

ADHD in adults: clinical subtypes and associated characteristics

L'ADHD negli adulti: sottotipi clinici e caratteristiche associate

VIRGINIO SALVI^{1*}, GIOVANNI MIGLIARESE¹, VIVIANA VENTURI¹, FEDERICO ROSSI¹, SARA TORRIERO¹, VERA VIGANÒ¹, GIANCARLO CERVERI², CLAUDIO MENCACCI¹

*E-mail: virginiosalvi@gmail.com

¹Dipartimento di Salute Mentale e Dipendenze, ASST Fatebenefratelli-Sacco, Milan, Italy

²Dipartimento di Salute Mentale e Dipendenze, ASST Lodi, Milan, Italy

SUMMARY. Introduction. Attention Deficit Hyperactivity Disorder (ADHD) is an early onset clinical condition characterized by attention difficulties, hyperactivity and impulsivity which can persist across the lifespan, significantly influencing the evolutionary course and facilitating the rise of psychiatric comorbidities. The presence of different ADHD subtypes in adults is a heterogeneity factor to be recognized in order to orient prognosis and treatment, as indicated by studies that described differences in the characterization of different subtypes in relation to both severity and comorbidities. **Materials and methods.** In the present study we evaluated the socio-demographic and clinical characteristics of a sample of adults with ADHD and the characteristics associated with the different disorder subtypes. We described 60 patients aged between 18 and 65 years (mean age 34.1) with primary diagnosis of ADHD consecutively admitted to the Regional Centre for diagnosis and treatment of ADHD in adults in Milan. **Results.** We observed high severity of symptoms and low quality of life, in particular in the “life outlook” dimension. The subtypes distribution was the following: 18.3% inattentive subtype, 8.3% hyperactive/impulsive subtype and 70% combined subtype. The hyperactive/impulsive subtype showed a significantly higher frequency in females, while the inattentive subtype was more frequent in males. Patients with the hyperactive/impulsive subtype showed worse quality of life and more frequent anxiety disorders. **Conclusions.** Considering the different clinical profiles among various subtypes, these data add relevance to subtypes classification of adult ADHD.

KEY WORDS: ADHD, adults, subtypes, comorbidity.

RIASSUNTO. Introduzione. Il disturbo da deficit di attenzione e iperattività (ADHD) è un disturbo a esordio nell'infanzia caratterizzato da deficit dell'attenzione, iperattività e impulsività che può persistere in età adulta, complicandosi con altri disturbi in comorbidità. La presenza di sottotipi nell'ADHD costituisce un fattore di eterogeneità che va riconosciuto in quanto i diversi sottotipi possono associarsi a profili di gravità e comorbidità differenti. **Materiali e metodi.** In questo studio abbiamo valutato le caratteristiche socio-demografiche e cliniche di un gruppo di pazienti adulti con ADHD, nonché le caratteristiche associate ai sottotipi del disturbo. Abbiamo reclutato 60 pazienti di età compresa fra i 18 e i 65 anni (età media 34,1) con diagnosi primaria di ADHD consecutivamente afferiti al Centro Regionale per la diagnosi e il trattamento dell'ADHD a Milano. **Risultati.** Il campione si caratterizza per un'elevata gravità sintomatologica e una bassa qualità di vita, in particolare nella dimensione “prospettive di vita”. La distribuzione in sottotipi è la seguente: 18,3% con sottotipo disattento, 8,3% con sottotipo iperattivo/impulsivo, 70% con sottotipo combinato. I pazienti con sottotipo iperattivo/impulsivo sono più frequentemente di sesso femminile, manifestano una peggiore qualità di vita e una più frequente comorbidità con disturbi d'ansia. **Conclusioni.** Considerando le diversità nelle manifestazioni cliniche associate, i dati presentati confermano l'utilità della classificazione in sottotipi dell'ADHD.

PAROLE CHIAVE: ADHD, adulti, sottotipi, comorbidità.

INTRODUCTION

Attention Deficit Hyperactivity Disorder (ADHD) is a clinical condition with onset in childhood and pre-adolescence characterized by attention deficits, hyperactivity and impulsivity leading to significant impairment in academic/occupational, familiar and social functioning¹. ADHD does not only affect childhood; indeed several studies found that it often persists into adult age²⁻⁵, with prevalence rates ranging between 1% and 5%⁶. The most significant clinical symptoms in adulthood are the difficulties in planning/organizing daily activities, an extreme restlessness and damaging impulsivity,

all of which contribute to the challenge in keeping stable job and relationships⁷. Moreover, adults with ADHD often present with concurrent psychiatric disorders⁸, to the extent that up to two thirds of adults with ADHD show at least one comorbid psychiatric condition⁶. Similarly, ADHD is found in approximately 15% of adults with other psychiatric disorders^{8,9}. Comorbid disorders often mask ADHD core symptoms, with the result that only a minority of these patients are correctly diagnosed and receive appropriate treatment^{10,11}.

In addition to comorbid disorders, the presence of different subtypes of ADHD in adults – hyperactive/impulsive,

ADHD in adults: clinical subtypes and associated characteristics

inattentive and combined subtypes – is a further element of heterogeneity to be recognized in order to orient prognosis and treatment. Recent studies demonstrated an association between the combined subtype and some severity indices of ADHD such as a higher frequency of comorbid disorders¹², substance abuse¹³ and neuroticism¹⁴, underlining the importance of subtype classification for prognostic purposes.

Aim of the present study is to describe the socio-demographic and clinical characteristics of ADHD in a sample of adult patients in charge of a regional reference center, and to evaluate their association with the different subtypes of the disorder.

MATERIALS AND METHODS

Subjects with a primary diagnosis of ADHD¹ aged between 18 and 65 years consecutively referred to the regional center for the diagnosis and treatment of ADHD in adults in Milan were recruited during a period of 2 years.

Patients included in the study were administered the following scales:

- MINI Neuropsychiatric Inventory 5.0.0¹⁵ and SCID-II¹⁶ for the diagnosis of psychiatric disorders;
- Diagnostic Interview for ADHD in adults (DIVA)¹⁷ for the diagnostic evaluation of ADHD subtypes;
- Adult ADHD Self Report scale (ASRS)¹⁸ to evaluate ADHD symptomatology in adulthood;
- Wender Utah ADHD rating scale (WURS)¹⁹ to evaluate ADHD symptomatology in childhood;
- Adult ADHD Quality of Life Questionnaire (AAQoL)²⁰ to evaluate the impact of ADHD symptomatology on quality of life;
- State Trait Anxiety Inventory (STAI-Y)²¹ to evaluate the presence of comorbid anxiety symptoms;
- Beck Depression Inventory II (BDI-II)²² to evaluate the presence of comorbid depressive symptoms.

Statistical analyses

Socio-demographic and clinical characteristics of the sample were described through mean and standard deviation. Socio-demographic characteristics included age, gender, biological or adoptive parents, education, occupation, civil status. Clinical characteristics included ADHD subtype, age of onset, comorbid psychiatric and medical diseases, family history of ADHD and other psychiatric disorders, suicidal ideation or attempts, traumatic episodes in childhood, severity of illness (scores at ASRS, CGI, WURS), quality of life (AAQoL), severity of anxiety symptoms (STAI-Y), and severity of depressive symptoms (BDI-II).

Socio-demographic and clinical characteristics were then compared in the three ADHD subtypes (inattentive, hyperactive/impulsive, combined). Between-group comparison of categorical variables were made with Pearson's Chi-square test. Comparisons of continue variables were performed using ANOVA.

Given the exploratory nature of our study, we decided to use a 2-tailed significance level of $p < .05$. All statistical analyses were performed using the IBM SPSS 20.0 software²³.

RESULTS

Sixty adult patients with ADHD consecutively admitted at the center from June 2015 to June 2017 were recruited for the present study. Thirty-two patients were referred by the Italian Association of Families with ADHD (AIFA), 16 patients self-referred to the center, 10 were referred by their general practitioner, while only 2 were referred by the local Child and Adolescent Mental Health Service. Forty-one (68.3%) were males, mean age was 34.1 ± 12.0 years. Four (6.7%) were adopted during childhood. Mean education was 13.5 ± 3.4 years. The majority were single. All socio-demographic characteristics of the sample are reported in Table 1.

Mean age of onset of the ADHD was 7.5 ± 2.2 years. Thirteen patients reported a family history of ADHD. Thirty-eight were diagnosed with at least one comorbid psychiatric disorder.

The most frequently associated disorders were personality disorders (20 patients), among which the majority was diagnosed with cluster B (17 patients) and the remaining with cluster C personality disorders. The following most frequent comorbidities were affective (16 patients) and anxiety disorders (10 patients). Less frequently comorbid were substance abuse (8 patients) and specific learning disorders such as dyslexia (5 patients) and dyscalculia (1 patient).

Severity of illness was measured referring to both the symptomatology recalled from childhood (WURS) and the current symptomatology (ASRS). Mean WURS score was 46.3 ± 16.2 , mean ASRS score was 41.3 ± 15.4 . Mean number of positive criteria at the ASRS was 12.1 ± 3.7 .

Looking at the severity of associated depressive and anxious symptoms, the mean BDI-II score was 27.4 ± 13.5 and the mean STAI-Y scores were 49.6 ± 14.1 (state anxiety) and 57.3 ± 11.2 (trait anxiety). Finally, the total mean quality of life score (AAQoL) was 44.3 ± 14.8 ; subscale scores were 41.3 ± 18.6 for 'Life productivity', 42.6 ± 25.7 for 'Psychological health', 36.5 ± 14.0 for 'Life outlook' and 53.3 ± 22.9 for 'Relationships'. All clinical characteristics of the sample are reported in Table 2.

Table 1. Socio-demographic characteristics of the sample (N=60).

	N (%) / mean (SD)
Age, years	34.1 (12.0)
Education, years	13.5 (3.4)
Gender	
females	19 (31.7)
males	41 (68.3)
Adopted	4 (6.7)
Occupation	
White collar	22 (36%)
Blue collar	4 (6.7%)
Housewife	1 (1.7%)
Student	16 (26.7%)
Unemployed	17 (28.3%)
Civil status	
Single	43 (71.7)
Married/partner	16 (26.7)
Divorced	1 (1.7)

ADHD subtypes and associated socio-demographic and clinical characteristics

Regarding ADHD subtypes, eleven patients (18.3%) were diagnosed the inattentive type, five (8.3%) the hyperactive/impulsive type and forty-two (70%) the combined type.

The subtypes did not differ in socio-demographic characteristics except for gender: we observed higher prevalence of females in the hyperactive/impulsive in comparison to the inattentive subtype (4 vs. 0 patients, p=0.005) and higher prevalence of males in the inattentive in comparison to the hyperactive/impulsive subtype (11 vs. 1 patient, p=0.005).

Hyperactive/impulsive subtype was more frequently associated with comorbid anxiety disorders (60% hyperactive/impulsive vs. 27% inattentive and 9.5% combined; p=0.011).

Hyperactive/impulsive type was also associated with worse quality of life in the Relationships domain in comparison to the other subtypes (5.00 hyperactive/impulsive vs. 60.43 inattentive and 55.45 combined; p=0.004).

The other variables were not significantly different in the three subtypes. ASRS and WURS total scores tended to be

higher in the combined subtype, but the difference with other subtypes did not reach the statistical significance.

All socio-demographic and clinical characteristics associated with ADHD subtypes are reported in Table 3.

Table 2. Clinical characteristics of the sample (N=60).

	N (%) / media (DS)
Suicidal ideation	6 (10)
Suicidal attempts	2 (3.3)
Traumatic episodes in childhood	8 (13.3)
ADHD familiarity	13 (21.1)
ADHD age of onset	7,5 (2.2)
DIVA	
Inattentive	11 (18.3)
Hyperactive/Impulsive	5 (8.3)
Combined	42 (70.3)
Not determined	2 (3.3)
Comorbidity	38 (63.3%)
Personality disorders	20 (33.3%)
Affective disorders	16 (26.7%)
Anxiety disorders	10 (16.7%)
Substance abuse	8 (13.3%)
SLD	6 (10%)
Psychotic disorders	1 (1.7%)
WURS	46.3 (16.2)
BDI_II	27.4 (13.5)
STAI	I: 49.6 (14.1) II: 57.3 (11.2)
ASRS	
18 criteria:	
Positive criteria	12.1 (3.7)
Total score	41.3 (15.4)
6 criteria:	
Positive criteria	4.6 (1.1)
Total score	15.9 (3.1)
AAQoL	
Total	44.3 (14.8)
Life productivity	41.3 (18.6)
Psychological health	42.6 (25.7)
Life outlook	36.5 (14.0)
Relationships	53.3 (22.9)

Table 3 (part I). Socio-demographic and clinical characteristics of the main subtypes (N=58).

	Inattentive subtype	Iperact/impuls subtype	Combined subtype		
	N=11	N=5	N=42	χ^2 / F	p
Gender					
females	0	4 (80.0%)	14 (33.3%)	10.655	0.005*
males	11 (100%)	1 (20%)	28 (66.7%)		
Adopted	1 (9.1%)	0	3 (7.1%)	0.457	0.796
Age, mean (SD)	33.2 (11.8)	44.4 (20.5)	33.4 (10.7)	1.964	0.150
Civil status				3.293	0.510
Single	10 (90.9%)	4 (80.0%)	27 (64.3%)		
Married/partner	1 (9.1%)	1 (20%)	14 (33.3%)		
Divorced	0	0	1 (2.4%)		
Education, mean (SD)	14.2 (4.7)	12.4 (2.6)	13.6 (3.1)	0.477	0.623
Age of onset, mean (SD)	7.0 (1.9)	9.2 (2.9)	7.4 (2.0)	1.981	0.148
Occupation				2.501	0.962
White collar	3 (27.3%)	3 (60.0%)	16 (38.1%)		
Blue collar	1 (9.1%)	0	3 (7.1%)		
Housewife	0	0	1 (2.4%)		
Student	4 (36.4%)	1 (20.0%)	10 (23.8%)		
Unemployed	3 (27.3%)	1 (20.0%)	12 (23.8%)		
ADHD familiarity	2 (20%)	2 (40%)	8 (20%)	1.066	0.587
Comorbid psychosis	0	0	1 (2.4%)	0.388	0.824
Comorbid affective disorder	4 (36.4%)	3 (60%)	9 (21.4%)	3.851	0.146
Comorbid anxiety disorder	3 (27.3%)	3 (60.0%)	4 (9.5%)	8.936	0.011*
Comorbid SLD	2 (18.2%)	0	4 (9.5%)	1.336	0.513
Comorbid substance abuse	0	0	7 (16.7%)	3.033	0.220
Comorbid personality disorder	2 (18.2%)	0	16 (38.1%)	4.077	0.130
Suicidal ideation	0	1 (20.0%)	5 (11.9%)	1.882	0.390
Suicidal attempts	0	1 (20.0%)	1 (2.4%)	4.651	0.098
Traumatic episodes in childhood	0	0	7 (16.7%)	3.033	0.220

ADHD in adults: clinical subtypes and associated characteristics

Table 3 (part II). Socio-demographic and clinical characteristics of the main subtypes (N=58).

	Inattentive subtype	Iperact/impuls subtype	Combined subtype		
	N=11	N=5	N=42	χ^2 / F	p
WURS	41.80	32.25	49.14	2.582	0.087
ASRS-18 total score	30.00	37.33	45.14	2.648	0.089
ASRS-6 total score	13.50	14.67	16.40	1.785	0.189
ASRS-18 n° positive items	10.40	13.00	12.39	0.642	0.534
ASRS-6 n° positive items	5.00	4.33	4.60	0.316	0.732
AAQoL Total score	47.56	31.08	46.18	1.463	0.248
AAQoL Life productivity	46.35	53.40	39.91	0.812	0.454
AAQoL Psychological health	44.04	8.50	46.91	2.447	0.104
AAQoL Life outlook	33.58	38.42	37.28	0.195	0.824
AAQoL Relationships	60.43	5.00	55.45	6.784	0.004*
BDI_II	16.00	37.50	28.46	1.824	0.195
STAI_I	51.86	66.00	47.58	2.641	0.084
STAI_II	56.57	64.33	56.88	0.614	0.546

DISCUSSION

This study aimed at characterizing a clinical sample of accurately diagnosed adults with ADHD referred to a regional specialist center in Italy. We also aimed at further validating the diagnostic construct of subtypes in our sample.

Several studies demonstrated the usefulness of assessing ADHD subtypes in adults, in particular for their impact on the prognosis. As far back as 20 years ago, a DSM-IV field trial found that 66% of children and adolescents with ADHD displayed the combined subtype²⁴. Our finding that the two thirds of adults with ADHD still present with the combined subtype, in agreement with other studies on adults with ADHD^{12,25-27}, suggests a stability of subtypes over time.

It is noteworthy that almost 90% of patients show inattentive symptoms, confirming the observation by Wilens and colleagues²⁷ that attention deficit tends to be far more prevalent than other symptom domains. On the other hand, the hyperactive/impulsive type appears to be the less represented, characterizing only the 8% of the patients' sample.

Regarding the gender distribution males were over represented, with a 2:1 male/female ratio in line with the 1.6:1 ratio indicated in the DSM-5¹. Although it tends to decrease over time²⁸, a predominance of males is confirmed also in

adult patients with ADHD^{12,29}. In our sample we observed a higher prevalence of females in the hyperactive/impulsive type; this observation is in contrast to several studies that showed higher levels of inattention in females, suggesting that in women the symptomatology is more internalized^{25-27,30}. According to some researchers this would lead to less frequent access to care and therefore to a reduced recognition of ADHD in females, resulting in a biased evidence of males preponderance in ADHD samples^{31,32}. In line with this hypothesis, our finding of hyperactive/impulsive type prevalence in females could mean that women asking for treatment in our center are those with the most evident clinical presentation, characterized by hardly tolerated hyperactivity and impulsive behaviors and for this reason either seeking treatment or being induced to treatment by their family members.

Looking at severity of illness, the mean score obtained at the WURS, administered to adults in order to retroactively report ADHD symptoms in childhood, was 46. The value matches those reported in Korean and Spanish samples^{33,34}, thus demonstrating the high consistency of the scale in different populations. Although the difference did not reach statistical significance, most likely because of the small sample size, we found that WURS scores were higher in the combined type, thus confirming the more severe progression of disease in this subtype. This result is in line with a German study, the only one that examined WURS scores in ADHD subtypes, also finding higher scores in the combined type versus the other subtypes¹⁴.

The ASRS total score, which evaluates the intensity of current symptomatology, was well beyond the cut-off of 32, further validating the diagnosis of ADHD³⁵. As well as with the WURS, although not reaching significance we found higher ASRS scores in the combined type. We also found higher total scores in females than in males; this finding, which confirms the hypothesis that mainly women with more severe ADHD clinical conditions and more externalized symptoms ask for clinical attention, is in accordance with a recent Norwegian study in adults with ADHD that showed greater severity of illness in females³⁶.

In our study the 63% of patients, about two thirds, present at least one comorbid psychiatric disease, thus confirming the high tendency in adults with ADHD to show a broad symptomatology. This phenomenon has been described in several studies, which indicated comorbidity rates between 57% and 92%^{12,25,27}.

Personality disorders appear to be the most frequent ones (33%, most of which cluster B disorders), in accordance with an Italian study indicating that up to 60% of patients with borderline personality disorder reported childhood behaviors and symptoms compatible with a diagnosis of ADHD³⁷.

The comorbidity of ADHD with depressive disorders in our sample is also in line with previous clinical observations reporting depression rates between 18% and 53% in adults with ADHD^{12,38,39}. Comorbid depression implies an increased burden of illness with further deterioration of the quality of life, which is worse in patients with ADHD and depression than in patients with depression alone⁴⁰. The co-occurrence between depressive disorders and ADHD can be explained by shared etiopathogenetic factors, both genetic^{41,42} and related to pregnancy, such as preterm birth, smoking or pathological conditions during pregnancy⁴³. Some authors have proposed that the development of depressive

symptoms represents an adaptive strategy for compensating hyperstimulation through a reduced “hedonic tone”⁴⁴. Moreover, impairment of functioning in all areas and the worsening of the quality of life brought by ADHD can induce secondary demoralization with associated decreased hedonic ability, sleep disorders and irritability^{45,46}.

Looking at the association between ADHD subtypes and comorbid disorders, we found a higher frequency of anxiety disorders (60%) in patients with hyperactive/impulsive ADHD. This results are partially consistent with those by Soendergaard and colleagues, in which 20% of hyperactive/impulsive patients showed anxiety disorders against 7% of patients with the combined subtype¹². However it substantially differs from two US studies in which anxiety disorders were mostly associated with the combined subtype^{27,47}.

Self-reported quality of life is consistent with two studies conducted on a sample of US college students and Spanish adults with ADHD^{34,48}. In both studies particularly low scores were found in the “Life outlook” subscale, while better quality of life was perceived in the “Relationships” dimension, suggesting that subjects perceive the impact of illness mainly in academic/occupational functioning. Our patients with hyperactive/impulsive subtype showed worse quality of interpersonal relationships in comparison to the other subtypes: this appears coherent with the clinical experience, which describes impulsive subjects as complicated ones, who have difficulty in waiting for their turn, often talk over other speakers and occasionally show aggressive behaviors, thus pushing others away.

The main strength of our study is the broad range of scales adopted and administered by expert psychologists in a regional reference center. The main limitation is the small sample size; accordingly, the observed higher frequency of depressive disorders and higher intensity of the depressive symptoms in this subtype as well as the observed higher severity of ADHD symptomatology in the combined subtype could not reach the statistical significance. Another limit of the study is the cross-sectional design, which cannot inform about the effectiveness of pharmacological treatments in the different subtypes.

CONCLUSIONS

We observed an ADHD subtype distribution similar to that evidenced in most previous studies, with a clear preponderance of the combined type and a reduced prevalence of the hyperactive/impulsive type. Besides the combined subtype, which appears to be characterized by higher severity of symptoms, the hyperactive/impulsive subtype also shows severe features such as a higher frequency of comorbid anxiety disorders and the worst quality of life in interpersonal relationships. Finally, the observation that women referred to our center more frequently present with hyperactivity and impulsive behaviors suggests the need for a better screening of symptoms of inattention (difficulties in attention, planning, organizing), which particularly in women are probably not recognized, although they can be associated to poor quality of life and to the development of secondary psychiatric symptoms and disorders^{49,50}.

Conflict of interests: the authors declare no conflict of interests.

REFERENCES

1. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders. Fifth edition (DSM-5). Washington, DC: American Psychiatric Association, 2013.
2. Barkley RA, Fischer M, Smallish L, Fletcher K. The persistence of attention-deficit/hyperactivity disorder into young adulthood as a function of reporting source and definition of disorder. *J Abnorm Psychol* 2002; 111: 279-89.
3. Kessler RC, Adler LA, Barkley R, et al. Patterns and predictors of attention-deficit/hyperactivity disorder persistence into adulthood: results from the national comorbidity survey replication. *Biol Psychiatry* 2005; 57: 1442-51.
4. Caye A, Spadini AV, Karam RG, et al. Predictors of persistence of ADHD into adulthood: a systematic review of the literature and meta-analysis. *Eur Child Adolesc Psychiatry* 2016; 25: 1151-9.
5. Zalsman G, Shilton T. Adult ADHD: A new disease? *Int J Psychiatry Clin Pract* 2016; 20: 70-6.
6. Fayyad J, De Graaf R, Kessler R, et al. Cross-national prevalence and correlates of adult attention-deficit hyperactivity disorder. *Br J Psychiatry* 2007; 190: 402-9.
7. Kooij JJS, Francken MH. Diagnostic Interview for ADHD in adults. DIVA Foundation, 2010, The Netherlands.
8. Deberdt W, Thome J, Lebecq J, et al. Prevalence of ADHD in nonpsychotic adult psychiatric care (ADPSYC): a multinational cross-sectional study in Europe. *BMC Psychiatry* 2015; 15: 242.
9. Pehlivanidis A, Papanikolaou K, Spyropoulou AC, Papadimitriou GN. Comorbid ADHD in adult psychiatric outpatients with depressive or anxiety disorders. *Int J Psychiatry Clin Pract* 2014; 18: 265-71.
10. Gustavsson A, Svensson M, Jacobi F, et al.; CDBE2010 Study Group. Cost of disorders of the brain in Europe 2010. *Eur Neuropsychopharmacol* 2011; 21: 718-79.
11. Wittchen HU, Jacobi F, Rehm J, et al. The size and burden of mental disorders and other disorders of the brain in Europe 2010. *Eur Neuropsychopharmacol* 2011; 21: 655-79.
12. Soendergaard HM, Thomsen PH, Pedersen E, et al. Associations of age, gender, and subtypes with ADHD symptoms and related comorbidity in a Danish sample of clinically referred adults. *J Atten Disord* 2016; 20: 925-33.
13. Liebrez M, Gamma A, Ivanov I, Buadze A, Eich D. Adult attention-deficit/hyperactivity disorder: associations between subtype and lifetime substance use: a clinical study. Version 2. *F1000Res*. 2015; 4: 407.
14. Retz-Junginger P, Rösler M, Giesen LK, Philipp-Wiegmann F, et al. [ADHD: Burden of Disease According to Subtypes in Adult Patients]. *Psychiatr Prax* 2016; 43: 279-82.
15. Sheehan DV, Lecrubier Y, Sheehan KH, et al. The Mini-International Neuropsychiatric Interview (M.I.N.I.): the development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. *J Clin Psychiatry* 1998; 59 Suppl 20: 22-33.
16. First MB, Gibbon M, Spitzer RL, et al. Structured Clinical Interview for DSM-IV Axis II Personality Disorders (SCID-II). Washington, DC: American Psychiatric Association, 1997.
17. Ramos-Quiroga JA, Nasillo V, Richarte V, et al. Criteria and concurrent validity of DIVA 2.0: a semi-structured diagnostic interview for adult ADHD. *J Atten Disord* 2016 Apr 28; pii: 1087054716646451.
18. Kessler RC, Adler L, Ames M, et al. The World Health Organization Adult ADHD Self-Report Scale (ASRS): a short screening scale for use in the general population. *Psychol Med* 2005; 35: 245-56.
19. Ward MF, Wender PH, Reimherr FW. The Wender Utah Rating Scale: an aid in the retrospective diagnosis of childhood attention deficit hyperactivity disorder. *Am J Psychiatry* 1993; 150: 885-90.

ADHD in adults: clinical subtypes and associated characteristics

20. Brod M, Johnston J, Able S, Swindle R. Validation of the adult attention-deficit/hyperactivity disorder quality-of-life Scale (AAQoL): a disease-specific quality-of-life measure. *Qual Life Res* 2006; 15: 117-29.
21. Spielberger CD, Gorsuch RL, Lushene PR, et al. *Manual for the State-Trait Anxiety Inventory*. Palo Alto, CA: Consulting Psychologists Press, 1983.
22. Beck AT, Steer RA, Brown GK. *Manual for the Beck Depression Inventory-II*. San Antonio, TX: Psychological Corporation, 1996.
23. IBM Corp. Released 2011. *IBM SPSS Statistics for Windows, Version 20.0*. Armonk, NY: IBM Corp.
24. Lahey B, Applegate B, Barkley R, et al. DSM-IV field trials for oppositional defiant disorder and conduct disorder in children and adolescents. *Am J Psychiatry* 1994; 151: 1163-72.
25. Sobanski E, Brüggemann D, Alm B, et al. Subtype differences in adults with attention-deficit/hyperactivity disorder (ADHD) with regard to ADHD-symptoms, psychiatric comorbidity and psychosocial adjustment. *Eur Psychiatry* 2008; 23: 142-9.
26. Rasmussen K, Levander S. Untreated ADHD in adults: are there sex differences in symptoms, comorbidity and impairment? *J Atten Disord* 2009; 12: 353-60.
27. Wilens TE, Biederman J, Faraone SV, Martelon M, Westerberg D, Spencer TJ. Presenting ADHD symptoms, subtypes, and comorbid disorders in clinically referred adults with ADHD. *J Clin Psychiatry* 2009; 70: 1557-62.
28. Willcutt EG. The prevalence of DSM-IV attention-deficit/hyperactivity disorder: a meta-analytic review. *Neurotherapeutics* 2012; 9: 490-9.
29. Lin YJ, Lo KW, Yang LK, Gau SS. Validation of DSM-5 age-of-onset criterion of attention deficit/hyperactivity disorder (ADHD) in adults: comparison of life quality, functional impairment, and family function. *Res Dev Disabil* 2015; 47: 48-60.
30. Jacob CP, Romanos J, Dempfle A, et al. Co-morbidity of adult attention-deficit/hyperactivity disorder with focus on personality traits and related disorders in a tertiary referral center. *Eur Arch Psychiatry Clin Neurosci* 2007; 257: 309-17.
31. Biederman J, Faraone SV, Monuteaux MC, Bober M, Cadogen E. Gender effects on attention-deficit/hyperactivity disorder in adults, revisited. *Biol Psychiatry* 2004; 55: 692-700.
32. Rucklidge JJ. Gender differences in attention-deficit/hyperactivity disorder. *Psychiatr Clin North Am* 2010; 33: 357-73.
33. Kim KM, Nam S, Kim SY, et al. Psychopathological, temperamental, and characteristic factors in adults with remaining childhood attention-deficit hyperactivity symptoms. *Int J Psychiatry Clin Pract* 2017; 21: 236-41.
34. Quintero J, Morales I, Vera R, Zuluaga P, Fernández A. The impact of adult ADHD in the quality of life profile. *J Atten Disord* 2017 Oct 1:1087054717733046.
35. Van de Glind G, van den Brink W, Koeter MW, et al; IASP Research Group. Validity of the Adult ADHD Self-Report Scale (ASRS) as a screener for adult ADHD in treatment seeking substance use disorder patients. *Drug Alcohol Depend* 2013; 132: 587-96.
36. Vildalen VU, Brevik EJ, Haavik J, Lundervold AJ. Females with ADHD report more severe symptoms than males on the Adult ADHD Self-Report Scale. *J Atten Disord* 2016 Jul 25. pii: 1087054716659362.
37. Fossati A, Novella L, Donati D, Donini M, Maffei C. History of childhood attention deficit/hyperactivity disorder symptoms and borderline personality disorder: a controlled study. *Compr Psychiatry* 2002; 43: 369-77.
38. Kessler RC, Adler L, Barkley R, et al. The prevalence and correlates of adult ADHD in the United States: results from the National Comorbidity Survey Replication. *Am J Psychiatry* 2006; 163: 716-23.
39. Torgersen T, Gjervan B, Rasmussen K. ADHD in adults: a study of clinical characteristics, impairment and comorbidity. *Nord J Psychiatry* 2006; 60: 38-43.
40. McIntyre RS, Kennedy SH, Soczynska JK, et al. Attention-deficit/hyperactivity disorder in adults with bipolar disorder or major depressive disorder: results from the international mood disorders collaborative project. *Prim Care Companion J Clin Psychiatry* 2010; 12: e1-7.
41. Cross-Disorder Group of the Psychiatric Genomics Consortium. Identification of risk loci with shared effects on five major psychiatric disorders: a genome-wide analysis. *Lancet* 2013; 381: 1371-9.
42. Cross-Disorder Group of the Psychiatric Genomics Consortium. Genetic relationship between five psychiatric disorders estimated from genome-wide SNPs. *Nat Genet* 2013; 45: 984-94.
43. Silva D, Colvin L, Hagemann E, Bower C. Environmental risk factors by gender associated with attention-deficit/hyperactivity disorder. *Pediatrics* 2014; 133: e14-22.
44. Sternat T, Lodzinski A, Katzman MA. Hedonic tone: a bridge between the psychobiology of depression and its comorbidities. *J Depress Anxiety* 2014; 3: 147.
45. McIntosh D, Kutcher S, Binder C, Levitt A, Fallu A, Rosenbluth M. Adult ADHD and comorbid depression: a consensus-derived diagnostic algorithm for ADHD. *Neuropsychiatr Dis Treat* 2009; 5: 137-50.
46. Mao AR, Findling RL. Comorbidities in adult attention-deficit/hyperactivity disorder: a practical guide to diagnosis in primary care. *Postgrad Med* 2014; 126: 42-51.
47. Sprafkin J, Gadow KD, Weiss MD, Schneider J, Nolan EE. Psychiatric comorbidity in ADHD symptom subtypes in clinic and community adults. *J Atten Disord* 2007; 11: 114-24.
48. O'Callaghan P, Sharma D. Severity of symptoms and quality of life in medical students with ADHD. *J Atten Disord* 2014; 18: 654-8.
49. Barkley RA, Brown TE. Unrecognized attention-deficit/hyperactivity disorder in adults presenting with other psychiatric disorders. *CNS Spectr* 2008; 13: 977-84.
50. Migliarese G, Venturi V, Cerveri G, Mencacci C. L'ADHD nell'adulto: misdiagnosi e incidenza della patologia nei servizi. *Psichiatria Oggi* 2015; 28: 16-25.