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Journal of Clinical & Developmental PsychologyJournal homepage: <http://cab.unime.it/journals/index.php/JCDP/index>**Problematic Internet Use and sensation seeking in adults with ADHD symptoms**Benedetto L.^{1*} , Ingrassia M.¹ ¹ Department of Experimental and Clinical Medicine, University of Messina, Via Bivona, 98122, Messina, Italy

ABSTRACT

Background and aims: Sensation seeking (SS) is a motivational disposition that can drive the person to seek several experiences and stimulation, and avoid rest through activities such as playing computer or video games. It was assumed that SS could play a significant role in Problematic Internet Use (PIU), but this relation is controversial. More recently SS, together with hyperactivity and inattention in ADHD disorder, was supposed as self-regulatory attempt to create a stimulating environment in order to stabilize vigilance and avoid monotonous situations. Since the literature shows a significant incidence of Internet Addiction in ADHD, the aim of the study was to explore how these two risk factors, SS and ADHD symptoms, influence the occurrence of PIU in a community sample of adults. *Method:* A total of 147 voluntary participants (46% males, age range 18-60 years old) completed the *Young's Internet Addiction Test* (IAT) for identifying normal or problematic users, the *Need for Stimulation* test for measuring SS, and the *Adult ADHD Self-Report Scale* (ASRS-v1.1) Symptom Checklist.

Results: The findings revealed that adults with high-ADHD symptoms resulted problematic users in higher percentage, reported significantly higher scores in SS and IAT questionnaires, with interference in many aspects of their life. In a regression procedure ADHD symptoms and SS explained 32.8% of variance as predictors of PIU.

Discussion and Conclusion: These preliminary findings support the role of ADHD and SS as risk factors in PIU, but they also suggest further studies for comprehending the interactions between ADHD clinical characteristics and Internet overuse.

Keywords: *Problematic Internet Use, Sensation Seeking; ADHD symptoms; Adults.*

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Introduction

Due to the increased diffusion of Internet accessibility and services over the last decade, a parallel growing of concern for the negative consequences associated to Internet overuse was among researchers and clinicians (Anderson, Steen, & Stavropoulos, 2016).

According to Weinstein, Feder, Rosenberg, and Dannon (2014) Problematic Internet Use (PIU) “is characterized by excessive or poorly controlled preoccupations, urges, or behaviors regarding Internet use that lead to impairment or distress” (p. 99). PIU can interfere in many areas of person’s daily life, including academic or vocational performance, social participation, family routine and relationships, mood regulation, health habits to the point to determine behavioral patterns similar to addiction (Shapira *et al.*, 2003). However, there is still a significant controversy among scholars over the terms to describe these problematic patterns, and the inclusion of Internet addiction among the behavioral dependences remains a complex and open question (*see*, for example, Weinstein & Lejoyeux, 2010).

In Europe, prevalence rate for PIU ranges from 3% in Germany (Wölfling, Fauth-Bühler, Leménager, Mörsen, & Mann, 2009) to 18.3% in the United Kingdom (Niemz, Griffiths, & Banyard, 2005), with a global prevalence of 4.4% among adolescents and youth population (Durkee *et al.*, 2014). In Italy, studies report an incidence equal to 5-5.4% for college students and adults (Pallanti, Bernardi, & Quercioli, 2006; Poli & Agrimi, 2012), whereas the prevalence among adolescents (36.7%) seems more a preoccupant phenomenon considering the data reported by Milani, Osualdella, and Di Blasio (2009). This variability in percentages of prevalence across the studies may be attributed to variations in definitions of PIU (or Internet Addiction), diagnostic instruments, as well as accessibility of the Internet services in different countries (Weinstein & Lejoyeux, 2010). However, overall these data are in line with the trend observed in recent reviews and meta-analysis, that is, the increased risk of PIU among adolescents who had grown up in an environmental with a well-developed Internet, but it must be remember that most data derive from studies conducted in Asia, less in European countries (Ho *et al.*, 2014; Koet *et al.*, 2012).

Several studies have investigated the various individual factors associated to an excessive Internet use. Particularly, the role of poor self-regulation capacities (*e.g.*, high impulsivity and sensation seeking, low inhibitory control, reinforcement sensibility, poor decision-making abilities) have recently received attention as critical factors potentially implicated in the development of PIU (Billieux & Van der Linden, 2012). Young (1998), among the firsts in defining the clinical characteristics of the Internet dependence, stressed the inability to control use of the Internet. Impulsivity plays a critical role in many theoretical models of addictive behaviors and high levels of

self-reported impulsivity have been found to be positively related with excessive computer game playing and excessive Internet use in general (Meerkerket *et al.*, 2010).

Other studies have investigated the co-morbidity with some psychiatric conditions potentially implicated in Internet addiction. Ho and colleagues (2014) in a meta-analysis found significant positive association with alcohol abuse, ADHD, depression and anxiety. Bernardi and Pallanti (2009) found that 14% of adults with Internet addiction were diagnosed with ADHD. Ding and colleagues (2014) confirmed a significant positive association between ADHD symptoms and severity of the addiction, addressing the deficits in inhibitory control that may be difficult to manage their online activities in people with ADHD (*see also* Wang *et al.*, 2017). Likewise, in a recent study from Germany on personality factors associated to Internet excessive use in a non-clinical sample, Sariyska and colleagues (2015) found a positive association with depression and ADHD symptoms and an increased risk for PIU in men compared to women. Increased risk for compulsive Internet use in men, together with a positive association with depression symptoms both in men and women, were found by Ingrassia, Taormina, and Benedetto (2017) in an Italian study with a community-based sample of adults.

Sensation seeking is another automatic aspects of self-regulation that might play a role in Internet addicted behaviors (Billieux & Van der Linden, 2012). Sensation seeking is defined as the tendency to seek various novel, complex and arousing sensory stimulations, and openness toward new experiences (Zuckerman, 1994). It was suggested that individual with high tendency for seeking sensation eagerly act impulsively to experience intense and different sensations (Arnett, 1992). As Siyez (2014) stated, these persons “fail to cope with boredom” and they seem to need greater external stimulation. Likewise, Shaffer (1996) stated that the Internet is a means of seeking sensation. It was also observed that the overwhelming amount of multimodal stimuli provided by Internet, the immediacy with which they change and the resulting state of excitement perfectly meet this need for novelty and excitation. This would explain why the sensation seeking is a predisposing factor for the development of technological dependencies, even if this relation is controversial (Rahmani & Lavasani, 2011). Some studies (Lin & Tsai, 2002, for example) showed that Internet dependents obtained significantly higher scores on overall sensation seeking than Internet non-dependents; on the contrary, findings of Lavin and colleagues (1999) showed that Internet dependents scored significantly lower than non-dependents in terms of overall sensation seeking, which has contradiction with previous results. More recently, it has been supposed that sensation seeking, together with hyperactivity and attention deficits observed in ADHD disorder, can be interpreted as a self-regulatory attempt to create a stimulating environment in order to stabilize vigilance and avoid monotonous situations (Geissler *et al.*, 2014).

Previous studies found a relationship between PIU and both sensation seeking and attention deficit/hyperactivity symptoms levels if they were considered separately. Therefore, the purpose of this study is to investigate how the following two types of risk factors, sensation seeking and high ADHD symptoms, influence the development of PIU in a community sample of adults.

The hypothesis to test are that adults with higher ADHD symptoms a) are more active online (duration and frequency of connections) and b) are more at risk of problematic or dependent Internet use than adults with lower levels of ADHD symptoms; and c) they also show a great motivational disposition to sensation seeking. Finally, in line with the literature, the expectation is that we observe a higher incidence of problematic Internet in males than females.

Methods

Participants and Procedures

A community-based sample of 147 adults, 46% men ($n=67$) and 54% women ($n=80$), took part in the study. Mean ages (and *SDs*) were 32.4 (11.6) and 33.4 (11.5) years, for males and females, respectively. Participants were recruited on a voluntary basis. Only Internet users, selected by means of a filter question (“Have you an Internet connection?”) received the self-report questionnaires to be completed. None has a previous diagnosis of ADHD, but no other data were available on the clinical history of these individuals.

The sample was dichotomized into a high-ADHD-symptom group ($n = 27$; men = 15, 55.6% within group) and a low-ADHD-symptom group ($n = 120$; men = 52, 43.3% within group) using the cut-off score of the ASRS-v1.1, a validated check-list designed to estimate the presence and severity of ADHD symptoms in adults (*see below*). Together with the ASRS-v1.1 check-list, the participants were administered other two questionnaires, which took a total of approximately 20-30 minutes to be completed.

Measures

ADHD symptoms: The *Adult ADHD Self-Report Scale (ASRS-v1.1) Symptom Checklist* (Kessler *et al.*, 2005) is a screen tool based on the *Diagnostic and Statistical Manual of Mental Disorders (IVth ed.-Text Revision; DSM-IV-TR; American Psychiatric Association, 2000)*. This self-report instrument is composed by eighteen items: six of them (Part A) were found to be the most predictive of symptoms consistent with ADHD. A cut-off of 4 or more items marked in the darkly shaded boxes within Part A was employed in this study for assigning participants at the high-ADHD-symptom group.

The check-list, with scoring instructions, is available at https://med.nyu.edu/psych/sites/default/files/psych/psych_adhd_checklist_0.pdf.

Internet Problematic Use: The Italian version of the *Internet Addiction Test* (IAT; Young, 1998; Ferraro *et al.*, 2007) was used to measure levels of Internet use during the previous month. IAT is composed by 20 items rated on a five point Likert scale assessing six crucial aspects of the Internet Addiction Disorder: (1) compromised quality of social life; (2) compromised quality of individual life; (3) compensatory use of the Internet; (4) compromised academic/working career; (5) compromised time control and (6) excitatory usage of the Internet. The higher the score, the greater are the problems caused by Internet usage. IAT total scores of 20-49 indicate no problem in Internet use, 50 or above were considered to indicate lack of control or problematic Internet use, while scores of 80 or above indicate a severe Internet addiction. These *cut-off* scores were used consistently with previous research on the psychometric properties of the Italian version of the IAT (Ferraro *et al.*, 2007; Milani *et al.*, 2009; Schimmenti *et al.*, 2012). The Cronbach's alpha was equal to .92 in this sample.

Sensation Seeking: The *Need for Stimulation* (NS) is a subscale of the *Need Inventory of Sensation Seeking* (Roth & Hammelstein, 2012) that assesses the motivational disposition to seek varied and novel experiences. NS is composed by 11 items (e.g., "I know the feeling of wanting to be pepped up and stimulated somehow") and respondent is required to rate how often he/she have felt this way in the past 6 months on a 5-point Likert scale (1 = *almost never*, 5 = *almost always*). The Italian version used here, already employed in a previous research with adolescents (Benedetto, Gullotta, & Ingrassia, 2015), has been adapted with the permission of the authors by two psychology researchers who independently translated the items and compared the two versions. The reliability (Cronbach's α) for this sample was equal to .88.

Demographic data: The instruments tool was completed by a list of items collecting social-demographic data (age and gender), a filter question to select Internet users ("Have you an Internet connection?"), frequency of connections (4 = "all days"; 3 = "2-3 times a week"; 2 = "1 time a week"; 1 = "1-2 times a month"), average time spent at each link (from 1 = "less than 10 minutes" to 7 = "all day long"), activities for connecting (studying, chatting, social networking, etc.) and relative frequency (from 1 = "almost never" to 5 = "very often").

Statistical and Data analysis

Descriptive statistics were calculated for all the variables under investigation: IAT scores, time spent e frequency of Internet activity, NS and ADHD-symptom levels. Chi-square tested the differences of proportion for PIU as function of ADHD-symptom levels. The Mann-Whitney's

*U*test served to compare the group measures of Internet activity, SS, and IAT. Then Pearson's correlations were run for testing the associations between the metric variables under investigation. Finally, a stepwise multiple regression analysis was conducted for testing if NS, ADHD symptoms, gender, and age were predictors of PIU. All analyses were performed with the SPSS for Windows 15.0.

Results

Participants with low-ADHD symptoms were 120 (52 men, 43.3%), those with high-ADHD symptoms 27 (15 men, 55.6%). Figure 1 reports percentage of normal and problematic Internet users as a function of the levels of the ADHD symptoms.

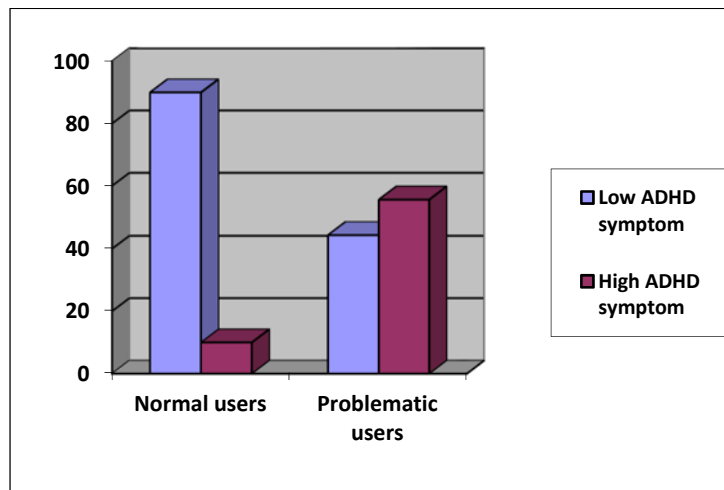


Figure 1. Percentage of normal and problematic users as a function of ADHD-symptom levels.

Table 1 reports the descriptive statistics of both groups and the comparison tests for all the variables under investigation.

The subjects with high-ADHD symptoms spent more time in connections and social networking, whereas working through Internet was more frequent for low-ADHD group. High-ADHD participants had higher scores for SS and all IAT subscales.

According to the IAT cut-offs, no participant was classified as addicted, the problematic users were 27 (15 [55.6%] among the participants in high-ADHD group, and 12 [10%] among low-ADHD group), and the normal users were 120 (81.6% of all subjects).

Variable	Low-ADHD symptoms (<i>n</i> = 120)		High-ADHD symptoms (<i>n</i> = 27)		Comparison		Effectsize
	<i>n</i>	% withinrow	<i>n</i>	% withinrow	$\chi^2(1)$	<i>p</i> ^a	
<i>Gender</i>							
Male	52	77.6	15	22.4	1.33	.29	
Female	68	85.0	12	15.0			
<i>Internet activity</i>	<i>M</i> (<i>DS</i>)	<i>Mdn</i> (min-max)	<i>M</i> (<i>DS</i>)	<i>Mdn</i> (min-max)	<i>U</i>		<i>r</i> ^b
Weekly frequency of connections	3.89 (0.4)	4 (1-4)	3.89 (0.32)	4 (3-4)	1566.0	.569	-.05
Duration of connections	3.78 (1.4)	4 (1-7)	5.30 (1.64)	6 (2-7)	791.0	<.001	-.35
Studying	2.50 (1.3)	3 (1-5)	3.00 (1.52)	3 (1-5)	1297.5	.095	-.14
Chatting	3.00 (1.2)	3 (1-5)	3.44 (1.22)	3 (1-5)	1292.0	.095	-.14
Social network	3.88 (0.9)	4 (1-5)	4.26 (0.90)	4 (1-5)	1206.0	.025	-.19
Watching video	3.40 (0.8)	3 (2-5)	3.41 (0.93)	3 (2-5)	1602.5	.926	-.01
On-line gambling/games	1.52 (0.9)	1 (1-5)	1.81 (0.96)	1 (1-4)	1315.0	.066	-.15
Working	2.40 (1.3)	2 (1-5)	1.89 (1.25)	1 (1-5)	1234.0	.048	-.16
<i>Sensation seeking (NS)</i>	30.73 (7.5)	32 (11-47)	36.37 (8.43)	38 (20-47)	905.0	<.001	-.30
<i>IAT</i>							
Compromised social life	12.18 (3.9)	12 (6-24)	18.07 (4.78)	19 (7-25)	592.5	<.001	-.43
Compromised private life	8.48 (3.2)	8 (5-21)	12.04 (4.23)	13 (5-19)	847.5	<.001	-.32
Compensatory use	4.63 (1.8)	4 (3-10)	7.78 (2.90)	8 (3-11)	660.5	<.001	-.41
Compromised academic/working career	2.80 (1.3)	2 (2-7)	4.22 (1.91)	4 (2-8)	951.5	<.001	-.30
Compromised time control	4.13 (1.5)	4 (2-9)	5.96 (1.99)	6 (2-9)	774.0	<.001	-.35
Excitatory usage	3.19 (1.3)	3 (2-7)	4.81 (2.22)	5 (2-9)	924.5	<.001	-.30
Total score	35.42 (9.9)	35 (20-66)	52.89 (15.69)	61 (26-72)	629.0	<.001	-.41
<i>Problematic Internet Use</i> (IAT cut-off = 50)	<i>n</i>	% withincolumn	<i>n</i>	% withincolumn	$\chi^2(1)$		
Under cut-off (not-PIU)	108	90.0	12	44.4	30.51	<.001	
Equal or above cut-off (PIU)	12	10.0	15	55.6			

Note: *N* = 147; *Mdn* = median;

^a two-tailed;

^b*r* = Z/\sqrt{N} .

Table 1. Descriptive statistics of the participants with ADHD symptoms (low vs. high) and comparison tests referred to measures under investigation.

Predictors of PIU: Pearson's coefficients showed positive associations ($ps < .01$) between IAT total scores and both sensation seeking [$r(147) = .37$] and ADHD rates [$r(147) = .64$]. Sensation seeking measures correlated positively with ADHD symptoms [$r(147) = .29$] and negatively with age [$r(147) = -.53$], both $ps < .01$.

Variable	Model 1		β	Model 2		β
	<i>B</i>	<i>SE B</i>		<i>B</i>	<i>SE B</i>	
(Constant)	70.36	4.40		53.63	6.47	
ADHD symptoms ^a	-17.47	2.37	-.52 ***	-15.22	2.38	-.46 ***
Sensation seeking				.40	.12	.24 **
R^2		.27			.33	
F for ΔR^2		54.43 ***			11.75 **	

$N = 147$;

^a high = 1, low = 2;

** $p < .01$, *** $p < .001$.

Table 2. Summary of stepwise regression analysis for variables predicting IAT scores.

Finally, in the regression analysis the severity of ADHD symptoms (high = 1, low = 2) resulted a significant negative predictor of IAT scores, explaining 27.3% of the variance. Sensation seeking explained an additional 5.5% of the variance (see Table 2). Gender and age did not enter in the regression models.

Discussion and Conclusion

Both ADHD symptoms and SS emerged as risk factors for Internet overuse: individuals with high-ADHD symptoms were more likely to report a deficit in self-regulation (i.e., less control over time). This Italian community study supports the idea that the self-regulation deficit plays a role in the development of PIU (Billieux & Van der Linden, 2012), and also it is in accordance with Dalbudak and colleagues (2015) who found severity of SS and ADHD (especially attention deficit) predicted the risk of IA among university students.

Interferences in many areas of daily lives related to Internet overuse are more common for high-ADHD-symptom participants. According to Caplan (2003), our findings indicate online interpersonal communication (i.e., social networks) have a significant relationships with PIU, but not other activities (like watching videos or online games). The high gratification obtained from online applications can explain the coexistence between ADHD and IA (Koet *al.*, 2012). Indeed

individuals with ADHD usually have an aversion for boredom and delayed reward, so the rapid feedbacks provided by Internet activities can reduce feeling of boredom.

Reinforcement sensitivity can also explain the association between SS and PIU, because positive outcomes obtained seeking new links lead individuals to spending more time on Internet. More recently, it has been supposed that SS, together with hyperactivity and attention deficits observed in ADHD disorder, can be interpreted as a self-regulatory attempt to create a stimulating environment with the purpose to steady vigilance and ward off the monotony (Geissler *et al.*, 2014).

The severity of ADHD symptoms was the most influential variable in predicting PIU, followed by SS. This is not surprising, considering that in general SS influence is greater in adolescence (Siyez, 2014) and in this sample it resulted negatively correlated with age.

Limit of the research and future prospective

Some limitations of this study should be mentioned to provide direction for future research. The greatest limit resides in the small size of the sample and the large variance of the age, which ranges from university students (50.34%) to young (22.45%) and middle adults (27.21%). These heterogeneous ages could reflect the different motives that lead young or adults to use Internet (i.e., meeting new people or maintaining old relationships, respectively), but studies in this field are few (e.g., Martinez-Pecino, Matos, & Silva, 2013).

The small sample also did not allow analyzing the incidence of ADHD among various age groups. In a study of co-morbidities associated to IA, Ho and colleagues (2014) noted that ADHD is more prevalent in young adults (19-39 years of age), probably because of the early onset of ADHD symptoms, whereas in middle-aged and the elderly subjects other disorders (such as depression or anxiety) resulted associated with IA. These data suggest a different potential role of ADHD as a predisposing factor of IA in various age subgroups.

The categorical subdivision of groups (based on level of symptoms) has not enabled to analyze separately the influence of ADHD subtypes (inattention or impulsivity) on PIU. Clinical observations suggest that inattention over and above hyperactivity was the most strongly associated one with IA in adults (Ho *et al.*, 2014).

These limitations suggest further researches for comprehending the interactions between ADHD clinical characteristics, gender differences, and the manifestation of Internet overuse.

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Declaration of Interest statement

Declarations of interest: none.

Authors' contribution

L.B assisted with concept and study design, data interpretation, manuscript preparation and manuscript editing; M.I. assisted with manuscript editing, data analysis, data interpretation, and study supervision. All authors contributed to and have approved the final manuscript.

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