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A multidimensional approach of impulsivity in adult attention deficit hyperactivity disorder

Régis Lopez^{a,b,c,*}, Yves Dauvilliers^{a,b,c}, Isabelle Jaussent^{b,c}, Joël Billieux^d, Sophie Bayard^{c,e,f}

^a Service de Neurologie, Unité des Troubles du Sommeil, Hôpital Gui-de-Chauliac Montpellier, France

^b Inserm U1061, Montpellier F-34000, France

^c Université Montpellier 1, Montpellier F-34000, France

^d Laboratory for Experimental Psychopathology, Psychological Science Research Institute, Université catholique de Louvain, Louvain-La-Neuve, Belgium

^e EuroMov, Laboratoire Movement to Health (M2H), France

^f Centre d'Investigation clinique, Centre Hospitalier Universitaire Montpellier, France

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ABSTRACT

We aimed to compare adult patients with attention deficit hyperactivity disorder (ADHD) and matched controls on four dimensions of impulsivity (urgency, lack of premeditation, lack of perseverance, and sensation seeking) and to examine the association between impulsivity and ADHD symptoms. The study was conducted on 219 participants: 72 adult ADHD patients and 147 aged and gender matched controls. All participants completed questionnaires measuring the various facets of impulsivity (UPPS Impulsive Behavior Scale), ADHD and depressive symptoms severity. Patients were also assessed for ADHD subtypes, mood disorders, and addictive behaviors. ADHD patients exhibited higher urgency, lower premeditation and lower perseverance in comparison to controls. Lack of perseverance showed the strongest association with ADHD (area under curve=0.95). Patients with combined inattentive and hyperactive/impulsive subtypes reported more frequently substance abuse problems and had higher scores on urgency and sensation seeking dimensions of impulsivity than those with predominantly inattentive subtype. We report for the first time a multidimensional evaluation of impulsivity in adult ADHD patients. The UPPS Impulsive Behavior Scale may constitute a useful screening tool for ADHD in adults and may help to further understanding the psychological mechanisms underlying the differences between the ADHD subgroups.

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1. Introduction

Attention deficit hyperactivity disorder (ADHD) is one of the most prevalent psychiatric disorders with estimated prevalence ranging from 3% to 5% in adults (Faraone and Biederman, 2005; Fayyad et al., 2007), with a 2.99% prevalence in France (Caci et al., 2014). Depending on the number of inattention, hyperactivity or impulsivity symptoms, the diagnostic formulation, as specified by the Diagnostic and Statistical Manual of Mental Disorders 4th edition, text revision (DSM-IV-TR) (American Psychiatric Association, 2000), includes three distinct subtypes: (1) ADHD Predominantly Inattentive (ADHD-PI), (2) ADHD Predominantly Hyperactive/Impulsive, (ADHD-HI) and (3) ADHD Combined (ADHD-C) subtypes. Impulsivity is a core symptom of ADHD. In fact, the DSM-IV-TR proposes three criteria to clinically assess impulsivity in ADHD (i.e., blurts out answers before questions have been completed; fails to await turns in games

or group situations; interrupts or intrudes on others). These criteria that mainly concern the behavioral aspect of impulsivity observed in ADHD children do not cover some specific impulsive symptoms frequently recorded in adults.

Various researchers have attempted to measure impulsivity with self-reported measures. Buss and Plomin (1975) proposed the Emotionality, Activity, Sociability, and Impulsivity Temperament Survey, with subscale such as inhibitory control, sensation seeking. Zuckerman et al. (1964) used two subscales to assess impulsivity (sensation seeking and boredom susceptibility). Patton et al. (1995) measured impulsivity with the Barrat Impulsive Scale including different factors (attentional impulsivity, motor impulsivity, and non-planning impulsivity). The Eysenck impulsivity questionnaire (Eysenck et al., 1985) was designed to assess dysfunctional aspect of impulsivity. Finally, several subscales of the NEO Personality Inventory (Costa et al., 1985) (e.g. impulsiveness, deliberation, and self-discipline) are also dedicated to measure impulsivity as well as the impulsivity scales of Cloninger's Temperament and Character Inventory (Cloninger, 1987).

In the present study, we capitalized on the multi-factorial construct of impulsivity proposed by Whiteside and Lynman in the early 2000s (Whiteside and Lynam, 2001). These authors

* Correspondence to: Service de Neurologie, CHU Montpellier, 80, Avenue #Augustin Fliche, 34295 Montpellier Cedex 5, France. Tel.: +33 4 67 33 74 78; fax: +33 4 67 33 72 85.

E-mail address: r-lopez@chu-montpellier.fr (R. Lopez).

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proposed a model for understanding the personality pathways to impulsive behaviors. They identified four distinct traits associated with impulsive-like behaviors (i.e., urgency, lack of premeditation, lack of perseverance, and sensation seeking) and proposed the UPPS Impulsive Behavior Scale (Whiteside et al., 2005). The early measures of impulsivity reviewed above can be aligned along one of these four dimensions, therefore providing an organized structure of the multi-faceted construct of impulsivity. The first dimension of the UPPS scale, urgency, refers to the tendency to act rashly when faced to intense negative emotions. The second, (lack of) premeditation, is characterized by an inability to consider the potential consequences of one's behavior. The third, (lack of) perseverance, refers to the lack of ability to stay on task while experiencing boredom and/or difficulty in realizing the task. Finally, sensation seeking refers to an individual's need for excitement and stimulation, as well as openness to new experiences.

These four dimensions correlated with and differently predict risky behaviors and clinical symptoms that may be associated with ADHD. Hence urgency may relate to both mood disorders, substance dependence and craving (Billieux et al., 2007; Verdejo-García et al., 2007), pathological gambling (Billieux et al., 2012), cyber addictions (Billieux et al., 2010), or eating disorders (Mobbs et al., 2010); lack of perseverance to procrastination-related behaviors (Dewitte and Schouwenburg, 2002) and risky sexual conducts (Miller and Lynam, 2003); lack of premeditation to antisocial personality, and substance abuse (Miller et al., 2003); and sensation seeking to drug and alcohol use as well as with gambling and delinquent acts (Miller et al., 2003; Smith et al., 2007).

The presence of impulsivity based on the UPPS model was assessed in an isolated children ADHD study showing elevated levels of urgency, lack of perseverance, and lack of premeditation in patients compared to controls, with a large level of urgency found in children with ADHD comorbid with behavioral problems (Miller et al., 2010).

To the best of our knowledge, no similar multidimensional approach of impulsivity was performed in adult ADHD patients. The aims of the present study are: (1) to compare the four dimensions of impulsivity (urgency, lack of premeditation, lack of perseverance, and sensation seeking) in adult ADHD patients in comparison with sex- and age-matched normal controls; (2) to determine the optimally efficient UPPS cut-point to discriminate patients from controls, and (3) to precise the association between UPPS impulsivity facets and ADHD subtypes. Finally, we investigated the relationship between substance abuse and mood disturbances, and ADHD subtypes.

2. Methods

2.1. Patients

Seventy-two adult outpatients with ADHD participated in this study (47 males, 18–56 years). Patients with ADHD were diagnosed by a trained psychiatrist (RL) through a 2 h structured face-to-face clinical interview based on Conners' adult ADHD diagnostic interview for DSM-IV-TR (CAADID) (Conners et al., 2001). The CAADID is a structured diagnostic interview that investigates the DSM-IV criteria of ADHD in childhood and adulthood. For most patients, childhood behavioral disturbances were confirmed by a reliable source such as family or teacher's comments on school reports. No neuropsychological examination was performed.

All patients also underwent the Mini International Neuropsychiatric Interview (MINI) for DSM-IV for past and current major depressive disorder, substance abuse/dependence (Sheehan et al., 1998). Tobacco consumption was also recorded.

All patients were drug-naïve at the time of the participation in the study and were recruited from the Academic Adult Department of Neurology, Hôpital Gui de Chaumié, Montpellier, France.

2.2. Controls

One hundred and forty seven sex- and age-matched subjects (89 males, 18–55 years) were recruited as healthy controls from the general population. All controls

were community-dwelling adults who were recruited by means of advertisements and personal contacts and through snowballing techniques. The eligibility criteria for the group controls included being 18 years or older and French speaking. Each patient was matched by gender, age (\pm one year) to one, two or three controls. All healthy subjects completed the MINI for past and current substance abuse/dependence and were drug-naïve for any psychotropic drug. This study has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) and was approved by the local ethics committee.

2.3. Measures

Conners' Adult ADHD Rating Scale-Self-Report: Short Version (CAARS-S:S) is only a screening tool that consists of 26 items rated from 0 'not at all, never' to 3 'very much, very frequently'. Four subscales each composed of 5 items (A: inattention/memory problems; B: hyperactivity/restlessness; C: impulsivity/emotional lability; and D: problems with self-concept) as well as a 12-item overall ADHD index can be computed. The raw indexes are then transformed into t-scores based on age and sex. High ADHD-index scores are useful for differentiating clinical ADHD from non-clinical individuals (Conners et al., 1999). A T-score threshold of 65 (at least 1.5 SD above population mean) was also used to identify participants with empirically elevated symptom severity.

The 21-item Beck Depression Inventory-II (BDI-II) measures the severity of self-reported depression and addresses all nine of the diagnostic criteria for a major depressive episode that are listed in the DSM-IV-TR. Each symptom is rated on a 4-point scale ranging from 0 to 3, and total scores can range from 0 to 63 (Beck et al., 1961).

The UPPS Impulsive Behavior Scale (UPPS) (Whiteside et al., 2005; Van der Linden et al., 2006) consists of 45 items that evaluate the four different facets of impulsivity, labeled urgency (12 items, e.g., "When I feel bad, I will often do things I later regret in order to make myself feel better now"), (lack of) premeditation (11 items, e.g., "I am a cautious person"), (lack of) perseverance (10 items, e.g., "I concentrate easily"), and sensation seeking (12 items, e.g., "I will try anything once"). Items on the scale are scored from 1="I agree strongly" to 4="I disagree strongly". All items are scored on a Likert scale from 1="I agree strongly" to 4="I disagree strongly", with higher scores reflecting higher impulsivity on the respective facet. The French version of the UPPS scale has similar psychometric properties than the original scale (Van der Linden et al., 2006), and is available in open access on the University of Geneva website (Billieux et al., 2014): http://www.unige.ch/fapse/psychoclinique/UPNC/publications/outils/UPPS_FR.pdf

The UPPS was not neither developed nor used to diagnose ADHD. In the present study, we tested whether the four components of UPPS Impulsive Behavior Scale were associated with ADHD diagnosis and its different subtypes.

2.4. Statistical analysis

The sample is described using percentages for categorical variables (sex, education level, the presence of mood disorders and psychotropic substance consumptions) and medians and ranges for continuous variables (Age, BDI-II, CAARS-S:S ADHD index and UPPS facets) as their distributions were tested with the Shapiro–Wilk statistic and were skewed. Clinical and social characteristics (sex, age, and education level, BDI-II) between cases and controls were compared using Chi-square tests (for categorical variables) or Mann–Whitney tests (for continuous variables). Odds ratios (OR) and their confidence intervals (CI) were estimated using a conditional logistic regression model. Variables associated with ADHD diagnosis in univariate analysis (with $p < 0.15$) were included in logistic regression model to estimate adjusted OR for the relationships between UPPS impulsivity profiles and ADHD diagnosis. A receiver-operating characteristic (ROC) curve was designed to identify a cut-off value of UPPS total score that best predicted the presence of ADHD. The specificity and sensitivity were calculated (95% CI), as well as the positive predictive value (PPV) and the negative predictive value (NPV). The best possible cut point was defined as the highest Youden Index ((specificity+sensitivity) – 1). The analyses of impulsivity profiles among ADHD subtypes were conducted using an unconditional regression logistic model. Significance was set at $p < 0.05$. Statistical analyses were carried out using SAS version 9.2 (SAS Institute, Inc. Cary, North Carolina).

3. Results

3.1. Demographic and clinical characteristics

Table 1 shows demographic data and clinical characteristics of patients and controls. Differences were found for educational level with an overrepresentation of the low educational level in the ADHD group. Patients scored higher than control participants on the CAARS-S:S ADHD index ($p < 0.0001$), with all patients but 15 being above the

Table 1
Demographic and psychometric characteristics of ADHD patients and control participants.

Characteristic	Controls N=147		ADHD N=72		p
	n	%	n	%	
Sex (Male) ^a	89	60.54	47	65.28	0.63
Educational level (in years) ^a					
< 9	14	9.52	15	20.83	0.02
9–12	4	2.72	5	6.94	
> 12	129	87.76	52	72.22	
Variable	Median [min–max]		Median [min–max]		p
Age (in years) ^a	28 [18–55]		29 [18–56]		0.95
BDI-II ^b	3 [0–42]		17.50 [0–46]		< 0.0001
CAARS-S:S ADHD index ^b	44 [31–77]		74.50 [49–90]		< 0.0001

CAARS-S:S: Conners Adult ADHD Rating Scale Self-report: Short Version.

BDI: Beck Depression Inventory.

^a Matching variables.

^b Associated with ADHD in a conditional logistic regression.

Table 2
UPPS impulsivity profiles in ADHD and controls participants.

UPPS impulsivity profile	Controls N=147 Median [min–max] Mean (S.D.)	ADHD N=72 Median [min–max] Mean [S.D.]	OR [95%CI] ^a	p ^a	OR [95%CI] ^b	p ^b
Urgency	27 [12–43] 26.59 (5.98)	34.50 [19–42] 33.81 (5.02)	1.24 [1.15–1.34]	< 0.0001	1.17 [1.08–1.28]	0.0003
Premeditation (lack of)	20 [11–31] 20.58 (4.56)	28 [12–43] 28.33 (6.40)	1.30 [1.19–1.43]	< 0.0001	1.32 [1.17–1.49]	< 0.0001
Perseverance (lack of)	19 [10–35] 18.43 (4.13)	29.50 [20–38] 29.31 (4.17)	2.16 [1.42–3.29]	< 0.0001	2.07 [1.33–3.21]	0.001
Sensation seeking	33 [14–47] 33.14 (7.54)	35 [13–48] 35.21 (8.45)	1.03 [0.99–1.08]	0.18	1.03 [0.97–1.09]	0.32

^a Associated with ADHD in a conditional logistic regression.

^b Associated with ADHD in a conditional logistic regression adjusted for BDI global score.

Table 3
Clinical characteristics and UPPS impulsivity profiles in ADHD patients according to CAARS-S:S ADHD index.

Variable	CAARS-S:S ADHD index < 65 N=15		CAARS-S:S ADHD index ≥ 65 N=57	
	n	%	n	%
Sex (Male)	11	73.33	36	63.16
ADHD-Predominantly inattentive	9	60.00	34	59.66
Variable	Median [min–max]		Median [min–max]	
Age	25.00 [18.00–50.00]		30.00 [18.00–56.00]	
Urgency	30.00 [19.00–40.00]		35.00 [21.00–42.00]	
Premeditation (lack of)	30.00 [12.00–40.00]		28.00 [15.00–33.00]	
Perseverance (lack of)	29.00 [15.00–35.00]		30.00 [21.00–38.00]	
Sensation seeking	34.00 [23.00–48.00]		36.00 [13.00–48.00]	

index of 65. However ADHD diagnosis was confirmed for the whole population of patients by the structured clinical interview.

In the control group, only five subjects (3.4%) had a CAARS-S:S ADHD index above 65. ADHD patients reported higher scores on the BDI-II compared to controls ($p < 0.0001$).

3.2. UPPS profiles

ADHD patients had significantly higher score on urgency ($p < 0.0001$), lack of premeditation ($p < 0.0001$) and lack of perseverance ($p < 0.0001$) in comparison to controls, but without between-group differences for sensation seeking. These results remained unchanged after adjustment for depressive symptoms (Table 2). Among the 15 ADHD patients with a CAARS-S:S ADHD index below 65, both clinical characteristics and UPPS subscores

were similar to other ADHD patients with a CAARS-S:S index above 65 ($n=57$) (Table 3).

To assess the properties of the UPPS scale to identify the presence of ADHD in comparison to normal controls, we further excluded from the analysis the five control subjects with a CAARS-S:S ADHD index above 65. These five patients were all female, had a median age of 30 years [22–50], an educational level above 12 years, a mean BDI at 17 [11–27], and UPPS scale revealed an urgency score at 34 [21–38], lack of premeditation at 19 [17–25], lack of perseverance at 20 [17–35] and sensation seeking at 36 [24–46].

Comparing patients to normal controls with a CAARS-S:S ADHD index below 65, ROC Curves analysis showed that the lack of perseverance had a good prediction for ADHD diagnosis with an area under ROC curve of 0.97. The cut-off value of lack of perseverance best predicting ADHD diagnosis, according to the

maximum of the Youden Index was 24 (sensitivity=92%; specificity=94%). The area under ROC curve for urgency and the lack of premeditation was 0.84 and 0.84, respectively (Table 4).

3.3. ADHD subtype comparisons

According to the structured interview, 44 (61.1%) patients were classified as ADHD-PI (≥ 6 inattentive criteria and < 6 hyperactivity/impulsivity criteria), and 28 (38.9%) as ADHD-C (≥ 6 inattentive criteria and ≥ 6 hyperactivity/impulsivity criteria) (Table 5). None of the patients were diagnosed with predominantly hyperactive/impulsive subtype. Neither gender nor age differences were found between ADHD subtypes. No statistical adjustment was applied for these variables.

Among ADHD patients, 22 (30.6%) had a current major depressive episode at time of the study and 30 (41.7%) had a past history of major depressive disorder. In addition, 16 (22.2%) had a past or current abuse/dependence for alcohol, 27 (37.5%) for cannabis and 17 (23.6%) for cocaine and illicit amphetamines. Comparing ADHD-PI and ADHD-C subgroups, patients with impulsivity (i.e., the latter group) had higher levels of cannabis ($p=0.007$) and amphetamines/cocaine ($p=0.004$) abuse/dependence, without any significant association with either past/actual major depressive disorder or depressive symptomatology (Table 5). Finally patients affected with ADHD-C subtype had higher levels of sensation seeking and urgency compared to ADHD-PI without any association for the lack of premeditation and of perseverance.

4. Discussion

The current study on impulsivity showed in a large population of adult ADHD patients compared to matched control participants that patients had higher urgency, lower premeditation and perse-

verance, the latter being the strongest association with ADHD. We also found that patients with ADHD-C subtype had higher scores than those with ADHD-PI on urgency and sensation seeking dimensions of impulsivity.

In the present study, ADHD patients had higher self-reported impulsivity behaviors compared to controls, results in according to previous studies (Malloy-Diniz et al., 2007; Nandagopal et al., 2011). All patients had inattentive symptoms with or without hyperactive/impulsive associated problems, but none were diagnosed with predominantly hyperactive/impulsive ADHD subtype. Considering the multidimensional approach of impulsivity, we found that urgency, lack of premeditation and lack of perseverance were all associated with ADHD diagnosis. Our results further confirmed those reported in children with ADHD compared to matched-controls (Miller et al., 2010). The area under ROC Curves for urgency, lack of perseverance and premeditation (respectively, 0.84, 0.97 and 0.84) were greater than traditional diagnostic measures like Adult ADHD Self-Report Scale, Wender Utah Rating Scale, Brown Attention Deficit Disorder Scales and CAARS-S:S (Taylor et al., 2011).

Recent advances in the understanding of the mechanisms underlying impulsivity were in line with our current results. Hence, distinct psychological mechanisms underlie the various facets of impulsivity. Specific neuropsychological pathways such as executive functions underlying self-control abilities (e.g., inhibitory control, decision-making, resistance to proactive interference) relate to urgency, lack of premeditation, and lack of perseverance facets (Bechara and Van Der Linden, 2005; Billieux et al., 2010; Dick et al., 2010). In addition, the fourth dimension of impulsivity (sensation seeking) rather depends on motivational mechanisms related to reward sensitivity and approach tendency (Torrubia et al., 2001).

The lack of perseverance was the impulsivity facet the most strongly associated with ADHD. Lack of perseverance is conceptualized as “the ability to remain focused on a task that may be boring or difficult” (Whiteside and Lynam, 2001), a behavior being potentially associated with poor executive performances, and with difficulties in overcoming proactive interference in working memory promoting intrusive thoughts and mind wandering (Gay et al., 2008, 2010). Recent works have documented that adults with ADHD had low resistance to distraction during working memory task implying sustained attention (Marx et al., 2011; Pelletier et al., 2013). An impairment in working memory is the hallmark of the ADHD neuropsychological profile. From a clinical perspective, this

Table 4
Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of UPPS impulsivity profile in ADHD and controls participants.

UPPS impulsivity profile	Threshold	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Urgency	32	70.83	81.69	66.23	84.67
Premeditation (lack of)	25	69.44	80.99	64.94	83.94
Perseverance (lack of)	24	91.67	93.66	88.00	95.68

Table 5
Demographical, clinical and UPPS impulsivity profiles according to ADHD subtypes.

Variable	ADHD- Predominantly Inattentive N=44		ADHD-Combined subtype N=28		p
	n	%	n	%	
Sex (Male)	29	65.91	17	60.71	0.65
Major depressive disorder (present)	16	36.36	6	21.43	0.18
Major depressive disorder (past)	16	36.36	14	50.00	0.25
Tobacco	17	38.64	16	57.14	0.13
Alcohol	11	25.00	5	17.86	0.48
Cannabis	11	25.00	16	57.14	0.007
Amphetamines, cocaine	5	11.36	12	42.86	0.004
Variable	Median [min–max]		Median [min–max]		
Age	29.00 [18.00–56.00]		29.00 [18.00–42.00]		0.21
CAARS-S:S ADHD index	72.50 [53.00–90.00]		80.00 [49.00–90.00]		0.02
BDI-II	22.50 [0.00–46.00]		15.50 [0.00–45.00]		0.16
Urgency	33.00 [19.00–42.00]		36.00 [28.00–41.00]		0.01
Premeditation (lack of)	28.00 [12.00–40.00]		29.00 [15.00–43.00]		0.63
Perseverance (lack of)	29.50 [20.00–38.00]		29.50 [21.00–38.00]		0.89
Sensation seeking	33.00 [13.00–47.00]		41.50 [23.00–48.00]		0.002

CAARS-S:S: Conners Adult ADHD Rating Scale Self-report: Short Version.
BDI: Beck Depression Inventory.

working memory impairment may account for a major part of ADHD inattention diagnosis criteria. Accordingly, we suggest that the strong association observed in the present study between lack of perseverance and ADHD can account for the overrepresentation of patients fulfilling the inattention diagnosis criteria.

Other dimensions of impulsivity (i.e., higher urgency, lower premeditation) were of key interest here as being also associated with ADHD diagnosis. Moreover patients with ADHD-C had higher scores than those with ADHD-PI on urgency and sensation seeking. The latter findings may be emphasized regarding the relationships between impulsivity facets and specific cognitive mechanisms. Urgency has been related to prepotent motor response inhibition deficits (Gay et al., 2008; Rochat et al., 2013) as well as with poor decision making in emotional context (Billieux et al., 2010). Thus in contrast to ADHD-PI, ADHD-C is characterized by resistance to proactive interference deficits resulting in attention deficits, but also by inhibition and decision-making deficits promoting motor activity and substance abuse. Indeed, we found that ADHD-C patients have more problems with abuse/dependence to stimulant illicit drugs and cannabis. Importantly, in addition to urgency dimension substance-abuse could also relate to high sensation seeking being noted at higher level in the ADHD-C subgroup. The presence of either executive control dysfunction or high reward sensitivity reported in these patients may contribute to the ADHD symptomatology and finally to addictive behaviors (Dawe et al., 2004; Bechara and Van Der Linden, 2005).

Our study has both strengths and limitations. Our ADHD patients were all drug-free and diagnosed by a trained clinician (RL) using a 2 h structured face-to-face clinical interview. Control participants were matched for age, and gender; however bias could have been introduced in their selections based on the CAARS-S:S only, i.e., without any structured interview in contrast to ADHD patients. The current study was also limited by a relatively modest sample size which limited the power of the statistical analyses especially for comparisons between ADHD subtypes. We failed to report any association between ADHD diagnosis and sensation seeking as assessed by UPPS. However, patients affected with ADHD-C subtype had higher levels of sensation seeking. The overrepresentation of predominantly inattentive subtype in our population of patients with ADHD may explain the absence of association with sensation seeking. An overrepresentation of predominantly inattentive subtype was found in comparison with other clinical samples of adults with ADHD (Halmoy et al., 2009; Yoon et al., 2013). This finding may relate to the modest sample size and to the recruitment bias (department of neurology in a tertiary hospital). Recent data confirmed this inattentive subtype overrepresentation in adult patients with ADHD ($n=211$; predominantly inattentive 54%, combined 42% and predominantly hyperactive 4%) (personal data).

In our study, diagnosis of patients with ADHD did not include a neuropsychological examination. Working memory, inhibition and other executive functions data might have reinforced our results, which only relied on self-reports. Several studies examined neuropsychological executive dysfunction and working memory in adults with ADHD; however results were mixed (Nigg et al., 2005; Cubillo et al., 2012). Consequently, objective neuropsychological evaluation does not ensure the presence of a reliable ADHD diagnosis. Recent literature also indicated that the neuropsychological profile of adults with ADHD is influenced by associated comorbidities (e.g. addiction, affective disorder and/or learning disabilities) (Crunelle et al., 2013).

Finally, we did not include another "impulsive" control group like alcohol seekers or borderline personality subjects to precise the specificity of the four dimensions of impulsivity reported in adult ADHD patients. To conclude, the present study emphasizes in adult ADHD patients the relevance of investigation of impulsive

symptoms in a multidimensional approach. UPPS Impulsive Behavior Scale may represent a useful self-report tool for screening ADHD in adults, with excellent sensibility and sensitivity. Finally, this scale may help to further understanding the psychological mechanisms underlying the clinical differences between the different subtypes of ADHD.

Declaration of conflicting interests

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