

## Attention-deficit hyperactivity disorder and addictions (substance and behavioral): Prevalence and characteristics in a multicenter study in France

LUCIA ROMO<sup>1,2\*</sup>, JOEL LADNER<sup>3,4,5</sup>, GAYATRI KOTBAGI<sup>1,6</sup>, YANNICK MORVAN<sup>1,7</sup>, DALIA SALEH<sup>1,8</sup>,  
MARIE PIERRE TAVOLACCI<sup>4,9</sup> and LAURENCE KERN<sup>1,10</sup>

<sup>1</sup>Department of Psychology, University Paris Nanterre EA 4430 CLIPSYD, Nanterre, France

<sup>2</sup>GHT Psychiatrie et Neurosciences, CMME, Centre Hospitalier Sainte Anne, Paris, France

<sup>3</sup>Epidemiology and Health Promotion Hospital, Rouen University Hospital, Rouen, France

<sup>4</sup>INSERM UMR 1073, Normandy University Hospital, Rouen, France

<sup>5</sup>INSERM UMR 1073, School of Medicine, Rouen University, Rouen, France

<sup>6</sup>Department of Sports Sciences, Grenoble Alpes University, EA 3742 SENS, France

<sup>7</sup>INSERM UMR 894, Laboratoire de Physiopathologie des Maladies Psychiatriques, Centre de Psychiatrie et Neurosciences, Sorbonne Paris Cité, Paris Descartes University, Paris, France

<sup>8</sup>Counseling Psychology, Tishreen University, Latakia, Syria

<sup>9</sup>Clinical Investigation Center 1404, Rouen University Hospital, Rouen, France

<sup>10</sup>University Paris Nanterre EA 2931, CeSRM, Nanterre, France

(Received: November 24, 2017; revised manuscript received: April 11, 2018; accepted: May 28, 2018)

**Aim:** The aim of this study is to determine the possible links between attention-deficit hyperactivity disorder (ADHD) and the presence of concomitant addictions with or without substance use in a French student population. **Measures:** A battery of questionnaire measuring socioeconomic characteristics, university curriculum, ADHD (Wender Utah Rating Scale and Adult ADHD Self-Report Scale), substance consumptions (alcohol, tobacco, and cannabis), and behavioral addictions [(eating disorders (SCOFF)), Internet addiction (Internet Addiction Test), food addiction (Yale Food Addiction Scale), compulsive buying (Echeburua's), and problem gambling (The Canadian Problem Gambling Index)] and measures of physical activity (Godin's Leisure Time Exercise Questionnaire) was filled up by university students in Rouen and Nanterre in France. **Results:** A total of 1,517 students were included (472 from Paris Nanterre and 1,042 from Rouen). The mean age was 20.6 years ( $SD = 3.6$ ) and the sex ratio male to female was 0.46. The prevalence of ADHD among the students (current ADHD with a history of ADHD in childhood) was 5.6%. A quarter (25.7%) of students had already repeated their university curriculum, compared to 42.2% among the students with ADHD. Students with possible ADHD had repeated classes more often and believed to have a lower academic level than the students without ADHD. Significant differences were found as students with ADHD were less likely to succeed in their studies (repeated classes more often) than non-ADHD students, and considered their academic level to be lower. They also had significantly higher scores on substance (alcohol, cannabis, and tobacco) as well as behavioral addictions (gambling, compulsive buying disorder, eating disorders, and Internet addiction). **Conclusion:** It seems essential to determine students' problems and propose interventions adapted to students' needs, in order to reduce the negative impact on their future academic and global successes.

**Keywords:** ADHD, behavioral addiction, student, addictions

### INTRODUCTION

Attention-deficit hyperactivity disorder (ADHD) is a chronic disorder characterized by symptoms of inattention, hyperactivity, and impulsivity that fail to match the normal developmental level of the child [*Diagnostic and Statistical Manual of Mental Disorders-5* (DSM-5); [American Psychiatric Association \[APA\], 2013](#)]. Three diagnostic presentations have been cited: (a) combined, (b) inattentive, and (c) hyperactive-impulsive. Diagnosis is based on the presence of symptoms before 12 years old, and in at least two settings (scholar, professional, social, or familial) (DSM-5;

[APA, 2013](#)). Globally, 5% of school-aged children suffer from ADHD (DSM-5; [APA, 2013](#)). Thus, ADHD is one of the most common neurodevelopmental disorders in this population. Furthermore, according to a study performed in 10 countries, 50% of childhood ADHD persists into

\* Corresponding author: Lucia Romo; Université Paris Nanterre UFR SPSE, EA 4430 CLIPSYD, 200 avenue de la république 92001 Nanterre Cedex, Unité Inserm U894 CH Sainte Anne, Paris, France; GHT Psychiatrie et Neurosciences, CMME, Centre Hospitalier Sainte Anne, Paris, France; Phone: +33 6 87 51 12 71; Fax: +33 01 40 97 71 58; E-mail: [lromodes@parisnanterre.fr](mailto:lromodes@parisnanterre.fr)

This is an open-access article distributed under the terms of the [Creative Commons Attribution-NonCommercial 4.0 International License](#), which permits unrestricted use, distribution, and reproduction in any medium for non-commercial purposes, provided the original author and source are credited, a link to the CC License is provided, and changes – if any – are indicated.

adulthood (Lara et al., 2009). Global prevalence of ADHD in adulthood is estimated to be between 1.2% and 7.3% and thus remains important (Fayyad et al., 2007). The prevalence of ADHD in France is estimated at 2.99% (Caci, Morin, & Tran, 2014). These authors found signs of attentional disorders among close relatives requiring a screening and assessment of the relatives.

Studies investigating ADHD and its links to addictions in student populations are rare, despite its deleterious consequences. Moreover, the scarce literature that exists is controversial (Howard & Pritchard, 2017).

A more recent study included 26,744 participants from different countries (Belgium, France, Germany, Italy, Colombia, China, Lebanon, Romania, Brazil, etc.) and found an estimated prevalence of 7.3% for ADHD in France (Fayyad et al., 2016). This prevalence seemed to be much higher compared to other countries. The French sample consisted of 727 participants in the age range of 18–44. In this study, the most comorbid disorders associated with ADHD involved mood disorders, anxiety disorders, eating disorders, and substance-use disorders. ADHD was found to be the temporarily a primary disorder, i.e., the first to appear in the person's life. This emphasizes the importance of early detection and follow-up in adulthood. ADHD is significantly associated with a higher level of negative consequences (e.g., addictive behavior, personal, and social problems; Elmore, Nikolas, & Canu, 2017). This being said, ADHD is an underdiagnosed and very often untreated disorder, with serious consequences. This reinforces the need to develop early detection programs and interventions adapted to the target population (i.e., the students in our case; Fayyad et al., 2016).

It is important to study ADHD in these students, given their psychological distress, low levels of self-esteem, and quality of life that they experience due to ADHD (Nicastro et al., 2017). Considering this fact, it seems necessary to have robust protocols of evaluation of this phenomenon among the students (Tinklenberg, Patel, Gelman, & Albuher, 2017).

As mentioned earlier, ADHD is often associated with comorbid conditions including addictive disorders. Links (Groen, Gaastra, Lewis-Evans, & Tucha, 2013; Starcevic & Khazaal, 2017) between ADHD and addictions, with or without substances use, have been reported in various studies. However, there is no French epidemiologic study in adults concerning the possible link between addictions and ADHD. Although the links between problem gambling and ADHD are the most investigated in literature, Porteret, Bouchez, Baylé, and Varescon (2016) show that people with a possible ADHD also indulged in compulsive buying (23.4%), problem gambling (7.4%), and compulsive sexual behaviors (2.4%). As for Internet addiction, Leménager et al. (2018) found higher prevalence rates of lifetime and current ADHD in addicted group of Internet users than problematic and healthy groups. Moreover, Kim, Lee, Lee, Namkoong, and Jung (2017), in their study, showed that the severity of Internet addiction significantly predicted most dimensions of ADHD symptoms.

A recent French study of prevalence including ADHD individuals, seeking help in addiction treatment centers, showed positive correlations between ADHD and multiple addictions, with or without substances (Fatséas et al., 2016). Thus, ADHD could be associated with other addictive

disorders. Results of a large cross-sectional study among French university students ( $N = 4,816$ ), which used the same questionnaire as ours [Adult ADHD Self-Report Scale (ASRS)], show dose-dependent associations between screen time and self-perceived levels of attention problems and hyperactivity (Montagni, Guichard, & Kurth, 2016).

The aim of this article is to study the possible links between ADHD and addictions with or without substance and other negative consequences. Our objectives are twofold: (a) to highlight the prevalence of ADHD in a student population and determine factors associated to ADHD [gender, body mass index (BMI), financial difficulties, academic field, and estimated academic level] and (b) to highlight the presence of addictive disorders [alcohol, tobacco, cannabis, compulsive buying disorder, problematic Internet use (PIU), pathologic gambling disorder, and eating disorders].

## METHODS

### *Participants and procedure*

A multicenter cross-sectional study was conducted between October 2015 and April 2016 among French college students. This study was conducted in various campuses of two universities in France: Rouen University (Normandy) and Paris Nanterre University (Greater Paris area).

The students were recruited between October 2015 and February 2016, during their medical check-up (Rouen University) or during mandatory lectures (Rouen and Paris Nanterre University). All students filled an anonymous hard-copy self-questionnaire. The questionnaire took approximately 15–20 min to fill.

## MEASURES

### *Socioeconomic characteristics*

The anonymous and confidential questionnaire filled by the university students included sociodemographic characteristics, such as age, gender, job, scholarship status, accommodation status (in a rented accommodation, living with parents, or on campus), marital status, and financial difficulties.

### *University curriculum*

Students were divided into four curriculum groups: (a) the healthcare group (medicine, pharmacy, nursing, physiotherapy, midwifery, and radiology technician studies); (b) the engineering group (engineering schools); (c) the technology group (studies of shorter duration and technical curriculum); and (d) the mixed group universities (literature, sciences, and art).

The academic year of study (1, 2, 3, or more) and the repetition of an academic year were also collected. The estimated academic level (low, middle, and high) was recorded.

### *Attention-deficit hyperactivity disorder (ADHD)*

Wender Utah Rating Scale (WURS-25; Ward, Wender, & Reimherr, 1993) is a 25-item scale used to evaluate the

presence and severity of ADHD symptoms in adults that might have been present during childhood.

The ASRS is a self-report screening scale of ADHD symptoms in adults. It was developed by the World Health Organization and is based on the DSM-IV criteria (ASRS-V1.1; Kessler et al., 2007). For this study, we used the revised 6-item version. Items 1–4 assess the gravity of inattention and items 5 and 6 assess hyperactivity. Students having a score of 46+ on the WURS and a score of 11+ on ASRS were categorized as having a potential ADHD.

#### *Tobacco and cannabis use*

All students reported their tobacco status as current or never smokers. A current smoker is defined as smoking at least one cigarette per day. Cannabis use in the previous year was recorded with a dichotomous “yes/no” question. An occasional cannabis user is defined as someone who has consumed cannabis at least once in the previous 12 months. A regular user is defined as someone who has consumed cannabis at least 10 times in the last month.

#### *Alcohol use*

Students who reported consuming, on a single occasion, five or more alcoholic drinks for males, and four or more alcoholic drinks for females were classified as binge drinkers (Naimi et al., 2003). Binge drinking is defined as either occasional (i.e., once a month or less) or frequent (i.e., more than twice a month).

Alcohol abuse problems were assessed using the French version of the Alcohol Use Disorders Identification Test questionnaire designed to identify hazardous drinkers, harmful drinkers, and drinkers at risk of alcohol dependence (Gache et al., 2005). A score below 8 for males or 7 for females indicates no problems with alcohol. A score between 8 and 12 for males or between 7 and 11 for females indicates hazardous drinking, and a score above 12 for males or 11 for females indicates risk of addiction. The Cronbach’s  $\alpha$  test was .83.

#### *Physical activity*

The Godin’s Leisure Time Questionnaire is based on three open-end questions measuring the frequency (0–7) of strenuous (i.e., jogging), moderate (i.e., fast walking), and light (i.e., easy walking) exercise for sessions more than 15 min during a subject’s leisure time in the preceding week (Godin & Shephard, 1985). The weekly frequencies of strenuous, moderate, and light activities are multiplied by 9, 5, and 3 metabolic equivalents (METs), respectively. Total weekly leisure activity (0–119 MET/min) is calculated by summing the products of the three separate components. Importantly, the score of 9 for strenuous exercise reflects one, 15-min bout per week, whereas the score of 9 for light exercise reflects three, 15-min bouts per week. The health contribution score (i.e., equivalent of time spent in moderate to vigorous physical activity) is calculated from the frequency of strenuous and moderate activities only. The frequencies for strenuous and moderate activities are multiplied by 9 and 5 METs, respectively, and then summed into a health

contribution score (0–98) that reflects MET/min per week. The scores are then classified into three categories: active (substantial benefits; 24 or more MET/min per week), moderately active (some benefits; 14–23 MET/min per week), and insufficiently active (less substantial or low benefits; 13 or fewer MET/min per week).

#### *Eating disorders*

The SCOFF Questionnaire was used to assess eating behaviors. This questionnaire is a screening tool used to identify eating disorders, including anorexia nervosa, and bulimia nervosa in young adults. It includes five dichotomous questions, and 1 point is given for every positive answer. Two or more positive answers indicate possible eating disorders (Morgan, Reid, & Lacey, 1999). The Cronbach’s  $\alpha$  test was .76.

#### *Internet addiction*

The Internet Addiction Test (IAT) is a 20-item scale that evaluates the level of preoccupation, compulsive use of Internet, behavioral problems, emotional changes, and impact of Internet use on an adolescent’s functioning. The IAT includes 20 items rated on a 5-point scale ranging from “very rarely” (one) to “very frequently” (five). The following cut-off scores were adopted in order to assess Internet addictive behavior (IAB): no signs of IAB (score <50), at risk for IAB (50–69), and IAB (70–100). The test had high internal reliability (Cronbach’s  $\alpha$  = .92; Young, 2013).

#### *Food addiction*

The Yale Food Addiction Scale abbreviated version is a 9-item, self-report scale designed by Gearhardt, Corbin, and Brownell (2009) to measure the symptoms of food addiction during the past 12 months. The authors developed this scale to identify people exhibiting signs of addiction regarding specific types of foods (e.g., high fat and sugar) by extrapolating the DSM-IV-TR criteria for substance dependence to the field of eating behaviors (Gearhardt et al., 2009).

#### *Compulsive buying disorder*

The Echeburua’s clinical screen test was used to assess online compulsive buyers. The test was adapted to the Internet use by the author himself. Echeburua’s screener explores loss of control, post-purchase guilt, and negative consequences, such as financial problems or personal relationships. A person is considered to have a compulsive buying disorder, if he or she answers positively to at least two questions on this 5-item screening test (Echeburua, 1999).

#### *Gambling disorder*

The Canadian Problem Gambling Index assesses two domains of problem gambling: the problem gambling behavior and its consequences on the individual or others. The 9-item index is also referred to as the *Problem Gambling Severity Index* (PGSI). Depending on how a respondent

scores on these nine PGSI items, he or she may be classified as being in one of four gambler subtypes: (a) non-problem gambler (score = 0), (b) low-risk gambler (score = 1–2), (c) moderate-risk gambler (score = 3–7), and (d) problem gambler (score >7) (Ferris & Wynne, 2001).

*Statistical analysis*

There were no missing data for the main variables. Qualitative variables and quantitative data were compared using Pearson’s  $\chi^2$  test and Student’s *t*-test, respectively. Variables with  $p < .20$  from the univariate analysis were then introduced into a multivariate model (logistic regression) to determine the factors associated with ADHD adjusted odds ratios (AOR). Their 95% confidence intervals (CI) were calculated. Logistic regressions were separately performed for consumptions and behaviors; the results were adjusted to universities, gender, field, and financial difficulties. Associations were considered statistically significant when  $p < .05$ . The analysis was conducted using Xlstat-Biomed 2016.

*Ethics*

This observational study design was approved by The French Electronic Data Protection Authority (Commission Nationale de l’Informatique et des Libertés) and by Rouen University Hospital’s Institutional Review Board without mandatory informed consent. This research is conducted in accordance with the Declaration of Helsinki.

RESULTS

*Sociodemographic characteristics*

A total of 1,517 students were included in this study (472 students from Paris Nanterre University and 1,042 from Rouen University). Sociodemographic characteristics are presented in Table 1. The mean age was 20.6 years ( $SD = 3.6$ ) and male to female sex ratio was 0.46. The prevalence of ADHD (defined as current ADHD with a history of ADHD in childhood) among the students was 5.6% (95% CI: 4.4%–6.8%);

Table 1. Description of sociodemographic characteristics of students and characteristics associated with ADHD (logistic regression) ( $N = 1,517$ )

	ADHD– ( $N = 1,432$ )	ADHD+ ( $N = 85$ )	Total ( $N = 1,517$ )	<i>p</i>	AOR (95% CI)	<i>p</i>
Age [mean ( <i>SD</i> )]	20.6 (4.0)	20.8 (2.0)	20.6	.63		
Men (%)	31.3	40.0	31.8	.09	1.43 (0.87–2.33)	.15
Universities (%)				<10 <sup>−3</sup>		
Rouen	70.3	54.1	68.9			
Nanterre	29.7	45.9	31.1			
Curriculum (%)				.11		
Technologist	6.3	7.1	6.4		1.70 (0.65–4.47)	.28
Faculty	63.9	72.6	64.3		Ref	
Engineering	17.8	16.7	17.8		1.50 (.69–3.27)	.31
Health	12.0	3.6	11.5		0.46 (0.13–1.67)	.23
Academic year of study (%)				.26		
1	43.2	36.5	42.8			
2	14.0	15.3	14.1			
3	29.7	38.8	30.2			
>3	13.1	9.4	12.9			
Accommodation (%)				.15		
With parents	43.3	43.9	43.3		Ref	
In rented accommodation	39.8	31.7	39.4		1.13 (0.63–2.03)	.69
On campus	16.9	24.4	17.3		1.65 (0.84–3.22)	.14
Living in couples	21.7	25.3	21.9	.44		
Student job holder (%)	21.8	28.0	22.2	.19	1.10 (0.63–1.92)	.73
Financial difficulties (%)	21.7	40.3	22.7	<10 <sup>−3</sup>	2.04 (1.23–3.37)	.006
Body mass index				.12		
Underweight	11.8	10.8	11.7		0.91 (0.42–1.98)	.81
Normal	73.9	73.5	73.9		Ref	
Overweight–obese	14.3	15.7	14.4		0.77 (0.39–1.52)	.45
Repetition of an academic year	24.7	42.2	25.7	<10 <sup>−3</sup>	1.98 (1.19–3.30)	.008
Estimated academic level				<10 <sup>−3</sup>		
Low	11.9	31.3	13.0		2.57 (1.42–4.62)	.002
Middle	39.7	38.6	39.6		Ref	–
High	48.4	30.1	47.4		0.78 (0.44–1.38)	.39

Note. Adjusted on universities. *SD*: standard deviation; ADHD: attention-deficit hyperactivity disorder; AOR: adjusted odds ratio; CI: confidence interval.

7.0% among men and 4.9% among women ( $p = .09$ ). Approximately, 7% of students had a history of ADHD in their childhood (WURS test positive) without having a current ADHD (ASRS).

A quarter of these students (25.7%) had repeated their university curriculum, compared to 42.2% among students with ADHD. Students with possible ADHD had repeated their classes more often and felt they had a lower academic level than those without ADHD (AOR = 1.98; 95% CI: 1.19–3.30 and AOR = 2.57; 95% CI: 1.42–4.62, respectively). They also reported financial difficulties (AOR = 2.04; 95% CI: 1.23–3.37) (Table 1).

*ADHD and substance use*

A total of 26.2% of students were smokers, 4.3% were regular users of cannabis, and 26.2% were casual consumers. Eight percent presented frequent binge drinking and 9.5% were at risk of alcohol addiction. Students with ADHD were more at risk of hazardous and alcohol dependence than the students without ADHD

(AOR = 2.47; 95% CI: 1.26–4.85 and AOR = 4.08; 95% CI: 1.26–4.86, respectively) (Table 2).

*ADHD and other behaviors*

A total of 62.0% of students had sufficient physical activity, whereas 24.2% had insufficient physical activity. Approximately, 18.3% of students suffered from an eating disorder and 4.5% had food addiction. Ten percent of students had behaviors at risk linked to the Internet use or cyber addiction and 13.4% had an online compulsive buying behavior. Around 9.9% of these students showed a pathologic gambling behavior. There were no differences in the different types of gambling whether the students had or did not have a ADHD, except for the online games where students with a possible ADHD played (21.5% vs. 13.0%;  $p = .03$ ) more frequently than the ones without ADHD.

ADHD was significantly associated with a risk of cyber addiction (AOR = 3.87; 95% CI: 2.14–7.01), online compulsive buying (AOR = 3.38; 95% CI: 2.02–5.65), and food addiction (AOR = 2.27; 95% CI: 1.05–4.88) (Table 3).

Table 2. Description of students' consumptions and the consumptions associated with ADHD ( $N = 1,517$ )

	ADHD– ( $N = 1,432$ )	ADHD+ ( $N = 85$ )	Total ( $N = 1,517$ )	$p$	AOR (95% CI)	$p$
Smoker (%)	25.5	38.1	26.2	.01	0.91 (0.52–1.57)	.73
Use of cannabis (%)				$<10^{-3}$		
No	70.6	50.6	69.5		Ref	
Occasional	25.3	40.2	26.2		1.59 (0.92–2.74)	.09
Regular	4.1	8.2	4.3		1.59 (0.61–4.14)	.34
Binge drinking (%)				.003		
Never	46.2	35.4	45.6		Ref	
Occasional	46.2	46.8	46.3		0.75 (0.41–1.39)	.37
Frequent	7.6	17.8	8.1		0.84 (0.33–2.14)	.72
Alcohol abuse problems				$<10^{-3}$		
No	76.3	50.6	74.9		Ref	
Hazardous drinking	15.2	23.5	15.6		2.47 (1.26–4.85)	.009
Risk of addiction	8.5	25.9	9.5		4.08 (1.26–4.86)	$<10^{-3}$

Note. Adjusted on universities, gender, cursus, and financial difficulties. ADHD: attention-deficit hyperactivity disorder; AOR: adjusted odds ratio; CI: confidence interval.

Table 3. Addictive behaviors associated with ADHD ( $N = 1,517$ )

	ADHD– ( $N = 1,432$ )	ADHD+ ( $N = 85$ )	Total ( $N = 1,517$ )	$p$	AOR (95% CI)	$p$
Physical activity (GLTEQ)				.30		
Insufficient	24.0	28.4	24.2			
Moderate	14.1	8.1	13.8			
Active	61.9	63.5	62.0			
Eating disorders (SCOFF)	17.4	32.9	18.3	$<10^{-3}$	1.33 (0.76–2.33)	.31
Internet Addiction Test (IAT)	8.4	34.5	9.9	$<10^{-3}$	3.87 (2.14–7.01)	$<10^{-4}$
Online compulsive buying (Echeburua's test)	11.8	40.0	13.4	$<10^{-3}$	3.38 (2.02–5.65)	$<10^{-4}$
Problem gambling (ICJE)	9.3	20.0	9.9	.001	1.76 (0.94–3.31)	.08
Food addiction (YFAS)	4.0	14.1	4.5	$<10^{-3}$	2.27 (1.05–4.88)	.04

Note. Adjusted on universities, gender, cursus, and financial difficulties. GLTEQ: Godin's Leisure Time Questionnaire; ADHD: attention-deficit hyperactivity disorder; AOR: adjusted odds ratio; CI: confidence interval; ICJE: Indice Canadian du Jeu excessif (Canadian Index of Excessive Gambling); YFAS: Yale Food Addiction Scale.

## DISCUSSION

The aim of this article was to highlight the prevalence of ADHD in a student population, as well as the possible links between the presence of a possible ADHD and the presence of addiction behaviors.

We found that 5.6% of the student population had ADHD. Our results are similar to those of Groen's and Starcevic's meta-analyses (Groen et al., 2013; Starcevic & Khazaal, 2017). According to these studies, ADHD affects 4%–5% of adults. Fayyad et al. (2016) found an ADHD prevalence of 3.4% among individuals aged between 18 and 24 years. This prevalence is slightly lower than ours. It could be due to the tools used to evaluate ADHD. In their study, Fayyad et al. administered the Composite International Diagnostic Interview (CIDI) to their 26,744 participants. We used the WURS-25 and ASRS as fast and self-assessed evaluation methods to evaluate a possible ADHD. Furthermore, 31.8% of our population consisted of men, compared to 68.5% in the study of Fayyad et al. (2016), which can possibly justify the difference in results.

Students with a possible ADHD were significantly more likely to report financial difficulties, repeat an academic year in university, and estimate their academic level to be low. Our results were similar to those found in the literature, since ADHD during childhood is commonly associated with an increased risk of poor academic performances that persist into adulthood (DuPaul, Morgan, Farkas, Hillemeier, & Maczuga, 2016; Fayyad et al., 2016; Tovar, Costes, & Eroukmanoff, 2012).

Concerning substance use, significantly more cannabis users, both occasional and regular, suffered from ADHD. On the other hand, students with ADHD were more prone to have binge drinking and alcohol-related problems (hazardous drinking and risk of addiction). In addition, students with ADHD were also more likely to have high scores on the SCOFF Questionnaire (screening on eating disorders), to report PIU, and to have compulsive buying, gambling problems, and food addictions.

Our results confirm the association between ADHD and polyaddiction found in the literature. In fact, there is a lot of research concerning the positive association between ADHD and gambling (Fatséas et al., 2016; Retz, Ringling, Retz-Junginger, Vogelgesang, & Rösler, 2016; Theule, Hurl, Cheung, Ward, & Henrikson, 2016; Tovar et al., 2012). Nevertheless, certain studies show contradictory evidence with regard to the prevalence of addictions in people with ADHD (Howard & Pritchard, 2017). Our results were not surprising, since ADHD is generally associated with risky behaviors and decision-making problems (Dekkers, Popma, Agelink van Rentergem, Bexkens, & Huizenga, 2016). Furthermore, it seems that gambling issues are stimulated by the predominant impulsivity in individuals with ADHD (Dai, Harrow, Song, Rucklidge, & Grace, 2016; Waluk, Youssef, & Dowling, 2016). According to Abozari et al. (2015), individuals with ADHD who are not treated have more serious problems (Abouzari, Oberg, Gruber, & Tata, 2015), cognitive problems, and excessive use of caffeine (Chamberlain, Derbyshire, Leppink, & Grant, 2015). This should promote an earlier screening and management.

Our results concerning PIU were consistent with those found by Dalbudak et al. (2015). Students with Internet addiction would often suffer from ADHD (Ong & Tan, 2014; Starcevic & Khazaal, 2017; Tateno et al., 2016). It is important to note that high impulsivity was present in the five types of addictions (Walther, Morgenstern, & Hanewinkel, 2012).

Logistic regression throws light upon the possible links between ADHD and behavioral addictions, especially problem gambling. It also allows us to trace a profile: students with a possible ADHD are males, with a high BMI, having financial difficulties, and not so satisfactory academic results.

These results were consistent with those found by Fayyad et al. (2016). Adults having a positive score on ADHD scales were more often male, previously married, with a low educational status. ADHD in adulthood was highly related to comorbidities, such as anxiety, mood changes, substance-use disorders, and professional impairments (days off, impaired cognition, and social interactions). Moreover, links between obesity and food addiction are already hypothesized by Weissenberger et al. (2017).

It is essential to continue the research in student population. In fact, in adults, it is important to consider the self-perception of ADHD, which causes an underestimation of the diagnosis (Cheng et al., 2016) and subsequently no request for help. In another study including 423 young adults, 20.3% showed symptoms of ADHD, but only 7.3% were clinically diagnosed, in spite of Internet dependence. In addition, since the symptoms were subjective, it was possible to have people seeking for treatment without truly suffering from ADHD. They could be seeking for benefits believed to be related to psychotropic drugs (Leppma, Long, Smith, & Lassiter, 2017).

Several limitations deserve consideration while interpreting the findings of this study. Self-questionnaires were only used. This study also only included two universities (medical studies and human sciences); other institutions, such as engineering schools, among others, were not represented. Developmental data were not included and data concerning the potential evolution of ADHD and psychopathologic variables, such as anxiety and depression, were not evaluated. In their cross-national epidemiological study, Fayyad et al. (2016) found that adult ADHD was highly comorbid with DSM-IV/CIDI anxiety, mood, behavior, and substance disorders, and significantly associated with role impairments (days out of role, impaired cognition, and social interactions) when controlling for comorbidities. Treatment seeking was low in all countries and targeted largely to comorbid conditions rather than to ADHD. This study shows that ADHD is prevalent, seriously impairing, and highly comorbid but vastly underrecognized and undertreated across countries and cultures.

Furthermore, as Starcevic and Khazaal (2017) suggest, there is a need to continue to investigate the deep links between ADHD and behavioral addictions. It is equally important to investigate the links between ADHD and other psychopathological behaviors such as anxiety and depression as well as expectancies toward these behaviors such as in the case of alcohol, which can be a mediator in the

maintenance of addictions in individuals with neurodevelopmental disorders (Elmore et al., 2017). The overlapping symptoms between ADHD and comorbid psychopathologies represent challenges for diagnosis and treatment. Guidelines recommend that when ADHD coexists with other psychopathologies in adults, the most impairing condition should generally be treated first (Katzman, Bilkey, Chokka, Fallu, & Klassen, 2017).

## CONCLUSIONS

This study found a 5.6% prevalence of probable ADHD in a student population. These students with ADHD had academic difficulties (which can affect their motivation levels and therefore cause a decline in their self esteem and self efficacy). These students present problems with both substance (alcohol, cannabis, and tobacco) as well as behavioral addictions (problem gambling, compulsive buying, eating disorders, and PIU). At the time, when the number of students in higher education in France is increasing exponentially, where the percentage of failure in the first year is high, it is necessary to recognize and understand the various health issues that these students may experience. We believe that it is the first step in order to propose multidisciplinary health interventions (psychological, physical activity, nutrition, etc.) to these students, so that they have a fair chance at succeeding in their academics as well as achieving a satisfactory level of quality of life.

---

*Funding sources:* This study was self-funded.

*Authors' contribution:* All authors were the investigators in this study. They oversaw the study's concept and design and performed the statistical analysis and initial interpretation of the data. All co-authors participated in collecting data in their respective universities, as well as co-writing and revising all versions of the manuscript.

*Conflict of interest:* The authors declare no conflict of interest.

---

## REFERENCES

- Abouzari, M., Oberg, S., Gruber, A., & Tata, M. (2015). Interactions among attention-deficit hyperactivity disorder (ADHD) and problem gambling in a probabilistic reward-learning task. *Behavioural Brain Research, 291*, 237–243. doi:10.1016/j.bbr.2015.05.041
- American Psychiatric Association [APA]. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: American Psychiatric Association.
- Caci, H. M., Morin, A. J. S., & Tran, A. (2014). Prevalence and correlates of attention deficit hyperactivity disorder in adults from a French community sample. *The Journal of Nervous and Mental Disease, 202*(4), 324–332. doi:10.1097/NMD.0000000000000126
- Chamberlain, S. R., Derbyshire, K., Leppink, E., & Grant, J. E. (2015). Impact of ADHD symptoms on clinical and cognitive aspects of problem gambling. *Comprehensive Psychiatry, 57*, 51–57. doi:10.1016/j.comppsy.2014.10.013
- Cheng, S. H., Lee, C.-T., Chi, M. H., Sun, Z.-J., Chen, P. S., Chang, Y.-F., Yeh, C. B., Yang, Y. K., & Yang, Y.-C. (2016). Factors related to self-reported attention deficit among incoming university students. *Journal of Attention Disorders, 20*(9), 754–762. doi:10.1177/1087054714550335
- Dai, Z., Harrow, S.-E., Song, X., Rucklidge, J. J., & Grace, R. C. (2016). Gambling, delay, and probability discounting in adults with and without ADHD. *Journal of Attention Disorders, 20*(11), 968–978. doi:10.1177/1087054713496461
- Dalbudak, E., Evren, C., Aldemir, S., Taymur, I., Evren, B., & Topcu, M. (2015). The impact of sensation seeking on the relationship between attention deficit/hyperactivity symptoms and severity of Internet addiction risk. *Psychiatry Research, 228*(1), 156–161. doi:10.1016/j.psychres.2015.04.035
- Dekkers, T. J., Popma, A., Agelink van Rentergem, J. A., Bexkens, A., & Huizenga, H. M. (2016). Risky decision making in attention-deficit/hyperactivity disorder: A meta-regression analysis. *Clinical Psychology Review, 45*, 1–16. doi:10.1016/j.cpr.2016.03.001
- DuPaul, G. J., Morgan, P. L., Farkas, G., Hillemeier, M. M., & Maczuga, S. (2016). Academic and social functioning associated with attention-deficit/hyperactivity disorder: Latent class analyses of trajectories from kindergarten to fifth grade. *Journal of Abnormal Child Psychology, 44*(7), 1425–1438. doi:10.1007/s10802-016-0126-z
- Echeburua, E. (1999). *Adicciones sin drogas? Las nuevas adicciones : juego, sexo, comida, compras, trabajo, Internet* [Addiction without substance? The new addictions : Gambling, sex, food addiction, compulsive buying, workaholism, Internet]. Bilbao, Spain: Desclée de Brouwer.
- Elmore, A., Nikolas, M., & Canu, W. (2017). Positive alcohol expectancies mediate associations between ADHD behaviors and alcohol-related problems among college students. *Attention Deficit and Hyperactivity Disorders, 10*(1), 65–75. doi:10.1007/s12402-017-0231-z
- Fatséas, M., Hurmic, H., Serre, F., Debrabant, R., Daulouède, J.-P., Denis, C., & Auriacombe, M. (2016). Addiction severity pattern associated with adult and childhood attention deficit hyperactivity disorder (ADHD) in patients with addictions. *Psychiatry Research, 246*, 656–662. doi:10.1016/j.psychres.2016.10.071
- Fayyad, J., De Graaf, R., Kessler, R., Alonso, J., Angermeyer, M., Demyttenaere, K., De Girolamo, G., Haro, J. M., Karam, E. G., Lara, C., Lépine, J. P., Ormel, J., Posada-Villa, J., Zaslavsky, A. M., & Jin, R. (2007). Cross-national prevalence and correlates of adult attention-deficit hyperactivity disorder. *The British Journal of Psychiatry: The Journal of Mental Science, 190*(5), 402–409. doi:10.1192/bjp.bp.106.034389
- Fayyad, J., Sampson, N. A., Hwang, I., Adamowski, T., Aguilar-Gaxiola, S., Al-Hamzawi, A., Andrade, L. H., Borges, G., de Girolamo, G., Florescu, S., Gureje, O., Haro, J. M., Hu, C., Karam, E. G., Lee, S., Navarro-Mateu, F., O'Neill, S., Pennell, B. E., Piazza, M., Posada-Villa, J., Ten Have, M., Torres, Y., Xavier, M., Zaslavsky, A. M., & Kessler, R. C. (2016). The descriptive epidemiology of DSM-IV adult ADHD in the World Health Organization World Mental Health Surveys. *Attention Deficit and Hyperactivity Disorders, 9*(1), 47–65. doi:10.1007/s12402-016-0208-3

- Ferris, J., & Wynne, H. (2001). *The Canadian Problem Gambling Index*. Ottawa, ON: Canadian Centre on Substance Abuse. Retrieved from <http://ccgr.ca/sites/default/files/CPGI-Final-Report-English.pdf>
- Gache, P., Michaud, P., Landry, U., Accietto, C., Arfaoui, S., Wenger, O., & Daeppen, J.-B. (2005). The Alcohol Use Disorders Identification Test (AUDIT) as a screening tool for excessive drinking in primary care: Reliability and validity of a French version. *Alcoholism, Clinical and Experimental Research*, 29(11), 2001–2007. doi:10.1097/01.alc.0000187034.58955.64
- Gearhardt, A. N., Corbin, W. R., & Brownell, K. D. (2009). Preliminary validation of the Yale Food Addiction Scale. *Appetite*, 52(2), 430–436. doi:10.1016/j.appet.2008.12.003
- Godin, G., & Shephard, R. J. (1985). A simple method to assess exercise behavior in the community. *Canadian Journal of Applied Sport Sciences*, 10(3), 141–146.
- Groen, Y., Gaastra, G. F., Lewis-Evans, B., & Tucha, O. (2013). Risky behavior in gambling tasks in individuals with ADHD – A systematic literature review. *PLoS One*, 8(9), e74909. doi:10.1371/journal.pone.0074909
- Howard, A. L., & Pritchard, T. R. (2017). Heavy drinking in university students with and without attention-deficit/hyperactivity disorder: Contributions of drinking motives and protective behavioral strategies. *Substance Abuse: Research and Treatment*, 11, 1178221817723318. doi:10.1177/1178221817723318
- Katzman, M. A., Bilkey, T. S., Chokka, P. R., Fallu, A., & Klassen, L. J. (2017). Adult ADHD and comorbid disorders: Clinical implications of a dimensional approach. *BMC Psychiatry*, 17(1), 302. doi:10.1186/s12888-017-1463-3
- Kessler, R. C., Adler, L. A., Gruber, M. J., Sarawate, C. A., Spencer, T., & Van Brunt, D. L. (2007). Validity of the World Health Organization Adult ADHD Self-Report Scale (ASRS) screener in a representative sample of health plan members. *International Journal of Methods in Psychiatric Research*, 16(2), 52–65. doi:10.1002/mpr.208
- Kim, D., Lee, D., Lee, J., Namkoong, K., & Jung, Y. C. (2017). Association between childhood and adult attention deficit hyperactivity disorder symptoms in Korean young adults with Internet addiction. *Journal of Behavioral Addictions*, 6(3), 345–353. doi:10.1556/2006.6.2017.044
- Lara, C., Fayyad, J., de Graaf, R., Kessler, R. C., Aguilar-Gaxiola, S., Angermeyer, M., Demyttenaere, K., de Girolamo, G., Haro, J. M., Jin, R., Karam, E. G., Lépine, J. P., Mora, M. E., Ormel, J., Posada-Villa, J., & Sampson, N. (2009). Childhood predictors of adult attention-deficit/hyperactivity disorder: Results from the World Health Organization World Mental Health Survey Initiative. *Biological Psychiatry*, 65(1), 46–54. doi:10.1016/j.biopsych.2008.10.005
- Leménager, T., Hoffmann, S., Dieter, J., Reinhard, I., Mann, K., & Kiefer, F. (2018). The links between healthy, problematic, and addicted Internet use regarding comorbidities and self-concept-related characteristics. *Journal of Behavioral Addictions*, 7(1), 31–43. doi:10.1556/2006.7.2018.13
- Leppma, M., Long, D., Smith, M., & Lassiter, C. (2017). Detecting symptom exaggeration in college students seeking ADHD treatment: Performance validity assessment using the NV-MSVT and IVA-Plus. *Applied Neuropsychology Adult*, 25(3), 210–218. doi:10.1080/23279095.2016.1277723
- Montagni, I., Guichard, E., & Kurth, T. (2016). Association of screen time with self-perceived attention problems and hyperactivity levels in French students: A cross-sectional study. *BMJ Open*, 6(2), e009089. doi:10.1136/bmjopen-2015-009089
- Morgan, J. F., Reid, F., & Lacey, J. H. (1999). The SCOFF Questionnaire: Assessment of a new screening tool for eating disorders. *BMJ*, 319(7223), 1467–1468. doi:10.1136/bmj.319.7223.1467
- Naimi, T. S., Brewer, R. D., Mokdad, A., Denny, C., Serdula, M. K., & Marks, J. S. (2003). Binge drinking among US adults. *JAMA*, 289(1), 70–75. doi:10.1001/jama.289.1.70
- Nicastro, R., Desseilles, M., Prada, P., Weibel, S., Perroud, N., & Gex-Fabry, M. (2017). Subjective distress associated with adult ADHD: Evaluation of a new self-report. *Attention Deficit and Hyperactivity Disorders*, 10(1), 77–86. doi:10.1007/s12402-017-0234-9
- Ong, S. H., & Tan, Y. R. (2014). Internet addiction in young people. *Annals of the Academy of Medicine, Singapore*, 43(7), 378–382.
- Porteret, R., Bouchez, J., Baylé, F. J., & Varescon, I. (2016). L'impulsivité dans le TDAH: Prévalence des troubles du contrôle des impulsions et autres comorbidités, chez 81 adultes présentant un trouble déficit de l'attention/hyperactivité (TDA/H) [ADHD and impulsiveness: Prevalence of impulse control disorders and other comorbidities, in 81 adults with attention deficit/hyperactivity disorder (ADHD)]. *L'Encephale*, 42(2), 130–137. doi:10.1016/j.encep.2015.12.013
- Retz, W., Ringling, J., Retz-Junginger, P., Vogelgesang, M., & Rösler, M. (2016). Association of attention-deficit/hyperactivity disorder with gambling disorder. *Journal of Neural Transmission (Vienna, Austria: 1996)*, 123(8), 1013–1019. doi:10.1007/s00702-016-1566-x
- Starcevic, V., & Khazaal, Y. (2017). Relationships between behavioural addictions and psychiatric disorders: What is known and what is yet to be learned? *Frontiers in Psychiatry*, 8, 53. doi:10.3389/fpsy.2017.00053
- Tateno, M., Teo, A. R., Shirasaka, T., Tayama, M., Watabe, M., & Kato, T. A. (2016). Internet addiction and self-evaluated attention-deficit hyperactivity disorder traits among Japanese college students. *Psychiatry and Clinical Neurosciences*, 70(12), 567–572. doi:10.1111/pcn.12454
- Theule, J., Hurl, K. E., Cheung, K., Ward, M., & Henrikson, B. (2016). Exploring the relationships between problem gambling and ADHD: A meta-analysis. *Journal of Attention Disorders*. Advance online publication. doi:10.1177/1087054715626512
- Tinklenberg, J., Patel, B., Gelman, K., & Albucher, R. (2017). Assessing adult attention deficit hyperactivity disorder (ADHD) in the university setting. *Journal of American College Health*, 66(2), 141–144. doi:10.1080/07448481.2017.1389733
- Tovar, M. L., Costes, J. M., & Eroukmanoff, V. (2012). Les jeux d'argent et de hasard sur Internet en France en 2012 [Online gambling in France in 2012]. *OFDT*, 85, 1–6.
- Walther, B., Morgenstern, M., & Hanewinkel, R. (2012). Co-occurrence of addictive behaviours: Personality factors related to substance use, gambling and computer gaming. *European Addiction Research*, 18(4), 167–174. doi:10.1159/000335662



- Waluk, O. R., Youssef, G. J., & Dowling, N. A. (2016). The relationship between problem gambling and attention deficit hyperactivity disorder. *Journal of Gambling Studies, 32*(2), 591–604. doi:[10.1007/s10899-015-9564-8](https://doi.org/10.1007/s10899-015-9564-8)
- Ward, M. F., Wender, P. H., & Reimherr, F. W. (1993). The Wender Utah Rating Scale: An aid in the retrospective diagnosis of childhood attention deficit hyperactivity disorder. *The American Journal of Psychiatry, 150*(6), 885–890. doi:[10.1176/ajp.150.6.885](https://doi.org/10.1176/ajp.150.6.885)
- Weissenberger, S., Ptacek, R., Klicperova-Baker, M., Erman, A., Schonova, K., Raboch, J., & Goetz, M. (2017). ADHD, lifestyles and comorbidities: A call for an holistic perspective – From medical to societal intervening factors. *Frontiers in Psychology, 8*, 454. doi:[10.3389/fpsyg.2017.00454](https://doi.org/10.3389/fpsyg.2017.00454)
- Young, K. S. (2013). Treatment outcomes using CBT-IA with Internet-addicted patients. *Journal of Behavioral Addictions, 2*(4), 209–215. doi:[10.1556/JBA.2.2013.4.3](https://doi.org/10.1556/JBA.2.2013.4.3)