Attention Deficit Hyperactivity Disorder among Pathological and At-Risk Gamblers Seeking Treatment: A Hidden Disorder

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Key Words

Pathological gambling · Problem gambling · Attention deficit hyperactivity disorder · Comorbidity · Impulsivity · Urgency

Abstract

Background: The links between attention deficit hyperactivity disorder (ADHD) and substance use disorders have been the subject of numerous papers. Few studies, however, have focused specifically on the relationship between ADHD and behavioural addictions. The aim of this study was to (i) examine the frequency of pathological and at-risk gamblers having a previous history of ADHD; (ii) give details of the characteristics of this association, and (iii) identify risk factors for a history of ADHD. **Methods:** 84 pathological and at-risk gamblers were assessed about socio-demographic, gambling and clinical characteristics. **Results:** Over 25% of the subjects had a history of ADHD. They were characterized as having more severe gambling problems and a higher level of gambling-related cognitions, a higher frequency of psychiatric comorbidities and an elevated risk of suicide. Finally, they differed in their level and type of impulsivity. Among

pathological and at-risk gamblers, a high level of impulsivity, or a history of anxiety disorders, constitute risk factors for a comorbidity with ADHD. **Conclusion:** The association 'ADHD-problem gambling' therefore appears to be not only frequent, but also linked to factors that are known to worsen the prognosis. Researching this relationship is therefore important to adapt strategies for effective future therapy.

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Introduction

Attention deficit hyperactivity disorder (ADHD) is a common and debilitating neurodevelopmental disorder [1]. Beginning in childhood, symptoms appear and intensify with age. In 60–85% of cases the syndrome goes into remission between the ages of 18 and 25. Symptomatic and functional remissions are less common [2]. Hyperactivity and impulsivity tend to decrease, while attention deficit becomes the main symptom of the adult form of ADHD, characterized by emotional and behavioural lability. While ADHD affects between 6 and 9% of children, its prevalence in adults remains at 4–5% [2, 3]. It

seems that 75% of cases are never diagnosed [3] and only 11% of sufferers receive suitable treatment [4].

A recent study stated that in subjects suffering from ADHD, the lifetime prevalence of psychiatric comorbidities was around 80%, and that foremost among these were addictive disorders [5]. The links between ADHD and addictions have been the subject of a large number of studies and it is now well established that the existence of ADHD is a major risk factor for initiation into the potentially dangerous consumption of psychoactive substances as well as for the development of substance use disorders (SUD) [6–8].

Prevalence studies are in agreement about the estimate that around 10–25% of patients seeking treatment for addictions, regardless of the type of addiction, display some kind of hyperactive disorder [4, 5]. Similarly, in adults with ADHD, the risk of also suffering from a SUD is multiplied by 2–4, according to the studies [9–11].

Despite this strong association, habitual underdiagnosis of adult ADHD may be even more prevalent among subjects who also suffer from addictive disorders. Indeed, the common symptoms they share could be attributed to the addictive disorder alone, particularly ‘impulsivity’.

The underestimation of this comorbidity seems to be even more obvious when the addictive disorder concerned is pathological gambling. As a matter of fact, despite the wealth of literature about the links between addictive disorders and ADHD, there is still very little data about ‘pathological gambling-ADHD’ comorbidity. Pathological gambling and ADHD share an essential characteristic, ‘impulsivity’, which suggests a close relationship between the two disorders [12].

The oldest article on this comorbidity dates back almost 25 years [13]. In this study, 14 pathological gamblers and 16 control subjects were assessed retrospectively on the presence of attention deficit disorder in their childhood. The results indicated a strong correlation between pathological gambling and the behaviours linked to attention deficit disorder in childhood. Since then, several studies have confirmed the existence of a link between attention deficit disorder in childhood and later prevalence of pathological gambling [14], or between current attention deficit disorder and pathological gambling [15].

These studies all show a methodological bias. In some cases this is due to a limited sample size (only 14 pathological gamblers were recruited in the Carlton study), or to the retrospective nature of the ADHD assessment, while in others it is a selection bias related to the choice of the population studied. The study by Breyer et al. [16] avoids these pitfalls and is therefore all the more interest-

ing. The authors included subjects taken from the general population, aged between 7 and 11 years, and assessed them again between the ages of 18 and 24. Their results indicated that the subjects suffering from ADHD in childhood and continuing on to early adulthood had a greater risk of suffering from gambling problems.

Our study aimed to measure the frequency of ADHD among subjects seeking treatment for problem gambling (PG) in a specialized centre, and evaluate the characteristics of this comorbidity. In particular, we wanted to verify whether the history of ADHD could help to identify a specific profile of pathological and at-risk gamblers, marked by elements of severity (in terms of socio-demographic variability, PG severity, overall psychopathology severity, degree and type of impulsivity). In a previous work (paper submitted for publication), we have shown that the ‘urgency’ dimension of impulsivity seemed to be the one whose average score came closest to the maximum value and was linked to the severity of pathological gambling. Identification of risk factors for a history of ADHD was also another objective of the study.

Subjects and Methods

Sample

Since September 2008, an exhaustive clinical assessment was carried out systematically on all patients who were starting to be treated for PG in our department (Addictions Care Centre, University Hospital of Nantes, France) prior to the first medical consultation. The objective of this assessment is primarily to assist the psychiatrist with a comprehensive collection of information. Moreover, each subject was asked whether data about them could be used, anonymously, for the sake of research.

This study was conducted with a sample group of consecutive problem gamblers seeking treatment, between April 2009 and September 2010. The main criterion for inclusion was being an ‘at-risk gambler’ or a ‘pathological gambler’. Exclusion criteria included cognitive impairment and difficulties in reading and writing French.

All participants underwent a structured interview and completed self-report questionnaires (see below). To shorten the duration of the assessment at the centre, the patients received the questionnaires beforehand by post and they were asked to complete them at home. If the questionnaires were not completed on the day of the evaluation, the subjects were asked to complete them on the spot immediately. Finally, if they refused, they were asked to complete them at home, and give them to the psychiatrist at the first medical appointment.

Despite several attempts, we were not able to obtain all the completed self-questionnaires for all the subjects.

This study was approved by the local research ethics committee, and all subjects provided written informed consent (no patients refused to give consent).

Measurements

We have chosen the following assessment tools because of their clinical interest on the one hand, their widespread use in many research on the other hand, their validation in French at last. We favoured the use of self-report tools whenever possible, to reduce the duration of the clinical assessment and to promote the acceptance of patients.

Clinical Characteristics

Wender-Utah Rating Scale-Child (WURS-C) [17, 18]. This self-report questionnaire is a tool that has been validated for retrospective evaluation in the adult of ADHD in childhood. Its specificity (89.1%) is good, which limits the risk of giving wrong diagnosis. It is designed to assess ADHD symptoms represented by 25 items on 5-point Likert scales. The authors thought that a score $\geq 46/100$ would allow for the diagnosis to be made.

Adult ADHD Self-Report Scale (ASRS-v1.1) [19, 20]. This self-report scale of adult ADHD is based on the 18 diagnostic criteria of the DSM-IV-TR [21], scored according to their frequency. We used the ASRS screener, which consists of 6 out of these 18 questions that were selected based on stepwise logistic regression to optimize concordance with the clinical classification [19]. According to the ASRS-v1.1 Symptom Checklist instructions, if four or more marks appear in the darkly shaded boxes within Part A, then the patient has symptoms highly consistent with ADHD. Some authors concluded that the ASRS-v1.1 screener was a simple screening tool that was useful and had acceptable validity for the identification of ADHD among addicted patients [22]. In particular, the sensitivity (87.5%) and negative predictive value (95.7%) are good, what is expected of a screening tool. Based on the results of the WURS-C v1.1 and the ASRS screener, it is possible to classify subjects into three groups: 'No history of ADHD' (WURS score < 46), 'ADHD only in childhood' (WURS score ≥ 46 and three or less marks in the darkly shaded boxes within Part A of the ASRS-v1.1), 'ADHD probably persistent at adulthood' (WURS score ≥ 46 and four or more marks in the darkly shaded boxes within Part A of the ASRS-v1.1).

Mini International Neuropsychiatric Interview (MINI) [23]. The fifth version of this structured diagnostic interview allows for the main axis-I psychiatric disorders (and the antisocial personality disorder) of the DSM-IV to be explored in a quick and standardized way.

UPPS Impulsive Behaviour Scale (UPPS) [24, 25]. This is a 45-item self-questionnaire developed by Whiteside et al. [24], with the aim of measuring four distinct pathways to impulsive behaviour: 'Urgency' (tendency to engage in impulsive behaviours under conditions of negative affects), (lack of) 'Premeditation' (difficulty in thinking and reflecting on the consequences of an act before engaging in that act), (lack of) 'Perseverance' (individual's inability to remain focused on a task that may be boring or difficult) and 'Sensation-Seeking' (tendency to enjoy and pursue activities that are exciting and openness to trying new experiences that may or may not be dangerous). We preferred to use that instrument rather than another to measure the impulsivity, because of the dimensions explored and their links with hypothetical motivational and executive processes (difficulty in inhibiting prepotent responses for the 'Urgency' facet, non-optimal decision-making for the 'Premeditation' facet, difficulty in inhibiting intrusive thoughts and memories for the 'Perseverance' facet and

hypersensitivity to positive reinforcement for the 'Sensation-Seeking' facet) [26]. In another work (paper in revision for publication), we showed that there were several clinical profiles as a function of degree and type of impulsivity, assessed by the UPPS, in pathological gamblers.

Gambling Characteristics

Pathological Gambling Section in the DSM-IV [27]. We used the mini screening test for pathological gambling, based on the 10 diagnostic criteria of the DSM-IV, firstly in a categorical approach in order to include participants in the study, and to obtain three categories of problem gamblers: 'at-risk gamblers' (showing 3 or 4 criteria), 'pathological gamblers' (showing 5–7 criteria) and 'severe pathological gamblers' (showing 8–10 criteria). Secondly, we added the positive DSM-IV criteria to get a severity score, in a dimensional approach.

Gambling Attitudes and Beliefs Survey (GABS) [28]. The GABS is a self-rated questionnaire constructed to measure cognitive biases, irrational beliefs, positively valued attitudes to gambling, subjective arousal and gambling behaviours (including within-session chasing). It is composed of 35 items. Respondents are asked to use a 4-point Likert scale to indicate the extent to which they agree with each statement. A high overall score on the GABS indicates a high level of irrational beliefs and attitudes about gambling (mean GABS scores in non-problem gamblers = 76.07 vs. mean GABS scores in problem gamblers and pathological gamblers seeking treatment is 92.11 and 92.65, respectively). We used the GABS because we have validated it in French (paper submitted for publication). The French version showed good psychometric properties.

Other Gambling Characteristics. In the structured interview, we were able to identify the favourite type of game for each subject. Lottery games, slot machines, scratch cards, etc. were thus classified under 'pure chance games', sports or horse-racing bets as well as black jack under 'chance games with pseudo-skills', and finally, poker (including Texas Hold'em poker) under 'chance games with elements of skills', according to the classification proposed by Boutin [29]. This interview also allowed us to define the medium or outlet habitually used for gambling (on- or off-line) and the main stages of the progression of the gambling habit.

Statistical Analysis

A descriptive analysis of the socio-demographic, clinical and gambling characteristics was carried out. Exploratory univariate analyses were performed in the following way. The links between the socio-demographic, clinical and gambling characteristics on the one hand, and the existence or absence of a history of ADHD on the other hand, were studied using Student tests for the quantitative variables and χ^2 or Fisher tests for the qualitative variables.

Thereafter, multivariate analyses were performed using an iterative selection procedure to select the variables that were significantly associated with ADHD, as assessed by the likelihood ratio test (variable candidates for the model were those associated with ADHD in univariate analyses with the $p < 0.20$ criterion and subsequently selected in the model using the $p < 0.05$ criterion). The corresponding odds ratio and associated 95% confidence interval were estimated. Discrimination of the final logistic model which describes its ability to discriminate between the presence and absence of a history of ADHD was assessed using the area

Table 1. Socio-demographic and gambling characteristics of the total sample

	Mean (SD) or percentage
<i>Socio-demographic characteristics (n = 84)</i>	
Male	85.7%
Age, years	41.8 ± 13.5
High-school graduates	53.6%
<i>Gambling characteristics (n = 84 or n = 73)</i>	
Severity of gambling (categorical approach)	
'At-risk gamblers'	15.5%
'Pathological gamblers'	47.6%
'Severe pathological gamblers'	36.9%
Severity of gambling (dimensional approach)	
DSM-IV score	6.6/10 ± 1.9
Severity of gambling-related cognitions (n = 73)	
GABS score	90.2 ± 13.7
Favorite type of game	
'Pure chance games'	40.5%
'Chance games with pseudo-skills'	44%
'Chance games with elements of skills'	15.5%
Usual medium of game	
Off-line	70.2%
On-line	29.8%

under the receiver operating characteristic (ROC) curve and the goodness-of-fit of the model was assessed using the Hosmer-Le-meshow test. The statistical analysis was carried out with SAS 9.1 and R statistical software (SAS Institute, Inc.).

The conditions for validity were verified for all of the tests and the models.

Results

Description of the Sample Group

Socio-Demographic Characteristics. A total of 84 subjects, aged 19–74 years, took part in this study. The sex ratio is clearly in favour of men, and the majority of the sample were high-school graduates. The data relating to socio-demographic characteristics are presented in table 1.

Gambling Characteristics. As shown in table 1, the patients were mostly categorized as 'pathological gamblers', with a mean DSM-IV score of 6.6/10. The level of gambling-related cognitions was relatively high. Most patients were 'off-line' gamblers, with a preference for the 'chance games with pseudo-skills'.

Table 2. Disorders associated with gambling problems in the total sample: ADHD in childhood diagnosed retrospectively using the WURS-C; ADHD persistent in adulthood screened using the ASRS v1.1 screener; other psychiatric and addictive disorders diagnosed by MINI

	Frequency
No history of ADHD (n = 76)	73.7%
History of ADHD (n = 76)	26.3%
ADHD only in childhood	15.8%
ADHD probably persistent at adulthood	10.5%
Mood disorders, current or past (n = 82)	42.7%
Risk of suicide (n = 82)	39.0%
Anxiety disorders, current or past (n = 82)	32.9%
Tobacco dependence, current or past (n = 82)	52.4%
Alcohol use disorders, current or past (n = 82)	41.5%
Other substance use disorders, current or past (n = 82)	29.3%
Antisocial personality disorder (n = 81)	4.9%

Clinical Characteristics. As the results displayed in table 2 indicate, psychiatric disorders associated with PG were common. In particular, 26.3% of subjects have a history of childhood ADHD (15.8% of the sample displayed characteristics of ADHD only in childhood, and 10.5% displayed characteristics of ADHD probably persisting into adulthood). The type and level of 'impulsivity' were evaluated using the UPPS and the average scores were 34.6/48 (SD = 6.4) for the 'urgency' facet, 24.5/44 (SD = 4.9) for the 'lack of premeditation' facet, 21.1/40 (SD = 3.8) for the 'lack of perseverance' facet and 27.9/48 (SD = 7.8) for the 'sensation-seeking' facet (n = 74). Although there was no link between the average score for each of the 4 facets and the subjects' gender, age was negatively correlated with lack of perseverance ($p < 0.05$).

Comparison of 'No History of ADHD' and 'History of ADHD' Subgroups according to Socio-Demographic, Clinical and Gambling Characteristics

On account of the low number of subjects in the subgroups 'ADHD only in childhood' (n = 12) and 'ADHD probably persistent at adulthood' (n = 8), subjects were combined together into a single group of subjects considered as having a 'History of ADHD' (n = 20).

The univariate analysis showed that more than half of the variables were associated with the history of ADHD at the 0.20 level of significance (table 3).

After multivariate analysis, only two variables remained independently associated with ADHD, namely

Table 3. Comparison of 'No history of ADHD' and 'History of ADHD' groups, according to socio-demographic, gambling and clinical variables

	Mean (SD) or percentage		
	'No history of ADHD' (n = 56)	'History of ADHD' (n = 20)	p value
<i>Socio-demographic characteristics (n = 76)</i>			
Male	82.1%	90%	0.499
Age, years	42.2 ± 13.6	43.3 ± 12.3	0.751
High-school graduates	60.7%	35%	0.047
<i>Gambling characteristics (n = 76)</i>			
Severity of gambling (categorical approach)			
'At-risk gamblers'	16.1%	10%	0.164
'Pathological gamblers'	53.6%	35%	
'Severe pathological gamblers'	30.3%	55%	
Severity of gambling (dimensional approach)			
DSM-IV score	6.4 ± 1.7	7.4 ± 2.0	0.041
Severity of gambling-related cognitions (n = 73)			
GABS score	87.2 ± 11.5	98.7 ± 16.3	0.001
Favorite type of game			
'Pure chance games'	37.5%	55%	0.013
'Chance games with pseudo-skills'	50%	15%	
'Chance games with elements of skills'	12.5%	30%	
Usual medium of game			
Off-line	64.3%	80%	0.194
On-line	35.7%	20%	
Gambling history			
Age at initiation to gambling	19.2 ± 10.6	20.6 ± 8.3	0.616
Age at start of gambling problem	35.0 ± 13.3	36.3 ± 12.8	0.724
<i>Psychiatric and addictive comorbidities (MINI) (n = 74)</i>			
Mood disorders, current or past	34.5%	63.2%	0.029
Risk of suicide	34.5%	62.5%	0.029
Anxiety disorders, current or past	23.6%	57.9%	0.005
Tobacco dependence, current or past	45.5%	68.4%	0.084
Alcohol use disorders, current or past	37.6%	63.2%	0.042
Other substance use disorders, current or past	29.1%	31.6%	0.838
Antisocial personality disorder	0%	15.8%	0.014
<i>Impulsivity (UPPS) (n = 74)</i>			
Urgency	32.8 ± 5.3	39.5 ± 6.7	<0.001
Lack of premeditation	24.4 ± 4.3	25.1 ± 6.2	0.563
Lack of perseverance	20.6 ± 3.4	22.5 ± 4.6	0.061
Sensation seeking	27.0 ± 7.9	30.2 ± 7.1	0.111

anxiety disorders (current or past) and urgency, both being identified as risk factors for a history of ADHD among pathological and at-risk gamblers (table 4). The Hosmer-Lemeshow goodness-of-fit test showed that the final model was well calibrated with $p = 0.874$ (a large p value indicating a good model fit). The area under the ROC curve was 0.82, showing that the model discriminated well between patients who had a history of ADHD and those who did not.

Table 4. Multivariate logistic regression analysis (final model) showing factors associated with a 'History of ADHD' (n = 72)

Variables	OR	IC _{95%} (OR)	p value
Anxiety disorders, current or past	4.08	[1.51; 14.48]	0.0294
Urgency	1.20	[1.07; 1.35]	0.0016
OR = Odds Ratio; IC _{95%} = 95% confidence interval.			

Discussion

This cross-sectional study found a high rate of ADHD history among a sample of pathological and at-risk gamblers seeking treatment. Our results therefore fell within the range of values found among populations of subjects seeking treatment for addictions, in particular for SUD [4, 5, 8]. Some authors concluded that the association 'ADHD addiction' is characterized by a greater addiction severity and more comorbid psychopathology [5, 8]. It is clear that pathological gambling and SUD have something else in common, thus supporting the concept of including pathological gambling in the nosographic framework of addictions, as provided for in the DSM-V.

Besides confirming that ADHD is a disorder that is frequently associated with pathological gambling, our work was one of the rare studies that researched this association in a sample group of pathological and at-risk gamblers. It is therefore of particular interest to clinicians dealing with this type of addiction, and should encourage them to look into the presence of ADHD in childhood and verify whether it persisted in adult life. This research must be carried out with great care since our study indicated that ADHD-PG comorbidity seems to be associated with a particular profile, marked by its severity at various levels.

Firstly, we found that the subjects with a history of ADHD had a lower level of education. Many control studies, in which the subjects were matched on IQ, arrived at the conclusion that the existence of ADHD led to difficulties at school (learning difficulties, repeating a grade or grades, leaving school at an early age) [30–32].

Secondly, the subjects with a history of ADHD appeared to have a higher severity of PG and a higher level of cognitive distortions specific to gambling. Gambling-related cognitions are directly linked to the severity of the gambling problem [28] and reflect the failure to understand or take into account the random and uncontrollable nature of chance [33]. They contribute to the persistence of PG.

For many authors, ADHD and PG may share several neurocognitive anomalies, such as impulsivity, lack of inhibition, attention deficit, changes in executive functions, decision-making difficulties, and even disruptions to the processes of reward and punishment [14, 16, 34, 35]. Impulsivity is considered to be a cardinal feature for both ADHD and PG. It is a complex, multidimensional concept. We have previously noted that impulsivity could be described according to 4 dimensions ('Urgency', (lack of) 'Premeditation', (lack of) 'Perseverance' and 'Sensation-

seeking'). Other authors identify 3 core domains: 'Inhibition of pre-potent responses', 'Delay impulsivity' and 'Reflection impulsivity', which refers to impulsivity at the pre-decisional stage [36]. Pathological gamblers show neuropsychological impairments in 'Reflection impulsivity' and 'Risky decision-making', as witnessed by deficits in tasks linked to ventromedial prefrontal cortical dysfunction (the same abnormalities are found in patients with alcohol dependence) [37]. The authors suggested that these impairments could reflect pre-existing vulnerability factors in the addictions. On 'Reflection impulsivity' task, pathological gamblers have a higher rate of errors than healthy controls, but are not different in terms of response time [38]. Little is known about 'Reflection impulsivity' in adult ADHD. The results of a study carried out in children with ADHD showed that they made more poor decisions than healthy controls, but they did not differ in terms of the amount of information they sampled, the degree of uncertainty tolerated prior to making a decision, or the speed at which they made their final choice [36]. It can be assumed that PG and ADHD are perhaps underpinned by the same form of impulsivity. The poor quality of decision-making may be linked to the subjects' inability to use the available information in their advantage [36].

The anomalies previously quoted result in a series of incorrect decision-making, in this case, repeated gambling, despite the long-term damages. Whereas non-problem gamblers tend to decrease their degree of confidence in their gambling-related cognitions over the course of a gambling session and then stop gambling, the opposite is true for pathological gamblers. They continue to gamble because they are convinced that they will win. This shows evidence of their diminished cognitive flexibility [34]. Gambling-related cognitions would also be mediated by brain networks involving ventromedial prefrontal cortex [39]. One might logically presume that when ADHD and PG are both present, the neurocognitive anomalies would be greater than when these disorders are observed separately. This may, in part, explain the difference in GABS scores between the two groups. Subjects demonstrating the ADHD-PG combination seem to prefer pure chance games (notably slot machines in casinos or scratch cards). These are games that do not require total attention.

Thirdly, our study found that ADHD-PG comorbidity tends to be more frequently associated with other psychiatric or addictive comorbidities. These associations are often noted in case of ADHD [4, 40, 41] and PG [42–48]. One might also evoke cumulative risk factors. In our

sample of pathological and at-risk gamblers, anxiety disorders (current or past) represent a risk factor for having a history of ADHD in itself. The links between ADHD and anxiety disorders have been raised in many studies [10, 11], and some authors even included anxiety among the diagnostic criteria for ADHD [49]. It is important to note that the risk of suicide was greater among problem gamblers with a history of ADHD and that this group also had a higher impulsivity level for the 'urgency' dimension. This shows that ADHD-PG comorbidity should be taken seriously in clinical evaluations. Blaszczynski et al. [50] described a subgroup of pathological gamblers characterized by the severity of their impulsivity, which they called 'antisocial impulsivist'. Besides the high level of impulsivity and the history of comorbidities characterized by this dimension (ADHD, SUD and antisocial behaviour), this subtype of problem gamblers suffered from behavioural, emotional and cognitive vulnerabilities [51]. In our study, the subjects with the combination of ADHD and PG seemed to match the subgroup 'antisocial impulsivist problem gamblers'. However, we were surprised to find that the subjects of our group with a history of ADHD did not start to gamble at a younger age. Early gambling constitutes one of the characteristics of the subgroup 'antisocial impulsivist problem gamblers'. One explanation could be the bias of failing memory since subjects were invited to remember and retrace the stages of their gambling habit as part of the assessment procedure.

Finally, we focused our study on impulsivity. The common point between ADHD and PG is, in all likelihood, this personality trait. The two nosographic items effectively make impulsivity a key symptom. Recently, several studies confirmed that the 'urgency' facet of impulsivity played a crucial role in the emergence of problem or maladaptive behaviours such as pathological gambling, compulsive buying and problem use of mobile phones and the internet [52, 53]. The results of our study go beyond this, demonstrating that it is this dimension of urgency that best allows us to differentiate between pathological and at-risk gamblers with or without a history of ADHD. A high score of 'urgency' constitutes a risk factor for having a history of ADHD. As Cyders and Smith [54] put it, 'positive and negative urgency are personality traits that represent individual differences in the tendency to engage in ill-considered, rash action when experiencing intense emotion'. It is widely recognized that for many of the subjects suffering from ADHD, the consumption of psychoactive substances represents an attempt to self-medicate (noting, for example, the attention-promoting effect of tobacco, the sedative effect of alcohol and the

stimulating effect of cocaine). The same process can be seen in gambling. Characterized by a particularly high level of urgency, overcome by their emotions and not knowing how to deal with them, these subjects seem to adopt an adaptation strategy which is effective in the short term, but which interferes with their self-control abilities, ultimately leading to wrong decision-making (getting involved in gambling) and then bringing negative consequences in the long run [52].

These results must be viewed in the context of several limitations. Firstly, this is a cross-sectional study. Supporting causal links between various events is therefore very difficult. Thus, we cannot say whether the presence of ADHD in childhood is responsible for the higher level of urgency, or whether a higher level of urgency, as a characteristic of temperament, is a risk factor for the incidence of ADHD. At any rate, the emergence of gambling problems in later life appears to be related to both the level of urgency and the history of ADHD, and a high level of urgency is identified as a risk factor for having history of ADHD among our patients with PG.

The sample's representativity to other populations is difficult to estimate, and the frequency estimate may reflect only our clinic. The sample size is also relatively small. Thus, the precision of the estimate and the ability to compare it with other clinical samples are limited. But it was however enough to highlight many interesting differences between the 'History of ADHD' and 'No history of ADHD' subgroups. Finally, the sample size also reflects the difficulty to recruit pathological gamblers seeking treatment. It is assumed that only 3–11% of them have access to care [55]. In any case, there is little available literature with a sample of 84 pathological and at-risk gamblers seeking treatment.

One might also criticize the retrospective nature of the ADHD assessment in childhood. Memory failure and biases can lead to false positives as well as false negatives. Also, diagnosis of ADHD in adulthood is merely suspected, in so far as the ASRS-v1.1 screener is only a screening tool and not a diagnostic tool. However, we took the precautions to only include in our group subjects who probably did have ADHD in childhood (according to the diagnostic criteria of the DSM-IV) and who still had characteristic symptoms in adulthood. For future investigations, we will be careful to use an instrument to assert with more certainty the diagnosis of ADHD, such as physician-administered Adult ADHD Clinical Diagnostic Scale (ACDS) [56] or the structured Diagnostic Interview for Adult ADHD (DIVA) [57].

In addition, current and past comorbidities were treated in an identical manner. It would probably be interesting to differentiate them.

Finally, we lacked certain elements of data, mostly regarding the self-report questionnaires. The reason for this would be the procedure for data collection.

In addition to gaining a better understanding of the psychological and neurobiological mechanisms that underlie pathological gambling with respect to the associated characteristics, the most important result of this work is to be able to focus on determining the best strategies for therapy. This raises the question of prescribing specifically listed medication in the treatment of ADHD (primarily methylphenidate or atomoxetine). To date, there is no data available about the benefits of these treatments for patients with ADHD and PG. Methylphenidate, prescribed for patients with ADHD and bulimia nervosa (another form of behavioural addiction) has, in some cases, brought improvement in eating disorder symptoms as well as ADHD symptoms (for a review, see Nazar et al. [58]). Psychostimulants could, indeed, reduce the overall level of impulsivity.

Moreover, specific psychotherapy interventions should be offered. Blaszczynski and Nower [51] advise offering intensive and prolonged cognitive-behavioural type interventions, particularly to 'antisocial impulsivist problem gamblers' in order to control impulsivity. Finally, Cyders and Smith [54] suggest helping subjects with a high level of urgency to 'control' their distress, due to intense emotional states, and not use immediate behavioural reactions as an escape.

Another way is the primary prevention of PG, with the treatment of ADHD in children. A study has shown that intervention-induced reductions in ADHD symptoms at age 9 may protect children from early-onset smoking [59].

In conclusion, ADHD, whether it has improved since childhood or whether it is still persistent in adulthood, is relatively frequent among pathological and at-risk gamblers seeking treatment in a specialized centre. This comorbidity is associated with elements of severity of varying degrees, and it can be assumed that these harm the prognosis. Risk factors for having also a history of ADHD are identified. The promising results of this study encourage us to pursue our efforts in this direction by increasing the sample size in order to compare subjects according to whether ADHD persists into adulthood or not, and to further investigate the most interesting associations in confirmatory analyses.

It would be particularly relevant to add to our clinical assessment tasks to better specify the neurocognitive impairments specifically linked to each subgroup.

Disclosure Statement

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