYPERACTIVITY DISORDER AND OPPOSITIONAL DEFIANT DISORDER: WHAT YOU CAN SEE IN THEIR EYES.

Prehn-Kristensen A, Molzow I, Förster A, et al.

Children with attention-deficit/hyperactivity disorder (ADHD) display deficits in sleep-dependent memory consolidation, and being comorbid with oppositional defiant disorder (ODD), results in deficits in face processing. The aim of the present study was to investigate the role of sleep in recognizing faces in children with ADHD + ODD. Sixteen healthy children and 16 children diagnosed with ADHD + ODD participated in a sleep and a wake condition. During encoding (sleep condition at 8 p.m.; wake condition at 8 a.m.) pictures of faces were rated according to their emotional content; the retrieval session (12 h after encoding session) contained a recognition task including pupillometry. Pupillometry and behavioral data revealed that healthy children benefited from sleep compared to wake with respect to face picture recognition; in contrast recognition performance in patients with ADHD + ODD was not improved after sleep compared to wake. It is discussed whether in patients with ADHD + ODD social stimuli are preferentially consolidated during daytime

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BMC Pediatr. 2017;17.

A LONGITUDINAL STUDY OF ASSOCIATIONS BETWEEN PSYCHIATRIC SYMPTOMS AND DISORDERS AND CEREBRAL GRAY MATTER VOLUMES IN ADOLESCENTS BORN VERY PRETERM.

Botellero VL, Skranes J, Bjuland KJ, et al.

Background: Being born preterm with very low birthweight (VLBW $\leq 1500\text{ g}$) poses a risk for cortical and subcortical gray matter (GM) abnormalities, as well as for having more psychiatric problems during childhood and adolescence than term-born individuals. The aim of this study was to investigate the relationship between cortical and subcortical GM volumes and the course of psychiatric disorders during adolescence in VLBW individuals.

Methods: We followed VLBW individuals and term-born controls (birth weight >math>\geq 10</math>th percentile) from 15 (VLBW;controls n = 40;56) to 19 (n = 44;60) years of age. Of these, 30;37 individuals were examined longitudinally. Cortical and subcortical GM volumes were extracted from MRPRAGE images obtained with the same 1.5 T MRI scanner at both time points and analyzed at each time point with the longitudinal stream of the FreeSurfer software package 5.3.0. All participants underwent clinical interviews and were assessed for psychiatric symptoms and diagnosis (Schedule for Affective Disorders and Schizophrenia for School-age Children, Children's Global Assessment Scale, Attention-Deficit/Hyperactivity Disorder Rating Scale-IV). VLBW adolescents were divided into two groups according to diagnostic status from 15 to 19 years of age: persisting/developing psychiatric diagnosis or healthy/becoming healthy.

Results: Reduction in subcortical GM volume at 15 and 19 years, not including the thalamus, was limited to VLBW adolescents with persisting/developing diagnosis during adolescence, whereas VLBW adolescents in the healthy/becoming healthy group had similar subcortical GM volumes to controls. Moreover, across the entire VLBW group, poorer psychosocial functioning was predicted by smaller subcortical GM volumes at both time points and with reduced GM volume in the thalamus and the parietal and occipital cortex at 15 years. Inattention problems were predicted by smaller GM volumes in the parietal and occipital cortex.

Conclusions: GM volume reductions in the parietal and occipital cortex as well as smaller thalamic and subcortical GM volumes were associated with the higher rates of psychiatric symptoms found across the entire VLBW group. Significantly smaller subcortical GM volumes in VLBW individuals compared with term-born peers might pose a risk for developing and maintaining psychiatric diagnoses during adolescence. Future research should explore the possible role of reduced cortical and subcortical GM volumes in the pathogenesis of psychiatric illness in VLBW adolescents

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BMC Pediatr. 2017;17.

COGNITIVELY AND PHYSICALLY DEMANDING EXERGAMING TO IMPROVE EXECUTIVE FUNCTIONS OF CHILDREN WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER: A RANDOMISED CLINICAL TRIAL.

Benzing V, Schmidt M.

Background: Attention deficit hyperactivity disorder (ADHD) is one of the most common mental disorders observed in childhood and adolescence. Its key symptoms - reduced attention, poor control of impulses as well as increased motor activity - are associated with decreased executive functions performance, finally affecting academic achievement. Although drug treatments usually show some effect, alternative treatments are continually being sought, due to lack of commitment and possible side effects. Cognitive trainings are frequently used with the objectives of increasing executive function performance. However, since transfer effects are limited and novelty and diversity are frequently ignored, interventions combining physical and cognitive demands targeting a broader range of cognitive processes are demanded.

Methods: The aim of the study is to examine the effects of a cognitively and physically demanding exergame on executive functions of children with ADHD. In a randomised clinical trial, 66 girls and boys diagnosed with ADHD (age 8-12) will be assigned either to an 8-week exergame intervention group (three training sessions per week +á 30 min) or a waiting-list control group. Before and afterwards, the executive function performance (computer-based tests), the sport motor performance and ADHD symptoms will be assessed.

Discussion: The current study will offer insights into the effectiveness of a combination of cognitive and physical training using exergaming. Positive effects on the executive functions, sport motor performance and ADHD symptoms are hypothesized. Beneficial effects would mean a large degree of scalability (simple and cost-effective) and high utility for patients with ADHD.

Trial registration: KEK BE 393/15 (March 8, 2016); DRKS00010171(March 14, 2016)

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BMC Psychiatry. 2017;17.

STUDY OF USER EXPERIENCE OF AN OBJECTIVE TEST (QbTEST) TO AID ADHD ASSESSMENT AND MEDICATION MANAGEMENT: A MULTI-METHODS APPROACH.

Hall CL, Valentine AZ, Walker GM, et al.

Background: The diagnosis and monitoring of Attention deficit hyperactivity disorder (ADHD) typically relies on subjective reports and observations. Objective continuous performance tests (CPTs) have been incorporated into some services to support clinical decision making. However, the feasibility and acceptability of adding such a test into routine practice is unknown. The study aimed to investigate the feasibility and acceptability of adding an objective computerised test to the routine assessment and monitoring of attention deficit hyperactivity disorder (ADHD).

Methods: Semi-structured interviews were conducted with clinicians (n = 10) and families (parents/young people, n = 20) who participated in a randomised controlled trial. Additionally, the same clinicians (n = 10) and families (n = 76) completed a survey assessing their experience of the QbTest. The study took place in child and adolescent mental health and community paediatric clinics across the UK. Interview transcripts were thematically analysed.

Results: Interviewed clinicians and families valued the QbTest for providing an objective, valid assessment of symptoms. The QbTest was noted to facilitate communication between clinicians, families and schools. However, whereas clinicians were more unanimous on the usefulness of the QbTest, survey findings showed

that, although the majority of families found the test useful, less than half felt the QbTest helped them understand the clinician's decision making around diagnosis and medication. The QbTest was seen as a potentially valuable tool to use early in the assessment process to streamline the care pathway. Although clinicians were conscious of the additional costs, these could be offset by reductions in time to diagnosis and the delivery of the test by a Healthcare Assistant.

Conclusions: The findings indicate the QbTest is an acceptable and feasible tool to implement in routine clinical settings. Clinicians should be mindful to discuss the QbTest results with families to enable their understanding and engagement with the process. Further findings from definitive trials are required to understand the cost/benefit; however, the findings from this study support the feasibility and acceptability of integrating QbTest in the ADHD care pathway.

Trial registration: The findings form the implementation component of the Assessing QbTest Utility in ADHD (AQUA) Trial which is registered with the ISRCTN registry (ISRCTN11727351, retrospectively registered 04 July 2016) and clinicaltrials.gov (NCT02209116, registered 04 August 2014)

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BMC Psychiatry. 2017 Jan;17.

PREVALENCE OF ATTENTION DEFICIT/HYPERACTIVITY DISORDER AMONG CHILDREN AND ADOLESCENTS IN CHINA: A SYSTEMATIC REVIEW AND META-ANALYSIS.

Wang T, Liu K, Li Z, et al.

Background: Attention deficit/hyperactivity disorder (ADHD), the most common childhood neurobehavioural disorder, can produce a series of negative effects on children, adolescents, and even adults as well as place a serious economic burden on families and society. However, the prevalence of ADHD is not well understood in China. The goal of this study was to estimate the pooled prevalence of ADHD among children and adolescents in China using a systematic review and meta-analysis.

Methods: A systematic literature search was conducted in PubMed, Web of Science, MEDLINE, CNKI, Wanfang, Weipu and CBM databases, and relevant articles published from inception to March 1, 2016, that provided the prevalence of ADHD among children and adolescents in China were reviewed. The risk of bias in individual studies was assessed using the Risk of Bias Tool for prevalence studies. Pooled-prevalence estimates were calculated with a random-effects model. Sources of heterogeneity were explored using subgroup analyses.

Results: Sixty-seven studies with a total of 275,502 individuals were included in this study. The overall pooled-prevalence of ADHD among children and adolescents in China was 6.26% (95% CI: 5.36–7.22%) with significant heterogeneity ($I^2 = 99.0\%$, $P < 0.001$). The subgroup analyses showed that, the variables 'geographic location' and 'source of information' partially explained of the heterogeneity in this study ($P < 0.05$). The prevalence of ADHD-I was the highest of the subtypes, followed by ADHD-HI and ADHD-C.

Conclusions: The prevalence of ADHD among children and adolescents in China is generally consistent with the worldwide prevalence and shows that ADHD affects quite a large number of people under 18 years old. However, a nationwide study is needed to provide more accurate estimations

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BMC Psychiatry. 2017 Jan;17.

ADHD, COMORBID DISORDERS AND PSYCHOSOCIAL FUNCTIONING: HOW REPRESENTATIVE IS A CHILD COHORT STUDY? FINDINGS FROM A NATIONAL PATIENT REGISTRY.

Oerbeck B, Overgaard KR, Aspenes ST, et al.

Background: Cohort studies often report findings on children with Attention Deficit Hyperactivity Disorder (ADHD) but may be biased by self-selection. The representativeness of cohort studies needs to be investigated to determine whether their findings can be generalised to the general child population. The aim of the present study was to examine the representativeness of child ADHD in the Norwegian Mother and Child Cohort Study (MoBa).

Methods: The study population was children born between January 1, 2000 and December 31, 2008 registered with hyperkinetic disorders (hereafter ADHD) in the Norwegian Patient Registry during the years

2008–2013, and two groups of children with ADHD were identified in: 1. MoBa and 2. The general child population. We used the multiaxial International Classification of Diseases (ICD-10) and compared the proportions of comorbid disorders (axes I–III), abnormal psychosocial situations (axis V) and child global functioning (axis VI) between these two groups. We also compared the relative differences in the multiaxial classifications for boys and girls and for children with/without axis I comorbidity, respectively in these two groups of children with ADHD.

Results: A total of 11 119 children were registered with ADHD, with significantly fewer in MoBa (1.45%) than the general child population (2.11%), $p < 0.0001$. The proportions of comorbid axis I, II, and III disorders were low, with no significant group differences. Compared with the general child population with ADHD, children with ADHD in MoBa were registered with fewer abnormal psychosocial situations (axis V: $t = 7.63$, $p < .0001$; $d = -.18$) and better child global functioning (axis VI: $t = 7.93$, $p < 0.0001$; $d = .17$). When analysing relative differences in the two groups, essentially the same patterns were found for boys and girls and for children with/without axis I comorbidity.

Conclusions: Self-selection was found to affect the proportions of ADHD, psychosocial adversity and child global functioning in the cohort. However, the differences from the general population were small. This indicates that studies on ADHD and multiaxial classifications in MoBa, as well as other cohort studies with similar self-selection biases, may have reasonable generalisability to the general child population

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Child Fam Behav Ther. 2017 Jan;39:19-42.

PROGRAM FOR THE EDUCATION AND ENRICHMENT OF RELATIONAL SKILLS: PARENTAL OUTCOMES WITH AN ADHD SAMPLE.

Gonring K, Gerdes A, Gardner D.

The goal of the current study was to examine the effect of the Program for the Education and Enrichment of Relational Skills (PEERS®), a 14-week parent-assisted friendship-building program for adolescents with ADHD, on parental functioning, quality of the parent-adolescent relationship, and family functioning. Participants included 25 parents of adolescents with ADHD. Families completed PEERS®. Measures of parenting stress, parental efficacy, parent-adolescent communication, parent-adolescent involvement, causal attributions for negative social interactions, and family chaos were completed by parents at pre- and post-treatment. Parents demonstrated statistically significant improvements in parenting stress and parent-adolescent communication and marginally statistically significant improvement in parental efficacy. Parents also demonstrated reliable change in parenting stress, parent-adolescent communication, parent-adolescent involvement, and family chaos. Overall, these findings demonstrate the benefit of PEERS® at improving parental functioning, quality of the parent-adolescent relationship, and family functioning for families of adolescents with ADHD. (PsycINFO Database Record (c) 2017 APA, all rights reserved)

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Chin J Med Imaging Technol. 2016;32:678-82.

BRAIN FMRI IN COMBINED AND INATTENTIVE SUBTYPES OF ATTENTION DEFICIT HYPERACTIVITY DISORDER DURING Go/NOGO TASK.

Wang M, Lei D, Zhang H, et al.

Objective: To compare the differences of brain function among children with combined attention deficit hyperactivity disorder (ADHD-C), inattentive ADHD (ADHD-I) and healthy controls during classical Go/Nogo task.

Methods: Totally 19 ADHD-I children (ADHD-I group), 21 ADHD-C children (ADHD-C group) and 25 healthy participants (HC group) underwent fMRI while performing the Go/Nogo task. Functional brain images were analyzed with the Statistical Parametric Mapping (SPM8) software. The activating brain area of response inhibition and error processing were compared among three groups.

Results: During response inhibition, significant differences of activating brain area among three groups were observed in left inferior frontal gyrus and right middle frontal gyrus, and ADHD-C group showed greater activation than ADHD-I group in inferior frontal gyrus ($P < 0.001$). During error processing, significant

differences of activating brain area among three groups were observed in right superior frontal gyrus, while there was no significant difference between ADHD-I group and ADHD-C group.

Conclusion: The children with ADHD-I and ADHD-C show dysfunctional inhibition control when performing Go/Nogo task, and the degree of dysfunctional inhibition control is different between ADHD-C and ADHD-I

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Clin Pediatr. 2017;56:171-76.

IMPROVING TREATMENT IN MINORITY CHILDREN WITH ATTENTION DEFICIT/HYPERACTIVITY DISORDER .

Alvarado C, Modesto-Lowe V.

Studies have shown that African American, Caucasian, and Hispanic children all have the same prevalence of attention deficit/hyperactivity disorder (ADHD) symptoms and respond similarly to treatment. However, the number of African American and Hispanic children actually diagnosed with ADHD is significantly lower than that of the Caucasian population. Consequently, the numbers of African American and Hispanic children receiving ADHD treatment is also low. This article investigates the barriers to diagnosis and treatment of ADHD in African American and Hispanic populations, which include financial limitations, differing parental views, and cultural norms. It then discusses potential solutions to help address those barriers with the hope of providing culturally sensitive care among African American and Hispanic communities

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Cochrane Database Syst Rev. 2017;2017.

PHARMACOLOGICAL INTERVENTIONS FOR ADHD SYMPTOMS IN CHILDREN WITH FETAL ALCOHOL SPECTRUM DISORDERS (FASD).

Peadon E, Thomas DE, Elliott EJ.

This is a protocol for a Cochrane Review (Intervention). The objectives are as follows: To evaluate the benefits and harms of pharmacological interventions for fetal alcohol spectrum disorders in children

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Current Medical Imaging Reviews. 2016;12.

NEURAL CORRELATES OF DEFAULT MODE NETWORK CONNECTIVITY IN CHILDREN WITH ATTENTION DEFICIT AND HYPERACTIVITY DISORDER.

Benli SG, Icer S, Gumus K, et al.

The Purpose: The objective of this study is to explore neural correlates of Default Mode Network (DMN) regions in children with attention deficit and hyperactivity disorder (ADHD) using resting-state functional magnetic resonance imaging (rs-fMRI).

Methods: The study included ten children with ADHD (aged between 9 and 16) and ten age-matched controls. Four DMN regions (medial prefrontal cortex (MPFC), the posterior cingulate cortex (PCC), left and right inferior parietal lobes (IPL) and the corresponding Brodmann areas in each one were used as seeds and their functional connectivity with the whole brain was explored and compared between ADHD and control groups using t-test ($p < 0.05$).

Results: We observed that when DMN regions were selected as seeds, the connected regions were different between two groups and were mostly in the right hemisphere in ADHD patients contrary to the left hemisphere in the control group.

Conclusion: In conclusion, neural correlates of DMN regions differ in ADHD patients compared to healthy controls. Our findings suggest that in ADHD patients, DMN regions show more connectivity with the right hemisphere of the brain whereas the left hemisphere is more functionally connected with DMN in health controls. Further research is required to explore this atypical DMN connectivity in ADHD using larger cohort

Curr Psychiatry Rep. 2017;19.

ATTENTION-DEFICIT/HYPERACTIVITY DISORDER (ADHD) AND OBESITY: UPDATE 2016.

Cortese S, Tessari L.

While psychiatric comorbidities of attention-deficit/hyperactivity disorder (ADHD) have been extensively explored, less attention has been paid to somatic conditions possibly associated with this disorder. However, mounting evidence in the last decade pointed to a possible significant association between ADHD and certain somatic conditions, including obesity. This paper provides an update of a previous systematic review on the relationship between obesity and ADHD (Cortese and Vincenzi, *Curr Top Behav Neurosci* 9:199–218, 2012), focusing on pertinent peer-reviewed empirical papers published since 2012. We conducted a systematic search in PubMed, Ovid, and Web of Knowledge databases (search dates: from January 1st, 2012, to July 16th, 2016). We retained a total of 41 studies, providing information on the prevalence of obesity in individuals with ADHD, focusing on the rates of ADHD in individuals with obesity, or reporting data useful to gain insight into possible mechanisms underlying the putative association between ADHD and obesity. Overall, over the past 4–years, an increasing number of studies have assessed the prevalence of obesity in individuals with ADHD or the rates of ADHD in patients with obesity. Although findings are mixed across individual studies, meta-analytic evidence shows a significant association between ADHD and obesity, regardless of possible confounding factors such as psychiatric comorbidities. An increasing number of studies have also addressed possible mechanisms underlying the link between ADHD and obesity, highlighting the role, among others, of abnormal eating patterns, sedentary lifestyle, and possible common genetic alterations. Importantly, recent longitudinal studies support a causal role of ADHD in contributing to weight gain. The next generation of studies in the field should explore if and to which extent the treatment of comorbid ADHD in individuals with obesity may lead to long-term weight loss, ultimately improving their overall well-being and quality of life

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Dev Psychopathol. 2017 Feb;29:107-20.

OBSERVED TEMPERAMENT FROM AGES 6 TO 36 MONTHS PREDICTS PARENT- AND TEACHER-REPORTED ATTENTION-DEFICIT/HYPERACTIVITY DISORDER SYMPTOMS IN FIRST GRADE.

Willoughby MT, Gottfredson NC, Stifter CA.

This study tested the prospective association between observational indicators of temperament, which were obtained across multiple assessments when children were 6–36 months of age, and parent and teacher reports of children's attention-deficit/hyperactivity disorder (ADHD) behaviors, when children were in first grade. Data were drawn from the Family Life Project and included 1,074 children for whom temperament and either parent- or teacher-reported ADHD behavioral data were available. The results of variable-centered regression models indicated that individual differences in temperament regulation, but not temperamental reactivity, was uniquely predictive of parent- and teacher-reported ADHD behaviors. Latent profile analyses were used to characterize configurations of temperamental reactivity and regulation. Person-centered regression models were subsequently estimated in which temperamental profile membership replaced continuous indicators of temperamental reactivity and regulation as predictors. The results of person-centered regression models indicated that temperamental reactivity and regulation both contributed (both alone and in combination) to the prediction of subsequent ADHD behaviors. In general, the predictive associations from early temperament to later ADHD were of modest magnitude ($R^2 = .10-.17$). Results are discussed with respect to interest in the early identification of children who are at elevated risk for later ADHD

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Dev Med Child Neurol. 2017;59:276-83.

PREVALENCE OF AUTISM AND ATTENTION-DEFICIT-HYPERACTIVITY DISORDER IN DOWN SYNDROME: A POPULATION-BASED STUDY.

Oxelgren UW, et al.

AIM: To investigate the prevalence of autism spectrum disorder (ASD) and attention-deficit-hyperactivity disorder (ADHD) in a population-based group of children and adolescents with Down syndrome, and to relate the findings to level of intellectual disability and to medical conditions.

METHOD: From a population-based cohort of 60 children and adolescents with Down syndrome, 41 individuals (29 males, 12 females; mean age 11y, age range 5-17y) for whom parents gave consent for participation were clinically assessed with regard to ASD and ADHD. The main instruments used were the Autism Diagnostic Interview-Revised, Autism Diagnostic Observation Schedule, Swanson, Nolan, and Pelham-IV Rating Scale, and the Adaptive Behavior Assessment System-II.

RESULTS: High rates of ASD and ADHD were found: 17 (42%) and 14 (34%) of the 41 children met DSM criteria for ASD and ADHD respectively.

INTERPRETATION: Children with Down syndrome and coexisting neurodevelopmental/neuropsychiatric disorders in addition to intellectual disability and medical disorders constitute a severely disabled group. Based on the results, we suggest that screening is implemented for both ASD and ADHD, at the age of 3 to 5 years and early school years respectively, to make adequate interventions possible.

Environ Int. 2016;97:85-92.

TRAFFIC-RELATED AIR POLLUTION AND HYPERACTIVITY/INATTENTION, DYSLEXIA AND DYSCALCULIA IN ADOLESCENTS OF THE GERMAN GINIPLUS AND LISAPLUS BIRTH COHORTS.

Fuertes E, Standl M, Fornis J, et al.

Background Few studies have examined the link between air pollution exposure and behavioural problems and learning disorders during late childhood and adolescence.

Objectives To determine whether traffic-related air pollution exposure is associated with hyperactivity/inattention, dyslexia and dyscalculia up to age 15 years using the German GINIplus and LISAPLUS birth cohorts (recruitment 1995-1999).

Methods Hyperactivity/inattention was assessed using the German parent-completed (10 years) and self-completed (15 years) Strengths and Difficulties Questionnaire. Responses were categorized into normal versus borderline/abnormal. Parent-reported dyslexia and dyscalculia (yes/no) at age 10 and 15 years were defined using parent-completed questionnaires. Individual-level annual average estimates of nitrogen dioxide (NO₂), particulate matter (PM)₁₀mass, PM_{2.5}mass and PM_{2.5}absorbance concentrations were assigned to each participant's birth, 10 year and 15 year home address. Longitudinal associations between the air pollutants and the neurodevelopmental outcomes were assessed using generalized estimation equations, separately for both study areas, and combined in a random-effects meta-analysis. Odds ratios and 95% confidence intervals are given per interquartile range increase in pollutant concentration.

Results The prevalence of abnormal/borderline hyperactivity/inattention scores and parental-reported dyslexia and dyscalculia at 15 years of age was 12.9%, 10.5% and 3.4%, respectively, in the combined population (N = 4745). In the meta-analysis, hyperactivity/inattention was associated with PM_{2.5}mass estimated to the 10 and 15 year addresses (1.12 [1.01, 1.23] and 1.11 [1.01, 1.22]) and PM_{2.5}absorbance estimated to the 10 and 15 year addresses (1.14 [1.05, 1.25] and 1.13 [1.04, 1.23], respectively).

Conclusions We report associations suggesting a potential link between air pollution exposure and hyperactivity/inattention scores, although these findings require replication

Environ Int. 2017;99:221-27.

EXPOSURE TO AMBIENT PM10 AND NO2 AND THE INCIDENCE OF ATTENTION-DEFICIT HYPERACTIVITY DISORDER IN CHILDHOOD.

Min JY, Min KB.

BACKGROUND: Epidemiological studies have implicated air pollution in the causation of neurodevelopmental disorders, including attention-deficit hyperactivity disorder (ADHD), but definitive evidence of this linkage is lacking.

OBJECTIVES: We examined the association between cumulative exposure to air pollutants from birth to diagnosis, particularly particulate matter of $<10\mu\text{m}$ (PM10) and nitric dioxide (NO2), and childhood ADHD.

METHODS: We used the National Health Insurance Service-National Sample Cohort (2002-2012), a population-wide health insurance claims dataset. A total of 8936 infants (age 0) born between January 2002 and December 2002 were followed-up for a 10-year period (2003-2012). ADHD was defined as per ICD-10 code F90.0. Exposure levels of PM10 and NO2 were extrapolated using geographic information systems and collated with the subjects' administrative district code, and individual exposure levels assigned. Hazard ratios (HRs) were calculated for the development of ADHD, after adjusting for gender, metropolitan area, income, and history of diseases.

RESULTS: During the study period, ADHD occurred in 314 subjects (3.5%). With the increase in $1\mu\text{g}/\text{m}^3$ of air pollutants, the HRs of childhood ADHD were 1.18 (95% CI: 1.15-1.21) in case of PM10 and 1.03 (95% CI: 1.02-1.04) in case of NO2. Compared with infants with the lowest tertile of PM10 or NO2 exposure, those with the highest tertile of PM10 (HR=3.88; 95% CI: 2.87-5.23) or NO2 (HR=2.10; 95% CI, 1.54-2.85) exposure had a 2 to 3 fold increased risk for ADHD.

CONCLUSION: Exposure to PM10 and NO2 was associated with the incidence of ADHD in childho

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Epilepsy Behav. 2017;67:7-12.

ATTENTION DEFICITS IN CHILDREN WITH EPILEPSY: PRELIMINARY FINDINGS.

Gascoigne MB, Smith ML, Barton B, et al.

OBJECTIVE: Attention difficulties are a common clinical complaint among children with epilepsy. We aimed to compare a range of attentional abilities between groups of children with two common epilepsy syndromes, Temporal Lobe Epilepsy (TLE) and Idiopathic Generalized Epilepsy (IGE), and to healthy controls. We also investigated whether epilepsy factors (laterality of seizure focus, epilepsy onset, duration, and severity) were related to attentional abilities.

METHODS: Multiple dimensions of attention (selective, sustained, and divided attention and attentional control) were assessed directly with standardized neuropsychological measures in 101 children aged 6-16years (23 children with TLE, 20 with IGE and 58 healthy controls). Attention was also assessed indirectly, via a parent-report measure.

RESULTS: Children with TLE performed worse than children with IGE ($p=0.013$) and healthy controls ($p<0.001$) on a test of attentional control, but no between-group differences were apparent on tests of other attentional abilities. Compared to healthy controls, greater attention problems were reported by parents of children with TLE ($p=0.006$) and IGE ($p=0.012$). Left-hemisphere seizure focus and greater epilepsy severity were associated with poorer attentional control and sustained-divided attention, respectively, but no other epilepsy factors were associated with attentional abilities.

SIGNIFICANCE: These findings suggest that children with localization-related epilepsy, but not generalized epilepsy, may be at risk of deficits in attentional control. Interventions aimed at improving attentional control may be targeted at children with localization-related epilepsy, particularly those with a left-hemisphere seizure focus, who appear to be particularly susceptible to this type of attentional deficit

Epilepsy Behav. 2017;67:111-21.

NEUROREHABILITATION WITH FORAMENREHAB FOR ATTENTION IMPAIRMENT IN CHILDREN WITH EPILEPSY.

Saard M, Kaldoja ML, Bachmann M, et al.

Epilepsy is a frequent neurological disorder in children and often accompanied with attention impairment. Still, few systematically controlled rehabilitation techniques for children exist. The aim of this study was to design and measure the impact of the FORAMENRehab computer-based intervention method for attention impairment rehabilitation in children with epilepsy. We chose the FORAMENRehab program because it allows separate training for different attention components based on individual needs. Forty-eight children participated in the study. At baseline, all patients underwent neuropsychological examination of attention with the NEPSY test battery. The study group consisted of 17 8- to 12-year-old children with partial epilepsy and attention impairment who received neurorehabilitation over 5 weeks (10 sessions) with FORAMENRehab Attention module accompanied by a therapist. Two control groups were included: the first control group of 12 children with partial epilepsy and attention impairment (waiting-list) participated in assessments with baseline tasks before and after the five-week period and received no active training. Additionally, all patients participated in the follow-up assessment 1.31 years later. The second control group consisted of 19 typically developing children who only participated in the first assessment. After the intervention, study group patients showed significant improvement in complex attention and tracking ($P < 0.025$). To achieve the effect of intervention in children with partial epilepsy, 10 sessions tailored to individual levels of ability were the minimum. Three attention components - sustained, complex, and tracking - need selective and longer training for more effective remediation. Follow-up assessment revealed a long-term positive effect of intervention. After 1.31 years, the study group had significantly improved in three out of the four attention components ($P < 0.025$), whereas the waiting-list group showed improvement in only two aspects of one complex attention component. In conclusion, attention impairment rehabilitation with FORAMENRehab is effective for children with epilepsy. Rehabilitation should focus on training specific components of attention and follow an individual-based rehabilitation process

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Eur Arch Psychiatry Clin Neurosci. 2017 Feb;267:73-82.

HOT EXECUTIVE CONTROL AND RESPONSE TO A STIMULANT IN A DOUBLE-BLIND RANDOMIZED TRIAL IN CHILDREN WITH ADHD.

Yarmolovsky J, Szwarc T, Schwartz M, et al.

Attention deficit hyperactivity disorder (ADHD) is thought to involve an executive inhibitory control (IC) deficit, yet it is not clear if this is a general deficit affecting both cold and hot EC, and if methylphenidate (MPH) affects both systems in treated children. We explored this by using a Stroop-like task in children with ADHD as compared to controls, containing different types of emotional stimuli (six levels), and we investigated the role of intervention with MPH on IC as compared to placebo. Children with ADHD and controls ($N = 40$; 7-13 years old) were tested with a hot and cold Stroop-like task. This was followed by a double-blind placebo-controlled crossover trial of the effect of MPH on these skills. Children with ADHD showed a specific difficulty inhibiting their responses, particularly to hot, angry and frustration-inducing stimuli. Further, treatment with MPH was effective in reducing errors toward frustration-inducing stimuli as compared to placebo ($p < .05$, $\eta^2 = .347$), particularly with repeated exposure to the stimuli. Results indicate that children with ADHD experience executive control difficulties, particularly in hot negative emotional contexts. These emotion regulation difficulties are amenable to stimulant intervention

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Eur Child Adolesc Psychiatry. 2017;26:165-75.

ATTENTION DEFICIT-HYPERACTIVITY DISORDER IS ASSOCIATED WITH REDUCED BLOOD PRESSURE AND SERUM VITAMIN D LEVELS: RESULTS FROM THE NATIONWIDE GERMAN HEALTH INTERVIEW AND EXAMINATION SURVEY FOR CHILDREN AND ADOLESCENTS (KIGGS).

Meyer T, Becker A, Sundermann J, et al.

Alterations in blood pressure in attention-deficit/hyperactivity disorder (ADHD), specifically during dopaminergic stimulant intake, are not fully understood. It has been reported that vitamin D deficiency might modify dopaminergic pathways and thus influence ADHD symptoms. Using data from the nationwide German Health Interview and Examination Survey for Children and Adolescents (KiGGS) study, we compared blood pressure and vitamin D levels in healthy controls to both diagnosed ADHD patients and suspected ADHD subjects, as defined by a value of ≥ 7 on the hyperactivity-inattention subscale of the Strengths and Difficulties Questionnaire. In a total cohort of $n = 6922$ study participants aged 11-17 years, mean arterial blood pressure was significantly higher in controls (86.7 ± 8.2 mmHg) than in the two groups of confirmed (85.5 ± 7.8 mmHg, $p = 0.004$, $n = 430$) and suspected ADHD patients (84.6 ± 8.2 , $p < 0.001$, $n = 399$). In addition, we found an inverse association between vitamin D and blood pressure in both ADHD groups ($p < 0.003$). Regression analyses adjusted for age, sex, body-mass index, psychotropic medication use, and serum vitamin D levels confirmed that low blood pressure was a significant and independent predictor of ADHD. Furthermore, we observed that vitamin D mediated the effect of systolic blood pressure on ADHD diagnosis ($b = 0.007$, 95 % confidence interval [CI] 0.001-0.013, $p = 0.021$, $R^2 = 0.050$). In a large and representative national sample of German adolescents, we found a significant association between low blood pressure and ADHD symptoms. In addition, we observed that circulating vitamin D mediated the inverse relation between blood pressure and ADHD, although the effect size was very low. These findings highlight the role of dysregulated pathways of the autonomic nervous system in ADHD

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Eur Child Adolesc Psychiatry. 2017;1-10.

IN UTERO EXPOSURE TO B-2-ADRENERGIC RECEPTOR AGONIST AND ATTENTION-DEFICIT/HYPERACTIVITY DISORDER IN CHILDREN.

Liang H, Chen J, Miao M, et al.

We aimed to examine the association between in utero exposure to β_2 AA and risk of attention-deficit/hyperactivity disorder (ADHD). We established a cohort of 672,265 children born from 1998 to 2008 in Denmark. Children were categorized as exposed if their mothers had redeemed a prescription of β_2 AA in pregnancy (from 30 days prior to conception until delivery). We identified children diagnosed with ADHD in the Danish National Hospital Register for the first time after his/her third birthday. Log-linear Poisson regression was used to estimate adjusted incidence rate ratio (aIRR) of ADHD. In total, 25,434 children were born to mothers who had redeemed a β_2 AA prescription in pregnancy. The exposed children had a 1.31-fold increased risk [aIRR = 1.30, 95% confidence interval (CI):1.20-1.42] of ADHD compared to unexposed children after adjusting for potential confounders. However, when extending the exposure window to 2 years prior to conception until delivery, exposure to maternal use of β_2 AA only before pregnancy, only during pregnancy, and both before and during pregnancy was associated with elevated risks of ADHD in children, with aIRRs of 1.31 (95% CI 1.22-1.40), 1.38 (95% CI 1.22-1.57), and 1.30 (95% CI 1.16-1.45), respectively. In mothers with a history of asthma, no association was observed between maternal use of β_2 AA during pregnancy and ADHD in offspring (aIRR = 0.92, 95% CI 0.74-1.15). In utero exposure to β_2 AA was associated with an increased risk of ADHD in children. However, it is more likely that confounding by indication, the underlying disorders or associated pathological conditions, may explain the association

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Eur Child Adolesc Psychiatry. 2017;1-24.

VITAMIN D AND MENTAL HEALTH IN CHILDREN AND ADOLESCENTS.

Föcker M, Antel J, Ring S, et al.

While vitamin D is known to be relevant for bone health, evidence has recently accumulated for an impact on mental health. To identify the potential benefits and limitations of vitamin D for mental health, an understanding of the physiology of vitamin D, the cut-off values for vitamin D deficiency and the current status of therapeutic trials is paramount. Results of a systematic PUBMED search highlight the association of vitamin D levels and mental health conditions. Here, we focus on children and adolescents studies as well as randomized controlled trials on depression in adults. 41 child and adolescent studies were identified including only 1 randomized controlled and 7 non-controlled supplementation trials. Overall, results from 25 cross-sectional studies as well as from 8 longitudinal studies suggest a role of vitamin D in the pathogenesis of mental disorders in childhood and adolescence. Findings from supplementation trials seem to support this hypothesis. However, randomized controlled trials in adults revealed conflicting results. Randomized controlled trials in childhood and adolescents are urgently needed to support the potential of vitamin D as a complementary therapeutic option in mental disorders. Study designs should consider methodological challenges, e.g., hypovitaminosis D at baseline, appropriate supplementation doses, sufficient intervention periods, an adequate power, clinically validated diagnostic instruments, and homogenous, well-defined risk groups

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Eur Child Adolesc Psychiatry. 2017;26:253-62.

MATERNAL PSYCHOPATHOLOGY AND OFFSPRING CLINICAL OUTCOME: A FOUR-YEAR FOLLOW-UP OF BOYS WITH ADHD.

Agha SS, Zammit S, Thapar A, et al.

Previous cross-sectional research has shown that parents of children with attention deficit hyperactivity disorder (ADHD) have high rates of psychopathology, especially ADHD and depression. However, it is not clear whether different types of parent psychopathology contribute to the course and persistence of ADHD in the child over time. The aim of this two wave study was to investigate if mother self-reported ADHD and depression influence persistence of offspring ADHD and conduct disorder symptom severity in adolescents diagnosed with ADHD in childhood. A sample of 143 males with a confirmed diagnosis of ADHD participated in this study. ADHD and conduct disorder symptoms were assessed at baseline and reassessed 4 years later. The boys in this sample had a mean age of 10.7 years at Time 1 (SD 2.14, range 6-15 years) and 13.73 years at Time 2 (SD 1.74, range 10-17 years). Questionnaire measures were used to assess ADHD and depression symptoms in mothers at Time 1. Mother self-reported ADHD was not associated with a change in child ADHD or conduct symptom severity over time. Mother self-reported depression was found to predict an increase in child conduct disorder symptoms, but did not contribute to ADHD symptom levels. This study provides the first evidence that concurrent depression in mothers may be a predictor of worsening conduct disorder symptoms in adolescents with ADHD. It may, therefore, be important to screen for depression in mothers of children with ADHD in clinical practice to tailor interventions accordingly

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Eur Child Adolesc Psychiatry. 2017;26:67-73.

PSYCHOSOCIAL RISK FACTORS UNDERLIE THE LINK BETWEEN ATTENTION DEFICIT HYPERACTIVITY SYMPTOMS AND OVERWEIGHT AT SCHOOL ENTRY.

Pauli-Pott U, Reinhardt A, Bagus E, et al.

The link between symptoms of attention deficit hyperactivity disorder (ADHD) and increased body weight is well established, while the underlying mechanisms are not yet clear. Since increased body weight and ADHD symptoms have been found to be associated with psychosocial risk factors in childhood, we analyzed whether the psychosocial risks explain the association between the two conditions. The sample consisted of 360 children (age range 6-7 years, 173 boys) attending the obligatory medical health exam before school entry. The children's height and weight were measured during the examination. ADHD symptoms

were ascertained by parent-report questionnaires. Psychosocial risks were ascertained by a structured interview. The link between ADHD symptoms and body weight could be completely explained by cumulative psychosocial risks while controlling for gender, symptoms of depression/anxiety and oppositional defiant disorder of the child, maternal smoking during pregnancy, parental body mass index, and potential diagnosis of ADHD in the parents. In current models pertaining to the etiology of overweight/obesity and ADHD, chronic stress caused by psychosocial adversity is assumed to act as a trigger for these conditions. Psychosocial risks experienced during childhood may activate processes that specifically lead to the combined ADHD-overweight phenotype

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Eur Child Adolesc Psychiatry. 2017;1-11.

PREDICTIVE VALIDITY OF PARENT- AND SELF-RATED ADHD SYMPTOMS IN ADOLESCENCE ON ADVERSE SOCIOECONOMIC AND HEALTH OUTCOMES.

Du Rietz E, Kuja-Halkola R, Brikell I, et al.

There is scarcity of research investigating the validity of self-report of attention deficit hyperactivity disorder (ADHD) symptoms compared to other informants, such as parents. This study aimed to compare the predictive associations of ADHD symptoms rated by parents and their children across adolescence on a range of adverse socioeconomic and health outcomes in early adulthood. Parent- and self-rated ADHD symptoms were assessed in 2960 individuals in early (13-14 years) and late adolescence (16-17 years). Logistic regression analyses were used to compare the associations between parent- and self-rated ADHD symptoms at both time points and adverse life outcomes in young adulthood obtained from Swedish national registries. Both parent- and self-ratings of ADHD symptoms were associated with increased risk for adverse outcomes, although associations of parent-ratings were more often statistically significant and were generally stronger (OR = 1.12-1.49, $p < 0.05$) than self-ratings (OR = 1.07-1.17, $p < 0.05$). After controlling for the other informant, parent-ratings of ADHD symptoms in both early and late adolescence significantly predicted academic and occupational failure, criminal convictions and traffic-related injuries, while self-ratings of ADHD symptoms only in late adolescence predicted substance use disorder and academic failure. Our findings suggest that both parent- and self-ratings of ADHD symptoms in adolescence provides valuable information on risk of future adverse socioeconomic and health outcomes, however, self-ratings are not valuable once parent-ratings have been taken into account in predicting most outcomes. Thus, clinicians and researchers should prioritize parent-ratings over self-ratings.

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Front Psychiatry. 2017;7.

SERIOUS GAMES FOR MENTAL HEALTH: ARE THEY ACCESSIBLE, FEASIBLE, AND EFFECTIVE? A SYSTEMATIC REVIEW AND META-ANALYSIS.

Lau HM, Smit JH, Fleming TM, et al.

Introduction: The development and use of serious games for mental health disorders are on the rise. Yet, little is known about the impact of these games on clinical mental health symptoms. We conducted a systematic review and meta-analysis of randomized controlled trials that evaluated the effectiveness of serious games on symptoms of mental disorder.

Method: We conducted a systematic search in the PubMed, PsycINFO, and Embase databases, using mental health and serious games-related keywords. Ten studies met the inclusion criteria and were included in the review, and nine studies were included in the meta-analysis.

Results: All of the serious games were provided via personal computer, mostly on CD-ROM without the need for an internet connection. The studies targeted age groups ranging from 7 to 80 years old. The serious games focused on symptoms of depression ($n = 2$), post-traumatic stress disorder ($n = 2$), autism spectrum disorder ($n = 2$), attention deficit hyperactivity disorder ($n = 1$), cognitive functioning ($n = 2$), and alcohol use disorder ($n = 1$). The studies used goal-oriented ($n = 4$) and cognitive training games ($n = 6$). A total of 674 participants were included in the meta-analysis (380 in experimental and 294 in control groups). A meta-analysis of 9 studies comprising 10 comparisons, using a random effects model, showed a moderate effect

on improvement of symptoms [$g = 0.55$ (95% confidence interval 0.28-0.83); $P < 0.001$], favoring serious games over no intervention controls.

Discussion/conclusion: Though the number of comparisons in the meta-analysis was small, these findings suggest that serious gaming interventions may be effective for reducing disorder-related symptoms. More studies are needed in order to attain deeper knowledge of the efficacy for specific mental disorders and the longer term effects of this new type of treatment for mental disorders

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Hum Brain Mapp. 2017;38:384-95.

DISORDER-SPECIFIC ALTERATION IN WHITE MATTER STRUCTURAL PROPERTY IN ADULTS WITH AUTISM SPECTRUM DISORDER RELATIVE TO ADULTS WITH ADHD AND ADULT CONTROLS.

Chiang HL, Chen YJ, Lin HY, et al.

Objective: Autism spectrum disorder (ASD) and attention deficit hyperactivity disorder (ADHD) are not only often comorbid but also overlapped in behavioral and cognitive abnormalities. Little is known about whether these shared phenotypes are based on common or different underlying neuropathologies. Therefore, this study aims to examine the disorder-specific alterations in white matter (WM) structural property.

Method: The three comparison groups included 23 male adults with ASD (21.4 ± 3.1 years), 32 male adults with ADHD (23.4 ± 3.3 years), and 29 age-matched healthy male controls (22.4 ± 3.3 years). After acquisition of the diffusion spectrum imaging (DSI), whole brain tractography was reconstructed by a tract-based automatic analysis. Generalized fractional anisotropy (GFA) values were computed to indicate tract-specific WM property with adjusted P value < 0.05 for false discovery rate correction.

Results: Post hoc analyses revealed that men with ASD exhibited significant lower GFA values than men with ADHD and male controls in six identified fiber tracts: the right arcuate fasciculus, right cingulum (hippocampal part), anterior commissure, and three callosal fibers (ventrolateral prefrontal cortex part, precentral part, superior temporal part). There was no significant difference in the GFA values of any of the fiber tracts between men with ADHD and controls. In men with ASD, the GFA values of the right arcuate fasciculus and right cingulum (hippocampal part) were negatively associated with autistic social-deficit symptoms, and the anterior commissure GFA value was positively correlated with intelligence.

Conclusions: This study highlights the disorder-specific alteration of the microstructural property of WM tracts in male adults with ASD.

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Infant Behav Dev. 2017;46:80-90.

VISUAL ORIENTING AND ATTENTION DEFICITS IN 5- AND 10-MONTH-OLD PRETERM INFANTS.

Ross-Sheehy S, Perone S, Macek KL, et al.

Cognitive outcomes for children born prematurely are well characterized, including increased risk for deficits in memory, attention, processing speed, and executive function. However, little is known about deficits that appear within the first 12 months, and how these early deficits contribute to later outcomes. To probe for functional deficits in visual attention, preterm and full-term infants were tested at 5 and 10 months with the Infant Orienting With Attention task (IOWA; Ross-Sheehy, Schneegans and Spencer, 2015). 5-month-old preterm infants showed significant deficits in orienting speed and task related error. However, 10-month-old preterm infants showed only selective deficits in spatial attention, particularly reflexive orienting responses, and responses that required some inhibition. These emergent deficits in spatial attention suggest preterm differences may be related to altered postnatal developmental trajectories. Moreover, we found no evidence of a dose-response relation between increased gestational risk and spatial attention. These results highlight the critical role of postnatal visual experience, and suggest that visual orienting may be a sensitive measure of attentional delay. Results reported here both inform current theoretical models of early perceptual/cognitive development, and future intervention efforts

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International Journal of Clinical Pharmacy. 2017;39:236-37.

CONSUMPTION OF PHARMACEUTICALS FOR ADHD IN THE NORDIC COUNTRIES.

Holm HM, et al

Background and objective: Attention Deficit/Hyperactivity Disorder (ADHD) or hyperkinetic disorders (HKF) is among the most common mental disorders in children, and may persist through adolescence into adulthood. Pharmacotherapy used for treating the disorders also has potential for misuse/abuse. The aim was to describe the prevalence and magnitude of use of stimulant drugs and atomoxetine, and compare consumption in the Nordic countries.

Setting and method: A descriptive pharmacoepidemiological study from the 26 million inhabitants of the five Nordic countries in the period 2004-2014. Data were collected from national prescription registers, public drug reports and by correspondence with public health institutions. Population data were obtained from official statistical databases or by correspondence with public health institutions. Main outcome measures: trend over time, comparison between countries, type of pharmaceutical, gender, age, comparability of data.

Results: The annual consumption has been increasing from 2004 to 2014, both in volume and prevalence of use. Denmark had the largest increase in volume, from 0.6 to 8.2 DDD/1000 inhabitants/day. Sweden had the highest increase in prevalence of use over the period, from 1.6 to 8.6 users/1000 inhabitants. Iceland had the largest consumption of ADHD medications in 2014, 21.9 DDD/1000 inhabitants/day. Prevalence data was not available for Iceland but Sweden was highest in prevalence of use among the other countries in 2014: 8.6 users/1000 inhabitants. Males aged 10-14 years had the largest volume and prevalence of use in 2014, but females' consumption had been increasing faster both in terms of numbers of users (1.5 9 faster) and in volume (29 faster) than men's consumption.

Conclusion: Variation in consumption is considerable and cannot be explained by diagnostic and prescription guidelines, as these are similar in the five countries. Consumption has been increasing fast in the period in all the countries, and faster for women than for men, although men still consume larger volumes than women, and are more frequent users

Int J Dev Neurosci. 2017;58:59-64.

REDUCED RELATIVE VOLUME IN MOTOR AND ATTENTION REGIONS IN DEVELOPMENTAL COORDINATION DISORDER: A VOXEL-BASED MORPHOMETRY STUDY.

Reynolds JE, Licari MK, Reid SL, et al.

Background and objectives Developmental coordination disorder (DCD) is a prevalent childhood movement disorder, impacting the ability to perform movement skills at an age appropriate level. Although differences in grey matter (GM) volumes have been found in related developmental disorders, no such evidence has been linked with DCD to date. This cross-sectional study assessed structural brain differences in children with and without DCD.

Methods High-resolution structural images were acquired from 44 children aged 7.8-12 years, including 22 children with DCD (16th percentile on MABC-2; no ADHD/ASD), and 22 typically developing controls (20th percentile on MABC-2). Structural voxel-based morphology analysis was performed to determine group differences in focal GM volumes.

Results Children with DCD were found to have significant, large, right lateralised reductions in grey matter volume in the medial and middle frontal, and superior frontal gyri compared to controls. The addition of motor proficiency as a covariate explained the between-group GM volume differences, suggesting that GM volumes in motor regions are reflective of the level of motor proficiency. A positive correlation between motor proficiency and relative GM volume was also identified in the left posterior cingulate and precuneus.

Conclusions GM volume reductions in premotor frontal regions may underlie the motor difficulties characteristic of DCD. It is possible that intervention approaches targeting motor planning, attention, and executive functioning processes associated with the regions of reduced GM volume may result in functional improvements in children with DCD

Int J Pediatr Otorhinolaryngol. 2017.

METHYLPHENIDATE EFFECTS ON P300 RESPONSES FROM CHILDREN AND ADOLESCENTS.

Sanfins MD, Hatzopoulos S, Della Torre OH, et al.

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International Journal of Pharma and Bio Sciences. 2017;8:B190-B195.

EFFECTIVENESS OF INTERVENTION PACKAGE ON BEHAVIOUR MODIFICATION OF CHILDREN WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER AMONG THEIR PARENTS AND TEACHERS.

Srignanasoundari E, Vijayalakshmi S, Vijayaraghavan R.

Attention Deficit Hyperactivity Disorder (ADHD) is one of the most common psychiatric disorders characterized by inappropriate levels of inattention, hyperactivity and impulsivity. The world wide prevalence of ADHD varies 4% to 8% in U.S, 7.6 to 9.5% in Korea, 10 to 20% in India. The worldwide prevalence of ADHD is 5.2% in 3-4 years and 29.2% in 11-12 years. Aim of the study to assess the behavior of ADHD children before and after the intervention as rated by their parents and teachers and to associate the behaviour of ADHD children with their selected demographic variables. Time series research design was used. The study was conducted at Adhiparasakthi Annai Illam, special school of Melmaruvathur in Kancheepuram district by using total enumerative sampling technique. Conner's parents rating scale and Conner's teacher rating scale was used to assess the behavior of ADHD children among their parents and teachers. Total of 10 ADHD children were selected. In parents rating scale before and after intervention package 50% of children had mild behaviour symptoms, 30% had moderate behaviour symptoms and 20% had severe behaviour symptoms. After the intervention package 70% of children had mild behaviour symptoms, 20% had moderate behaviour symptoms and 10% had severe behaviour symptoms in post test. In teachers rating scale before intervention package 100% of children had severe behaviour symptoms. After the intervention package 40% of children had mild behaviour symptoms, 50% had moderate behaviour symptoms and 10% had severe behaviour symptoms. Over all findings of the study reported that the intervention packages had been effective and brought good changes in the behavior of ADHD children

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International Journal of Pharma and Bio Sciences. 2017;8:B294-B297.

A COMPARATIVE STUDY OF TWO DIFFERENT WEIGHTED VESTS AND ITS EFFECT ON ATTENTION SPAN IN CHILDREN WITH ATTENTION DEFICIT HYPERACTIVE DISORDER.

Sarojini GL, Abraham J.

ADHD is characterized by developmentally inappropriate impulsivity, inattention, and hyperactivity This study describes the comparison about the effect of two different weighted vests and its increase on attention span in children with ADHD .This is a quantitative research model and convenient sampling procedure was done for the study. Twenty children with ADHD of age group of five to seven years and both genders were used for this study. Vanderbilt ADHD diagnosing parent rating scale (VADPRS) was used for screening. Twenty students with documented attention difficulties and hyperactivity were timed with a stopwatch to measure their on-task behavior during fine motor activities in the clinical setup. The results shows that There is a statistical significance difference between 5% and 10% weighted vest in the Attention span at 95% [P < 0.05].These preliminary findings support the hypothesis that wearing of increased weighted vest(10% of body weight) to apply deep pressure increases the task behavior than 5% of weighed vest during fine motor activities

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Iran J Psychiatry. 2016;11:224-33.

WORKING MEMORY TRAINING IN THE FORM OF STRUCTURED GAMES IN CHILDREN WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER.

Kermani FK, Mohammadi MR, Yadegari F, et al.

Objective: In this study, a new training method of working memory (WM) was used in the form of structured games, and the effect of training was evaluated with a controlled design. The training method of WM in the form of structured games includes 20 sets of structured games that can improve WM and performance of executive functions.

Method: Sixty children with attention deficit hyperactivity disorder (ADHD) aged 8.5 to 11.2 years (35 boys), using no stimulant medication were selected. We randomly assigned 30 participants to the experimental group and provided them with WM training. The training was in the form of structured games and was offered to the participants in two 60-minute sessions weekly for 12 weeks. Other participants were assigned to the control group, receiving no treatment. All the participants were also evaluated at follow-up 6 months later. The main measures were the Child Behavior Checklist (CBCL), the Digit Span and Symbol Search B subscale of the Wechsler Intelligence Scale for Children (WISC-IV); and scores of dictation and mathematics were used in terms of pre and post-test.

Results: The results of the t-test revealed a significant improvement in the post-test measures as well as a significant reduction of parents' reports of inattentiveness, and improvement in academic performance in the experimental group. However, no significant changes were found in the control group.

Conclusion: The academic and working memory improvements were primarily due to the training method of WM. Our findings suggest that the training method of WM in the form of structured games may be a practical method for treating children with ADHD, but it needs to be further investigated

JAMA Pediatr. 2016;170.

ASSOCIATION OF STIMULANT MEDICATION USE WITH BONE MASS IN CHILDREN AND ADOLESCENTS WITH ATTENTION-DEFICIT/HYPERACTIVITY DISORDER.

Feuer AJ, Thai A, Demmer RT, et al.

IMPORTANCE Murine studies reveal that sympathetic nervous system activation leads to decreased bone mass. Stimulant medications used to treat attention-deficit/hyperactivity disorder (ADHD) increase sympathetic tone and may affect bone remodeling. Because bone mass accrual is completed by young adulthood, assessing stimulant effects on bone density in growing children is of critical importance.

OBJECTIVE To investigate associations between stimulant use and bone mass in children and adolescents.

DESIGN, SETTING, AND PARTICIPANTS This cross-sectional analysis used data collected from January 1, 2005, to December 31, 2010, from the National Health and Nutrition Examination Survey (NHANES) database. NHANES is a series of cross-sectional, nationally representative health and nutrition surveys of the US population. All children, adolescents, and young adults aged 8 to 20 years with dual-energy x-ray absorptiometry (DXA), anthropometric, demographic, and prescription medication use data were eligible for participation. Of the 6489 respondents included in the multivariable linear regression analysis, 159 were stimulant users and 6330 were nonusers. Data were analyzed from October 8, 2015, to December 31, 2016.

EXPOSURES Stimulant use, determined by questionnaires administered via interview.

MAIN OUTCOMES AND MEASURES The association between stimulant use and total femur, femoral neck, and lumbar spine bone mineral content (BMC) and bone mineral density (BMD) was assessed using DXA.

RESULTS Study participants included 6489 NHANES participants with a mean (SD) age of 13.6 (3.6) years. Stimulant use was associated with lower bone mass after adjustment for covariates. Mean lumbar spine BMC was significantly lower in stimulant users vs nonusers (12.76 g; 95%CI, 12.28-13.27 g vs 13.38 g; 95%CI, 13.26-13.51 g; P = .02), as was mean lumbar spine BMD (0.90 g/cm²; 95%CI, 0.87-0.94 g/cm² vs 0.94 g/cm²; 95%CI, 0.94-0.94 g/cm²; P = .03) and mean femoral neck BMC (4.34 g; 95%CI, 4.13-4.57 g vs 4.59 g; 95%CI, 4.56-4.62 g; P = .03). Mean BMD of the femoral neck (0.88 g/cm²; 95%CI, 0.84-0.91 g/cm² vs 0.91 g/cm²; 95%CI, 0.90-0.91 g/cm²; P = .08) and total femur (0.94 g/cm²; 95%CI, 0.90-0.99 g/cm² vs 0.99 g/cm²; 95%CI, 0.98-0.99 g/cm²; P = .05) were also lower in stimulant users vs nonusers. Participants treated with stimulants for 3 months or longer had significantly lower lumbar spine BMD (0.89 g/cm²; 95%CI, 0.85-0.93 g/cm² vs 0.94 g/cm²; 95%CI, 0.94-0.94 g/cm²; P = .02) and BMC (12.71 g; 95%CI, 12.14-13.32

g vs 13.38 g; 95%CI, 13.25-13.51 g; $P = .03$) and femoral neck BMD (0.87 g/cm²; 95%CI, 0.74-0.83 g/cm² vs 0.91 g/cm²; 95%CI, 0.83-0.84 g/cm²; $P = .048$) than nonusers.

CONCLUSIONS AND RELEVANCE Children and adolescents reporting stimulant use had lower DXA measurements of the lumbar spine and femur compared with nonusers. These findings support the need for future prospective studies to examine the effects of stimulant use on bone mass in children

JAMA Psychiatry. 2016;73:1285-92.

ASSOCIATION OF GENETIC RISK VARIANTS WITH ATTENTION-DEFICIT/HYPERACTIVITY DISORDER TRAJECTORIES IN THE GENERAL POPULATION.

Riglin L, Collishaw S, Thapar AK, et al.

IMPORTANCE Attention-deficit/hyperactivity disorder (ADHD) is a heritable neurodevelopmental disorder that shows clinical and genetic overlap with other childhood neurodevelopmental disorders. Levels of ADHD symptoms typically decline across childhood and adolescence, although they remain elevated for some individuals. The determinants of symptom persistence and decline are not yet fully understood.

OBJECTIVES To test the hypothesis that genetic risk variant load for ADHD (indexed by polygenic risk scores [PRS]), but not for other psychiatric disorders, is associated with population-based ADHD symptom trajectories across childhood and adolescence, and to examine whether higher genetic liability for ADHD is correlated with total number of additional neurodevelopmental disorders (multimorbidity) in childhood.

DESIGN, SETTING, AND PARTICIPANTS The Avon Longitudinal Study of Parents and Children, an ongoing prospective population-based cohort study, has been collecting data on 14 701 children, including 9757 with data on symptoms of ADHD at multiple time points, since September 6, 1990. The primary exposure variables, PRS, were generated using results of a genome-wide association study from the Psychiatric Genomics Consortium. Childhood multimorbidity scores (ages 7-9 years) were measured by total impairments in 4 domains known to share genetic liability with ADHD: IQ, social communication, pragmatic language, and conduct. Data analysis was conducted from March 1 to September 8, 2016.

MAIN OUTCOMES AND MEASURES Attention-deficit/hyperactivity disorder symptom trajectories from ages 4 to 17 years (7 time points). **RESULTS** Among 9757 children with data on symptoms of ADHD at multiple time points (age range, 4-17 years; 4968 boys and 4789 girls), 4 ADHD symptom trajectories were identified: low (82.6%), intermediate (7.7%), childhood-limited (5.8%), and persistent (3.9%). Mean (SE) PRS for ADHD were higher in children in the persistent trajectory (0.254 [0.069]) compared with each of the other 3 trajectories (low, -0.018 [0.014], $\chi^2_1 = 14.67$, $P < .001$, odds ratio, 1.31; intermediate, 0.054 [0.055], $\chi^2_1 = 4.70$, $P = .03$, odds ratio, 1.22; and childhood-limited, 0.017 [0.060], $\chi^2_1 = 6.50$, $P = .01$, odds ratio, 1.27). Findings were specific to PRS for ADHD; PRS for other psychiatric conditions did not differ across trajectories. The proportion of children with multimorbidity was also highest in those in the persistent trajectory (42.5%; 95%CI, 33.9%-51.1%; $P < .001$) and was associated with persistence of ADHD symptoms independent of PRS.

CONCLUSIONS AND RELEVANCE Persistence of ADHD symptoms across childhood and adolescence in the general population is associated with higher PRS for ADHD. Childhood multimorbidity was also associated with persistence of ADHD symptoms and may help to identify children with ADHD whose symptoms are most likely to continue into adolescence

J Adolesc Health. 2016.

ADHERENCE TO ATTENTION-DEFICIT/HYPERACTIVITY DISORDER MEDICATION DURING THE TRANSITION TO COLLEGE.

Schaefer MR, Rawlinson AR, Wagoner ST, et al.

Purpose: The present study explores the medication self-management experiences of adolescents with attention-deficit/hyperactivity disorder (ADHD) during their transition to young adulthood in college.

Methods: Participants were college freshmen with ADHD prescribed daily medication for their condition. Ten individual interviews were conducted using a semistructured interview script. Measures related to ADHD

medication management were also completed. Qualitative data were analyzed via directed content analysis and quantitative data via descriptive statistics.

Results: Five themes emerged from interviews: (1) transitions to independence are often abrupt, and many adolescents lack critical self-management skills; (2) volitional nonadherence is high due to inaccurate disease beliefs, perceived academic demands, and medication side effects; (3) poor self-management negatively impacts school performance; (4) peer pressure to share medication affects social functioning and adherence; and (5) social support is greatly needed. Common barriers to adherence included "don't feel like taking medication" (90%) and "difficulties in sticking to a fixed medication schedule" (80%).

Conclusions: Participants with ADHD were not prepared to manage their chronic illness independently in context of increased demands and newfound freedom, resulting in negative academic consequences. Social factors also play an influential role in ADHD self-management, particularly related to the isolation associated with sharing the medication and its side effects. Intervention programs targeting medication self-management during the transition to independence are greatly needed for young adults with ADHD as high academic performance in college is critical for future success

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J Autism Dev Disord. 2017;47:90-100.

EVALUATION OF THE ADHD RATING SCALE IN YOUTH WITH AUTISM.

Yerys BE, Nissley-Tsiopinis J, de Marchena A, et al.

Scientists and clinicians regularly use clinical screening tools for attention deficit/hyperactivity disorder (ADHD) to assess comorbidity without empirical evidence that these measures are valid in youth with autism spectrum disorder (ASD). We examined the prevalence of youth meeting ADHD criteria on the ADHD rating scale fourth edition (ADHD-RS-IV), the relationship of ADHD-RS-IV ratings with participant characteristics and behaviors, and its underlying factor structure in 386, 7-17-year olds with ASD without intellectual disability. Expected parent prevalence rates, relationships with age and externalizing behaviors were observed, but confirmatory factor analyses revealed unsatisfactory fits for one-, two-, three-factor models. Exploratory analyses revealed several items cross-loading on multiple factors. Implications of screening ADHD in youth with ASD using current diagnostic criteria are discussed

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J Autism Dev Disord. 2017;1-13.

DOES THE PRESENCE OF ANXIETY AND ADHD SYMPTOMS ADD TO SOCIAL IMPAIRMENT IN CHILDREN WITH AUTISM SPECTRUM DISORDER?

Factor RS, Ryan SM, Farley JP, et al.

Children with autism spectrum disorder (ASD) experience internalizing and externalizing problems at higher rates than typically developing children, which could worsen social impairment. The present study compared impairment scores (social responsiveness scale, 2nd edition; SRS-2 scores) in 57 children (3-17 years, 82.5% male) with ASD, either with or without heightened levels of anxiety or ADHD symptoms, all per parent report. Children with heightened anxiety problems showed higher scores on four SRS-2 subscales (Social Cognition, Social Communication, Social Motivation, and Restricted Interests and Repetitive Behavior). Children with heightened ADHD traits showed higher scores on two subscales (Social Communication and Social Awareness). These findings suggest similarities and differences in how social deficits in ASD may worsen with anxiety or ADHD symptoms

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J Child Adolesc Psychopharmacol. 2017;27:104-05.

ATOMOXETINE USE IN ATTENTION-DEFICIT/HYPERACTIVITY DISORDER AND COMORBID TIC DISORDER IN PEDIATRIC AUTOIMMUNE NEUROPSYCHIATRIC DISORDERS ASSOCIATED WITH STREPTOCOCCAL INFECTIONS.

Demirkaya SK, Demirkaya M, Yusufolu C, et al.

Attention-deficit/hyperactivity disorder (ADHD) is a common comorbid disease in children with pediatric autoimmune neuropsychiatric disorders associated with streptococcal infections (PANDAS), in which tic-like involuntary movements are frequently seen clinical conditions. In contrast to psychostimulants, atomoxetine is considered as having minimal effects on tics. Here we report two cases with ADHD and PANDAS who were treated with atomoxetine for their ADHD and comorbid tics

J Child Adolesc Psychopharmacol. 2017;27:19-28.

EFFECT OF ATOMOXETINE TREATMENT ON READING AND PHONOLOGICAL SKILLS IN CHILDREN WITH DYSLEXIA OR ATTENTION-DEFICIT/HYPERACTIVITY DISORDER AND COMORBID DYSLEXIA IN A RANDOMIZED, PLACEBO-CONTROLLED TRIAL.

Shaywitz S, Shaywitz B, Wietecha L, et al.

Objectives: Evaluated the effects of atomoxetine on the reading abilities of children with dyslexia only or attention-deficit/hyperactivity disorder (ADHD) and comorbid dyslexia.

Methods: Children aged 10-16 years (N = 209) met Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision (DSM-IV-TR) criteria for dyslexia only (n = 58), ADHD and comorbid dyslexia (n = 124), or ADHD only (n = 27) and were of normal intelligence. Patients were treated with atomoxetine (1.0-1.4 mg/kg/day) or placebo in a 16-week, randomized, placebo-controlled, double-blind trial. The dyslexia-only and ADHD and comorbid dyslexia groups were randomized 1:1; the ADHD-only group received atomoxetine in a blinded manner. Reading abilities were measured with the Woodcock Johnson III (WJIII), Comprehensive Test of Phonological Processing (CTOPP), Gray Oral Reading Tests-4, and Test of Word Reading Efficiency.

Results: Atomoxetine-treated dyslexia-only patients compared with placebo patients had significantly greater improvement (p < 0.02) with moderate to approaching high effect sizes (ES) on WJIII Word Attack (ES = 0.72), Basic Reading Skills (ES = 0.48), and Reading Vocabulary (ES = 0.73). In the atomoxetine-treated ADHD and comorbid dyslexia group, improvement on the CTOPP Elision measure (ES = 0.50) was significantly greater compared with placebo (p < 0.02). Total, inattentive, and hyperactive/impulsive ADHD symptom reductions were significant in the atomoxetine-treated ADHD and comorbid dyslexia group compared with placebo, and from baseline in the ADHD-only group (p ≤ 0.02). ADHD symptom improvements in the ADHD and comorbid dyslexia group were not correlated with improvements in reading.

Conclusions: Atomoxetine treatment improved reading scores in patients with dyslexia only and ADHD and comorbid dyslexia. Improvements for patients with dyslexia only were in critical components of reading, including decoding and reading vocabulary. For patients with ADHD and comorbid dyslexia, improvements in reading scores were distinct from improvement in ADHD inattention symptoms alone. These data represent the first report of improvements in reading measures following pharmacotherapy treatment in patients with dyslexia only evaluated in a randomized, double-blind trial

J Child Adolesc Psychopharmacol. 2017;27:66-74.

EFFICACY, SAFETY, AND TOLERABILITY OF AN EXTENDED-RELEASE ORALLY DISINTEGRATING METHYLPHENIDATE TABLET IN CHILDREN 6-12 YEARS OF AGE WITH ATTENTION-DEFICIT/HYPERACTIVITY DISORDER IN THE LABORATORY CLASSROOM SETTING.

Childress AC, Kollins SH, Cutler AJ, et al.

Objective: Methylphenidate extended-release orally disintegrating tablets (MPH XR-ODTs) represent a new technology for MPH delivery. ODTs disintegrate in the mouth without water and provide a pharmacokinetic profile that is consistent with once-daily dosing. This study sought to determine the efficacy, safety, and

tolerability of this novel MPH XR-ODT formulation in school-age children with attention-deficit/hyperactivity disorder (ADHD) in a laboratory classroom setting.

Methods: Children aged 6-12 years with ADHD (n = 87) were enrolled in this randomized, multicenter, double-blind, placebo-controlled, parallel, laboratory classroom study. The MPH XR-ODT dose was titrated to an optimized dose during a 4-week open-label period and maintained on that dose for 1 week. Participants (n = 85) were then randomized to receive their optimized dose of MPH XR-ODT or placebo once daily for 1 week (double blind), culminating in a laboratory classroom testing day. Efficacy was evaluated using the Swanson, Kotkin, Agler, M-Flynn, and Pelham (SKAMP) Attention, Department, and Combined scores along with Permanent Product Measure of Performance (PERMP; Attempted and Correct) assessments. Onset and duration of drug action were also evaluated as key secondary endpoints. Safety assessments included adverse events (AEs), physical examinations, electrocardiograms (ECGs), and the Columbia Suicide Severity Rating Scale (C-SSRS).

Results: The average SKAMP-Combined score on the classroom study day was significantly better for the MPH XR-ODT group (n = 43) than for the placebo group (n = 39; $p < 0.0001$). The effect was evident at 1 hour and lasted through 12 hours postdose. The average SKAMP-Attention, SKAMP-Department, PERMP-A, and PERMP-C scores were indicative of significantly greater ADHD symptom control for the MPH XR-ODT group. The most common AEs reported were decreased appetite, upper abdominal pain, headache, insomnia, upper respiratory tract infection, affect lability, irritability, cough, and vomiting. **Conclusions:** MPH XR-ODT was effective and well tolerated for the treatment of children with ADHD in a laboratory classroom setting.

Clinical Trial Registry: NCT01835548 (ClinicalTrials.gov)

J Child Adolesc Psychopharmacol. 2017;27:38-42.

ATOMOXETINE-RELATED CHANGE IN SLUGGISH COGNITIVE TEMPO IS PARTIALLY INDEPENDENT OF CHANGE IN ATTENTION-DEFICIT/HYPERACTIVITY DISORDER INATTENTIVE SYMPTOMS.

McBurnett K, Clemow D, Williams D, et al.

Objectives: To evaluate effects of atomoxetine versus placebo on sluggish cognitive tempo (SCT) and determine factors affecting improvement of SCT in children with attention-deficit/hyperactivity disorder (ADHD) with dyslexia (ADHD+D) or dyslexia only.

Methods: This is a post hoc analysis of a 16-week placebo-controlled, double-blind randomized phase of a previously reported atomoxetine study in children aged 10-16 years with ADHD+D, Dyslexia-only, or ADHD-only (no placebo arm). Least squares mean changes from baseline to endpoint for atomoxetine versus placebo on the Kiddie-Sluggish Cognitive Tempo Interview (K-SCT) (Parent, Teacher, and Youth) were analyzed using analysis of covariance and multiple regression (partial R²) analyses to test contributions of ADHD and dyslexia to improvements in K-SCT scores.

Results: Results were examined for the three informants within the three diagnostic groups (nine outcomes). Atomoxetine treatment was associated with significant reductions from baseline in seven of the nine outcomes using the $p = 0.05$ significance level, appropriate for exploratory analysis. When change in ADHD symptom severity was controlled, all of the seven SCT outcomes remained significant; changes in effect sizes were minimal. Regression analyses using SCT change as the criterion found a significant contribution by inattention change only for parent report, whereas, baseline SCT severity was a significant predictor in the randomized groups with the exception of teacher report in the Dyslexia-only group.

Conclusion: Given that controlling for change in ADHD symptoms had little effect on change in SCT scores, findings suggest that change in SCT is substantially independent of change in ADHD. By inference, SCT and its response to treatment is a partially distinct phenomenon from ADHD response. Regression analyses did not reveal global effects of inattention change on SCT change; instead, baseline SCT severity was the strongest predictor of placebo-controlled treatment effect on SCT. Atomoxetine effects on SCT appear to be best predicted by how much room for improvement exists for SCT rather than by severity or improvement in inattention.

Clinical trial registration: NCT00607919, www.clinicaltrials.gov

J Child Neurol. 2017 Feb;32:215-21.

CEREBELLAR VOLUME IN CHILDREN WITH ATTENTION-DEFICIT HYPERACTIVITY DISORDER (ADHD): REPLICATION STUDY.

Wyciskiewicz A, Pawlak MA, Krawiec K.

Attention Deficit Hyperactivity Disorder (ADHD) is associated with altered cerebellar volume and cerebellum is associated with cognitive performance. However there are mixed results regarding the cerebellar volume in young patients with ADHD. To clarify the size and direction of this effect, we conducted the analysis on the large public database of brain images. The aim of this study was to confirm that cerebellar volume in ADHD is smaller than in control subjects in currently the largest publicly available cohort of ADHD subjects. We applied cross-sectional case control study design by comparing 286 ADHD patients (61 female) with age and gender matched control subjects. Volumetric measurements of cerebellum were obtained using automated segmentation with FreeSurfer 5.1. Statistical analysis was performed in R-CRAN statistical environment. Patients with ADHD had significantly smaller total cerebellar volumes ($134.5 \pm 17.11 \text{ cm}^3$ vs. $138.90 \pm 15.32 \text{ cm}^3$). The effect was present in both females and males (males $136.9 \pm 14.37 \text{ cm}^3$ vs. $141.20 \pm 14.75 \text{ cm}^3$; females $125.7 \pm 12.34 \text{ cm}^3$ vs. $131.20 \pm 15.03 \text{ cm}^3$). Age was positively and significantly associated with the cerebellar volumes. These results indicate either delayed or disrupted cerebellar development possibly contributing to ADHD pathophysiology. (PsycINFO Database Record (c) 2017 APA, all rights reserved)

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J Child Neurol. 2017 Feb;32:188-93.

DOPAMINE D4 RECEPTOR GENE POLYMORPHISM IN A SAMPLE OF EGYPTIAN CHILDREN WITH ATTENTION-DEFICIT HYPERACTIVITY DISORDER (ADHD).

Mohamed FE, Kamal TM, Zahra SS, et al.

This study aimed to detect DRD4 receptor gene polymorphisms in attention-deficit hyperactivity disorder (ADHD) children and to correlate their phenotype-genotype. Fifty children with ADHD were diagnosed by Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, criteria and were subjected to Conners Parent Rating Scale. All cases and controls were subjected to history taking, physical examination, IQ assessment, and dopamine receptor D4 (DRD4) exon 3 genotyping. The 7-repeat allele was present only in controls, whereas 2-repeat allele was present in the ADHD children (heterozygous 2-repeat allele in 16% and homozygous in 26% of cases). Eight percent of cases had homozygous 4-repeat allele vs 28% of controls, whereas 10% of cases had heterozygous 4-repeat allele vs 6% of controls, with its predominance in controls. The 2-repeat and 4-repeat alleles have been associated with more inattention, hyperactivity, and impulsivity phenotypes. In conclusion, children with ADHD had a significant presence of the 2-repeat allele and absence of the 7-repeat allele. (PsycINFO Database Record (c) 2017 APA, all rights reserved)

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J Child Psychol Psychiatry. 2017 Feb;58:206-14.

CHILDREN WITH ADHD SYMPTOMS SHOW DECREASED ACTIVITY IN VENTRAL STRIATUM DURING THE ANTICIPATION OF REWARD, IRRESPECTIVE OF ADHD DIAGNOSIS.

van Hulst BM, De Zeeuw P, Bos DJ, et al.

Background: Changes in reward processing are thought to be involved in the etiology of attention-deficit/hyperactivity disorder (ADHD), as well as other developmental disorders. In addition, different forms of therapy for ADHD rely on reinforcement principles. As such, improved understanding of reward processing in ADHD could eventually lead to more effective treatment options. However, differences in reward processing may not be specific to ADHD, but may be a trans-diagnostic feature of disorders that involve ADHD-like symptoms.

Methods: In this event-related fMRI study, we used a child-friendly version of the monetary incentive delay task to assess performance and brain activity during reward anticipation. Also, we collected questionnaire data to assess reward sensitivity in daily life. For final analyses, data were available for 27 typically

developing children, 24 children with ADHD, and 25 children with an autism spectrum disorder (ASD) and ADHD symptoms.

Results: We found decreased activity in ventral striatum during anticipation of reward in children with ADHD symptoms, both for children with ADHD as their primary diagnosis and in children with autism spectrum disorder and ADHD symptoms. We found that higher parent-rated sensitivity to reward was associated with greater anticipatory activity in ventral striatum for children with ADHD symptoms. In contrast, there was no relationship between the degree of ADHD symptoms and activity in ventral striatum.

Conclusions: We provide evidence of biological and behavioral differences in reward sensitivity in children with ADHD symptoms, regardless of their primary diagnosis. Ultimately, a dimensional brain-behavior model of reward sensitivity in children with symptoms of ADHD may be useful to refine treatment options dependent on reward processing

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J Clin Psychopharmacol. 2017.

SHORT-TERM EFFECTS OF METHYLPHENIDATE ON MATH PRODUCTIVITY IN CHILDREN WITH ATTENTION-DEFICIT/HYPERACTIVITY DISORDER ARE MEDIATED BY SYMPTOM IMPROVEMENTS: EVIDENCE FROM A PLACEBO-CONTROLLED TRIAL.

Kortekaas-Rijlaarsdam AF, Luman M, Sonuga-Barke E, et al.

BACKGROUND: Although numerous studies report positive effects of methylphenidate on academic performance, the mechanism behind these improvements remains unclear. This study investigates the effects of methylphenidate on academic performance in children with attention-deficit/hyperactivity disorder (ADHD) and the mediating and moderating influence of ADHD severity, academic performance, and ADHD symptom improvement.

METHODS: Sixty-three children with ADHD participated in a double-blind placebo-controlled crossover study comparing the effects of long-acting methylphenidate and placebo. Dependent variables were math, reading, and spelling performance. The ADHD group performance was compared with a group of 67 typically developing children.

RESULTS: Methylphenidate improved math productivity and accuracy in children with ADHD. The effect of methylphenidate on math productivity was partly explained by parent-rated symptom improvement, with greater efficacy for children showing more symptom improvement. Further, children showing below-average math performance while on placebo profited more from methylphenidate than children showing above-average math performance.

CONCLUSIONS: The results from this study indicate positive effects of methylphenidate on academic performance, although these were limited to math abilities. In light of these results, expectations of parents, teachers, and treating physicians about the immediate effects of methylphenidate on academic improvement should be tempered. Moreover, our results implicate that positive effects of methylphenidate on math performance are in part due directly to effects on math ability and in part due to reductions in ADHD symptoms

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J Comp Eff Res. 2017;6:109-25.

THE IMPACT OF ADJUNCTIVE GUANFACINE EXTENDED RELEASE ON STIMULANT ADHERENCE IN CHILDREN/ADOLESCENTS WITH ATTENTION-DEFICIT/HYPERACTIVITY DISORDER.

Meyers J, Gajria K, Candrilli SD, et al.

Aim: To assess stimulant adherence among children/adolescents with attention-deficit/hyperactivity disorder (ADHD) augmenting stimulants with guanfacine extended-release (GXR). **Patients & methods:** Inclusion criteria: 6-17 years, ≥1 ADHD diagnosis, ≥1 long-acting and/or short-acting stimulant with GXR augmentation. Modified medication possession ratio (mMPR; days medication available/days in period, excluding medication holidays) was assessed; mMPR <0.80 nonadherent. Regression models assessed change in mMPR adjusting for demographic and clinical characteristics. **Results:** Among patients nonadherent to stimulants pre-augmentation (n = 165), unadjusted mean (SD) pre- and post-stimulant

mMPRs were 0.68 (0.11) and 0.87 (0.16). Adjusted mean change in mMPR was 0.20 for long-acting versus 0.18 for short-acting stimulants ($p = 0.34$). Conclusion: Among patients nonadherent to stimulants, GXR augmentation was associated with increased stimulant adherence

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J Consult Clin Psychol. 2016 Dec;84:1078-93.

EFFICACY OF A FAMILY-FOCUSED INTERVENTION FOR YOUNG DRIVERS WITH ATTENTION-DEFICIT HYPERACTIVITY DISORDER.

Fabiano GA, Schatz NK, Morris KL, et al.

Objective: Teenage drivers diagnosed with attention-deficit/hyperactivity disorder (ADHD) are at significant risk for negative driving outcomes related to morbidity and mortality. However, there are few viable psychosocial treatments for teens with ADHD and none focus on the key functional area of driving. The Supporting the Effective Entry to the Roadway (STEER) program was evaluated in a clinical trial to investigate whether it improved family functioning as a proximal outcome and driving behavior as a distal outcome. Method: One hundred seventy-two teenagers with ADHD, combined type, were randomly assigned to STEER or a driver education driver practice program (DEDP).

Results: Relative to parents in the DEDP condition, parents in STEER were observed to be less negative at posttreatment and 6-month follow-up but not at 12-month follow-up, and there were no significant differences for observed positive parenting. Relative to teens in the DEDP condition, teens in STEER reported lower levels of risky driving behaviors at posttreatment and 6-month follow-up, but not at 12-month follow-up. Groups did not differ on objective observations of risky driving or citations/accidents.

Conclusions: The STEER program for novice drivers with ADHD was effective in reducing observations of negative parenting behavior and teen self-reports of risky driving relative to DEDP; groups did not significantly differ on observations of positive parenting or driving behaviors. What is the public health significance of this article?—Families with a teenager with ADHD may benefit from engaging in behavioral parent training around the transition to independent driving, especially via reductions in negative parenting. Teenagers with ADHD self-reported fewer risky driving behaviors within the family-focused intervention, but these findings were not replicated on objective observations of driving.

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J Consult Clin Psychol. 2017;85:250-61.

OUTCOMES FOR ADOLESCENTS WHO COMPLY WITH LONG-TERM PSYCHOSOCIAL TREATMENT FOR ADHD.

Schultz BK, Evans SW, Langberg JM, et al.

Objective: We conducted a large ($N = 216$) multisite clinical trial of the Challenging Horizons Program (CHP) - a yearlong afterschool program that provides academic and interpersonal skills training for adolescents with attention-deficit/hyperactivity disorder. Intent-to-treat analyses suggest that, as predicted, the CHP resulted in significant reductions in problem behaviors and academic impairment when compared to community care. However, attendance in the CHP ranged from zero to 60 sessions, raising questions about optimal dosing.

Method: To evaluate the impact of treatment compliance, complier average causal effect modeling was used to compare participants who attended 80% or more of sessions to an estimate of outcomes for comparable control participants.

Results: Treatment compliers exhibited medium to large benefits ($d_s = 0.56$ to 2.00) in organization, disruptive behaviors, homework performance, and grades relative to comparable control estimates, with results persisting 6 months after treatment ended. However, compliance had little impact on social skills.

Conclusions: Students most in need of treatment were most likely to comply, resulting in significant benefits in relation to comparable control participants who experienced deteriorating outcomes over time. Difficulties relating to dose-response estimation and the potentially confounding influence of treatment acceptability, accessibility, and client motivation are discussed

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J Dev Behav Pediatr. 2017 Feb;38:151-54.

TIC SYMPTOMS INDUCED BY ATOMOXETINE IN TREATMENT OF ADHD: A CASE REPORT AND LITERATURE REVIEW.

Yang R, Li R, Gao W, et al.

Objective: Patients with attention-deficit/hyperactivity disorder (ADHD) are at increased risk for tic disorders. Atomoxetine (ATX) has been accepted as an alternative medication for patients with ADHD and a comorbid tic disorder. It is rarely reported that tic symptoms are induced by ATX.

Methods: This present report described a boy with ADHD who developed tic symptoms during ATX initiation. We used an ABAB trial to confirm the tics were related to ATX administration. In addition, we reviewed the published literature of patients whose tic symptoms were confirmed or suspected of relating to ATX usage.

Results: This present case with an ABAB design showed on-off control of tics with or without ATX, which allowed us to make a strong conclusion that the tics were related to ATX administration. Literature review also indicated that ATX might induce tic symptoms in children with ADHD, especially in those being boys and having a history of tics. The time from starting ATX to tics symptoms appearing was approximately 19 days. The most common tic symptoms were eye blinking, vocal tics, or throat clearing, and neck movements. These tics symptoms in most cases could be resolved after discontinuing ATX without further pharmacotherapy.

Conclusion: Pediatricians and child psychiatrists should be well aware of this potential adverse effect in children with ADHD receiving ATX

J Dev Behav Pediatr. 2017 Feb;38:169-72.

IT IS JUST ATTENTION-DEFICIT HYPERACTIVITY DISORDER...OR IS IT?

Won DC, Guilleminault C, Koltai PJ, et al.

Case: Carly is a 5-year-old girl who presents for an interdisciplinary evaluation due to behaviors at school and home suggestive of attention-deficit hyperactivity disorder (ADHD). Parent report of preschool teacher concerns was consistent with ADHD. Psychological testing showed verbal, visual-spatial, and fluid reasoning IQ scores in the average range; processing speed and working memory were below average. Carly's behavior improved when her mother left the room, and she was attentive during testing with a psychologist. Tests of executive function (EF) skills showed mixed results. Working memory was in the borderline range, although scores for response inhibition and verbal fluency were average. Parent ratings of ADHD symptoms and EF difficulties were elevated. Carly's parents recently separated; she now lives with her mother and sees her father on weekends. Multiple caregivers with inconsistent approaches to discipline assist with child care while her mother works at night as a medical assistant. Family history is positive for ADHD and learning problems in her father. Medical history is unremarkable. Review of systems is significant for nightly mouth breathing and snoring, but no night waking, bruxism, or daytime sleepiness. She has enlarged tonsils and a high-arched palate on physical examination. At a follow-up visit, parent rating scales are consistent with ADHD-combined type; teacher rating scales support ADHD hyperactive-impulsive type. Snoring has persisted. A sleep study indicated obstructive sleep apnea. After adenotonsillectomy, Carly had significant improvement in ADHD symptoms. She developed recurrence of behavior problems 1 year after the surgery.

J Exp Child Psychol. 2017 Feb;154:1-12.

HYPERACTIVITY IN BOYS WITH ATTENTION-DEFICIT/HYPERACTIVITY DISORDER: THE INFLUENCE OF UNDERLYING VISUOSPATIAL WORKING MEMORY AND SELF-CONTROL PROCESSES.

Patros CHG, Alderson RM, Hudec KL, et al.

Changes in motor activity were examined across control and executive function (EF) tasks that differ with regard to demands placed on visuospatial working memory (VS-WM) and self-control processes. Motor activity was measured via actigraphy in 8- to 12-year-old boys with ($n = 15$) and without ($n = 17$) attention-deficit/hyperactivity disorder (ADHD) during the completion of VS-WM, self-control, and control tasks. Results indicated that boys with ADHD, relative to typically developing boys, exhibited greater motor activity across tasks, and both groups' activity was greater during EF tasks relative to control tasks. Lastly, VS-WM performance, relative to self-control performance, accounted for significantly more variance in activity across

both VS-WM and self-control tasks. Collectively, findings suggest that ADHD-related hyperactivity is positively related to increased cognitive demands and appears to be better explained by deficient VS-WM rather than insufficient self-control. (PsycINFO Database Record (c) 2016 APA, all rights reserved)

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Journal of IMAB - Annual Proceeding (Scientific Papers). 2017;23:1441-43.

QUANTITATIVE EEG COMPARATIVE ANALYSIS BETWEEN AUTISM SPECTRUM DISORDER (ASD) AND ATTENTION DEFICIT HYPERACTIVITY DISORDER (ADHD).

Dimitrov PD, Petrov P, Aleksandrov I, et al.

Background: Autism is a mental developmental disorder, manifested in the early childhood. Attention deficit hyperactivity disorder is another psychiatric condition of the neurodevelopmental type. Both disorders affect information processing in the nervous system, altering the mechanisms which control how neurons and their synapses are connected and organized.

Purpose: To examine if quantitative EEG assessment is sensitive and simple enough to differentiate autism from attention deficit hyperactivity disorder and neurologically typical children.

Material and methods: Quantitative EEG is a type of electrophysiological assessment that uses computerized mathematical analysis to convert the raw waveform data into different frequency ranges. Each frequency range is averaged across a sample of data and quantified into mean amplitude (voltage in microvolts mV). We performed quantitative EEG analysis and compared 4 cohorts of children (aged from 3 to 7 years): with autism (high [n=27] and low [n=52] functioning), with attention deficit hyperactivity disorder [n=34], and with typical behaviour [n75]. Results: Our preliminary results show that there are significant qEEG differences between the groups of patients and the control cohort. The changes affect the potential levels of delta-, theta-, alpha-, and beta- frequency spectrums.

Conclusion: The present study shows some significant quantitative EEG findings in autistic patients. This is a step forward in our efforts, aimed at defining specific neurophysiologic changes, in order to develop and refine strategies for early diagnosis of autism spectrum disorders, differentiation from other development conditions in childhood, detection of specific biomarkers and early initiation of treatment

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J Invest Med. 2017;65:370-75.

TREND OF NOCTURNAL ENURESIS IN CHILDREN WITH ATTENTION DEFICIT/HYPERACTIVITY DISORDER: A NATIONWIDE POPULATION-BASED STUDY IN TAIWAN.

Tsai JD, Wang IC, Chen HJ, et al.

Attention-deficit/hyperactivity disorder (ADHD) and nocturnal enuresis are common disorders with extensive psychosocial suffering in affected children, and healthcare burden on parents. Whether the childhood psychological disorders and nocturnal enuresis are factors contributing to ADHD have not been clearly established. This study conducted a population-based case-control study using data sets from the National Health Research Insurance database, and identified 14 900 children diagnosed with ADHD. Risk factors that have been associated with or possibly related to ADHD development were included in this study. Performance of in groups of ADHD with enuresis was compared with controls. With adjustment for potential covariates, participants with enuresis exhibited a 2.24-fold greater risk of subsequent ADHD development compared with controls (95% CI 1.84 to 2.73). Participants with enuresis and comorbidity had a significantly greater risk of ADHD than those with no enuresis and no comorbidity (adjusted OR=8.43, 95% CI 4.38 to 16.2). Children who are assessed for ADHD should be evaluated for the presence of enuresis or other neurobehavioral comorbidities. Multidisciplinary treatment may benefit children with ADHD and minimize psychological burden on parents

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J Neural Transm. 2017 Feb;124:S3-S26.

SWEAT IT OUT? THE EFFECTS OF PHYSICAL EXERCISE ON COGNITION AND BEHAVIOR IN CHILDREN AND ADULTS WITH ADHD: A SYSTEMATIC LITERATURE REVIEW.

Den Heijer AE, Groen Y, Tucha L, et al.

As attention-deficit/hyperactivity disorder (ADHD) is one of the most frequently diagnosed developmental disorders in childhood, effective yet safe treatment options are highly important. Recent research introduced physical exercise as a potential treatment option, particularly for children with ADHD. The aim of this review was to systematically analyze potential acute and chronic effects of cardio and non-cardio exercise on a broad range of functions in children with ADHD and to explore this in adults as well. Literature on physical exercise in patients with ADHD was systematically reviewed based on categorizations for exercise type (cardio versus non-cardio), effect type (acute versus chronic), and outcome measure (cognitive, behavioral/socio-emotional, and physical/(neuro)physiological). Furthermore, the methodological quality of the reviewed papers was addressed. Cardio exercise seems acutely beneficial regarding various executive functions (e.g., impulsivity), response time and several physical measures. Beneficial chronic effects of cardio exercise were found on various functions as well, including executive functions, attention and behavior. The acute and chronic effects of non-cardio exercise remain more questionable but seem predominantly positive too. Research provides evidence that physical exercise represents a promising alternative or additional treatment option for patients with ADHD. Acute and chronic beneficial effects of especially cardio exercise were reported with regard to several cognitive, behavioral, and socio-emotional functions. Although physical exercise may therefore represent an effective treatment option that could be combined with other treatment approaches of ADHD, more well-controlled studies on this topic, in both children and adults, are needed

J Neural Transm. 2017 Feb;124:S127-S138.

THE ROLE OF SLEEP PROBLEMS AND CIRCADIAN CLOCK GENES IN ATTENTION-DEFICIT HYPERACTIVITY DISORDER AND MOOD DISORDERS DURING CHILDHOOD AND ADOLESCENCE: AN UPDATE.

Dueck A, Berger C, Wunsch K, et al.

A more recent branch of research describes the importance of sleep problems in the development and treatment of mental disorders in children and adolescents, such as attention-deficit hyperactivity disorder (ADHD) and mood disorders (MD). Research about clock genes has continued since 2012 with a focus on metabolic processes within all parts of the mammalian body, but particularly within different cerebral regions. Research has focused on complex regulatory circuits involving clock genes themselves and their influence on circadian rhythms of diverse body functions. Current publications on basic research in human and animal models indicate directions for the treatment of mental disorders targeting circadian rhythms and mechanisms. The most significant lines of research are described in this paper

J Psychopathol Behav Assess. 2017;1-15.

DO PARENT AND TEACHER REPORT OF ADHD SYMPTOMS IN CHILDREN DIFFER BY SES AND RACIAL STATUS?

Lawson GM, Nissley-Tsiopinis J, Nahmias A, et al.

Parent and teacher reports of symptoms of Attention Deficit Hyperactivity Disorder (ADHD) in children often differ from each other. These informant report differences may occur in systematic ways that vary by child socioeconomic status (SES) and race, but little is known about how SES and race together relate to parent and teacher report of ADHD symptoms in school-aged children. We examined the relationship between child SES, child race and parent and teacher reports of ADHD symptoms in two samples of school-aged Caucasian and African American children being evaluated for ADHD (N = 1056; N = 317). Multivariate regression was used to predict parent and teacher reports of ADHD symptoms from child SES, race, age, gender and interaction terms. The Wald test of parameter constraints was used to test the contrast between the predictors of interest and parent and teacher report of symptoms. In the second sample, we also examined observer report measures of ADHD symptoms during one-to-one testing and in the classroom. In both samples, lower SES was associated with higher levels of inattention symptoms, as reported by teachers,

but not by parents. Lower SES was also associated with higher levels of hyperactivity/impulsivity symptoms, as reported by both teachers and parents. African American race was associated with higher levels of inattention and hyperactivity/impulsivity symptoms reported by teachers than reported by parents. Observer report measures showed a different pattern of associations with SES and race. Investigating how children's SES and race influence cross-informant agreement on ratings of children's behavior might lead to the development of better assessment practices and more accurate diagnoses for diverse child populations

J Am Acad Child Adolesc Psychiatry. 2017 Jan;56:40-50.

ASSOCIATION OF PRETERM BIRTH WITH ATTENTION-DEFICIT/HYPERACTIVITY DISORDER–LIKE AND WIDER-RANGING NEUROPHYSIOLOGICAL IMPAIRMENTS OF ATTENTION AND INHIBITION.

Rommel AS, James SN, McLoughlin G, et al.

Objective: Preterm birth has been associated with an increased risk of attention-deficit/hyperactivity disorder (ADHD)–like symptoms and cognitive impairments similar to those seen in ADHD, including attention and inhibitory control difficulties. Yet data on direct comparisons across ADHD and preterm birth on cognitive-neurophysiological measures are limited.

Method: We directly compared 186 preterm-born adolescents to 69 term-born adolescents with ADHD and 135 term-born controls on cognitive-performance and event-related potential measures associated with attentional and inhibitory processing from a cued continuous performance test (CPT-OX), which we have previously shown to discriminate between the adolescents with ADHD and controls. We aimed to elucidate whether the ADHD-like symptoms and cognitive impairments in preterm-born individuals reflect identical cognitive-neurophysiological impairments in term-born individuals with ADHD.

Results: Go-P3 amplitude was reduced, reflecting impaired executive response control, in preterm-born adolescents compared to both controls and adolescents with ADHD. Moreover, in preterm-born adolescents, as in term-born adolescents with ADHD, contingent negative variation amplitude was attenuated, reflecting impairments in response preparation compared to controls. Although the ADHD group showed significantly increased NoGo-P3 amplitude at FCz compared to preterm group, at Cz preterm-born adolescents demonstrated significantly decreased NoGo-P3 amplitude compared to the control group, similar to term-born adolescents with ADHD.

Conclusion: These findings indicate impairments in response preparation, executive response control, and response inhibition in preterm-born adolescents. Although the response preparation and response inhibition impairments found in preterm-born adolescents overlap with those found in term-born adolescents with ADHD, the preterm group also shows unique impairments, suggesting more wide-ranging impairments in the preterm group compared to the ADHD group

J Am Acad Child Adolesc Psychiatry. 2016;55:921-22.

HERE/IN THIS ISSUE AND THERE/ABSTRACT THINKING: AUGMENTED REALITY TESTING.

Vanderwal T.

Marmara Medical Journal. 2016;29:177-80.

HALLUCINOSIS DUE TO METHYLPHENIDATE OVERDOSE IN AN EIGHT-YEAR-OLD CHILD: A CASE REPORT.

Atabay E, Rodopman Arman A.

Methylphenidate, which blocks the presynaptic norepinephrine and dopamine transporters, is the most common used medication and offered as first choice in the treatment guidelines of attention deficit hyperactivity disorder (ADHD). One of its rarely seen adverse effects is, hallucinations that can be formed idiosyncratically, which can be correlated with increased dopaminergic functioning in synaptic cleft. We will present an eight year old boy diagnosed with ADHD-combined type, and oppositional defiant disorder (ODD)

with no previous medical and family history who has impulsively taken extra dose of methylphenidate in the course of usual drug treatment. The acute hallucinosis presentation which has subsided the next day completely with the cessation of drug treatment will be discussed

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Med Hypotheses. 2017;100:64-66.

Infant acetylcholine, dopamine, and melatonin dysregulation: Neonatal biomarkers and causal factors for ASD and ADHD phenotypes.

Hellmer K, Nyström P.

Autism spectrum disorders (ASD) and ADHD are common neurodevelopmental disorders that benefit from early intervention but currently suffer from late detection and diagnosis: neurochemical dysregulations are extant already at birth but clinical phenotypes are not distinguishable until preschool age or later. The vast heterogeneity between subjects' phenotypes relates to interaction between multiple unknown factors, making research on factor causality insurmountable. To unlock this situation we pose the hypothesis that atypical pupillary light responses from rods, cones, and the recently discovered ipRGC system reflect early acetylcholine, melatonin, and dopamine dysregulation that are sufficient but not necessary factors for developing ASD and/or ADHD disorders. Current technology allows non-invasive cost-efficient assessment already from the first postnatal month. The benefits of the current proposal are: identification of clinical subgroups based on cause rather than phenotypes; facilitation of research on other causal factors; neonatal prediction of later diagnoses; and guidance for targeted therapeutical intervention

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Med J Aust. 2017;206:85-2017.

INFLUENCE OF BIRTH MONTH ON THE PROBABILITY OF WESTERN AUSTRALIAN CHILDREN BEING TREATED FOR ADHD.

Whitely M, Lester L, Phillimore J, et al.

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Mol Psychiatry. 2017;22:250-56.

EPIGENETIC PROFILING OF ADHD SYMPTOMS TRAJECTORIES: A PROSPECTIVE, METHYLOME-WIDE STUDY.

Walton E, Pingault JB, Cecil CAM, et al.

Attention-deficit/hyperactivity disorder (ADHD) is a prevalent developmental disorder, associated with a range of long-term impairments. Variation in DNA methylation, an epigenetic mechanism, is implicated in both neurobiological functioning and psychiatric health. However, the potential role of DNA methylation in ADHD symptoms is currently unclear. In this study, we examined data from the Avon Longitudinal Study of Parents and Children (ALSPAC)-specifically the subsample forming the Accessible Resource for Integrated Epigenomics Studies (ARIES)-that includes (1) peripheral measures of DNA methylation (Illumina 450k) at birth (n=817, 49% male) and age 7 (n=892, 50% male) and (2) trajectories of ADHD symptoms (7-15 years). We first employed a genome-wide analysis to test whether DNA methylation at birth associates with later ADHD trajectories; and then followed up at age 7 to investigate the stability of associations across early childhood. We found that DNA methylation at birth differentiated ADHD trajectories across multiple genomic locations, including probes annotated to SKI (involved in neural tube development), ZNF544 (previously implicated in ADHD), ST3GAL3 (linked to intellectual disability) and PEX2 (related to peroxisomal processes). None of these probes maintained an association with ADHD trajectories at age 7. Findings lend novel insights into the epigenetic landscape of ADHD symptoms, highlighting the potential importance of DNA methylation variation in genes related to neurodevelopmental and peroxisomal processes that play a key role in the maturation and stability of cortical circuits

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Neuroendocrinol Lett. 2016;37:289-94.

LONG TERM PHARMACOTHERAPY BY METHYLPHENIDATE OR ATOMOXETINE DAT 1 10/10 ADHD CHILDREN IN CORRELATION WITH RESULTS OF THE IMAGING METHODS.

Pribilova N, Paclt I, Kollarova P, et al.

OBJECTIVES: ADHD is one of the most significant diagnostic units in child and adolescent psychiatry. The occurrence in children is 5-6% and 50-80% continued to adult age. The presence of individual genes (polymorphism) on particular symptoms and processes in ADHD are not known. It is estimated that ADHD symptoms are up to 80% to genetic. The higher density of resultant DAT 1 protein was observed in ADHD patients in comparison with controls. The question was if DAT 1 10/10 predicted bad prognoses in long term therapy.

METHODS: We compared 30 ADHD DAT 110/10 adolescents treated for 5-6 years. Patients with 30 control adolescents. They were the same age of probands and controls. All these subjects were examined by child psychiatry scales (Conners, Achenbach..). Biological changes were tested by MRI specific CNS volumometry.

RESULTS: We didn't confirm bad prognoses in long term therapy with methylphenidate or atomoxetine in ADHD children DAT 1 10/10 in long term therapy. In MRI specific CNS volumometry were not identify any differences in controls and ADHD probands. Gray matter thickness was significantly higher in prefrontal and occipital areas in patients compared to control in prefrontal and occipital areas with cluster-wise p-value<0.05. By this method were not identify any cerebrum damage in long term therapy by methylphenidate and atomoxetine

Neuropsychiatr Dis Treat. 2017;13:443-55.

CAREGIVER PERSPECTIVE ON PEDIATRIC ATTENTION-DEFICIT/HYPERACTIVITY DISORDER: MEDICATION SATISFACTION AND SYMPTOM CONTROL.

Fridman M, Banaschewski T, Sikirica V, et al.

The caregiver perspective on pediatric attention-deficit/hyperactivity disorder (ADHD) study (CAPP) was a web-based, cross-sectional survey of caregivers of children and adolescents (6-17 years of age) with ADHD and was conducted in 10 European countries. CAPP included caregiver assessments of global medication satisfaction, global symptom control, and satisfaction with ADHD medication attributes. Overall, 2,326 caregiver responses indicated that their child or adolescent was currently receiving ADHD medication and completed the "off medication" assessment required for inclusion in the present analyses. Responses to the single-item global medication satisfaction question indicated that 88% were satisfied (moderately satisfied to very satisfied) with current medication and 18% were "very satisfied" on the single-item question. Responses to the single-item global symptom control question indicated that 47% and 19% of caregivers considered their child or adolescent's symptoms to be "controlled" or "very well controlled", respectively. Significant variations in response to the questions of medication satisfaction and symptom control were observed between countries. The correlation between the global medication satisfaction and global symptom control questions was 0.677 ($P<0.001$). Global medication satisfaction was significantly correlated ($P<0.001$) with all assessed medication attributes, with the highest correlations observed for symptom control ($r=0.601$) and effect duration ($r=0.449$). Correlations of medication attributes with global symptom control were generally lower than with global medication satisfaction but were all statistically significant ($P<0.001$). CAPP medication satisfaction and symptom control were also significantly correlated ($P<0.001$) with symptom control as based on the ADHD-Rating Scale-IV symptom score and the number of bad days per month when on medication. In conclusion, caregiver responses in this European sample suggest that current treatment could potentially be improved. The observed correlations of global medication satisfaction with global symptom control and other CAPP assessments, including medication attributes, provide support for the inter-connectivity of the medication satisfaction and symptom control

Neuropsychiatr Dis Treat. 2017;13:357-71.

A REVIEW OF THE EFFICACY OF ATOMOXETINE IN THE TREATMENT OF ATTENTION-DEFICIT HYPERACTIVITY DISORDER IN CHILDREN AND ADULT PATIENTS WITH COMMON COMORBIDITIES.

Clemow DB, Bushe C, Mancini M, et al.

Attention-deficit hyperactivity disorder (ADHD) is a common neuropsychiatric disorder that is often diagnosed during childhood, but has also increasingly been recognized to occur in adults. Importantly, up to 52% of children (including adolescents) and 87% of adults with ADHD also have a comorbid psychiatric disorder. The presence of a comorbid disorder has the potential to impact diagnosis and could affect treatment outcomes. Atomoxetine is a nonstimulant treatment for ADHD. Despite numerous published studies regarding efficacy of atomoxetine in the treatment of ADHD in patients with comorbid disorders, there is limited information about the impact of individual common comorbid disorders on the efficacy of atomoxetine for ADHD, especially with regard to adults. Moreover, a cumulative review and assessment of these studies has not been conducted. For this reason, we performed a literature review to find, identify, and cumulatively review clinical studies that examined the efficacy of atomoxetine in the treatment of patients with ADHD and comorbid psychiatric disorders. We found a total of 50 clinical studies (37 in children; 13 in adults) that examined the efficacy of atomoxetine in patients with ADHD and a comorbid disorder. The comorbidities that were studied in children or in adults included anxiety, depression, and substance use disorder. Overall, the presence of comorbidity did not adversely impact the efficacy of atomoxetine in treatment of ADHD symptoms in both patient populations. In the studies identified and assessed in this review, atomoxetine did not appear to exacerbate any of the comorbid conditions and could, therefore, be an important therapy choice for the treatment of ADHD in the presence of comorbid disorders

Neuropsychiatr Dis Treat. 2017;13:499-506.

BLOOD PRESSURE AND ANTHROPOMETRY IN CHILDREN TREATED WITH STIMULANTS: A LONGITUDINAL COHORT STUDY WITH AN INDIVIDUAL APPROACH.

Landgren M, Nasic S, Johnson M, et al.

Background: Knowledge about the long-term effects on blood pressure (BP) and body mass index (BMI) when treating young patients for attention-deficit/hyperactivity disorder (AD/HD) with stimulants is limited. Most of the studies have reported mean and not individual values for anthropometrics and BP in treatment with stimulants. This seems to be the first study of changes based on the analyses of individual data measured over time.

Patients and methods: Seventy young patients (aged 8-18 years) diagnosed with AD/HD and responding well to treatment with stimulants were followed for a mean period of 3 years and 3 months. BP, heart rate, height, weight, and BMI were transformed to standard deviations or z-scores from before treatment to the last registered visit.

Results: The mean dose of methylphenidate was 0.95 mg/kg. The mean increase of systolic and diastolic BP was 0.4 z-score and 0.1 z-score, respectively. The systolic BP was associated with BMI; a higher BMI at baseline increased the risk for an increase in systolic BP. Ten percent of the total group had a weight at follow-up of -1.5 standard deviation (SD) and 12% had a height of -1.5 SD. Mean height at follow-up was -0.2 SD, but 40% had a reduced height of at least 0.5 SD during the treatment period. BMI on a group level was reduced from $+0.8$ SD to $+0.3$ SD. Of the 19 patients with a BMI $+1.5$ SD at baseline, 50% had a significantly reduced BMI.

Conclusion: Consequences of stimulant treatment must be evaluated individually. Besides significant effects on core AD/HD symptoms, some patients have lower BMI and BP and some increase/maintain their BMI and/or increase their systolic BP. The risk of reduced height trajectory needs further research

Neuropsychiatr Dis Treat. 2017;13:373-86.

FACTORS ASSOCIATED WITH CAREGIVER BURDEN AMONG PHARMACOTHERAPY-TREATED CHILDREN/ADOLESCENTS WITH ADHD IN THE CAREGIVER PERSPECTIVE ON PEDIATRIC ADHD SURVEY IN EUROPE.

Fridman M, Banaschewski T, Sikirica V, et al.

BACKGROUND: Burden on caregivers of children/adolescents with attention-deficit/hyperactivity disorder (ADHD) is multidimensional, but incompletely understood.

OBJECTIVE: To analyze caregiver burden across the concepts of work, social/family life, and parental worry/stress, in relation to selected contributing factors.

METHODS: The online Caregiver Perspective on Pediatric ADHD survey was fielded in ten European countries. Analysis included children/adolescents (6-17 years) who were receiving/had received ADHD pharmacotherapy in the previous 6 months. Caregivers recorded their child's/adolescent's symptoms "on"/"off" medication (ie, when the caregiver reported that the child/adolescent forgot/chose not to take medication, before the onset of medication effect, or medication worn off). Effects of ADHD severity, comorbidities, and medication adherence on each burden outcome were assessed (multiple regression models).

RESULTS: In total, 2,326 caregivers were included (children/adolescents' mean age: 11.5 years, 80% male). Caregivers reported missed/altered work, avoiding social activity, increased parental worry/stress, and strain on family life, despite using ADHD pharmacotherapy. Child/adolescent comorbidities and ADHD severity were significantly related to all burden concepts measured; the strongest comorbidity associations were with altered work (odds ratios [ORs] =1.68 [95% confidence interval {CI} 1.33, 2.12], 1.87 [1.37, 2.54], 3.47 [2.51, 4.78] for 1, 2, 3+ comorbidities, respectively) and planning the day around the child/adolescent (OR =1.42 [95% CI 1.17, 1.72], 1.73 [1.33, 2.15], 2.65 [1.99, 3.53]); the strongest severity associations were: quitting a job (OR =1.41 [95% CI 1.26, 1.59]) and planning a day around the child/adolescent (OR =1.26 [95% CI 1.20, 1.32]). Increased medication adherence was most associated with reducing the caregiver burden for altered work (OR =0.57 [95% CI 0.45, 0.72]), worrying about how they are being perceived as a parent (OR =0.68 [0.56, 0.83]), and avoiding social activity (OR =0.56 [0.45, 0.68]), but not family or stress burden.

CONCLUSION: Burdens related to work, social activity, family life, and parental worry/stress were experienced by the caregivers of children/adolescents with ADHD, despite using ADHD pharmacotherapy. Better understanding of clinical/treatment characteristics most associated with the components of caregiver burden may help improve ADHD management and may ease caregiver burden

Neuropsychology. 2017;31:119-28.

SUBOPTIMAL DECISION MAKING BY CHILDREN WITH ADHD IN THE FACE OF RISK: POOR RISK ADJUSTMENT AND DELAY AVERSION RATHER THAN GENERAL PRONENESS TO TAKING RISKS.

Sørensen L, Sonuga-Barke E, Eichele H, et al.

Objective: Suboptimal decision making in the face of risk (DMR) in children with attention-deficit hyperactivity disorder (ADHD) may be mediated by deficits in a number of different neuropsychological processes. We investigated DMR in children with ADHD using the Cambridge Gambling Task (CGT) to distinguish difficulties in adjusting to changing probabilities of choice outcomes (so-called risk adjustment) from general risk proneness, and to distinguish these 2 processes from delay aversion (the tendency to choose the least delayed option) and impairments in the ability to reflect on choice options. Based on previous research, we predicted that suboptimal performance on this task in children with ADHD would be primarily relate to problems with risk adjustment and delay aversion rather than general risk proneness.

Method: Drug-naïve children with ADHD (n = 36), 8 to 12 years, and an age-matched group of typically developing children (n = 34) performed the CGT.

Results: As predicted, children with ADHD were not more prone to making risky choices (i.e., risk proneness). However, they had difficulty adjusting to changing risk levels and were more delay aversive-with these 2 effects being correlated.

Conclusions: Our findings add to the growing body of evidence that children with ADHD do not favor risk taking per se when performing gambling tasks, but rather may lack the cognitive skills or motivational style to appraise changing patterns of risk effectively

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Nord J Psychiatry. 2017;1-7.

PREDICTIVE VALIDITY OF THE K-SADS-PL 2009 VERSION IN SCHOOL-AGED AND ADOLESCENT OUTPATIENTS.

Jarbin H, Andersson M, R+Ñstam M, et al.

Background: The schedule for affective disorders and schizophrenia for school-age children (K-SADS) is one of the most commonly used standardized diagnostic interviews in child and adolescent psychiatry. Validity studies are scarce, and limited to concurrent validity with other measures and clinical diagnoses.

Aims: To evaluate the K-SADS interview in an outpatient child and adolescent psychiatry (CAP) setting with a Longitudinal Expert All Data (LEAD) procedure.

Methods: CAP residents performed a K-SADS-PL interview with the revised 2009 version containing the new PDD section on 239 clinically referred outpatients of 6–17 years old and their parent(s). A consensus LEAD diagnosis by two senior clinicians 1.2 (SD = 0.6) years later was based on clinical records including the K-SADS and subsequent information from further assessments, information from teachers and other informants, outcome of treatment, and at least three visits after the K-SADS.

Results: Predictive validity for K-SADS vs LEAD diagnoses were good-to-excellent for broader categories of anxiety disorders ($\kappa = 0.94$), depressive ($\kappa = 0.91$), behavioural ($\kappa = 0.91$) and tic ($\kappa = 0.81$) disorders, good for ADHD ($\kappa = 0.80$), and good-to-moderate for autism spectrum disorders ($\kappa = 0.62$). Bipolar, psychotic, and eating disorders were too few to be analysed.

Conclusion: The K-SADS diagnoses elicited from an interview with the child and one from parents on one occasion have an excellent validity for most major child psychiatric disorders. ADHD can be reliably diagnosed at one visit, but clinicians need to stay alert for possible undiagnosed ADHD. Diagnosing autism with K-SADS-PL 2009 version at one visit is not advisable

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Paediatr Anaesth. 2017.

HEMODYNAMIC PROFILE AND BEHAVIORAL CHARACTERISTICS DURING INDUCTION OF ANESTHESIA IN PEDIATRIC PATIENTS WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER.

Cartabuke RS, Tobias JD, Rice J, et al.

Aim: There is no consensus regarding the administration of stimulant drugs preoperatively, particularly in pediatric patients diagnosed with ADHD. The primary objective of the current study was to assess differences in blood pressure and heart rate before and after induction of anesthesia between patients on chronic amphetamine or methylphenidate therapy who receive their normal dose preoperatively compared to patients in whom the prescribed medication was withheld. Secondary objectives were to assess the anxiety level during the induction of anesthesia and the effect of premedication with midazolam.

Method: Patients, ranging in age from 2 through 18 years, were enrolled if they were diagnosed with ADHD, were taking amphetamines or methylphenidate at any time in the 6 months prior to admission, and were undergoing an outpatient surgical or diagnostic procedure. The study cohort was divided into those who took their ADHD medications prior to surgery and those who did not take their medications preoperatively. The primary objective was addressed by comparing heart rate, systolic and diastolic BP, and mean arterial pressure before and during anesthetic induction between the two groups. Hypotension after anesthetic induction was defined as systolic blood pressure and mean arterial pressure <5th percentile for age. To address the secondary objectives, modified Yale Preoperative Anxiety Scale (mYPAS) scores assessed prior to induction and during induction were compared between groups.

Results: Fifty patients were enrolled, 14 of whom took their ADHD medication and 34 of whom did not take ADHD medication preoperatively. Two patients with unknown ADHD medication status were excluded from the primary analysis (stratification by medication withholding), but all 50 patients were used for the secondary analysis (stratification by midazolam use). There was no intraoperative hypotension in either group. Despite

weak evidence for a difference in heart rate between the group receiving medication and the group with no medication (96.8 ± 14.0 vs 88.0 ± 14.0 beats/min; difference of means = 8.8; 95% CI of difference: 0.2, 17.7; $P = 0.055$), there was no evidence for differences between the groups in systolic BP, diastolic BP, or mean arterial pressure. There were no differences between groups in mYPAS at the two time periods assessed.

Conclusion: The evidence suggests that continuing preoperative stimulant medication is not associated with cardiovascular instability in the pediatric population. The evidence suggests that withholding or allowing stimulant medication preoperatively does not improve behavior on anesthetic induction or reduce the need for anxiolytic medication. Research efforts should focus on perioperative management strategies that will decrease the likelihood of long-term behavioral issues

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Pediatrics. 2016;138.

PRESCHOOL ADHD DIAGNOSIS AND STIMULANT USE BEFORE AND AFTER THE 2011 AAP PRACTICE GUIDELINE.

Fiks AG, Ross ME, Mayne SL, et al.

OBJECTIVE: To evaluate the change in the diagnosis of attention-deficit/hyperactivity disorder (ADHD) and prescribing of stimulants to children 4 to 5 years old after release of the 2011 American Academy of Pediatrics guideline.

METHODS: Electronic health record data were extracted from 63 primary care practices. We included preventive visits from children 48 to 72 months old receiving care from January 2008 to July 2014. We compared rates of ADHD diagnosis and stimulant prescribing before and after guideline release using logistic regression with a spline and clustering by practice. Patterns of change (increase, decrease, no change) were described for each practice.

RESULTS: Among 87 067 children with 118 957 visits before the guideline and 56 814 with 92 601 visits after the guideline, children had an ADHD diagnosis at 0.7% (95% confidence interval [CI], 0.7% to 0.8%) of visits before and 0.9% (95% CI, 0.8% to 0.9%) after guideline release and had stimulant prescriptions at 0.4% (95% CI, 0.4% to 0.4%) of visits in both periods. A significantly increasing preguideline trend in ADHD diagnosis ended after guideline release. The rate of stimulant medication use remained constant before and after guideline release. Patterns of change from before to after the guideline varied significantly across practices.

CONCLUSIONS: Release of the 2011 guideline that addressed ADHD in preschoolers was associated with the end of an increasing rate of diagnosis, and the rate of prescribing stimulants remained constant. These are reassuring results given that a standardized approach to diagnosis was recommended and stimulant treatment is not first-line therapy for this age group

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Pediatrics. 2016;138.

IT TAKES A FULL-SERVICE VILLAGE TO TREAT CHILDREN WITH ADHD.

Wolraich ML.

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PeerJ. 2017;2017.

EFFECTS OF AN 8-WEEK YOGA PROGRAM ON SUSTAINED ATTENTION AND DISCRIMINATION FUNCTION IN CHILDREN WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER.

Chou CC, Huang CJ.

This study investigated whether a yoga exercise intervention influenced the sustained attention and discrimination function in children with ADHD. Forty-nine participants (mean age = 10.50 years) were assigned to either a yoga exercise or a control group. Participants were given the Visual Pursuit Test and Determination Test prior to and after an eight-week exercise intervention (twice per week, 40 min per session) or a control intervention. Significant improvements in accuracy rate and reaction time of the two tests were observed over time in the exercise group compared with the control group. These findings suggest that

alternative therapies such as yoga exercises can be complementary to behavioral interventions for children with attention and inhibition problems. Schools and parents of children with ADHD should consider alternatives for maximizing the opportunities that children with ADHD can engage in structured yoga exercises

Physician and Sportsmedicine. 2017;45:1-10.

COMPARISON OF BASELINE AND POST-CONCUSSION IMPACT TEST SCORES IN YOUNG ATHLETES WITH STIMULANT-TREATED AND UNTREATED ADHD.

Gardner RM, Yengo-Kahn A, Bonfield CM, et al.

OBJECTIVES: Baseline and post-concussion neurocognitive testing is useful in managing concussed athletes. Attention deficit hyperactivity disorder (ADHD) and stimulant medications are recognized as potential modifiers of performance on neurocognitive testing by the Concussion in Sport Group. Our goal was to assess whether individuals with ADHD perform differently on post-concussion testing and if this difference is related to the use of stimulants.

METHODS: Retrospective case-control study in which 4373 athletes underwent baseline and post-concussion testing using the ImPACT battery. 277 athletes self-reported a history of ADHD, of which, 206 reported no stimulant treatment and 69 reported stimulant treatment. Each group was matched with participants reporting no history of ADHD or stimulant use on several biopsychosocial characteristics. Non-parametric tests were used to assess ImPACT composite score differences between groups.

RESULTS: Participants with ADHD had worse verbal memory, visual memory, visual motor speed, and reaction time scores than matched controls at baseline and post-concussion, all with $p \leq .001$ and $|r| \geq 0.100$. Athletes without stimulant treatment had lower verbal memory, visual memory, visual motor speed, and reaction time scores than controls at baseline ($p \leq 0.01$, $|r| \geq 0.100$ [except verbal memory, $r = -0.088$]) and post-concussion ($p = 0.000$, $|r| > 0.100$). Athletes with stimulant treatment had lower verbal memory (Baseline: $p = 0.047$, $r = -0.108$; Post-concussion: $p = 0.023$, $r = -0.124$) and visual memory scores (Baseline: $p = 0.013$, $r = -0.134$; Post-concussion: $p = 0.003$, $r = -0.162$) but equivalent visual motor speed and reaction time scores versus controls at baseline and post-concussion.

CONCLUSIONS: ADHD-specific baseline and post-concussion neuropsychological profiles, as well as stimulant medication status, may need to be considered when interpreting ImPACT test results. Further investigation into the effects of ADHD and stimulant use on recovery from sport-related concussion (SRC) is warranted

PLoS ONE. 2017;12.

INCREASED ANTERIOR PELVIC ANGLE CHARACTERIZES THE GAIT OF CHILDREN WITH ATTENTION DEFICIT/HYPERACTIVITY DISORDER (ADHD).

Naruse H, Fujisawa TX, Yatsuga C, et al.

Background Children with attention deficit/hyperactivity disorder (ADHD) frequently have motor problems. Previous studies have reported that the characteristic gait in children with ADHD is immature and that subjects demonstrate higher levels of variability in gait characteristics for the lower extremities than healthy controls. However, little is known about body movement during gait in children with ADHD. The purpose of this study was to identify the characteristic body movements associated with ADHD symptoms in children with ADHD.

Methods Using a three-dimensional motion analysis system, we compared gait variables in boys with ADHD ($n = 19$; mean age, 9.58 years) and boys with typical development (TD) ($n = 21$; mean age, 10.71 years) to determine the specific gait characteristics related to ADHD symptoms. We assessed spatiotemporal gait variables (i.e. speed, stride length, and cadence), and kinematic gait variables (i.e. angle of pelvis, hip, knee, and ankle) to measure body movement when walking at a self-selected pace.

Results In comparison with the TD group, the ADHD group demonstrated significantly higher values in cadence ($t = 3.33$, $p = 0.002$) and anterior pelvic angle ($t = 3.08$, $p = 0.004$). In multiple regression analysis,

anterior pelvic angle was associated with the ADHD rating scale hyperactive/ impulsive scores ($r = 0.62$, $t = 2.58$, $p = 0.025$), but not other psychiatric symptoms in the ADHD group.

Conclusions Our results suggest that anterior pelvic angle represents a specific gait variable related to ADHD symptoms. Our kinematic findings could have potential implications for evaluating the body movement in boys with ADHD

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Prog Neuro-Psychopharmacol Biol Psychiatry. 2017;75:135-41.

ALTERED FUNCTIONAL CONNECTIVITY IN DEFAULT MODE NETWORK IN INTERNET GAMING DISORDER: INFLUENCE OF CHILDHOOD ADHD.

Lee D, Lee J, Lee JE, et al.

Objective Internet gaming disorder (IGD) is a type of behavioral addiction characterized by abnormal executive control, leading to loss of control over excessive gaming. Attention deficit and hyperactivity disorder (ADHD) is one of the most common comorbid disorders in IGD, involving delayed development of the executive control system, which could predispose individuals to gaming addiction. We investigated the influence of childhood ADHD on neural network features of IGD.

Methods Resting-state functional magnetic resonance imaging analysis was performed on 44 young, male IGD subjects with and without childhood ADHD and 19 age-matched, healthy male controls. Posterior cingulate cortex (PCC)-seeded connectivity was evaluated to assess abnormalities in default mode network (DMN) connectivity, which is associated with deficits in executive control.

Results IGD subjects without childhood ADHD showed expanded functional connectivity (FC) between DMN-related regions (PCC, medial prefrontal cortex, thalamus) compared with controls. These subjects also exhibited expanded FC between the PCC and brain regions implicated in salience processing (anterior insula, orbitofrontal cortex) compared with IGD subjects with childhood ADHD. IGD subjects with childhood ADHD showed expanded FC between the PCC and cerebellum (crus II), a region involved in executive control. The strength of connectivity between the PCC and cerebellum (crus II) was positively correlated with self-reporting scales reflecting impulsiveness.

Conclusion Individuals with IGD showed altered PCC-based FC, the characteristics of which might be dependent upon history of childhood ADHD. Our findings suggest that altered neural networks for executive control in ADHD would be a predisposition for developing IGD

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Psychiatr Serv. 2016;67:937.

ADHD AMONG U.S. CHILDREN AND ADULTS: INCREASING ACCESS TO CARE.

Kataoka SH.

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Psychiatry Res. 2017;251:148-54.

CONTROLLING ATTENTION TO GAZE AND ARROWS IN ATTENTION DEFICIT HYPERACTIVITY DISORDER.

Marotta A, Pasini A, Menotti E, et al.

The aim of this research was to assess implicit processing of social and non-social distracting cues in children with ADHD. Young people with ADHD and matched controls were asked to classify target words (LEFT/RIGHT) which were accompanied by a distracter eye-gaze or arrow. Typically developing participants showed evidence of interference effects from both eye-gaze and arrow distracters. In contrast, the ADHD group showed evidence of interference effects from arrow but failed to show interference from eye-gaze. This absence of interference effects from eye-gaze observed in the participants with ADHD may reflect an attentional impairment in attending to socially relevant information

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Psychiatry Res. 2017;251:182-91.

CHILDREN WITH ADHD AND SYMPTOMS OF OPPOSITIONAL DEFIANT DISORDER IMPROVED IN BEHAVIOR WHEN TREATED WITH METHYLPHENIDATE AND ADJUVANT RISPERIDONE, THOUGH WEIGHT GAIN WAS ALSO OBSERVED □ Ç Ö RESULTS FROM A RANDOMIZED, DOUBLE-BLIND, PLACEBO-CONTROLLED CLINICAL TRIAL.

Jahangard L, Akbarian S, Haghghi M, et al.

Children with ADHD often show symptoms of oppositional defiant disorders (ODD). We investigated the impact of adjuvant risperidone (RISP) to a standard treatment with methylphenidate (MPH) in children with ADHD and symptoms of ODD. Eighty-four children with ADHD and ODD (age: M=8.55; range: 7.28-9.95 years; 73.8% males) took part in a double-blind, randomized, placebo-controlled, clinical trial lasting eight weeks. Participants were randomly assigned either to the MPH+RISP (1 mg/kg/d+0.5 mg/d) or to the MPH+PLCO (1 mg/kg/d+placebo) condition. Symptoms of ADHD, weight, height, and blood pressure were assessed at baseline, and at weeks 2, 4, 6 and 8. Symptoms of ADHD decreased over time, but more so in the MPH+RISP than in the MPH only condition. In the MPH+RISP condition weight, waist circumference and prolactin levels increased over time. Data suggest that adjuvant RISP improved symptoms in children with ADHD and ODD, but weight gain and higher prolactin levels were also observed, which are two alarming side effects. This may become an issue, once children become adolescents, a period of life in which body shape and body self-image are closely linked to self-confidence and peer acceptance. Health care professionals should carefully balance the short-term and long-term costs and benefits of administration of RISP

Quality of Life Research. 2017;1-7.

THE WEISS FUNCTIONAL IMPAIRMENT RATING SCALE-PARENT FORM FOR ASSESSING ADHD: EVALUATING DIAGNOSTIC ACCURACY AND DETERMINING OPTIMAL THRESHOLDS USING ROC ANALYSIS.

Thompson T, Lloyd A, Joseph A, et al.

PURPOSE: The Weiss Functional Impairment Rating Scale-Parent Form (WFIRS-P) is a 50-item scale that assesses functional impairment on six clinically relevant domains typically affected in attention-deficit/hyperactivity disorder (ADHD). As functional impairment is central to ADHD, the WFIRS-P offers potential as a tool for assessing functional impairment in ADHD. These analyses were designed to examine the overall performance of WFIRS-P in differentiating ADHD and non-ADHD cases using receiver operating characteristics (ROC) analysis. This is the first attempt to empirically determine the level of functional impairment that differentiates ADHD children from normal controls.

METHODS: This observational study comprised 5-19-year-olds with physician-diagnosed ADHD (n = 476) and non-ADHD controls (n = 202). ROC analysis evaluated the ability of WFIRS-P to discriminate between ADHD and non-ADHD, and identified a WFIRS-P cut-off score that optimises correct classification. Data were analysed for the complete sample, for males versus females and for participants in two age groups (5-12 versus 13-19 years).

RESULTS: Area under the curve (AUC) was 0.91 (95% confidence interval 0.88-0.93) for the overall WFIRS-P score, suggesting highly accurate classification of ADHD distinct from non-ADHD. Sensitivity (0.83) and specificity (0.85) were maximal for a mean overall WFIRS-P score of 0.65, suggesting that this is an appropriate threshold for differentiation. DeLong's test found no significant differences in AUCs for males versus females or 5-12 versus 13-19 years, suggesting that WFIRS-P is an accurate classifier of ADHD across gender and age.

CONCLUSIONS: When assessing function, WFIRS-P appears to provide a simple and effective basis for differentiating between individuals with/without ADHD in terms of functional impairment

CLASSIFICATION: Disease-specific applications of QOL research

Res Dev Disabil. 2017;62:115-23.

ATTENTION-DEFICIT/HYPERACTIVITY DISORDER SYMPTOMS AND LONELINESS AMONG ADULTS IN THE GENERAL POPULATION.

Stickley A, Koyanagi A, Takahashi H, et al.

BACKGROUND: Research on the association between adult attention-deficit/hyperactivity disorder (ADHD) and loneliness is scarce even though factors which have been previously linked to loneliness, such as divorce and poorer mental health may be more prevalent among adults with ADHD. This study investigated the relation between ADHD symptoms/symptom severity and loneliness in the general adult population.

METHODS: Data from the Adult Psychiatric Morbidity Survey 2007 (N=7403, aged ≥16years) were analyzed. ADHD symptoms and common mental disorders (CMDs) were assessed with the Adult ADHD Self-Report Scale (ASRS) Screener and the Clinical Interview Schedule Revised, respectively. Loneliness was measured with a question from the Social Functioning Questionnaire. Multivariable logistic regression analysis was used to examine the associations.

RESULTS: In the fully adjusted model, an ASRS score ≥14 was strongly associated with loneliness (OR=2.48 95%CI=1.83-3.36). ADHD symptom severity was related to loneliness in a dose-response fashion. Over one-third of the association between ADHD symptoms and loneliness was explained by CMDs.

CONCLUSIONS: Adults with more ADHD symptoms are at an increased risk of feeling lonely. Future research should determine how ADHD symptoms are linked to loneliness and if loneliness is affecting well-being

Res Dev Disabil. 2017;61:55-65.

VINELAND-II ADAPTIVE BEHAVIOR PROFILE OF CHILDREN WITH ATTENTION-DEFICIT/HYPERACTIVITY DISORDER OR SPECIFIC LEARNING DISORDERS.

Balboni G, Incognito O, Belacchi C, et al.

Background The evaluation of adaptive behavior is informative in children with attention-deficit/hyperactivity disorder (ADHD) or specific learning disorders (SLD). However, the few investigations available have focused only on the gross level of domains of adaptive behavior.

Aims To investigate which item subsets of the Vineland-II can discriminate children with ADHD or SLD from peers with typical development.

Methods and procedures Student's t-tests, ROC analysis, logistic regression, and linear discriminant function analysis were used to compare 24 children with ADHD, 61 elementary students with SLD, and controls matched on age, sex, school level attended, and both parents' education level.

Results Several item subsets that address not only ADHD core symptoms, but also understanding in social context and development of interpersonal relationships, allowed discrimination of children with ADHD from controls. The combination of four item subsets (Listening and attending, Expressing complex ideas, Social communication, and Following instructions) classified children with ADHD with both sensitivity and specificity of 87.5%. Only Reading skills, Writing skills, and Time and dates discriminated children with SLD from controls.

Conclusions Evaluation of Vineland-II scores at the level of item content categories is a useful procedure for an efficient clinical description

J Individ Psychol (1998). 2016;72:290-307.

SOCIAL INTEREST IN CHILDREN WITH AND WITHOUT ATTENTION-DEFICIT/HYPERACTIVITY DISORDER.

Alizadeh H, Walton FX, Soheili F.

This research compared social interest (SI) and its constituents in children with and without attention-deficit/hyperactivity disorder (ADHD). The sample consisted of 86 children aged 7 to 12 years of age, including 41 children with ADHD and 45 children without ADHD. The diagnosis of ADHD was established based on the criteria of DSM-5, and through clinical interviews with parents, children, and teachers. Parents of the two groups of children completed the Social Interest Scale for Iranian Children (SISIQ). Results

revealed that SI in children with ADHD was lower than in children without ADHD in three subscales of SISIC. Accordingly, we conclude that underdeveloped SI in children with ADHD should be considered in the evaluative and treatment processes

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The Lancet Psychiatry. 2017.

SUBCORTICAL BRAIN VOLUME DIFFERENCES IN PARTICIPANTS WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER IN CHILDREN AND ADULTS: A CROSS-SECTIONAL MEGA-ANALYSIS.

Hoogman M, Bralten J, Hibar DP, et al.

BACKGROUND: Neuroimaging studies have shown structural alterations in several brain regions in children and adults with attention deficit hyperactivity disorder (ADHD). Through the formation of the international ENIGMA ADHD Working Group, we aimed to address weaknesses of previous imaging studies and meta-analyses, namely inadequate sample size and methodological heterogeneity. We aimed to investigate whether there are structural differences in children and adults with ADHD compared with those without this diagnosis.

METHODS: In this cross-sectional mega-analysis, we used the data from the international ENIGMA Working Group collaboration, which in the present analysis was frozen at Feb 8, 2015. Individual sites analysed structural T1-weighted MRI brain scans with harmonised protocols of individuals with ADHD compared with those who do not have this diagnosis. Our primary outcome was to assess case-control differences in subcortical structures and intracranial volume through pooling of all individual data from all cohorts in this collaboration. For this analysis, p values were significant at the false discovery rate corrected threshold of $p=0.0156$.

FINDINGS: Our sample comprised 1713 participants with ADHD and 1529 controls from 23 sites with a median age of 14 years (range 4-63 years). The volumes of the accumbens (Cohen's $d=-0.15$), amygdala ($d=-0.19$), caudate ($d=-0.11$), hippocampus ($d=-0.11$), putamen ($d=-0.14$), and intracranial volume ($d=-0.10$) were smaller in individuals with ADHD compared with controls in the mega-analysis. There was no difference in volume size in the pallidum ($p=0.95$) and thalamus ($p=0.39$) between people with ADHD and controls. Exploratory lifespan modelling suggested a delay of maturation and a delay of degeneration, as effect sizes were highest in most subgroups of children (<15 years) versus adults (>21 years): in the accumbens (Cohen's $d=-0.19$ vs -0.10), amygdala ($d=-0.18$ vs -0.14), caudate ($d=-0.13$ vs -0.07), hippocampus ($d=-0.12$ vs -0.06), putamen ($d=-0.18$ vs -0.08), and intracranial volume ($d=-0.14$ vs 0.01). There was no difference between children and adults for the pallidum ($p=0.79$) or thalamus ($p=0.89$). Case-control differences in adults were non-significant (all $p>0.03$). Psychostimulant medication use (all $p>0.15$) or symptom scores (all $p>0.02$) did not influence results, nor did the presence of comorbid psychiatric disorders (all $p>0.5$).

INTERPRETATION: With the largest dataset to date, we add new knowledge about bilateral amygdala, accumbens, and hippocampus reductions in ADHD. We extend the brain maturation delay theory for ADHD to include subcortical structures and refute medication effects on brain volume suggested by earlier meta-analyses. Lifespan analyses suggest that, in the absence of well powered longitudinal studies, the ENIGMA cross-sectional sample across six decades of ages provides a means to generate hypotheses about lifespan trajectories in brain phenotypes.

FUNDING: National Institutes of Health

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Therapeutics, Pharmacology and Clinical Toxicology. 2015;19:141-45.

A STUDY REGARDING THE INTERRELATION BETWEEN A GOOD STATE OF MIND AS AN INDICATOR OF HEALTH STATE AND PSYCHOTHERAPY IN CHILDREN WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER.

Mihaela MA, Maria DA, Elena T, et al.

Throughout one year: 2013 - 2014, a lot of 50 children from the residential institution "SOS Satele Copiilor" Bucharest, was included in our research. The children were distributed in two groups: Group A which consisted of 25 children (12 girls, 13 boys) who were not diagnosed with ADHD and Group B which consisted of 25 children (14 boys, 11 girls) who were diagnosed with ADHD. Initially, the two groups were subjected to

a psychodiagnostic battery of tests, one of them being: "Evaluating the Health State of children with ADHD questionnaire" elaborated by the study team, particularly for this research, with the purpose of highlighting the direct link between children's health status and their ADHD symptoms. Subsequently, the children from group B benefited from a psychotherapy protocol which combined the strategies of the short term psychodynamic psychotherapy. The emotional wellbeing average values of the children from group B and group A were significantly different at the beginning of our program, while at the end the difference were highly reduced based on the statistical analysis

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Trials. 2016;17.

ATTENTION TRAINING FOR INFANTS AT FAMILIAL RISK OF ADHD (INTERSTAARS): STUDY PROTOCOL FOR A RANDOMISED CONTROLLED TRIAL.

Goodwin A, Salomone S, Bolton P, et al.

Background: Attention deficit hyperactivity disorder (ADHD) is a prevalent neurodevelopmental disorder that can negatively impact on an individual's quality of life. It is pathophysiologically complex and heterogeneous with different neuropsychological processes being impaired in different individuals. Executive function deficits, including those affecting attention, working memory and inhibitory control, are common. Cognitive training has been promoted as a treatment option, based on the notion that by strengthening the neurocognitive networks underlying these executive processes, ADHD symptoms will also be reduced. However, if implemented in childhood or later, when the full disorder has become well-established, cognitive training has only limited value. INTERSTAARS is a trial designed to test a novel approach to intervention, in which cognitive training is implemented early in development, before the emergence of the disorder. The aim of INTERSTAARS is to train early executive skills, thereby increasing resilience and reducing later ADHD symptoms and associated impairment.

Methods/design: Fifty 10-14-month-old infants at familial risk of ADHD will participate in INTERSTAARS. Infants will be randomised to an intervention or a control group. The intervention aims to train early attention skills by using novel eye-tracking technology and gaze-contingent training paradigms. Infants view animated games on a screen and different events take place contingent on where on the screen the infant is looking. Infants allocated to the intervention will receive nine weekly home-based attention training sessions. Control group infants will also receive nine weekly home visits, but instead of viewing the training games during these visits they will view non-gaze-contingent age-appropriate videos. At baseline and post treatment, infant attention control will be assessed using a range of eye-tracking, observational, parent-report and neurophysiological measures. The primary outcome will be a composite of eye-tracking tasks used to assess infant attention skills. Follow-up data will be collected on emerging ADHD symptoms when the infants are 2 and 3 years old.

Discussion: This is the first randomised controlled trial to assess the potential efficacy of cognitive training as a prevention measure for infants at familial risk of ADHD. If successful, INTERSTAARS could offer a promising new approach for developing early interventions for ADHD.

Trial registration: International Standard Randomised Controlled Trial registry: ISRCTN37683928. Registered on 22 June 2015

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Turk J Pediatr. 2016;58:291-96.

ATTENTION DEFICIT HYPERACTIVITY DISORDER AND OTHER DISRUPTIVE BEHAVIOR DISORDERS ARE RISK FACTORS FOR RECURRENT EPISTAXIS IN CHILDREN: A PROSPECTIVE CASE-CONTROLLED STUDY.

Özgür E, Aksu H, Gürbüz-Özgür B, et al.

The aim of this study was to investigate the frequency of attention deficit hyperactivity disorder (ADHD) and other disruptive behavior disorders in children with recurrent epistaxis (RE). Children aged between 6-11 years were enrolled according to presence (n=34) and absence (n=103) of RE. Turgay DSM-IV-Based Child and Adolescent Disruptive Behavior Disorders Screening and Rating Scale was applied to parents. Moreover, Schedule for Affective Disorders and Schizophrenia for School-Age Children Present and Lifetime

Version was performed. Oppositional defiant disorder (ODD) and ADHD were determined in 17.6% and 32.4% of patients, respectively. When psychiatric diagnoses between both groups were compared, statistically significant differences were found in terms of ADHD and ODD ($p=0.028$ and $p=0.003$). In children with RE, the frequency of ADHD and ODD are higher than children without RE. A referral to a child psychiatrist should be considered, if a child with RE also has symptoms of increased activity, inattention and/or body-injurious behaviors

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Attention-Deficit/Hyperactivity Disorder (ADHD) and Obesity: Update 2016

Samuele Cortese^{1,2} · Luca Tessari^{1,3}

Published online: 19 January 2017

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Abstract While psychiatric comorbidities of attention-deficit/hyperactivity disorder (ADHD) have been extensively explored, less attention has been paid to somatic conditions possibly associated with this disorder. However, mounting evidence in the last decade pointed to a possible significant association between ADHD and certain somatic conditions, including obesity. This paper provides an update of a previous systematic review on the relationship between obesity and ADHD (Cortese and Vincenzi, *Curr Top Behav Neurosci* 9:199–218, 2012), focusing on pertinent peer-reviewed empirical papers published since 2012. We conducted a systematic search in PubMed, Ovid, and Web of Knowledge databases (search dates: from January 1st, 2012, to July 16th, 2016). We retained a total of 41 studies, providing information on the prevalence of obesity in individuals with ADHD, focusing on the rates of ADHD in individuals with obesity, or reporting data useful to gain insight into possible mechanisms underlying the putative association between ADHD and obesity. Overall, over the past 4 years, an increasing number of studies have assessed the prevalence of obesity in individuals with ADHD or the rates of

ADHD in patients with obesity. Although findings are mixed across individual studies, meta-analytic evidence shows a significant association between ADHD and obesity, regardless of possible confounding factors such as psychiatric comorbidities. An increasing number of studies have also addressed possible mechanisms underlying the link between ADHD and obesity, highlighting the role, among others, of abnormal eating patterns, sedentary lifestyle, and possible common genetic alterations. Importantly, recent longitudinal studies support a causal role of ADHD in contributing to weight gain. The next generation of studies in the field should explore if and to which extent the treatment of comorbid ADHD in individuals with obesity may lead to long-term weight loss, ultimately improving their overall well-being and quality of life.

Keywords ADHD · Obesity · Overweight · Eating

Introduction

Attention-deficit/hyperactivity disorder (ADHD) is a major public health issue. It is one of the most frequent childhood-onset psychiatric conditions, with an estimated prevalence exceeding 5% in school-age children [1]. It has been reported that impairing symptoms of ADHD persist into adulthood in up to 65% of childhood-onset cases [2], with a prevalence of ADHD in adults estimated at ~2.5% [3]. Due to its core symptoms and associated disorders/conditions, ADHD imposes an enormous burden on society in terms of psychological dysfunction, adverse vocational outcomes, stress on families, and societal financial costs. The US annual incremental costs of ADHD have been recently estimated at \$143–\$266 billion

This article is part of the Topical Collection on *Attention-Deficit Disorder*

✉ Samuele Cortese
samuele.cortese@gmail.com

¹ Academic Unit of Psychology, Developmental Brain-Behaviour Laboratory, University of Southampton, Southampton, UK

² The Child Study Center at NYU Langone Medical Center, New York, NY, USA

³ Department of Woman and Child Health, University of Padua, Padua, Italy

[4], and costs are substantial also in other countries as well (e.g., [5]).

Whereas the comorbidity between ADHD and psychiatric disorders has been extensively explored [6], the association with somatic conditions has received much less attention. However, a mounting body of evidence on the association between neuropsychiatric disorders and medical conditions has emerged in the past years. In particular, there has been a focus on the relationship between ADHD and obesity. Gaining insight into this possible link is highly relevant from a public health perspective, given the epidemic of obesity and the substantial morbidity (including risk for cardiovascular disease, diabetes, and cancer) and increased risk of mortality associated with this condition [7].

Cortese et al. [8••] first systematically reviewed the literature on the relationship between ADHD and obesity in 2008 and updated this initial review in 2012 [9]. Given that the body of research has continuously grown since then, a further update is warranted. In this paper, we review and critically discuss papers on the relationship between ADHD and obesity/overweight published in the last 4 years (2012–2014).

Methods

Although the present paper is not intended to be a systematic review with a formal and quantitative appraisal of the quality of the studies, we performed a systematic search for original peer-reviewed papers in a set of electronic databases, including PubMed, Ovid databases (Medline, PsycINFO, Embase+Embase classic), and ISI Web of Knowledge (Web of Science [Science Citation Index Expanded], Biological Abstracts, Biosis, Food Science and Technology Abstracts). The search terms and syntax for the search in PubMed were (ADHD OR Attention-Deficit/Hyperactivity Disorder OR Attention Deficit Hyperactivity Disorder OR Hyperkinetic Syndrome) AND (obes* OR overweight). The search terms and syntax were adapted for each of the other electronic databases. References from each paper were examined to find additional studies possibly missed in the electronic search.

We searched for studies reporting information on (1) the prevalence of obesity in individuals with ADHD, (2) the prevalence of ADHD in individuals with obesity, (3) possible mechanisms underlying the putative association between ADHD and obesity, and (4) the implications of the possible association between ADHD and obesity for the clinical management of individuals with both conditions. Regarding criteria no. 1 and no. 2, we included only studies that used either a formal diagnosis of ADHD or in

which the diagnosis of ADHD was self-reported. In order to avoid possible bias in the estimation of the prevalence of ADHD in individuals with obesity or of obesity in individuals with ADHD, we did not include studies in which participants presented only with ADHD symptoms above a cutoff on any scale for ADHD. However, we did not apply this exclusionary criterion when considering studies on the possible mechanisms linking ADHD and obesity, since a dimensional approach can still be informative in this respect. We did not apply any language restriction. We searched for reports published from January 1st, 2012, to July 16th, 2016.

Results

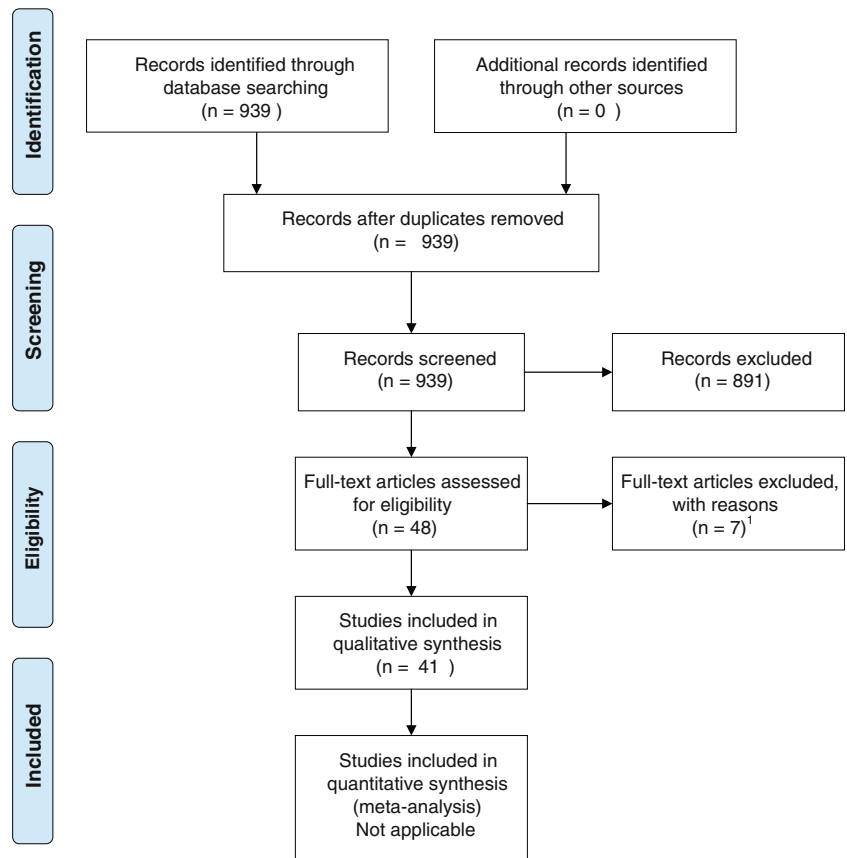
The search retrieved 3412 potentially pertinent hits. After excluding references not meeting our criteria, we retained a total of 41 [10–50] studies (Fig. 1 and Tables 1, 2, and 3). Table 4 reports the references excluded [51–57], with reasons for exclusion. Of the included references, 17 [10–26] provided information on the prevalence of obesity in individuals with ADHD, 2 [27, 28] included data on the prevalence of ADHD in individuals with obesity, and 28 [12, 19–22, 25, 29–46, 48–50, 58] reported data useful to gain insight into possible mechanisms underlying the putative association between ADHD and obesity (We note that references providing information both on the prevalence of obesity in individuals with ADHD and obesity and on possible mechanisms were counted twice). Of note, none of the retrieved studies addressed the implications of the association between ADHD and obesity for the management of patients with both conditions.

Details of the studies retained in our review are presented in Tables 1, 2, and 3, which show first study author, year of publication, country (or countries) where the study was carried out, and study key findings. The results of these studies are reported in the following sections, highlighting how studies published after 2012 advance previous knowledge summarized in Cortese and Vincenzi [9].

Prevalence of Obesity/Overweight in Individuals With ADHD

Cortese and Vincenzi [9] reviewed 12 studies [59–70]. Of these, six [61, 63–65, 69] more specifically compared the rates of obesity/overweight between individuals with ADHD and without ADHD (or from the general population). Overall, Cortese and Vincenzi [9] concluded that studies in both clinical and epidemiological samples suggested that individuals with ADHD have higher than average BMI-SDS or a higher prevalence of obesity

Fig. 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart



compared to non-ADHD subjects. However, one of the drawbacks highlighted by Cortese and Vincenzi [9] was that a sizable portion of studies had not controlled for the possible confounding effect of psychiatric comorbidities, so that it was not possible to establish to which extent the increased rates of obesity/overweight found in individuals with ADHD are accounted for by ADHD per se or by comorbid psychiatric disorders. In our updated search focused on the last 4 years, we found 17 additional studies reporting rates of obesity/overweight in individuals with ADHD. As shown in Table 1, overall findings from these studies are still mixed. While some studies showed significantly higher rates of obesity in individuals with compared to those without ADHD, even after controlling for possible confounding factors, others did not. Additionally, the impact of psychostimulant treatment was not consistent across studies, with some of them showing a significant reduction of the rates of obesity in individuals treated with psychostimulants and others not confirming such finding. However, importantly, given the increasing number of studies, recently, this body of search has been recently meta-analyzed. In fact, currently two meta-analyses have been published by two different groups. In the first meta-analysis, Cortese et al. [71••] pooled 42 studies, including a total of 48,161 ADHD subjects and 679,975 comparison subjects. Cortese et al. [71••] found that a

significant association between obesity and ADHD was found for both children (odds ratio = 1.20, 95% CI = 1.05–1.37) and adults (odds ratio = 1.55, 95% CI = 1.32–1.81). The pooled prevalence of obesity was increased by about 70% in adults with ADHD (28.2%, 95% CI = 22.8–34.4) compared with those without ADHD (16.4%, 95% CI = 13.4–19.9), and by about 40% in children with ADHD (10.3%, 95% CI = 7.9–13.3) compared with those without ADHD (7.4%, 95% CI = 5.4–10.1). Interestingly, the significant association remained when limiting the analysis to studies reporting odds ratio adjusted for possible confounding factors (such as low socioeconomic status, comorbid depression, or comorbid anxiety). Gender, study setting, study country, and study quality did not moderate the association between obesity and ADHD. Additionally, ADHD was also significantly associated with overweight. Importantly, individuals medicated for ADHD were not at higher risk of obesity, suggesting that ADHD pharmacological treatment may exert a protective action on the risk of development of obesity, although the meta-analysis could not prove this assumption. In the second meta-analysis by Nigg et al. [20••], published after the one by Cortese et al. [71••], the authors confirmed a significant association between ADHD and obesity (odds ratio = 1.22 (95% CI = 1.11–1.34), highlighting that the association was larger in adults

Table 1 Key findings from studies on the prevalence of obesity in individuals with ADHD

First author (year)	Country	Design	Participants (N)	Mean age (SD)/age range (years)	Key results
Aguirre Castaneda et al. (2016) [10]	USA	Longitudinal	Participants with at least 2 measures of height/weight on or after 2 years of age: Total = 1001 ADHD = 336 Controls = 665 Subsample with BMI data after 20 years from baseline: Total = 735 ADHD = 285 Controls 450 Total = 3050 ADHD = 412	ADHD 26.4 (5.7) Controls 23.4 (7.1)	Participants with ADHD were 1.23 times more likely (95% CI = 1.00–1.50; $p < 0.05$) to be obese during the follow-up than controls, even after adjusting for birth weight and maternal age at birth. At 20-year follow-up, 34.4% of ADHD participants and 25.1% of controls, respectively, were obese ($p = 0.01$). Treatments with stimulants did not significantly impact the results.
Byrd et al. (2013) [11]	USA	Cross-sectional	Subsample of ADHD Medicated = 185 Not medicated = 227 Non-ADHD = 2638	8–15	Males with ADHD who were medicated had lower odds of obesity compared to males without ADHD (aOR = 0.42, 95% CI = 0.23–0.78). Unmedicated males with ADHD were as likely as males without ADHD to be obese (aOR = 1.02, 95% CI = 0.43–2.42). The odds of obesity for females taking medication for ADHD did not differ statistically from those of females without ADHD (adjusted OR = 1.21, 95% CI = 0.52–2.81). Females with ADHD not taking medication had odds of obesity 1.54 times those of females without ADHD; however, the 95% CI (0.79–2.98) indicated that the finding was not significant.
Cook et al. (2015) [12]	USA	Cross-sectional	Total sample = 45,897 ADHD = 506	10–17	In both nonadjusted and adjusted models (controlling for social demographic factor), individuals with ADHD only were not significantly more likely to present with obesity compared to controls.
Cortese et al. (2013a) [13•]	USA	Cross-sectional	Total = 34,653 Lifetime ADHD = 616 Persistent ADHD = 340 Remitted ADHD = 276 Non-ADHD = 34,037	>20 years old	In the unadjusted model, obesity rates and BMI were significantly higher in adults with persistent ADHD than in those without ADHD (obesity: OR = 1.44, 95% CI = 1.06–1.95; BMI = $p = 0.015$). Obesity rates were not significantly higher in adults with lifetime ADHD vs. those without ADHD. In the model adjusted for sociodemographic factors and psychiatric comorbidities, persistent, lifetime, or remitted ADHD was not significantly associated with obesity. The number of ADHD symptoms in childhood was significantly associated with obesity in adulthood, even in the adjusted model, but in women only.
Cortese et al. (2013b) [14]	USA		111 individuals with childhood ADHD		Men with childhood ADHD had significantly higher obesity rates (41.4 vs. 21.6%; $p = 0.001$) than men

Table 1 (continued)

First author (year)	Country	Design	Participants (N)	Mean age (SD)/age range (years)	Key results
		Longitudinal but only data at follow-up at age 41 where considered	111 individuals without childhood ADHD Persistent ADHD = 24 Remitted ADHD = 87		without childhood ADHD, even in the model adjusted for socioeconomic status and comorbid lifetime mental disorders. Participants with persistent ADHD were not significantly more obese than those without childhood ADHD. By contrast, participants with remitted ADHD were significantly more likely to be obese than those without childhood ADHD. The rates of obesity did not significantly differ between participants with persistent and remitted ADHD.
Fliers et al. (2013) [15]	Netherlands	Cross-sectional	Total = 372 children with ADHD	5–17	Boys with ADHD aged 10–17 and girls aged 10–12 were more likely to be overweight than children in the general Dutch population. Younger girls and female teenagers, however, were at lower risk for being overweight.
Gungor et al. (2016) [16]	Turkey	Cross-sectional	Total = 752 ADHD = 362 Controls = 390	5–15	Frequency of overweight/obesity according to Weight For Height (WFH) criteria was significantly higher in the ADHD group compared with the control group (24.8 vs. 18.9%, $p < 0.0001$).
Hanc et al. (2015a) [17]	Poland	Cross-sectional	Total = 615 ADHD = 219 Controls = 396	6–18	ADHD was significantly related to higher rate of overweight, both when ADHD was treated as a single factor (unadjusted OR = 2.31, 95% CI = 1.40–3.81, $p = 0.001$) and after controlling for birth weight, place of residence, parents' education, and income level (unadjusted OR = 2.31, 95% CI 1.40–3.81, $p = 0.001$; aOR = 2.44, 95% CI 1.38–4.29, $p = 0.002$).
Hanc et al. (2015b) [18]	Poland	This study reports a retrospective analysis on participants from Hanc et al. [17].	Total = 420 ADHD = 112 308 controls	6–18	At age 2 (retrospective analysis), children with ADHD were overweight/obese less frequently than controls (ADHD 10.71%, control group 20.13%, $p = 0.02$). At age 6 (retrospective analysis), children with ADHD were significantly more often diagnosed with underweight than boys without ADHD (8.93 vs. 3.25%, $p = 0.02$).
Kummer et al. (2016) [19]	Brazil	Cross-sectional	ADHD = 23 Controls = 19	ADHD 8.5 (2.4) Controls 8.6 (2.9)	Children and adolescents with ADHD had significantly increased frequency of overweight and obesity ($p = 0.04$) compared to controls.
Nigg et al. (2016) [20••]	USA	Cross-sectional	Total = 43,796 ADHD = 6209 Non-ADHD = 37,587	10–17	In boys, ADHD was not significantly associated with obesity, even in unadjusted models. In girls, ADHD and obesity were significantly associated considering the age range 14–17 in the unadjusted model.

Table 1 (continued)

First author (year)	Country	Design	Participants (N)	Mean age (SD)/age range (years)	Key results
it presents data on BMI but not on rates of obesity (see Supplemental Table 1). Data here refer to the second study Özcan et al. (2015) [21]	Turkey	Cross-sectional	Total = 76 ADHD = 36 Controls = 40 Total = 360 ADHD = 257 Controls (adjustment disorder) = 103	9.3 years (1.78)	In the ADHD and control group, 2.5 and 13.9%, respectively, were overweight/obese.
Pauli-Pott et al. (2014) [22]	Germany	Cross-sectional	Total = 9619 ADHD = 845 Non-ADHD = 8774	6–12 years	Rates of obesity in the pure ADHD and control groups were 5.7 and 3.9%, respectively.
Phillips et al. (2014) [23]	USA	Cross-sectional	Total = 408 ADHD = 300 Controls = 75	12–17 years	The prevalence of obesity in individuals with ADHD and in those without developmental disorders was 17.6 and 13.1%, respectively. Compared to adolescents without developmental disorders, obesity was significantly increased in adolescents with ADHD not taking prescription medications [aPR = 1.6 (95% CI 1.2–2.1)]. The prevalence of overweight (14.71 vs. 12.83%, $p < 0.001$) and obesity (6.37 vs. 3.45%, $p < 0.001$) was significantly higher in children with ADHD compared with controls in the general population. The rate of overweight/obese children was higher in the ADHD group ($p < 0.001$) than controls.
Racicka et al. (2015) [24]	Poland	Cross-sectional	Total = 158 children with ADHD	7 to 18 years	Children with ADHD in the pubertal stage were more likely to be overweight/obese (OR = 3.162, $p = 0.027$) than children in the general population. Children with ADHD combined subtype had a greater chance of being overweight/obese (OR = 2.192, $p = 0.048$) than children in the general population. Gender was not a risk factor for obesity/overweight. Children in puberty who had ADHD had a 4-fold increase in the odds ratio of obesity/overweight than those in the prepubertal stage (95% CI = 1.337–12.191).
Turkodu et al. (2015) [25]	Turkey	Cross-sectional	Total = 375 ADHD = 300 Controls = 75	10.1 years (2.5), 7–17 years	Children with ADHD combined subtype were 2.8 times more likely to be obese/overweight than those with either of the other two ADHD subtypes (95% CI = 1.225–6.434).
Yang et al. (2013) [26]	China	Cross-sectional	Total = 158 children with ADHD	9.2 years (2.0), 6–16.6 years	Children with ADHD combined subtype were 2.8 times more likely to be obese/overweight than those with either of the other two ADHD subtypes (95% CI = 1.225–6.434).

OR odds ratio, aOR adjusted odds ratio, BMI body mass index

Table 2 Key findings from studies on the prevalence of ADHD in individuals with obesity

First author (year)	Country	Design	Participants (N)	Mean age (SD)/age range (years)	Key results
Halfon et al. (2013) [27]	USA	Cross-sectional	Total = 43,297 43,106 population with available records ADHD = 3879 (9%) Non-ADHD = 39,418 (91%)	10–17	Children with obesity not taking stimulant medication were significantly more likely to present with ADHD compared to nonoverweight children (OR = 1.93, 95% CI 1.26–2.94; aOR 1.85, 95% CI 1.18–2.92). This finding was not significant when considering obese children taking stimulant medication.
Perez-Bonaventura et al. (2015) [28]	Spain	Longitudinal	Participants available at age of 3 years = 611 ADHD nonoverweight (558, 3.3%) = 20 ADHD overweight (53, 8.3%) = 4 Total ADHD = 24 Participants available at age of 4 years = 596 ADHD nonoverweight (541, 4.4%) = 24 ADHD overweight (55, 13.6%) = 7 Total ADHD = 31	All patients tested at 3, 4, and 5 years	At age 4 years, being overweight was associated with higher percentages of ADHD. A higher BMI z-score at age 3 years was related to higher mean scores in hyperactivity problems, peer relationship problems, and total difficulties and to higher percentages for ADHD at age 4 years.

OR odds ratio, aOR adjusted odds ratio, BMI body mass index

(odd ratio = 1.37 [1.19–1.58]) than in youth (odd ratio = 1.13 [1.00–1.27]).

Prevalence of ADHD in Individuals With Obesity/Overweight

Cortese and Vincenzi [9] presented a total of five studies [72–76] exploring the prevalence of ADHD in individuals referred for specialist treatment of obesity. All these studies, with the exception of Braet et al. [74], reported significantly higher rates of ADHD in individuals with obesity compared to controls (either nonobese or general population). In our update, we located an additional two studies [27, 28] both confirming significantly higher rates of ADHD (as categorical diagnosis) in individuals with obesity compared to normal weight controls (Table 2). Of note, the meta-analysis by Cortese et al. [71••] excluded studies of individuals in bariatric clinics because these individuals represent a subsample of severely obese individuals, whereas their meta-analysis focused on the association between ADHD and any degree of obesity.

Taking together the two types of studies (focusing on rates of obesity in individuals with ADHD and on the prevalence ADHD in individuals with obesity, respectively), it is fair to state that evidence supports a bidirectional relationship between ADHD and obesity, irrespective of possible confounding factors.

Studies Suggesting Possible Mechanisms Underlying the Association Between ADHD and Obesity

When Cortese and Vincenzi [9] wrote their review in 2012, there was a paucity of studies addressing the possible mechanisms underlying the association between ADHD and obesity/overweight. Since all the studies that they reviewed on the link between the two conditions were cross-sectional, Cortese and Vincenzi [9] hypothesized three pathways: (1) obesity/overweight or factors associated with obesity/overweight (such as sleep-disordered breathing) lead to ADHD symptoms, (2) ADHD and obesity are underpinned common biological dysfunction, and (3) ADHD contributes to obesity. Overall, beyond case reports, they only found initial evidence from empirical studies pointing to a role of abnormal eating patterns (including binge eating) mediating a link between ADHD and overweight, possibly supporting hypothesis no. 3 but not excluding hypothesis no. 1 [77–79].

Over the past 4 years, there have been remarkable progresses in the understanding of the possible mechanisms linking ADHD and obesity. In fact, we located 28 studies [12, 19–22, 25, 29–46, 48–50, 58] (Table 3). Several of these studies [32, 36, 42–44, 46] provide support to the notion that abnormal eating patterns may contribute to the increased risk of obesity in individuals with ADHD, although the cross-sectional nature of the majority of the studies cannot prove causality. Another series of studies has also pointed to a

Table 3 Key findings from studies exploring possible mechanisms underlying the association between ADHD and obesity

First author (year)	Country	Design	Participants	Mean age (SD)/age range (years)	Key results
Albayrak et al. (2013) [29] ^a	Germany	Cross-sectional	ADHD = 495 Controls = 1300	6–18	rs206936 NUDT3 gene (nucleoside diphosphate linked moiety X-type motif 3) was significantly associated with ADHD risk (OR 1.39; <i>p</i> 3.4104; <i>P</i> corr 0.01)
Choudhry et al. (2013a) [30]	Canada	Cross-sectional	Total = 451 children ADHD	9.05 (1.86), 6–12	FTO SNP rs8050136 gene was marginally associated with ADHD (<i>p</i> = 0.05). Exploratory analysis based on ADHD subtype and medication status did not show any significant association between FTO SNP rs8050136 and ADHD.
Choudhry et al. (2013b) [31]	Canada	Cross-sectional	Total = 284 ADHD children	9.15 (1.86), 6–12	Obese ADHD children were significantly less likely to be previously on medication (20.3%) compared to subjects in the overweight (25.0%) and normal weight (36.1%) groups (<i>p</i> = 0.04). There were no significant differences between normal overweight and obese subjects in their neurocognitive, emotional, and motor profile.
Cook et al. (2015) [12]	USA	Cross-sectional	Total sample = 45,897 ADHD = 506	10–17	After controlling for demographic variables, participants with ADHD only were 57% less likely to meet recommended levels of physical activity than controls but not significantly more likely to exceed recommended level of sedentary behavior.
Docet et al. (2012) [32]	Spain	Case-control	Total = 51 ADHD = 45 Non-ADHD = 6 Total = 179 ADHD = 52 Non-ADHD = 127 Total = 450	42.3 (15.5), 18–76 50.9 (2.4 years), 19–79	88.2% of obese patients with symptoms of ADHD above the threshold of the ASRS-V1.1 scale vs. 70.9% of those without significant symptoms with ADHD presented with abnormal eating behaviors (including eating between-meal snacks and binge eating).
Ebenegger et al. (2012) [33]	Switzerland	Cross-sectional	Total = 80 ADHD	4–6	Scores of hyperactivity and less inattention were significantly associated with a higher level of physical activity (<i>p</i> < 0.01) and more television viewing (<i>p</i> < 0.04).
Graziano et al. (2012) [34]	USA	Cross-sectional	Total = 80 ADHD	4.5–18	Children with ADHD who performed poorly on the neuropsychological battery were more likely to be classified as overweight/obese compared with children with ADHD who performed better on the neuropsychological battery (2.31 (1.01–5.26), <i>p</i> < 0.05). Participants in the stimulant group had significantly lower BMI z-scores than children in the nonstimulant.
Khalife et al. (2014) [35•]	Finland	Longitudinal	Total (at age 8) = 8106		Significant association between probable ADHD at 8 years and obesity at 16 years (OR ¼ 2.01, 95% CI ¼ 1.37–3.00) but nonsignificance in the opposite direction, that is, from obesity at 8 years to probable ADHD at 16 years (OR 0.90, 95% CI 0.69–1.18). There were significant associations between probable ADHD at 8 years and physical inactivity at 16 years (OR 1.30, 95% CI 1.01–1.67), and reduced physically active play at 8 years and inattention at 16 years (OR 1.53, 95% CI 1.15–2.05).

Table 3 (continued)

First author (year)	Country	Design	Participants	Mean age (SD)/age range (years)	Key results
Kim et al. (2014) [36]	South Korea	Cross-sectional	Total = 12,350 children Non-ADHD = 11,418 With above threshold symptoms ADHD = 932	9.4 years (1.7), 5–13 years	The adjusted analyses revealed similar results. The association between ADHD symptoms and BMI was mediated by unhealthy food and dietary behaviors ($\beta = 0.086, p < 0.001$).
Korezak et al. (2014) [37]	Canada	Longitudinal	Total = 1992 aged 4 to 11 years With above threshold symptoms of ADHD = 105 Total = 1302 aged 12 to 16 years With above threshold symptoms of ADHD = 61	4–11	In children, the association between above threshold symptoms of childhood ADHD and adult overweight was accounted for by the effect of comorbid conduct disturbance ($p < 0.001$). In adolescents, ADHD symptoms were not associated with BMI in adulthood, for either boys and girls.
Kummer et al. (2016) [19]	Brazil	Cross-sectional	ADHD = 23 Controls = 19	ADHD 8.5 (2.4) Controls 8.6 (2.9)	BMI was significantly and negatively correlated with the severity of opposition and defiance symptoms; no correlation with inattention or hyperactivity/impulsivity symptoms was found.
Lindblad et al. (2015) [38]	Sweden	Cross-sectional	Total = 32 ADHD = 10 Controls = 22	10–15	Fasting blood glucose was similar in ADHD and controls. HbA1c values were significantly higher in ADHD than in controls ($p = 0.039$). BMI and BMI-SDS were higher in the ADHD group but were not significantly associated with HbA1c values.
Lingineni et al. (2012) [39]	USA	Cross-sectional	Total = 68,634 children ADHD = 7137 Non-ADHD = 61,378	5–17	Significant association between ADHD and watching TV for ≥ 1 h (OR 1.32, 95% CI 1.03–1.70). Inverse association between ADHD and practicing sport (OR 0.80, 95% CI 0.65–0.98)
McWilliams et al. (2013) [40]	UK	Cross-sectional	Total = 424 overweight or obese children	9–11	Children with obesity and teacher-rated abnormal hyperactivity/inattention scores reported higher levels of sedentary activity (OR 1.13, 95% CI 1.02–1.17) than those with subthreshold scores.
Müller et al. (2014) [41]	Germany	Cross-sectional	Total = 156 obese individuals	39.91 (11.42), 18–65	Patients in the “emotionally dysregulated/undercontrolled” cluster reported significantly more childhood ($p = 0.035$) and adult ($p = 0.004$) ADHD symptoms than those in the “resilient/high functioning” cluster.
Nazar et al. (2014) [42]	Brazil	Cross-sectional	Total = 132 ADHD = 40	18–59	Compared to those without ADHD, obese ADHD patients had a higher number of psychiatric comorbidities ($p < 0.001$), especially substance abuse disorders, and higher scores on psychopathology rating scales ($p < 0.05$). In regression models, ADHD symptoms predicted binge eating.
Nazar et al. (2016) [43]	Brazil	Cross-sectional	Total = 106 adult women with obesity ADHD = 30 Controls = 76	38.9 (10.7)	The relationship between ADHD and increased BMI was not statistically significant ($\chi^2 = 0.591, p > 0.05$) After controlling for depressive and anxiety symptoms, neither the number of current inattention symptoms nor the hyperactivity/impulsivity

Table 3 (continued)

First author (year)	Country	Design	Participants	Mean age (SD)/age range (years)	Key results
Nigg et al. (2016) [20••] Note: this paper presents data from 2 empirical studies plus a meta-analysis. The first study is not pertinent for the present review since it presents data on BMI but not on rates of obesity (see Supplemental Table 1). Data here refer to the second study	USA	Cross-sectional	Total = 43,796 ADHD = 6209 Non-ADHD = 37,587	10–17	($r = -0.031$; $p = 0.350$ and $r = -0.05$; $p = 0.307$, respectively) showed a significant correlation with BMI. Compared to participants without ADHD, those with ADHD had significantly higher scores of binge eating. In the unadjusted model and controlling for depression, but not in the model adjusting simultaneously for depression and conduct disorder, ADHD and obesity were significantly associated in girls aged 14–17.
Özcan et al. (2015) [21]	Turkey	Cross-sectional	Total = 76 ADHD = 36 Controls = 40	9.3 years (1.78)	Adiponectin plasma levels were significantly lower ($p = 0.03$) and leptin/adiponectin (L/A) ratio was significantly higher ($p = 0.09$) in the ADHD group compared to the non-ADHD group.
Patte et al. (2016) [44]	Canada	Cross-sectional	Total = 421	33.56 (6.66), 24–50	Structural equation model showed that ADHD symptoms, predicted by hypodopaminergic functioning in the prefrontal cortex, in combination with an enhanced appetitive drive, predicted hedonic eating and, in turn, higher BMI. ADHD symptoms were not significantly associated with disordered eating behaviors.
Pauli-Pott et al. (2013) [45]	Germany	Cross-sectional	Total = 128 overweight obese ADHD = 17 Subclinical ADHD = 71 Non-ADHD = 40	8–15 years	
Pauli-Pott et al. (2014) [22]	Germany	Cross-sectional	Total = 360 ADHD = 257 Controls (adjustment disorder) = 103	6–12	The association between ADHD and obesity, after controlling for age, gender, and ODD/CD, was no more significant.
Pracek et al. (2014) [46]	Czech Republic	Cross-sectional	Total = 200 ADHD = 100 Controls = 100	6–10	Subjects with ADHD skipped meals—breakfast ($p < 0.004$), lunch ($p < 0.007$), and dinner ($p < 0.001$)—significantly more often than controls. ADHD children eat more than 5 times a day ($p < 0.001$). Compared to controls, children with ADHD drank significantly more sweetened beverages ($p < 0.003$).
Turkotlu et al. (2015) [25]	Turkey	Cross-sectional	Total = 375 ADHD = 300 treatment-naive children Controls = 75	1 0.1 (2.5), 7–17	Breast-feeding duration in the ADHD group was significantly shorter than in the controls ($p < 0.001$). BMI percentile scores were significantly correlated with the oppositional, cognitive problems/inattentive, social problems, and psychosomatic subscores of the Conners Parents Rating Scales. Adjusting for sex and age only, ADHD symptoms score severity was significantly and positively associated with television exposure,
Van Egmond-Frohlich et al. (2012) [47]	Germany	Cross-sectional	Total = 11,676	6–17	

Table 3 (continued)

First author (year)	Country	Design	Participants	Mean age (SD)/age range (years)	Key results
Vogel et al. (2015) [48]	Netherlands	Cross-sectional	Total = 470 ADHD = 202 Obese = 114 Controls = 154	18–65	medium- to high-intensity physical activity, and total energy intake, while they were negatively associated with the HuSKY diet quality index (all $p < 0.001$). Decreased sleep duration CI = 0.003–0.028 and an unstable eating pattern (CI = 0.003–0.031) mediated the association between ADHD symptoms and BMI.
White et al. (2012) [49]	UK	Longitudinal	Total = 12,432	For these analyses, data on BMI were available in 9661 at 10 years (67% of the sample at 10 years) 5732 (66%) at 26 years 8466 (78%) at 30 years 7356 (79%) at 34 years	Inattention/hyperactivity at 10 years increased risk of obesity at 30 years (aOR 1.3, 95% CI 1.0–1.6). After adjustment, conduct problems and hyperactivity were predictive at 30 years.
Wynchank et al. (2015) [50]	Netherlands	Longitudinal	Total = 2303 Depressive/anxiety disorders with ADHD = 183 Depressive/anxiety disorders No ADHD = 1566 Controls = 554	18–65	The presence of ADHD symptoms in individuals with depressive/anxiety disorders did not significantly increase risk for metabolic syndrome.

BMI body mass index

^a Sample size refers to the German sample

Table 4 Studies excluded, with reasons for exclusion

First author (year)	Reason for exclusion
Erhart et al. (2012) [51]	No formal ADHD diagnosis
Goulardins et al. (2016) [52]	No formal ADHD diagnosis
Hanc et al. (2012) [53]	No data on overweight/obesity
Ja (2014) [54]	No formal ADHD diagnosis
Kerekes et al. (2015) [55]	No formal ADHD diagnosis
McClure et al. (2012) [56]	No formal ADHD diagnosis
Nigg et al. (2016) [20••] ^a	The first study of this paper is not pertinent to the present review since it presents data on BMI but not on rates of obesity
Pagoto et al. (2012) [57]	Review (treatment) without empirical data

^a This reference is not counted in the PRISMA flowchart in Fig. 1 since the second empirical study reported in it provides data on the prevalence of obesity in individuals with ADHD

possible role of decreased physical activity (less involvement in sport activities) or increased hours/day spent watching TV, in individuals with ADHD compared to controls, as a possible mechanism favoring abnormal weight gain associated with ADHD [12, 33, 35, 39, 40, 58]. Additionally, there have been also some studies suggesting that comorbid conduct disorder, in addition to or rather than ADHD core symptoms, might contribute to the link between obesity and ADHD [19, 22, 25, 37, 49, 50]. This initial insight should be further developed in future research. Moreover, researchers started addressing possible common neurobiological underpinnings of obesity and ADHD. Two studies [29, 30] among the ones that we retrieved focused on the genetic mechanisms: the first one [29] suggested a possible role of rs206936 NUDT3 gene (nudix; nucleoside diphosphate linked moiety X-type motif 3); the second one [30] found a marginally significant association with the FTO SNP rs8050136 gene. Finally, the hypothesis by Cortese and Vincenzi [9] that sleep disruption could be involved in the association between ADHD and obesity has been initially tested and supported [48].

Importantly, in the last 4 years, longitudinal studies have explored the direction of the link between ADHD and obesity. Three studies retrieved in our search showed that ADHD chronologically precedes, and likely contributes to, weight gain [10, 35, 49]. However, another study has shown the reverse pattern [28]. It is indeed possible that bidirectional pathways are involved.

Studies on the Clinical Implications of the Association Between ADHD and Obesity

Cortese and Vincenzi [9] cited the study by Levy et al. [80] which provided preliminary evidence showing that the screening and pharmacological treatment of

previously overlooked ADHD in adults with refractory obesity leads to beneficial effects on weight gain. Clearly, a possible important confounder of this study is the anorexigenic effect associated with psychostimulants. However, Levy et al. [80] noted that appetite reduction was evident in the first 4–6 weeks of treatment, but then it diminished and vanished in most subjects within 2 months. Therefore, the authors of the study concluded that it is unlikely that the anorexigenic effect of psychostimulants contributed to weight loss at follow-up, after more than 1 year from the start of treatment. Rather, they highlighted how the pharmacological treatment of ADHD led to “self-directedness, a reduction in novelty seeking, and an increased capacity for persistence,” which in turn enhanced adherence to diet and ultimately led to weight loss. However, given the naturalistic design of this study, its conclusions should be considered as preliminary and further replication using more rigorous designs is warranted.

Unfortunately, since then, no other studies have been published directly testing, by means of a randomized design, the effects of ADHD screening and treatment of obesity outcomes. However, evidence from recent studies, including those retrieved in our search (e.g., [31] and [34]), supports the notion that individuals with ADHD pharmacologically treated are not at increased risk of obesity.

Conclusions

Over the past 4 years, there has been an increasing interest for the relationship between ADHD and obesity. Studies that addressed the questions: “Is obesity (or overweight) more frequent in individuals with, compared to those without, ADHD?” or “Is there a significant relationship between ADHD and obesity/overweight?” provide overall mixed findings, likely due to heterogeneity in diagnostic methods for ADHD and obesity, population characteristics (e.g., comorbidities), and medication status. However, meta-analytical evidence controlling for these confounding factors support a significant association between nontreated ADHD and obesity.

Remarkably, in the past 4 years, a large number of studies have contributed to our insight on the factors underlying the links between ADHD and obesity. Such body of research has pointed to the role of abnormal (dysregulated) eating patterns, decreased physical activity, sleep disruption, and psychiatric comorbidities, including conduct disorder. Preliminary evidence has also revealed possible common genetic underpinnings. Importantly, longitudinal studies have been published that show how ADHD may be a risk for the future

development of obesity, although the reverse causal link cannot be ruled out.

Given the epidemic of obesity, if ADHD does contribute to it, understanding how and to which extent the treatment of comorbid ADHD in individuals with obesity may lead to long-term weight loss in individuals with obesity, improving adherence to diet programs is fundamental. There is a paucity of studies on this issue and we believe that this should receive further attention in future research. This line of research has ultimately the potential to improve the clinical management and, as a consequence, the quality of individuals with both ADHD and obesity.

Compliance with Ethical Standards

Conflict of Interest Samuele Cortese and Luca Tessari declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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Controlling attention to gaze and arrows in attention deficit hyperactivity disorder



Andrea Marotta^{a,b,*}, Augusto Pasini^c, Erica Menotti^d, Alessia Pasquini^b, Maria Bernarda Pitzianti^b, Maria Casagrande^b

^a Department of Experimental Psychology and Physiology of Behaviour, Mind, Brain, and Behavior Research Center, University of Granada, Granada, Spain

^b Dipartimento di Psicologia, "Sapienza" Università di Roma, Italy

^c Department of Neuroscience, Child Neurology and Psychiatry Unit, 'Tor Vergata' University of Rome, Rome, Italy

^d AIDAI ONLUS Regione Lazio, Italy

ARTICLE INFO

Keywords:

Social attention
Cognitive control
Eye-gaze
Arrow
ADHD

ABSTRACT

The aim of this research was to assess implicit processing of social and non-social distracting cues in children with ADHD. Young people with ADHD and matched controls were asked to classify target words (LEFT/RIGHT) which were accompanied by a distracter eye-gaze or arrow. Typically developing participants showed evidence of interference effects from both eye-gaze and arrow distracters. In contrast, the ADHD group showed evidence of interference effects from arrow but failed to show interference from eye-gaze. This absence of interference effects from eye-gaze observed in the participants with ADHD may reflect an attentional impairment in attending to socially relevant information.

1. Introduction

The ability to follow another person's direction of gaze appears very early in life and marks an important breakthrough in the development of social communication, given that gaze provides important information regarding individual's interests and mental states (Emery, 2000; Moore and Dunham, 1995). By 2 years of age, children are using gaze following for words learning (Poulin-Dubois and Forbes, 2002). Four and 5-year old children are able to make inferences about another person's mental state, using eye gaze frequency and duration (Baron-Cohen et al., 1995). Receptivity to the social meaning of gaze-direction continues to develop across childhood into adulthood (Baron-Cohen et al., 2001; Dawel et al., 2015; Neath et al., 2013) and it is a strong predictor of adult social competence (Klin et al., 2002). This skill-development outline does not necessarily apply to children with developmental disorders, such as the Attention Deficit Hyperactivity Disorder (ADHD). ADHD is a neuropsychiatric condition characterized by developmentally inappropriate levels of inattention, impulsivity and hyperactivity (Biederman and Faraone, 2005) that negatively impacts multiple areas of children's lives, including their ability to develop healthy interpersonal relationships. Children with ADHD are less accepted by their peers and are perceived negatively by other children (Carlson et al., 1987; Erhardt and Hinshaw, 1994; Hoza et al., 2005; King and Young, 1982; Klein and Young, 1979). These problems are

known to be strong predictors of serious negative outcomes in later adolescence and adulthood (Greene et al., 1997; Mrug et al., 2012). A factor that may in part contribute to these deficits is the failure to perceive, attend and interpret the meaning of social cues and drawing inferences about other people's thoughts, intentions, and feelings (Petersen and Grahe, 2012; Uekermann et al., 2010). Consistent with this view, deficits in social cognition are an evident clinical phenomenon in ADHD and several studies have reported various impairments in domains such as facial affect recognition (Ibáñez et al., 2011a; Sinzig et al., 2008), theory of mind (Sodian et al., 2003) and empathy (Braaten and Rosen, 2000; Dyck et al., 2001). These findings suggest that children with ADHD are impaired in making explicit social judgments about other people's emotions. Much less is known about implicit processing of social cues such as eye-gaze direction.

Studies with typically developing individuals suggest that observing averted gaze can elicit a reflexive shift of attention to the gazed-at location and/or object (Friesen and Kingstone, 1998; Hietanen, 1999; Marotta et al., 2013a). The mechanisms underlying the reflexive orienting towards the direction of other's eye gaze have been generally assessed using a variant of the traditional cueing paradigm (Posner, 1980). In this paradigm, a drawing/photograph of a face looking to the left or right is presented in the center of the screen. The participant is required to respond to a target that might appear either at the looked-at (valid) or at the

* Corresponding author at: Department of Experimental Psychology and Physiology of Behaviour, Mind, Brain, and Behavior Research Center, University of Granada, Granada, Spain.
E-mail address: andrea.marotta@uniroma1.it (A. Marotta).

<http://dx.doi.org/10.1016/j.psychres.2017.01.094>

Received 25 January 2016; Received in revised form 23 January 2017; Accepted 24 January 2017

Available online 09 February 2017

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opposite location (invalid). Quicker reaction times for validly cued targets are thought to indicate an allocation of attention to the looked-at location (i.e. gaze cueing effect). Over the last two decades, reflecting the idea that gaze cueing paradigm tapped into social cognition, several researchers have successfully adapted and applied this paradigm to study social attention in both healthy (Cole et al., 2015; Marotta et al., 2012b; Schulz et al., 2014; Zhao et al., 2014) and clinical populations (Akiyama et al., 2008; Dalmaso et al., 2013; Marotta et al., 2013b). Importantly, in a recent study Marotta and colleagues used the cueing paradigm described above and found that children with ADHD children showed evidence of reflexive orienting only to locations previously cued by non-social stimuli (arrow and peripheral cues) but failed to show such orienting effect in response to social eye gaze cues (Marotta et al., 2014). These findings suggested that automatic processing of gaze direction may be impaired in ADHD.

In line with our previous data demonstrating social attention impairments in ADHD, in the present research, we have examined whether ADHD individuals also exhibit impairments in the cognitive control of social information. Several studies have reported that children with ADHD have social cue processing deficits (Matthys et al., 1999; Milich and Dodge, 1984), have biased interpretations of social information (Murphy et al., 1992), and generate more inappropriate and fewer social responses than children without ADHD (King et al., 2009; Matthys et al., 1999). Collectively, these findings are indicative of deficits in the cognitive control of social information in ADHD. However, to our knowledge, no previous study has investigated the ability to inhibit irrelevant eye-gaze information in ADHD. The aim of the present study is to address this issue directly. A widely used method for investigating inhibition of interference is the Stroop task. It is important to underline that gaze orientating task and the Stroop task map onto different attentional systems. The orienting of attention refers to the processing or selection of one out of several sources of information separated from one another in space. This process does not entail the logical relation of conflict or agreement, but only that of alignment or disengagement of attention from the target. On the other hand, the Stroop task applies to stimuli whose constituent features are in conflict or agreement with that of another. Because the presence of congruent and incongruent information combinations, the Stroop task is it is widely considered a prime process of executive attention (Botvinick et al., 2001). Therefore, “orienting and executive control are widely thought to be relatively independent aspects of attention that are linked to separable brain regions” (Fan et al., 2005, p. 471). In the present study, to investigate executive cognitive control of social information in ADHD individuals we employed an interference Stroop-like task in which manual responses to a target word (LEFT/RIGHT) are required in the context of to-be-ignored arrow (pointing left or right) or eye-gaze (left or right averted) distracters. To the extent that the unattended distracter is processed, target response times (RTs) are generally slowed by incongruent—relative to congruent—distracters with both eye-gaze and arrow cues in typically developing children (Barnes et al., 2007; Marotta and Casagrande, 2016). To our knowledge, no previous experiment has used this paradigm with children with ADHD. The predictions were straightforward: whether people with ADHD attend to fewer or less-relevant social cues, and spend less time generating possible responses to social information than we expect that eye-gaze distracter should not capture attention and influence their classification performance. Interference effects from eye-gaze should be observed only within typically developing participants. In contrast, no difference between ADHD group and matched comparison group should be observed for arrow distracters since normal levels of attentional orienting have been generally reported with non-social cues in individuals with ADHD (for a review, see Huang-Pollock and Nigg, 2003).

2. Method

2.1. Participants

A total of 38 children and adolescents (aged 7–17 years) participated in the study: 19 were diagnosed with ADHD¹ (mean age 12.3 ± 3.1 years; 14 males/5 female) and 19 were typically developing individuals (mean age 12.2 ± 2.9 years; 14 males/5 female). The ADHD group included 11 participants who met the criteria for the ADHD/C subtype (exhibit both inattentiveness and hyperactivity/impulsiveness symptoms) and 8 who met the criteria for ADHD/I (show prevalently inattentive symptoms; Diagnostic and Statistical Manual of Mental Disorders, DSM-IV, American Psychiatric Association, 2000). All participants with ADHD were drug-naive patients first admitted to the Day Hospital of the Child Psychiatry Unit of the University of Rome “Tor Vergata.” A psychopathological evaluation was performed by a team of child psychiatrists by means of the Kiddie Schedule of Affective Disorders (K-SADS; Kaufman et al., 1996), the Conners’ Parent Rating Scale, the Conners’ Teacher Rating Scale (Conners, 1989), the Children Depression Inventory (Kovacs, 1985), and the Multidimensional Anxiety Scale for Children (March, 1997). The inclusion criteria to participate in the study were the diagnosis of ADHD (based on the DSM-IV criteria and confirmed by K-SADS), no history of mental retardation, brain trauma, neurological diseases or physical impairment, a lack of comorbid mental disorders with the exception of oppositional defiant disorder (ODD). The participants for the control group were matched in gender and age with the ADHD group and were recruited from two public schools in Rome. The control group participants had no history of cerebral injury or other neurological or psychiatric disorders. All participants aged 11 years and older had a full-scale IQ greater than 80 on the Progressive Standard Matrices, and all children aged 10.5 years or younger had an IQ that fell above the 75 th percentile on the Progressive Colored Matrices (Raven et al., 1990, 1993). The presence of ADHD in participants from the control group was assessed via an independent evaluation carried out by the teacher and by one parent who completed a DSM-IV-TR report card. Any participant with a possible indication of ADHD was not considered. The mean age and IQ scores of participants from the two groups did not differ significantly ($F < 1$). Participant demographic characteristics are showed in Table 1. The Ethical Committee of Child Psychiatry and Neurology Institute approved the study. The experiment was conducted according to the ethical standards of the 1964 Declaration of Helsinki. All parents or legal guardians of children gave written informed consent before testing.

2.2. Apparatus

Stimuli were presented on a 15-in. colour monitor. A computer running E-Prime software controlled the presentation of the stimuli, timing operations, and data collection. Responses were gathered with a standard keyboard.

2.3. Stimuli

In the gaze condition, the distracter was represented by the eye region of a face with the pupils directed to the left or to the right ($2^\circ \times 12^\circ$ degree of visual angle). In the arrow condition, the distracter was an arrow directed either to the left or to the right ($2^\circ \times 7^\circ$ degree of visual angle). Target stimuli were the words “Sinistra” or “Destra”, Italian words for “LEFT” or “RIGHT” presented immediately above the distracter stimuli (the distance between the center of the target and the

¹ Although the present study follows the authors’ recently published work on the same topic (Marotta et al., 2014), it is important to note that a different group of ADHD individuals participated in this experiment.

Table 1
Participant Demographic and Descriptive Characteristics.

Variables	ADHD Group		N	Control Group		N	ANOVA results	
	Mean	SD		Mean	SD		F	p
Sex (male/female)			14/5			14/5		
Age (years)	12.3	3.1		12.2	2.9		< 1	n.s.
Education (years)	7.26	3		7.16	2.8		< 1	n.s.
PCM and PSM corrected responses	35.9	7.9		35.7	4.4		< 1	n.s.
Subtype (Combined/Inattentive)			11/8					
Parents Inattention Conners' scores	64.2	8.6						
Parents Hyperactivity Conners' scores	63.3	10.1						
Parents ADHD index	64.4	9.3						
Teachers Hyperactivity Conners' scores	70.5	10.4						
Teachers ADHD index	74.1	12.6						
ADHD/I: inattention symptoms	6.3	1.8						
ADHD/I: hyperactivity symptoms	3.6	.6						
ADHD/I: impulsivity symptoms	1.3	.8						
ADHD/C: inattention symptoms	2.7	4.1						
ADHD/C: hyperactivity symptoms	4.5	1.1						
ADHD/C: impulsivity symptoms	2.7	0						
Oppositional defiant disorder			3			0		
Conduct disorder			0			0		
Learning disabilities			3			0		
Depression/anxiety disorders			0			0		

Note: PCM=Progressive Colored Matrices; PSM=Progressive Standard Matrices; ADHD/I=children showing prevalently inattentive symptoms; ADHD/C=children showing inattentiveness and hyperactivity/impulsiveness symptoms; n.s.=not significant.

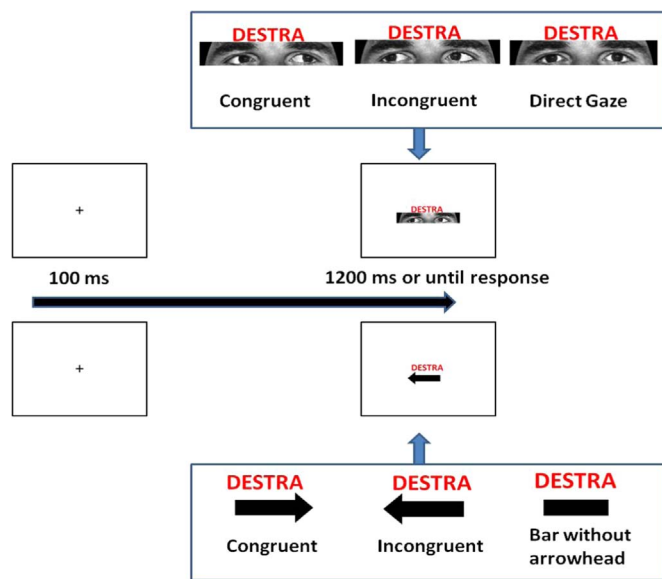


Fig. 1. Illustration of the trial sequence. The panel above depicts the displays observed in the gaze cue condition, and the panel below depicts those in the arrow cue condition. “Destra” is the Italian word for “RIGHT”.

center of the distracter stimuli was 2.3°). Sample stimuli are shown in Fig. 1. Distracters pointed in a direction congruent (e.g. word ‘LEFT’ in the context of leftward arrow or gaze) or incongruent (e.g. word ‘LEFT’ in the context of rightward arrow or gaze) to the word’s meaning; Distracters without directional information were also included (e.g. a bar without arrowheads and direct gaze).

2.4. Procedure

Participants were seated at the distance of about 56 cm in front of a computer monitor, in a dimly lit, sound-attenuated room, and their heads were held steady with a chin/head rest.

Each trial began with a display consisting of a cross presented in the center of the screen for 100 ms replaced by the stimulus display. The target display remained until response, or until 1200 ms had elapsed.

Participants were instructed to attend to the words “Sinistra” or “Destra” (Italian words for “LEFT” and “RIGHT”) and to ignore arrows or faces that would appear with the words. Participants were told to respond to the word as quickly and accurately pressing either the “C” key (with the left hand) or the “M” key (with the right hand) on the computer keyboard for the word “LEFT” and “RIGHT”, respectively. Participants completed a practice block of 10 trials, followed by two experimental blocks of 42 trials (one for each stimulus type). Trials were presented in a pseudorandom order with no more than three successive trials of the same type and response.

2.5. Design

The experiment used a mixed factor design with the following factors: Group, Cue Type and Trial Type. Group had two levels: ADHD and typically developing people.² Cue Type had two levels: gaze and arrow. Trial Type had two levels: congruent trials (the direction indicated by the arrows or eye gaze was the same as the target word) and incongruent trials (the direction indicated by the cues was the opposite as the target). Planned comparisons were used for the analysis of interactions. To examine whether direct gaze affects the performance of individuals with ADHD, a Group by Cue Type ANOVA was also conducted on the reaction times and accuracy of the trials without interference.³ Trials with reaction times (RTs) faster than 200 ms

² The effect of ADHD subtype (Combined vs. Inattentive) on performance was examined first. The main effect was not significant ($F < 1$), and no interactions were observed with the ADHD subtype (Cue Type by Subtype: $F_{1,17}=1.38, p=.257$; Trial Type by Subtype: $F < 1$; Cue Type by Subtype by Trial Type: $F_{1,17}=2.92, p=.105$). Given the limited number of participants, interference effects were also compared between ADHD subtypes using a non-parametric Mann–Whitney U Test. Results showed that there was no significant difference between ADHD subtypes for interference effect from arrow ($U = 22; p=.314$) or interference effect from gaze ($U = 29; p=.791$). Since the preliminary analyses showed no differences between the ADHD subtypes, we entered the factor Group into the statistical analyses with just two levels (ADHD and typically developing people).

³ Consistent with the majority of the studies investigating interference effect from gaze by means of Stroop tasks (Barnes et al., 2007; Marotta et al., 2016; Schwartz et al., 2010) in the present study direct gaze trials were not considered an appropriate comparison condition and were not included in the analysis because they are not neutral in terms of attentional demands. Indeed, perception of direct gaze involves different cognitive and neural processes than those in the perception of averted gaze (for reviews, see George and

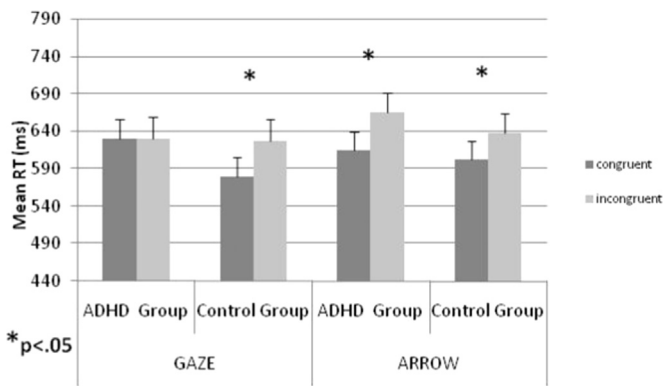


Fig. 2. Mean reaction time as a function of Trial Type (congruent or incongruent) for each combination of Cue Type (gaze and arrow) and group (ADHD group or control group).

(0.4% of the trials) as well as incorrect responses (misses and mistakes: 4.2% and 12.3% of the trials, respectively) were excluded from the RTs analysis. Mean RTs and mistakes percentages are displayed in Table 1.

3. Results

3.1. Reaction Times

ANOVA revealed a significant main effect of Trial Type ($F_{1,36}=23.31$; $p < .001$; $\eta_p^2 = .39$), with longer RTs for incongruent trials than congruent trials (606 ms vs. 640 ms). Neither the main effects of Group ($F < 1$; $p = .52$) and Cue Type ($F_{1,36}=2.51$; $p = .122$) nor the interactions Group by Trial Type ($F_{1,36}=1.51$; $p = .227$), Group by Cue Type ($F < 1$) and Trial Type by Cue Type ($F_{1,36}=1.91$; $p = .176$) were significant. Importantly, the critical Group by Cue Type by Trial Type interaction was significant ($F_{1,36}=4.70$; $p = .037$; $\eta_p^2 = .12$, see Fig. 2). To further examine the three-way interaction, Group by Trial Type ANOVAs were conducted for each Cue Type separately.

The ANOVA for the gaze condition revealed a significant effect of Trial Type ($F_{1,36}=9.26$; $p = .004$; $\eta_p^2 = .20$) with longer RTs for incongruent trials than congruent trials (628 ms vs. 605 ms). The main effect of Group was not significant ($F < 1$; $p = .49$). Importantly, the critical Group by Trial Type interaction was significant ($F_{1,36}=10.53$; $p = .003$; $\eta_p^2 = .22$). Planned comparisons showed that RTs were significantly faster on congruent trials than on incongruent trials (580 ms vs. 627 ms) only in the control group ($F_{1,36}=19.31$; $p < .001$; $\eta_p^2 = .35$). In contrast, no differences were found between congruent and incongruent trials (630 ms vs. 629) in the ADHD group ($F < 1$; $p = .93$).

The analysis for the arrow cue condition showed a significant effect of Trial Type ($F_{1,36}=13.18$; $p < .001$; $\eta_p^2 = .27$) with longer RTs for incongruent trials than congruent trials (651 ms vs. 608 ms). The main effect of Group was not significant ($F < 1$; $p = .57$). Of interest, the

(footnote continued)

Conty, 2008; Senju and Johnson, 2009). However, since deficits in the perception of direct gaze have been observed across a range of psychiatric conditions characterized by social and interpersonal dysfunctions, including autism spectrum disorder (e.g., Senju et al., 2008), and schizophrenia (e.g., Schwartz et al., 2010), in the present study direct gaze trials were examined separately to investigate whether direct gaze also affects the performance of individuals with ADHD. Moreover, although the results regarding the difference between interference trials (congruent and incongruent) and trials without interference are not germane to the questions addressed in this article, they may be of interest to some readers. For that reason, the results of a full ANOVA Group (ADHD vs. typically developing people) \times Cue Type (gaze vs arrow) \times Trial Type (trials without interference, congruent trials, incongruent trials) are presented here. Results only showed a significant effect of Trial Type ($F_{2,72}=14.41$; $p < .001$), with longer RTs for incongruent trials than congruent trials ($F_{1,36}=23.31$; $p < .001$) or trials without interference ($F_{1,36}=18$; $p < .001$). RTs for congruent trials were not significantly different from RTs for congruent trials ($p = .606$). All other main effects and interactions failed to reach significance (all $p > .148$).

interaction Group by Trial Type was not significant ($F < 1$; $p = .54$): planned comparisons showed that RTs were significantly faster on congruent trials than on incongruent trials both in ADHD (614 ms vs. 665 ms; $F_{1,36}=9.56$; $p = .005$; $\eta_p^2 = .20$) and in control group (602 ms vs. 638 ms; $F_{1,36}=4.56$; $p = .039$; $\eta_p^2 = .11$).

3.2. Errors

The Group by Trial Type by Cue Type ANOVA on error percentages revealed a significant main effect of Trial Type ($F_{1,36}=11.44$; $p < .002$; $\eta_p^2 = .24$), indicating that participants committed significantly more incorrect responses on incongruent trials than on congruent trials (11.9% vs. 7.4%). No other main effect or interactions were found (Group: $F_{1,36}=2.54$; $p = .12$; Cue Type: $F < 1$; $p = .71$; Group by Cue Type: $F_{1,36}=1.33$; $p = .26$; Group by Trial Type: $F_{1,36}=3.02$; $p = .091$; Cue Type by Trial Type: $F_{1,36}=2.55$; $p = .12$; Group by Trial Type by Cue Type: $F < 1$; $p = .79$).

3.2.1. Trials without interference

The ANOVA on reaction times did not reveal any significant main effects or interaction (all $F < 1$). In the same way, the ANOVA on incorrect responses did not reveal any significant main effects or interaction: Group ($F_{1,36}=1.03$; $p = .316$), Cue Type ($F < 1$) and Group by Cue Type ($F < 1$). (Table 2).

4. Discussion

In this study, we examined whether gaze direction and arrow cues capture the attention of people with and without ADHD when their attention is directed to another task. Participants performed a word directional classification task in the context of arrows and eye gaze cues, either congruent or incongruent with the target word. Eye-gaze and arrow cues represented social and non-social distracter signals, respectively. When arrow stimuli were used as distracters, interference effects were observed in all participants. In contrast, when eye gaze was used, important differences were observed between participants with ADHD and the control group: a significant interference effect (RTs advantage for congruent than for incongruent trials) was only observed in typically developing individuals, while in participants with ADHD gaze stimuli failed to show such interference effect, suggesting that young people with ADHD were more effective at ignoring another person's distracting gaze than controls. Although such results may be construed as instances in which the ADHD group has an advantage, this seems unlikely for the following reason. Eye-gaze following behavior has been posited as vital in the development of important social communicative skills, such as language acquisition, cultural learning and theory-of-mind development in children (Baron-Cohen et al., 1995; Bruner, 1983; Tomasello, 1995) and impairments in the receptivity to the social gaze-direction in childhood represent a strong predictor of abnormal social competence in adults (Klin et al., 2002; Toth et al., 2006). In the ADHD group, our data suggest that the receptivity to the eye-gaze direction is considerably flatter than in the control group, maybe as a consequence of an attentional difficulty in modulating responses to socially relevant information. This is consistent with the “response modulation” hypothesis (Newman and Wallace, 1993) according to which some individuals have an intrinsic deficit in their ability to switch attention while they are actively engaged in performing a task. Thus, in the present study, the lack of interference effects from eye-gaze observed in ADHD people might be due to their inability to shift from the execution of a dominant response to relevant social cues. These results are of considerable clinical interest, suggesting that many of their socially inappropriate interactions might be in part due to a single-minded pursuit behavior insensible to social relevant information that should constrain or interrupt their inadequate behavior. Our results are also consistent with recent findings demonstrating that ADHD showed evidence of reflexive orienting only

Table 2
Mean Correct Response Times (RTs, in Milliseconds), Standard Deviations (SD) and Percentages of Incorrect Responses Errors (%IR) for Each Experimental Condition and Group.

GROUP	GAZE									ARROW								
	CONGRUENT			INCONGRUENT			DIRECT			CONGRUENT			INCONGRUENT			BAR		
	RT	SD	%IR	RT	SD	%IR	RT	SD	%IR	RT	SD	%IR	RT	SD	%IR	RT	SD	%IR
ADHD	630.06	123.07	15.7	629.09	137.07	18.4	622.66	151.55	12.5	614.08	120.70	11.9	664.61	104.28	2.4	612.89	118.09	14.9
CONTROL	579.72	102.83	7.1	627.09	115.33	7.4	598.83	110.60	9.5	601.69	97.74	8.2	637.65	120.07	14	604.70	104.55	8.3

to locations previously cued by non-social stimuli (arrow and peripheral cues) but failed to show such orienting effect in response to social eye gaze cues (Marotta et al., 2014). Taken together, these findings suggest a specific social impairment in the ability to attend another person's eye-gaze direction, which is in keeping with evidence of ADHD difficulties in the ability to decode more complex social cues such as the emotions and mental states of others (Pelc et al., 2006; Sinzig et al., 2008; Sodian et al., 2003). It might be argued that the poor sensitivity to the eye-gaze of others shown by people with ADHD is linked to their dysfunctional activity in right cerebral hemisphere (Acosta and Leon-Sarmiento, 2003; Lee et al., 2005; Overmeyer et al., 2001; Sandson et al., 2000) the brain area mainly involved in orienting to gaze cues (Greene and Zaidel, 2011; Kingstone et al., 2000; Marotta et al., 2012a). Various other brain areas have been implicated in attention deficit hyperactivity disorder, including temporal areas implicated in face perception (i.e. fusiform gyrus and superior temporal sulcus, Ibáñez et al., 2011a), frontoparietal attention regions (Silk et al., 2009) and areas implicated in emotion and social cognition (i.e. medial prefrontal cortex; Kain and Perner, 2003) and these regions have also been tentatively linked to processing of eye gaze cues driving social attention (Itier and Batty, 2009; Grosbras et al., 2005; Laube et al., 2011; Nummenmaa and Calder, 2009).

The finding that ADHD have specific tendency to ignore eye-gaze direction suggests that they may have fundamental problems establishing eye-contact and joint attention with others. Given the importance of joint attention in facilitating social interactions and communication (Langton et al., 2000; Mundy et al., 1990; Stone and Yoder, 2001), these difficulties may have negative implications for social functioning in ADHD. In particular, previous research has reported that when interacting with their peers, children with ADHD engage in more socially inappropriate behaviours including problems with maintaining conversations (e.g. not listening to others, frequently shifting the conversation, not following the details of the conversation, interrupting others) (Nijmeijer et al., 2008). Eye-gaze plays an important role in signalling turn-taking in conversational settings and thus problems in responding to eye-gaze in individuals with ADHD could contribute to their socially inappropriate interactions with others. Further studies are required to directly investigate the link between ADHD impairment in attending to eye-gaze cues and social functioning.

Finally, our results are different to those reported by a study with patients with schizophrenia (Schwartz et al., 2010), who are generally referred to as impaired in social attention behavior (Sasson et al., 2007). In particular, Schwartz and colleagues (2010) found that interference effects from averted gaze did not differ between patients and controls. These findings suggest that the absence of interference effect from averted gaze observed in people with ADHD may be representative of this specific disorder and it cannot be generalized to all populations with impaired social attention behavior. Future studies will be important in clarifying and strengthening this conclusion.

4.1. Limitations

Interpretation of our findings should be tempered by some limitations of our study. First of all, a limitation of the present study concerns the grouping of participants diagnosed with ADHD/C subtype and

those diagnosed with ADHD/I. Although our preliminary analyses support the notion of an undifferentiated cognitive profile, it is plausible that the different ADHD subtypes may exhibit differential social attentional profiles. Indeed, some studies have found differences in important classification dimensions (e.g. demographics, family history, and symptom presentation), suggesting that children with ADHD/I may have a distinct disorder and not a subtype of ADHD (Adams et al., 2008; Barkley, 2001; Milich et al., 2001). Future studies should address this limitation by means of a larger sample including groups of different ADHD subtypes. Another limitation of this study was the lack of information on reading fluency levels of the subjects. Moreover, in the present study, only the eye region of a face was presented to reduce the amount and complexity of details that could potentially draw and hold more attention in the eye-gaze condition as compared to the arrow condition. Nevertheless, this does raise the question as to whether our results can be generalized to full faces. Therefore, further research will be necessary to shed light upon this issue. Finally, comparisons of social attention performance should include other disorders that occur co-morbidly with ADHD, such as bipolar disorder and schizophrenia (Barr, 2001; Ibáñez et al., 2011b; Lus and Mukaddes, 2009).

5. Conclusions

The present findings lead to some new insights about social attention in ADHD. Despite being irrelevant to the task, ADHD attended to arrow to the same extent as typically developing individuals as evidenced by equal behavioral response interference. However, unlike typically developing individuals, ADHD did not show interference effects from eye-gaze cues and therefore they showed no evidence of attending to eye-gaze direction. This dissociation highlights that people with ADHD demonstrate to have a specific impairment in social attention that could account at least partially for the higher levels of interpersonal problems generally observed in ADHD. Accordingly, understanding the nature of basic social attention deficits, and further uncovering its specific association with the social behavioral problems of ADHD, represents an essential next step toward knowing and treating individuals with ADHD.

Acknowledgments

The authors would like to thank all the participants who took part in this study. This research was supported, in part, by the grant "Ricerca di Ateneo Federato AST 2007 –prot. C26N15R8JC -'Sapienza'-Università di Roma; Dr. Marotta acknowledges Ministry of Education and Science (Spain) for a "Juan de la Cierva" research contract.

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Vineland-II adaptive behavior profile of children with attention-deficit/hyperactivity disorder or specific learning disorders



Giulia Balboni^{a,*}, Oriana Incognito^b, Carmen Belacchi^c, Sabrina Bonichini^d, Roberto Cubelli^e

^a University of Perugia, Piazza G. Ermini, 1, 06123 Perugia, Italy

^b University of Pisa, Via Roma, 67, 56126 Pisa, Italy

^c University of Urbino Carlo Bo, Via Saffi, 15, 60129 Urbino, Italy

^d University of Padua, Via Venezia, 8, 35131 Padova, Italy

^e University of Trento, Corso Bettini, 31, 38068 Rovereto, Italy

ARTICLE INFO

Article history:

Received 18 April 2016

Received in revised form 9 December 2016

Accepted 11 December 2016

Number of reviews completed is 3

Keywords:

Adaptive behavior profile

ADHD

SLD

Vineland

Matching

ABSTRACT

Background: The evaluation of adaptive behavior is informative in children with attention-deficit/hyperactivity disorder (ADHD) or specific learning disorders (SLD). However, the few investigations available have focused only on the gross level of domains of adaptive behavior.

Aims: To investigate which item subsets of the Vineland-II can discriminate children with ADHD or SLD from peers with typical development.

Methods and procedures: Student's *t*-tests, ROC analysis, logistic regression, and linear discriminant function analysis were used to compare 24 children with ADHD, 61 elementary students with SLD, and controls matched on age, sex, school level attended, and both parents' education level.

Results: Several item subsets that address not only ADHD core symptoms, but also understanding in social context and development of interpersonal relationships, allowed discrimination of children with ADHD from controls. The combination of four item subsets (Listening and attending, Expressing complex ideas, Social communication, and Following instructions) classified children with ADHD with both sensitivity and specificity of 87.5%. Only Reading skills, Writing skills, and Time and dates discriminated children with SLD from controls.

Conclusions: Evaluation of Vineland-II scores at the level of item content categories is a useful procedure for an efficient clinical description.

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What this paper adds

The unique contribution of this study can be summarized as follows. (1) For the first time, the adaptive behavior profile of children with ADHD or SLD has been investigated using the updated Vineland-II. (2) Rigorous strategies have been used to

* Corresponding author at: Department of Philosophy, Social and Human Sciences and Education, University of Perugia, Piazza G. Ermini, 1, 06123 Perugia, Italy.

E-mail addresses: giulia.balboni@unipg.it (G. Balboni), oriana.incognito@gmail.com (O. Incognito), carmen.belacchi@uniurb.it (C. Belacchi), s.bonichini@unipd.it (S. Bonichini), roberto.cubelli@unitn.it (R. Cubelli).

establish equivalence (i.e., matching) of children with and without ADHD or SLD and to rule out the effects of other variables that could influence adaptive behavior. (3) The analyses went beyond the Vineland-II total domain and subdomain scores and considered specific item subsets to help in diagnosis and intervention.

1. Introduction

Adaptive behavior has been defined as the collection of learned “conceptual, social, and practical skills” (Luckasson et al., 2002) performed by people in their everyday lives (Schalock et al., 2010; Tassé et al., 2012). The Vineland Adaptive Behavior Scale (VABS; Sparrow, Balla, & Cicchetti, 1984) has been proposed as one of the most valid and reliable tools for the evaluation of adaptive behavior skills (Balboni, Pedrabissi, Molteni, & Villa, 2001; Schalock et al., 2010). These properties have been confirmed for the revised second (Vineland-II; Sparrow, Cicchetti, & Balla, 2005) and third (Vineland-3; Sparrow, Cicchetti, & Saulnier, 2016) editions. The four scales of Communication, Daily Living Skills, Socialization, and Motor Skills allow for the measurement of all adaptive behavior skills, as well as motor skills, by means of a semi-structured interview with the individual’s caregiver.

Traditionally, the assessment of adaptive behavior has been associated with a diagnosis of intellectual disability disorder (Heber, 1961; Schalock et al., 2010). However, the assessment has also proved useful for planning personalized treatments for individuals with other disorders, for instance, autism spectrum disorder (e.g., Balboni, Tasso, Muratori, & Cubelli, 2016; Kanne et al., 2011).

The evaluation of adaptive behavior also appears to be informative in children with attention-deficit/hyperactivity disorder (ADHD) or specific learning disorder (SLD), both neurodevelopmental disorders (Leigh, 1987; Roizen, Blondis, Irwin, & Stein, 1994). ADHD is characterized by a persistent pattern of inattention, disorganization, and/or hyperactivity-impulsivity, which interferes with functioning or development (American Psychiatric Association, 2013). Social dysfunctions and difficulties in social communication are generally associated with ADHD (Nijmeijer et al., 2008), starting in early childhood and in most cases persisting into adolescence and adulthood (Barkley, Fischer, Smallish, & Fletcher, 2002). Recently, deficits in social cognition and pragmatic language have been suggested as causes of these social dysfunctions (Caillies, Bertot, Motte, Raynaud, & Abely, 2014; Staikova, Gomes, Tartter, McCabe, & Halperin, 2013; Uekermann et al., 2010). SLD concerns difficulties in learning and using academic skills (e.g., reading, writing, and mathematics), and affects academic and occupational performance and/or daily life activities (American Psychiatric Association, 2013).

Although deficits in adaptive behavior are considered peripheral in ADHD and SLD, they can provide additional information about the underlying disorder and may be useful in diagnostic and therapeutic stages. However, very few studies have investigated the adaptive behavior profile of children with ADHD or SLD, and findings are far from conclusive (e.g., Clark, Prior, & Kinsella, 2002; Ditterline, Banner, Oakland, & Becton, 2008).

Typically, investigations of adaptive behavior in ADHD have involved comparisons of children with ADHD and peers with other disorders occurring in isolation or associated with ADHD. The main aim was to identify the adaptive behavior domains that distinguish ADHD from the other pathologies, e.g., autism spectrum disorder (Ashwood et al., 2015; Magnúsdóttir, Saemundsen, Einarsson, Magnússon, & Njardvik, 2016; Stein, Szumowski, Blondis, & Roizen, 1995), oppositional defiant/conduct disorder (Clark et al., 2002), obsessive compulsive disorder (Sukhodolsky et al., 2005), or prenatal alcohol exposure (Crocker, Vaurio, Riley, & Mattson, 2009).

In just few studies, children and adolescents with ADHD or SLD have been compared with peers with typical development. Participants with ADHD showed delays in all three domains of conceptual, social, and practical adaptive behavior skills (Clark et al., 2002; Crocker et al., 2009; Sukhodolsky et al., 2005). In contrast, children with SLD showed deficits that were specific to the conceptual adaptive behavior domain and affected all areas related to functional academic skills (Fagerlund et al., 2012; Leigh, 1987). However, to investigate the adaptive behavior profile deeply, some methodological concerns should be addressed.

To understand the adaptive behavior of children with behavioral and cognitive impairments, researchers should match the profiles of these children with those of typically developing peers on the relevant socio-demographic variables (i.e., age, sex, socio-cultural level, and school level attended). As suggested by Kover and Atwood (2013) and Steiner, Cook, Shadish, and Clark (2010), for each matching variable, equivalence between the clinical and control groups should be based not only on *p* values, but also on effect sizes (Cohen’s *d* within 0.10) and on variance ratios (between 0.9 and 1.25). In previous investigations with matched clinical and typical development groups (Clark et al., 2002; Crocker et al., 2009; Fagerlund et al., 2012; Sukhodolsky et al., 2005), the matching criteria suggested by Kover and Steiner were not met for all of the relevant socio-demographic variables. Moreover, equivalence was based on the mean of the matched variables. A customary group-matching procedure is to exclude participants iteratively, from one or both clinical-control groups, until matching criteria are fit. In this way, however, the exclusion of participants can compromise the power of statistical procedures. Moreover, this approach prevents any data analysis procedure that takes into account the relationship between the dependent variables. To overcome these methodological concerns, the one-to-one matching procedure is preferable (e.g., Tabachnick & Fidell, 2013): each participant in the clinical group is associated with a control participant with the same or similar values of all the matching variables.

In the present study, we examined the adaptive behavior profiles of children with ADHD or SLD selected for the Italian standardization of the Vineland-II Survey Interview Form (hereafter, Vineland-II; Balboni, Belacchi, Bonichini, & Coscarelli, 2016). We compared children with ADHD or SLD and peers with typical development matched one-to-one on relevant socio-

Table 1
Characteristics of the two clinical-control group pairs with ADHD or with SLD and with typical development.

	ADHD (n = 24)	Controls (n = 24)	SLD (n = 61)	Controls (n = 61)
Age (yrs)				
M (SD)	9.98 (2.64)	9.91 (2.59)	9.14 (1.21)	9.12 (1.18)
Range	5.19–14.41	5.19–14.51	6.22–10.99	6.22–10.98
Sex (n)				
M–F	20–4	20–4	37–24	37–24
School level attended (n)				
Kindergarten	1	1	0	0
Elementary	14	14	61	61
Middle	8	8	0	0
High school	1	1	0	0
School year attended (yrs)				
Mdn	3	3	4	3
Range	0–9	0–9	1–5	1–5
Parents' educational level				
Mother				
Certificate (n)				
Middle school	6	6	20	20
High	13	12	30	30
University degree or higher	5	6	10	10
Missing	0	0	1	1
School year attended (yrs)				
Mdn	13	13	13	13
Range	8–18	8–18	8–18	8–18
Father				
Certificate (n)				
Middle school	7	6	16	16
High	11	12	35	35
University degree or higher	5	5	8	8
Missing	1	1	2	2
School year attended (yrs)				
Mdn	13	13	13	13
Range	8–24	8–24	5–19	8–18

Note. According to criteria proposed by [Kover and Atwood \(2013\)](#) for establishing equivalence in group-matching designs with participants with developmental disabilities, the matched pairs did not differ on age (ADHD: $t[23] = 0.89$, $p = 0.382$, Cohen's $d = 0.18$, $SD^2_{ADHD}/SD^2_{CONTROL} = 1.04$; SLD: $t[60] = 0.55$, $p = 0.586$, Cohen's $d = 0.07$, $SD^2_{ADHD}/SD^2_{CONTROL} = 1.05$). Children with ADHD and controls did not differ on parents' educational level ($\chi^2[2] = 0.13$, $p = 0.937$, Cohen's $w = 0.05$; $\chi^2[2] = 0.12$, $p = 0.989$, Cohen's $w = 0.05$, respectively, for mother's and father's educational level). (Cohen's w [[Cohen, 1988](#)] was evaluated as negligible [< 0.10], small [0.10 – 0.29], medium [0.30 – 0.49], or large [≥ 0.50].)

demographic variables. The main goal was to identify the subsets of items that could discriminate the clinical and control groups. Moreover, we aimed to identify the combination of item subsets that renders the best classification of participants. To our knowledge, this procedure has never been employed with the Vineland-II to investigate the profiles of children with ADHD or SLD. To identify which specific areas of adaptive behavior are more impaired, researchers should consider not only the total scores on the Vineland-II domains and subdomains, but also the scores on the item subsets that measure specific adaptive behavior skills ([Balboni, Tasso, et al., 2016](#); see also, [Paul et al., 2004](#)).

2. Method

2.1. Participants

From the database used for the Italian standardization of the Vineland-II ([Balboni, Belacchi, et al., 2016](#)), we selected the records of 170 Italian children: 24 children with a diagnosis of ADHD (age range: 5–14 years), 61 children with a diagnosis of SLD (age range: 6–11 years), and 85 controls with typical development (age range: 5–14 years). Control children were matched one-to-one on relevant socio-demographic variables. For each child with ADHD or SLD, a peer with typical development was selected with a comparable age (mean difference = 2.00 months [$SD = 2.40$]; median = 1.10; range: 0.03–14.03 months), and same biological sex, school year attended, and both parents' education level ([Table 1](#)). All participants were Italian native speakers and attended a regular education program. They all lived with their families, except two children with ADHD, one who lived in a foster home and one in a group home.

Children received the diagnosis of ADHD at a mean age of 9 years (range: 5–15 years). No child had a dual diagnosis of ADHD and SLD. An oppositional defiant disorder was diagnosed in seven children with ADHD. Only two children were on medication for ADHD symptoms. For 36 children with SLD (59%), information about the impaired domain was available: 24 were impaired in reading, 3 in written expression, 7 in both reading and written expression, and 2 in reading, written expression, and mathematics.

The clinical participants had been recruited in several Italian centers specializing in the assessment of children with developmental disabilities, where they had received the diagnosis of ADHD or SLD according to the DSM-IV-TR criteria (American Psychiatric Association, 2005) and on the basis of standardized instruments, direct observation, and parent interview. The diagnosis of the ADHD disorder was based on a testing battery assessing attentional and executive functions and on questionnaires given to parents and teachers to evaluate the presence of psychological problems. In cases of concern, all children underwent further testing to evaluate the presence of other mental disorders. Children with a prenatal alcohol exposure or a diagnosis of any major disorders (e.g., intellectual disability or autism spectrum disorder) were not present. Twelve children with ADHD were attending a self-control training program; their parents were attending a parent training program.

Twenty-one individuals with ADHD (87%) and 20 with SLD (33%) underwent the Wechsler scales (Wechsler, 1991, 2003) and 10 with SLD (16%) the Colored Progressive Matrices (Raven, Raven, & Court, 1998). The IQ mean (*SD*) was 99.43 (15.68) (range: 68–127) for the children with ADHD; 101.38 (9.01) (range: 88–119) and 121.40 (12.17) (range: 94–133) for those with SLD evaluated with the Wechsler scales and the Colored Progressive Matrices, respectively.

The participants with typical development had been recruited from different areas in Italy. None of them presented actual or previous signs of developmental abnormalities or neuropsychiatric disorders. As there were no hints of specific disorders, cognitive and intellectual abilities were not assessed. For all participants, parental informed consent was obtained. No monetary reimbursement was given.

2.2. Instruments and procedure

The Vineland-II scales assess adaptive behavior in terms of abilities for personal and social functioning in different domains of everyday life. Specifically, the four different domains assess each developmental step from 0 to 90 years in communication (conceptual), socialization (social), and daily living (practical) adaptive skills, and from 0 to 6 years in motor adaptive skills. Each domain comprises subdomains (Receptive, Expressive, and Written skills in Communication; Personal, Domestic, and Community skills of Daily Living; Interpersonal relationship, Play and leisure time, and Coping skills of Socialization; and Gross and Fine Motor skills) with item sets assessing specific content areas (i.e., adaptive skills). In the present study, the scores obtained for all 47 item sets of Communication, Daily living skills, and Socialization domains were used (see supplementary material). Each item subset comprises the items that allow for measurement of that specific content category and that were identified by Sparrow et al. (2005) while developing the instrument. All sets contain 1–14 individual items (median = 6 items); possible item scores are 2, 1, or 0, and the score for each set is calculated as the mean of the individual item scores (for more detail see Sparrow et al., 2005). Scores on the Motor skills domain were not used because they were available only for the 5- and 6-year-old participants.

An Italian adaptation of the Vineland-II, approved by Pearson Editor and with excellent psychometric properties (Balboni, Belacchi, et al., 2016), was used. Trained psychologists administered the Vineland-II to the caregivers of the children of both clinical and control groups (mother [86%], father [11%], others [3%]). For more details on the data collection for the Italian standardization of the Vineland-II, see Balboni, Belacchi, et al., (2016).

2.3. Data analysis

Before analyzing the data, according to Tabachnick and Fidell's (2013) recommendation, we checked for the presence of univariate outliers in the Vineland-II Adaptive Behavior Composite normative score within each of the four clinical and control groups. No outliers were found.

We used Student's *t*-tests for matched samples to identify the Vineland-II domains, subdomains, and item subsets on which there were statistically significant differences between the ADHD or SLD group and the corresponding control group. Given the number of comparisons with the same participants, to avoid Type I error we computed *p* values by means of the False Discovery Rate procedure (Benjamini & Yekutieli, 2001). In case of statistically significant differences, Cohen's *d* for matched samples was computed as an estimate of effect size (Cohen, 1988; Morris & DeShon, 2002).

To identify the item subsets that classified the clinical and control groups at above-chance levels, we used ROC analysis to estimate the probability of correct classification, and logistic regression to compute the percentage of participants correctly classified into each group (Tabachnick & Fidell, 2013). We then computed the total capacity for classification, i.e., the mean probabilities of correct classification and of participants correctly classified. To identify the best combination of item subsets, linear discriminant function analyses were run.

Finally, to identify the within-ADHD and -SLD group domain and subdomain profiles, we ran repeated measures multivariate analyses of variance (MANOVAs) with the normative scores obtained by each clinical group on the three domains, or on each of the three subdomains of the same domain, as repeated measures. To locate the sources of the global differences reflected by the MANOVAs, we ran repeated measures ANOVAs followed by Bonferroni's post hoc comparisons (Tabachnick & Fidell, 2013). In case of statistically significant differences, we computed η^2 for multivariate analysis, *partial* η^2 (η^2_p) for univariate analysis, and Cohen's *d* for matched sample post-hoc analysis.

In agreement with Cohen's criteria (1988), effect sizes were evaluated as negligible (η^2 , $\eta^2_p < 0.01$; $d < 0.20$), small ($0.01 \leq \eta^2$, $\eta^2_p < 0.06$; $0.20 \leq d < 0.50$), medium ($0.06 \leq \eta^2$, $\eta^2_p < 0.14$, $0.50 \leq d < 0.80$), or large (η^2 , $\eta^2_p \geq 0.14$, $d \geq 0.80$).

Table 2

Comparison between ADHD and SLD groups with their control groups on normative scores on the Vineland-II domains, subdomains and Adaptive Behavior Composite: mean (SD) and Student's *t*-test (Cohen's *d*).

	ADHD M (SD)	Controls M (SD)	t-test (Cohen's <i>d</i>)	SLD M (SD)	Controls M (SD)	t-test (Cohen's <i>d</i>)
Communication	69.87 (14.75)	95.25 (13.23)	6.38** (1.27)	88.57 (16.07)	102.92 (13.77)	5.26*** (0.67)
Receptive	9.04 (2.66)	14.29 (2.39)	8.98** (1.80)	13.00 (2.85)	14.46 (2.58)	3.15** (0.40)
Expressive	10.08 (2.00)	14.46 (2.41)	5.96** (1.19)	14.18 (3.04)	15.41 (2.60)	2.21
Written	13.08 (3.41)	14.04 (2.39)	1.14	12.51 (2.93)	15.66 (2.81)	6.12*** (0.78)
Daily living skills	84.96 (13.21)	95.17 (12.43)	2.91* (0.58)	101.80 (18.83)	103.98 (12.74)	0.79
Personal	13.58 (2.38)	13.79 (1.77)	0.36	14.98 (2.88)	14.85 (2.59)	0.29
Domestic	13.04 (1.88)	14.50 (2.21)	2.33* (0.47)	15.28 (3.40)	15.41 (3.03)	0.23
Community	11.42 (3.76)	14.54 (3.05)	3.49** (0.70)	15.02 (4.37)	16.28 (3.27)	1.90
Socialization	76.67 (14.72)	98.08 (11.52)	5.75*** (1.15)	98.69 (15.40)	103.47 (12.08)	2.01
Interpersonal relationships	10.87 (2.45)	14.54 (2.04)	6.40*** (1.28)	14.05 (3.39)	14.97 (2.37)	1.74
Play and leisure time	11.58 (3.11)	14.46 (2.26)	3.66** (0.73)	14.15 (3.19)	14.64 (1.96)	1.18
Coping skills	9.62 (2.92)	14.12 (3.93)	4.79** (0.96)	14.39 (3.87)	15.44 (3.59)	1.65
Adaptive Behavior Composite	73.87 (14.64)	95.58 (11.78)	6.04** (1.21)	95.84 (16.14)	104.49 (12.19)	3.56** (0.45)

Note. Normative scores on domains and on the Adaptive Behavior Composite are Standard Scores ($M = 100, SD = 15$); on subdomains they are *v*-Scale Scores ($M = 15, SD = 3$). *p* value was computed according to the False Discovery Rate procedure (Benjamini and Yekutieli, 2001).

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

3. Results

3.1. Vineland-II adaptive behavior profile of participants with ADHD

As shown in Table 2, children with ADHD had statistically significant lower normative scores on the Adaptive Behavior Composite (large effect) and on the following domains: Communication and its Receptive and Expressive subdomains (large effect); Daily living skills and the Domestic and Community subdomains (medium effect, but small for the Domestic); Socialization and all three subdomains of Interpersonal relationships, Play and leisure time, and Coping skills (large effect, but for the Play and leisure time medium).

3.1.1. Identification of the item subsets that discriminate ADHD and control groups

Table 3 shows the item subsets for which there were statistically significant differences between the two groups, as revealed by the Student's *t*-test, and those with discriminant ability at above-chance level, as revealed by both ROC analysis and logistic regression. For the Communication domain, the item subsets for which both these conditions were satisfied and for which the magnitude of the differences was at least medium were the three subsets of the Receptive subdomain and the following subsets of the Expressive subdomain: Interactive speech, Speech skills, and Expressing complex ideas. For the Daily living skills domain, the relevant item subsets were Money skills and Restaurant skills (Community subdomain). Finally, for the Socialization domain, the following subsets were relevant: Expressing and recognizing emotions, Social communication, and Friendship (Interpersonal relationships subdomain); Sharing and cooperating, Playing games, and Recognizing social cues (Play and leisure time subdomain); Controlling impulses, Keeping secrets, Responsibility, and Appropriate social caution (Coping skills subdomains). In all comparisons, the ADHD group obtained lower scores. The percentage of individuals correctly classified ranged from 63.5% to 87.5%.

3.1.2. Identification of the item subset combination that best classifies participants into the ADHD or control group

To identify the best combination of item subsets, linear discriminant function analyses were run. Linear discriminant analysis requires at least five participants in each group per predictor variable (Fletcher, Rise, & Ray, 1987). Because each of the two matched groups included 24 participants, four predictors could be entered.

To select the item subsets to be used as predictors, we ordered them in one list based on the magnitude of differences found and on each subset's total capacity for classification. The first three subsets on this list were Listening and attending,

Table 3

Sets of Vineland-II Items with a statistically significant capacity to discriminate the ADHD and control groups: Differences (Student's t-test), probability of correct classification (ROC analysis), percentage correctly classified (logistic regression), with corresponding effect sizes, and total capacity for classification.

	ADHD M (SD)	Control M (SD)	t-test (Cohen's d)	Correct classification probability (SE)	Correct classification percentage (Nagelkerke's R ²)	Total capacity classification in percentage
Communication						
Receptive						
Understanding	1.85 (0.10)	1.95 (0.08)	4.24*** (0.82)	.77 (.07)	73 (.31)	75.0
Listening and attending	1.01 (0.40)	1.75 (0.28)	9.89*** (1.99)	.92 (.04)	83 (.65)	87.5
Following instructions	1.41 (0.42)	1.87 (0.28)	4.91*** (0.98)	.84 (.06)	75 (.42)	79.5
Expressive						
Interactive speech	1.57 (0.38)	1.92 (0.15)	4.27** (0.86)	.87 (.05)	81 (.47)	84.0
Speech skills	1.68 (0.41)	1.95 (0.10)	3.35** (0.69)	.88 (.05)	77 (.47)	82.5
Expressing complex ideas	0.75 (0.39)	1.57 (0.43)	7.28*** (1.46)	.91 (.04)	81 (.63)	86.0
Daily living skills						
Community						
Telephone skills	1.79 (0.34)	1.94 (0.17)	2.60* (0.52)	—	—	—
Money skills	0.88 (0.32)	1.07 (0.32)	3.65** (0.75)	.67 (.08)	65 (.12)	66.0
Rules, rights and safety	1.41 (0.32)	1.58 (0.40)	2.81* (0.55)	—	—	—
Computer skills	1.19 (0.48)	1.50 (0.51)	2.61* (0.51)	—	—	—
Restaurant skills	0.87 (0.90)	1.46 (0.83)	2.70* (0.54)	.67 (.08)	67 (.14)	67.0
Socialization						
Interpersonal relationships						
Expressing and recognizing emotions	1.86 (0.14)	1.97 (0.10)	4.15** (0.83)	.76 (.07)	77 (.25)	76.5
Social communication	1.00 (0.45)	1.55 (0.38)	7.33*** (1.50)	.81 (.06)	75 (.40)	78.0
Friendship	1.47 (0.39)	1.75 (0.30)	3.14* (0.62)	.70 (.08)	73 (.19)	71.5
Play and leisure time						
Sharing and cooperating	1.51 (0.49)	1.91 (0.14)	4.25** (0.85)	.74 (.07)	69 (.34)	71.5
Playing games	1.30 (0.46)	1.69 (0.37)	4.00** (0.81)	.75 (.07)	67 (.24)	71.0
Recognizing social cues	1.00 (0.88)	1.75 (0.53)	3.89** (0.78)	.73 (.07)	71 (.28)	72.0
Coping skills						
Manners	1.46 (0.46)	1.71 (0.45)	2.83* (0.57)	—	—	—
Controlling impulses	0.53 (0.50)	1.21 (0.64)	4.68*** (0.94)	.80 (.06)	73 (.34)	76.5
Keeping secrets	0.48 (0.54)	1.12 (0.77)	3.76** (0.76)	.74 (.07)	73 (.25)	73.5
Responsibility	0.32 (0.51)	0.87 (0.77)	3.16* (0.64)	.69 (.08)	67 (.21)	68.0
Appropriate social caution	0.37 (0.54)	0.89 (0.87)	3.66** (0.77)	.67 (.08)	60 (.15)	63.5

Note. *p* value was computed according to the False Discovery Rate procedure (Benjamini and Yekutieli, 2001).

* *p* < 0.05.

** *p* < 0.01.

*** *p* < 0.001.

Expressing complex ideas, and Social communication. Therefore, we ran discriminant analyses with these three item subsets as fixed predictors. The following five item subsets remaining from the list based on discriminant capacity were entered, one at a time, as the fourth predictor: Following instructions, Interactive speech, Controlling impulses, Expressing and recognizing emotions, and Understanding. The following combination produced the best classification results: Listening and attending, Expressing complex ideas, Social communication, and Following instructions (Wilks' $\lambda = 0.43$; $\chi^2[4] = 37.37$; $p < 0.001$). This

Table 4

Comparison of normative scores on the Vineland-II domains and subdomains within ADHD and SLD Groups: Repeated measures MANOVA and ANOVA with corresponding effect sizes and Bonferroni's post-hoc comparisons (Cohen's *d*).

	MANOVA Wilks's λ	F ^a (η^2)	ANOVA F ^b (η^2_p)	Post-hoc (Cohen's <i>d</i>)
ADHD				
Domains	0.289	27.00 ^{***} (0.71)	23.76 ^{***} (0.16)	C<AVQ ^{***} (1.54), S ^{**} (0.64); S<AVQ ^{**} (0.71)
Communication subdomains	0.391	17.16 ^{***} (0.61)	25.59 ^{***} (0.29)	R<W ^{***} (1.24); E<W ^{***} (1.09)
Daily living skills subdomains	0.512	10.46 ^{***} (0.49)	42.37 ^{***} (0.10)	CO<P ^{***} (1.02)
Socialization subdomains	0.414	15.59 ^{***} (0.59)	14.13 ^{***} (0.08)	CS<IR [*] (0.64), PLT ^{***} (1.17)
SLD				
Domains	0.578	21.55 ^{***} (0.42)	24.89 ^{***} (0.10)	C<AVQ ^{***} (0.81), S ^{***} (0.69)
Communication subdomains	0.775	8.56 ^{**} (0.22)	8.68 ^{**} (0.05)	R<E [*] (0.36); W<E ^{***} (0.53)

Note. Mean (*SD*) of the normative scores obtained by the ADHD and SLD groups are reported in Table 2. C=Communication; DLS=Daily living skills; S=Socialization; R=Receptive; Expressive=E; Written=W; Personal=P; Domestic=D; CO=Community; IR=Interpersonal relationships; PLT=Play and leisure time; CS=Coping skills.

^a Degrees of freedom: 2, 22 for ADHD group and 2, 59 for SLD group.

^b Degrees of freedom: 2, 46 (1.44, 33.125 for Daily living skills subdomains comparison) for ADHD group and 2, 120 for SLD group.

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

combination correctly classified 87.5% of children with ADHD and 87.5% of children with typical development. In children classified with ADHD, both sensitivity and specificity were 87.5%.

Only three children with ADHD were misclassified. They were males between 7 and 12 years of age, one of whom was the child living with a foster mother.

3.1.3. Identification of the within-ADHD group domain and subdomain profiles

To investigate further the value of the identified item subset combination, we verified the agreement with the within-ADHD group domain and subdomain profiles. Repeated measures MANOVAs revealed statistically significant differences within the normative scores obtained by the children with ADHD in the Vineland-II domains as well as in the Communication, Daily living skill, and Socialization subdomains (see Table 4). Subsequent ANOVAs revealed that the children with ADHD presented the Communication < Socialization < Daily living skills domain profile; Receptive and Expressive < Written Communication subdomain profile; and Copying Skills < Interpersonal Relationships and Play and leisure time Socialization profile. Moreover, the normative score on the Community subdomain was lower than that on the Personal subdomain. The effect sizes were generally large; they were medium in only two comparisons.

3.2. Vineland-II adaptive behavior profile of participants with SLD

As shown in Table 2, the SLD group obtained statistically significantly lower normative scores, with a medium effect size in the Communication domain and in the Written subdomain. Also, children with SLD obtained lower scores on the Adaptive Behavior Composite and the Receptive subdomains; however, the effect sizes were small enough that the differences should be evaluated as clinically irrelevant.

3.2.1. Identification of the item subsets that discriminate SLD and control groups

Table 5 shows the item subsets for which there were statistically significant differences between the two groups, as revealed with the Student's *t*-test, and those with a discriminant ability at above-chance level, as revealed by both ROC analysis and logistic regression. The item subsets for which both these conditions were satisfied and for which the magnitude of the differences was at least medium were Reading skills and Writing skills (Written subdomain) and Time and dates (Community subdomain). The fraction of individuals correctly classified ranged from 64.5% to 69.5%.

3.2.2. Identification of the item subset combination that best classifies participants into the SLD or control group

As with the previous groups, linear discriminant function analyses were run to identify the best combination of item subsets. Because the two matched groups included 61 participants each, 12 predictors could be entered. However, just for Reading skills, Writing skills, and Times and dates item subsets, there were statistically significant medium-sized differences between the two groups, and discriminant ability was at above-chance level. Therefore, we ran discriminant analyses with these three item subsets as predictors. This combination correctly classified 68.9% of participants, and, specifically, 65.6% of children with SLD and 72.1% of children with typical development (Wilks' $\lambda = 0.84$; $\chi^2[4] = 20.90$; $p < 0.001$). In children classified with SLD, sensitivity was 70.2% and specificity was 67.7%.

Twenty-one children with SLD were misclassified. Compared with the correctly classified children, misclassified children with SLD were older and more likely to be female, and had obtained higher normative scores on Vineland-II Adaptive Behavior Composite and domains and subdomains except the Expressive and the Interpersonal Relationship subdomains. The effect sizes were from medium to high, except for the sex comparison, for which the effect size was small.

Table 5

Sets of Vineland-II Items with a statistically significant capacity to discriminate the SLD and control groups: differences (Student's *t*-test), probability of correct classification (ROC analysis), percentage correctly classified (logistic regression), with corresponding effect sizes, and total capacity for classification.

	SLD M (SD)	Controls M (SD)	<i>t</i> -test (Cohen's <i>d</i>)	Correct classification probability (SE)	Correct classification percentage (Nagelkerke's R^2)	Total capacity classification in percentage
Communication						
Receptive						
Listening and attending	1.55 (0.38)	1.75 (0.34)	3.07* (0.39)	.67 (.05)	63 (.09)	65.0
Expressive						
Speech skills	1.88 (0.17)	1.96 (0.10)	3.20* (0.40)	.64 (.05)	61 (.11)	62.5
Written						
Reading skills	0.70 (0.40)	0.99 (0.35)	5.95*** (0.76)	.71 (.05)	66 (.17)	68.5
Writing skills	1.24 (0.28)	1.47 (0.26)	5.52*** (0.71)	.73 (.05)	66 (.20)	69.5
Daily living skills						
Community						
Time and dates	1.50 (0.55)	1.78 (0.41)	4.36*** (0.57)	.69 (.05)	60 (.10)	64.5
Socialization						
Play and leisure time						
Playing games	1.54 (0.47)	1.79 (0.23)	3.87** (0.49)	.65 (.05)	65 (.14)	65.0
Coping Skills						
Controlling impulses	1.08 (0.53)	1.35 (0.46)	3.15* (0.41)	.65 (.05)	61 (.10)	63.0

Note. *p* value was computed according to the False Discovery Rate procedure (Benjamini and Yekutieli, 2001).

* *p* < 0.05.

** *p* < 0.01.

*** *p* < 0.001.

3.2.3. Identification of the within-SLD group domain and subdomain profiles

Repeated measures MANOVAs revealed statistically significant differences within the normative scores obtained by the children with SLD in the Vineland-II domains and in the Communication subdomains (see Table 4). Subsequent ANOVAs revealed that the children with SLD presented Communication < Daily living skills and Socialization domain profile (with at least a medium effect size). The score on the Expressive subdomain was significantly higher than that on the Written (medium effect) and Receptive (small effect) subdomains.

3.3. Comparisons between ADHD and SLD groups Vineland-II profiles

We also investigated the utility of the Vineland-II in discriminating ADHD and SLD groups. A Student's *t*-test for independent samples (with False Discovery Rate correction for multiple comparisons) was run to compare the normative scores of the two clinical groups on the Vineland-II domains, subdomains, and Adaptive Behavior Composite. We found that children with ADHD had a medium-sized score on the Adaptive Behavior Composite and on all domains and subdomains except the Written subdomain (see analysis in the supplementary material) that was significantly lower than that of children with SLD. However, based on the criteria proposed by Kover and Atwood (2013) and by Steiner and colleagues (2010) for establishing equivalence in group-matching designs, the ADHD and SLD groups did not emerge as comparable. They were equivalent only for the educational level of mothers ($\chi^2[3] = 1.01, p = 0.798$, Cohen's $w = 0.11$) and fathers ($\chi^2[3] = 1.19, p = 0.756$, Cohen's $w = 0.11$). They were not matched on age (Cohen's $d = 0.49, SD^2_{ADHD}/SD^2_{SLD} = 2.18$), school level attended ($\chi^2[2] = 28.81, p < 0.001$, Cohen's $w = 0.58$) or sex ($\chi^2[2] = 4.01, p = 0.045$, Cohen's $w = 0.22$). The ADHD group were significantly older, attended higher school levels and were more likely to be male.

4. Discussion

Our main goal was to identify the item subsets of the Vineland-II that could best discriminate children with ADHD or SLD and control groups of typically developing peers. To this end, following the criteria proposed by Kover and Atwood (2013) and Steiner et al. (2010) for establishing equivalence in group-matching designs, the participants of the clinical and control groups were matched one-to-one for age, biological sex, school level attended, and both parents' education levels. To obtain robust and reliable results (Balboni & Cubelli, 2009; Sun, Pan, & Wang, 2010), we used more than one type of data analysis and considered not only the statistical significance but also the effect size. In this way, we were able to identify the

item subsets that both showed statistically significant differences between the children with ADHD or SLD and the matched control group and allowed the classification of participants at above-chance level.

For the ADHD children, some item subsets concern adaptive behaviors strictly connected with the core symptoms of ADHD, i.e., inattention, disorganization, and/or hyperactivity-impulsivity: Controlling impulses, Listening and attending, Understanding, Following instructions, and Playing games. However, the majority of the item subsets discriminating children with ADHD and typically developing controls address different content areas. They were communicating with others (Interactive speech, Speech skills, Expressing complex ideas, Social communication, and Recognizing social cues); developing and maintaining relationships with peers (Expressing and recognizing emotions, Sharing and cooperating, Friendship, Keeping secrets); and being responsible in social context (Appropriate social caution, Responsibility, Restaurant skills, and Money skills).

Consistent with previous investigations (Clark et al., 2002; Crocker et al., 2009; Sparrow et al., 2005; Stein et al., 1995; Sukhodolsky et al., 2005), we found that children with ADHD obtained lower scores in all three Vineland-II domains of Communication, Daily living skills, and Socialization. Moreover, in agreement with the standard diagnostic criteria (American Psychiatric Association, 2013), the analysis of the item subsets we introduced revealed that ADHD affects the adaptive behavior skills encompassing self-control, attention, and organizational capacities. However, the same analysis shows that ADHD also impairs adaptive behavior skills related to understanding in social context and developing interpersonal relationships.

These results are consistent with studies reporting that social impairments are associated with ADHD (e.g., Nijmeijer et al., 2008) and can have a causal role in developing its clinical manifestations (Caillies et al., 2014; Staikova et al., 2013; Uekermann et al., 2010). Usually, *ad hoc* scales are used for psychological problems (e.g., Conners Comprehensive Behavior Rating Scales, Conners, 2008; Childhood Behavior Checklist, Achenbach & Rescorla, 2001), social skills (e.g., Social Skills Improvement System; Gresham & Elliott, 2008), or pragmatics and social cognition (see for example Caillies et al., 2014; Staikova et al., 2013). However, whereas these instruments can detect *symptoms* and defective *knowledge*, the item subsets of the Vineland-II allow the identification of *functional* impairments, thus completing the picture of the consequences of ADHD in *performance* of the functions of daily living.

Our results show that four Vineland-II item subsets, Listening and attending, Expressing complex ideas, Social communication, and Following instructions, constitute the combination that best discriminates between the ADHD and control groups. This combination allowed the discrimination between children with ADHD and peers with typical development with a sensitivity and a specificity of 87.5%, which is very high (Matthey & Petrovski, 2002). The deficits found in the social functioning areas (as revealed by the Expressing complex ideas and the Social communication item subsets) reflect the reduced quality of social, academic, or occupational functioning, which is required by the DSM-5 for the diagnosis of ADHD. These results are in agreement with studies on social deficits associated with ADHD (e.g., de Boo & Prins, 2007; Kofler, Rapport, Bolden, Sarver, Raiker, & Alderson, 2011; Nijmeijer et al., 2008; Staikova et al., 2013).

Additionally, the analysis of the within-ADHD group adaptive behavior profile showed deficits in communication and socialization areas: Receptive and Expressive subdomains were weaker compared with the Written subdomain; the Coping skills subdomain was defective compared with the Interpersonal relationship and Play and leisure time subdomains. Further, the Community subdomain was more impaired than the Personal subdomain. However, the study of the Vineland-II item subsets allowed a more specific picture of weaknesses and strengths in adaptive behavior of children with ADHD.

Similarly, for children with SLD the evaluation of adaptive behavior results appears to be useful for identifying difficulties in specific activities of daily living. In particular, the Vineland-II item subsets that showed statistically significant differences between children with SLD, all attending primary school, and the matched control group, and allowed classification at above-chance level, were Reading skills, Writing skills, and Times and dates. Moreover, the combination of these item subsets allowed discrimination between children with SLD and control children with a sensitivity of 70.2% and a specificity of 67.7%. Primary school children with SLD showed difficulties connected to the core symptoms of the disorder: reading and understanding materials appropriate to their school level, writing and editing simple correspondence or reports and papers, and putting words in alphabetical order. Consistent with the previous studies (Ditterline et al., 2008; Fagerlund et al., 2012; Leigh, 1987), these children with SLD obtained statistically significantly lower scores than controls on the Vineland-II Communication domain and on the Written subdomain. Moreover, the study of within-SLD group adaptive behavior profile revealed that the Written subdomain was weaker than the Receptive and Expressive subdomains. By means of the item subsets, analysis difficulties in temporal orientation (i.e., saying the current day of the week and telling time on an analog clock) were also found.

On the basis of our results, it appears that children with SLD have learned to cope with the deficits in reading and in writing. Areas of daily living skills, like Money, Computer, or Restaurant skills, which also require reading and writing skills, emerged unimpaired. It follows that, as there is not a direct relationship between impairment severity and corresponding disability (e.g., Balboni & Ceccarani, 2003), the Vineland-II appears to be a useful tool to evaluate if and to what extent the SLD disorder affects everyday living skills, and whether children with SLD are able to overcome their impairments.

Vineland-II allows measurement of the performance, but not the competence, of an individual. Responses to the instrument are compiled by interviewing a respondent who is familiar with the everyday behavior of the evaluated individual. The third-person interview, however, presents some limitations. First, evaluation is based on the respondent's knowledge, which is inherently limited. Second, any answer tends to reflect the respondents' biases (e.g., parents of children with a developmental disorder may over-represent clinical symptoms in their children). Finally, the clinical diagnosis, if known by the respondent, prevents the blind evaluation of the adaptive behavior.

The present study is an *a posteriori* investigation of information derived from the database used for the Italian standardization of the Vineland-II. This procedure allows us to obtain results independently of the specific properties of the single clinical centers where the data have been collected. However, we must mention some limitations that are intrinsic to any standardization of psychological tests. First, information about individuals with typical development does not include any clinical assessment. Typically, data on cognitive processes like language and executive functions are not available. Consequently, in the present study, the control and clinical groups were matched on relevant socio-demographic variables but not on cognitive variables. Further, we found that children with ADHD, despite being older (and expected to have higher scores) had significantly lower scores than those with SLD on the Vineland-II domains. These results are clinically relevant. However, given that the ADHD and SLD groups were not matched on all variables we cannot identify the item subsets that distinguish between the two groups. Further investigations should address these limitations.

In the present study, seven participants with ADHD also presented with oppositional defiant disorder. Previous studies have not identified any differences in adaptive behavior between children with ADHD alone and peers with ADHD associated with oppositional defiant disorder (Clark et al., 2002). Nevertheless, a group with ADHD alone might better enhance the understanding of the unique characteristics of these children's adaptive behavior.

Previous studies found that girls with ADHD occasionally present with a profile distinct from that of boys with ADHD (e.g., American Psychiatric Association, 2013). In the present investigation we found that, within the SLD groups, girls were misclassified more often than boys by the best combination of Vineland-II subsets. Therefore, further investigations should study the invariance of the profile between sexes.

Finally, the ADHD analysis included only the data of 48 individuals. Given the low prevalence of the disorder, a relatively small sample is quite common in this kind of investigation. However, we found that each item subset of the combination that best classifies the children into the ADHD or control group had a large Cohen's *d* effect size, ranging from 0.98 to 1.99. Statistical power of the Student's *t*-test for matched samples ($n = 24$, two-tailed, $\alpha = 0.05$) for the smallest of these effect sizes (i.e., $d = 0.98$) is 0.99.

4.1. Conclusions

In this study, we used different types of data analysis to identify the differences in functional impairments in daily living performance between children with ADHD or SLD and matched peers with typical development. Our results clearly demonstrate that performance on certain Vineland-II item content categories can be very useful for deriving a valid picture of abilities and disabilities of children with ADHD or SLD.

Conflict of interest

The authors declare that they have no conflict of interest.

Ethical standards

This study was performed in accordance with the ethical standards laid down in the 2013 version of the Declaration of Helsinki. Informed consent was obtained from parents or other caregivers, as appropriate.

Acknowledgments

The authors wish to thank Silvia Re (Child Neuropsychiatric Unit, ASL Cuneo 1, Cuneo-Mondovì, Italy), Claudio Grada and Susanna Villa (IRCCS Eugenio Medea, La Nostra Famiglia, Conegliano Veneto, Treviso, Italy) for their help with the data collection.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.ridd.2016.12.003>.

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Iniziativa nell'ambito del Progetto di Neuropsichiatria dell'Infanzia e dell'Adolescenza
(Delibera n. 406 - 2014 del 04/06/2014 Progetti NPI)
Il Progetto è realizzato con il contributo, parziale, della Regione Lombardia
(in attuazione della D.G. sanità n. 3798 del 08/05/2014, n. 778 del 05/02/2015 e n.
5954 del 05/12/2016) Capofila Progetto: UONPIA Azienda Ospedaliera "Spedali
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IRCCS ISTITUTO DI RICERCHE FARMACOLOGICHE MARIO NEGRI
DIPARTIMENTO DI SALUTE PUBBLICA
Laboratorio per la Salute Materno Infantile
Via Giuseppe La Masa, 19 - 20156 Milano MI - Italia - www.marionegri.it tel
+39 02 39014.511 - fax +39 02 3550924 - mother_child@marionegri.it