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# A multidimensional approach of impulsivity in adult attention deficit hyperactivity disorder



Régis Lopez<sup>a,b,c,\*</sup>, Yves Dauvilliers<sup>a,b,c</sup>, Isabelle Jausse<sup>b,c</sup>, Joël Billieux<sup>d</sup>, Sophie Bayard<sup>c,e,f</sup>

<sup>a</sup> Service de Neurologie, Unité des Troubles du Sommeil, Hôpital Gui-de-Chauliac Montpellier, France

<sup>b</sup> Inserm U1061, Montpellier F-34000, France

<sup>c</sup> Université Montpellier 1, Montpellier F-34000, France

<sup>d</sup> Laboratory for Experimental Psychopathology, Psychological Science Research Institute, Université catholique de Louvain, Louvain-La-Neuve, Belgium

<sup>e</sup> EuroMov, Laboratoire Movement to Health (M2H), France

<sup>f</sup> 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 Lynman, 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](mailto:r-lopez@chu-montpellier.fr) (R. Lopez).

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 Chauliac, 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](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 + sensibility) – 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

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