Emotionally laden impulsivity interacts with affect in predicting addictive use of online sexual activity in men

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Abstract

The interest in studying addictive use of online sexual activities (OSA) has grown sharply over the last decade. Despite the burgeoning number of studies conceptualizing the excessive use of OSA as an addictive disorder, few have tested its relations to impulsivity, which is known to constitute a hallmark of addictive behaviors. To address this missing gap in the literature, we tested the relationships between addictive OSA use, impulsivity traits, and affect among a convenience sample of men ($N = 182$; age, $M = 29.17$, SD $= 9.34$), building upon a theoretically driven model that distinguishes the various facets of impulsivity. Results showed that negative urgency (an impulsivity trait reflecting the tendency to act rashly in negative emotional states) and negative affect interact in predicting addictive OSA use. These results highlight the pivotal role played by negative urgency and negative affect in addictive OSA use, supporting the relevance of psychological interventions that focus on improving emotional regulation (e.g., to reduce negative affect and learn healthier coping strategies) to mitigate excessive use of OSA.

1. Introduction

Since the beginning of the 2000s, interest in studying online sexual activities (OSA) has grown, partly because of the presence of excessive use among a small yet significant part of the population, with prevalence rates estimated at between 4.9% and 9.6% according to available studies [1–4]. OSA is defined as the use of the Internet for any activity that involves human sexuality (e.g., viewing pornography, searching for offline sexual partners, or finding information about sexuality; [5]). Excessive involvement in OSA is generally considered to be uncontrolled or compulsive, displayed to regulate emotional states, and associated with a variety of negative outcomes [6–8], including professional and financial problems [9,10],

interpersonal isolation [11,12], risky sexual behaviors [13–15], and offline sexual difficulties (less sexual arousal and satisfaction; erectile difficulties in intimate sexual relationships; [10,16]). Although debates still abound regarding the classification and diagnosis of online and offline sex-related disorders [17,18], these disorders are often conceptualized as behavioral addictions (i.e., addictive disorders not related to the use of psychoactive substances).

In recent years, a growing number of studies have explored the correlates of addictive OSA use. Regarding demographics, males appeared to be almost systematically more prone to displaying addictive OSA use than females [3,6,19,20], although some gender differences in OSA-related preferences have been highlighted. Indeed, women have been found to favor partnered activities (e.g., sexual chat), whereas men prefer solitary activities (e.g., pornography; [9,21,22]). Regarding psychopathological correlates, some studies focusing on excessive sexuality or "sexual addiction" (not specifically related to online content) revealed that this disorder is frequently comorbid with emotional disorders such as anxiety and depression [11,23–26] or with other types of substance abuse and

addictive disorders [27–29]. Some studies also indicated that traumatic history and post-traumatic stress disorder are prevalent in people displaying excessive sexual behaviors [30–34]. In addition, a growing number of studies were interested in the psychological factors associated with addictive use of OSA (see [18] for a review) and emphasized the importance of insecure attachment styles [32,35,36], or the individual correlates fueling OSA use [3,5,16]. In particular, mood regulation motives (i.e., to reduce aversive thoughts, feelings, or sensations) and sexual fantasizing motives (i.e., to compensate for unfulfilled and/or shameful sexual fantasizing) appeared to be important predictors of addictive use of OSA [3,16]. Despite the burgeoning studies focusing on addictive OSA use, however, the psychological factors involved in its development and maintenance remain scarcely explored.

1.1. Impulsivity and addictive use of OSA

Some psychological factors that have been largely explored in other types of excessive appetitive behaviors (including disordered gambling or substance abuse-related disorders) have to date received little attention in relation to addictive use of OSA. This is especially the case for impulsivity, which is a trans-diagnostic factor that plays a crucial role in a wide range of addictive behaviors, including other types of Internet-related disorders such as Internet gaming disorder [37,38]. Although recent models of Internet-related disorders emphasize the pivotal role of impulsivity in the etiology of the trouble [39], currently available data regarding addictive use of OSA remain scarce, with most published studies examining the link between impulsivity and sexual addiction in general (i.e., not restricted to online sexual behaviors). One of these studies involved over 203 men with sexual addiction and highlighted that this disorder is significantly correlated with the impulsiveness facet of the NEO Personality Inventory-Revisited [40]. Another study conducted in a sample of 31 women and 47 men with sexual addiction by Reid, Dhuffar, Parhami, and Fong [41] found that patients considered to be sexually addicted present high impulsivity traits. More precisely, this study showed that elevated scores characterized men and women with sexual addiction on three of the NEO subfacets associated with impulsivity, namely, impulsiveness (a subfacet of neuroticism), self-discipline (a subfacet of consciousness), and deliberation (a subfacet of consciousness). These traits reflect tendencies toward seeking immediate gratification, proneness to procrastination, difficulties in following through on tasks, and acting quickly without considering the potential adverse consequences of choices. However, in contrast to the men in the sample, the women had a significantly higher desire for excitement and stimulation (excitement seeking, a subfacet of extraversion). Similarly, another recent study by Reid and colleagues [28] found that 48% of patients with sexual addiction are characterized by a high level of impulsivity (measured by the Barratt Impulsiveness Scale; [42]). Regarding OSA, a recent study by Wetterneck and colleagues [20] revealed that a higher use of Internet

pornography is associated with impulsivity (assessed by the Impulsivity, Risk-Taking, and Sensation Seeking Scale; [43]), especially in men, but the study failed to show differences in impulsivity levels in addictive versus non-addictive pornography use. Two conclusions emerged from our review of existing studies: (1) Most previous data did not take into account the specificity of OSA and instead focused on sexual addiction in general and (2) studies are lacking that rely on comprehensive impulsivity models to allow consideration of the various facets of this multidimensional construct.

1.2. The current study

The current study aims to fill a gap in the literature by testing the relationships between addictive use of OSA and impulsivity, building on a theoretically driven model that distinguishes between the various facets of impulsive traits: the UPPS-P model of impulsivity [44,45].

Assuming that impulsivity traits reflect a combination of multiple and separable psychological factors [44–47]; Whiteside and Lynam [45] conducted an influential study that helped to differentiate the various facets of the umbrella impulsivity construct. This was carried out by administering several widely used questionnaires of impulsivity (such as the Barratt Impulsivity Scale, the Eysenck Impulsiveness Scale, or the Zuckerman Sensation Seeking Scale) and the Revised NEO Personality Inventory to a large sample of nonclinical participants. A factor analysis conducted on these questionnaires identified four separable dimensions, which were the basis of a growing body of data that helped create a scale called the UPPS (Urgency-Premeditation-Perseverance-Sensation seeking) Impulsive Behavior Scale. The four dimensions of impulsivity measured by the UPPS were (1) urgency, defined as the tendency to act rashly while faced with intense negative emotional contexts; (2) premeditation, defined as the tendency to take into account the consequences of an act before engaging in that act; (3) perseverance, defined as the ability to remain focused on a task that may be boring and/or difficult; and (4) sensation seeking, considered as the tendency to enjoy and pursue activities that are exciting and openness to trying new experiences.

More recently, Cyders and Smith [44] proposed that the urgency dimension should be subdivided into a "positive urgency" component (impulsive behaviors taking place in reaction to intense positive affect) and a "negative urgency" component (impulsive behaviors taking place in reaction to intense negative affect). The work conducted by Cyders et al. [48,49] resulted in a modified model that incorporated positive urgency and was relabeled as the UPPS-P model. A growing corpus of psychometric studies have since confirmed that the UPPS-P model presents robust psychometric properties e.g., theoretically sound factorial structure supported by exploratory and confirmatory factor analyses, high internal consistency, and adequate test-retest validity of the subscales; see, e.g., [48,50], and the distinction between

the four subscales of the UPPS has also been confirmed by means of semistructured interviews [51].

In recent years, the UPPS has proven to be a useful theoretical rationale to disentangle the role of specific impulsivity facets in different forms of psychopathology (see [52] for a meta-analysis) and has become a dominant model to account for the role of impulsivity traits in the onset and perpetuation of addictive and excessive behaviors [53–55]. Yet, to date the UPPS-P has not been used in relation to the study of impulsive behaviors in (cyber)sexual addictive behaviors.

In contrast to the quasi-absence of studies having focused on the role of impulsivity in the addictive use of OSA, a more substantial body of research has studied the associations between UPPS impulsivity facets and risky (online and offline) sexual behaviors. Available data showed that sensation seeking, both types of urgency (positive and negative), and lack of premeditation are associated with risky sexual behaviors, including having a large number of sexual partners (including strangers and prostitutes), having sex without contraceptive devices, or having sex under the influence of alcohol or illegal drugs. More specifically, negative urgency seems to play a pivotal role in risky sexual behaviors. People with high negative urgency are especially prone to making rash decisions about sexual health and engaging in sexual behaviors as an emotional coping mechanism [56–59].

Such findings are in accordance with the view that elevated urgency level is associated with involvement in a wide range of behaviors that are displayed to regulate (i.e., suppress or exacerbate) emotional states [44,53,60,61]. It is thus possible that individual differences in positive and negative urgency act as risk factors for developing addictive use of OSA. Indeed, in line with recent proposals [39,62], excessive online sexual behaviors result from the combination of positive expectancies (e.g., sexual gratification involving positive reinforcement) and avoidance expectancies (e.g., reducing negative affect involving negative reinforcement). In their model, these authors state that using OSA frequently and experiencing positive outcomes (e.g., pleasure or escaping from reality) develops and consolidates implicit positive associations, pushing the individual to use it repeatedly. These authors also emphasized the important role of negative reinforcement, which takes place when individuals use OSA to reduce or alleviate aversive states or moods, or when they escape the difficulties engendered by their excessive behaviors (e.g., conflict with significant other, shame associated with the fact of having viewed pornographic content).

The study hypotheses are as follows:

H1. In accordance with the negative reinforcement hypothesis of addictive use of OSA (e.g., [62]), we predicted that negative affect and negative urgency would be more elevated in individuals presenting an addictive use of OSA.

H2. In accordance with the positive reinforcement hypothesis of addictive use of OSA (e.g., [62]), we predicted that positive urgency would be more elevated in individuals

presenting an addictive use of OSA. No hypothesis was made regarding positive affect, which has not been shown to trigger OSA, in contrast to negative affect.

H3. In terms of H1 and/or H2 confirmation, we predicted the occurrence of an additional interaction effect so that the association between urgency traits and addictive use of OSA would vary with affect and that the variations would be strongest for individuals with higher levels of negative/positive affect.

2. Method

2.1. Participants and procedure

Participants were males recruited through announcements sent on a university messaging service, social networks, and sexuality-related forums. The study was restricted to male participants as they were found to be 3 to 5 times more frequently engaged in excessive use of OSA than females were [6,19,27], and including females would have resulted in an unbalanced sample. Moreover, males and females are known to differ in several of the key study variables, including UPPS-P impulsivity facets [50] and negative affect [63,64]. The survey was accessible online via the *LimeSurvey* website. All participants received information about the study (i.e., the fact that we were focusing on the links between OSA and personality), and then gave their online consent before starting the online survey. Anonymity of the participants was guaranteed (no personal data or Internet Protocol [IP] address was collected). No compensation was given for participating in the study. The study protocol was approved by the ethical committee of the Psychological Sciences Research Institute (Université catholique de Louvain).

Inclusion criteria were being male, over 18 years, and a native or fluent French speaker. The study investigated sociodemographic characteristics, symptoms of problematic use of OSA, impulsivity, and affect (see Measures section). Other variables were also assessed and some results unrelated to the current study have already been reported elsewhere [16]. In total, 182 participants completed all measures used in the current study. The age of the final sample ranged from 19 to 72 years ($M = 29.17$, $SD = 9.34$). The majority of participants were Belgian (42.9%) or French (36.3%). Participants reported whether they predominantly had a university degree (62.4%), were students (50%), or were employed (41.2%), as well as whether they were in a stable relationship (56%) and were heterosexual (86.3%). Sociodemographic information was assessed regarding age, nationality, education, occupation, relationship status, and sexual orientation (see Table 1). The mean scores, standard deviations, and ranges for the short Internet Addiction Test dedicated to cybersex (s-IAT-sex; assessing symptoms of problematic use of OSAs), the UPPS-P (assessing facets of impulsivity), and the Positive and Negative Affect Schedule

Table 1
Sample characteristics.

Characteristic	M (SD) or %
Age	29.17 (9.3)
Nationality	
Belgian	42.9%
French	36.3%
Canadian	16.5%
Swiss	1.6%
Other European country	1.6%
Other non-European country	1.1%
Education	
Primary school	1.7%
College	11.0%
High school	22.1%
University	62.4%
Other	2.8%
Occupational status	
Employed	41.2%
Student	50.0%
Unemployed	6.6%
Retired	1.7%
Housework/Parental leave	0.5%
Sexual orientation	
Heterosexual	86.3%
Homosexual	10.4%
Bisexual	3.3%
Relationship	
Never been in a relationship	3.8%
Single (without occasional sexual partner)	20.3%
Single (with occasional sexual partner(s))	19.8%
In a stable relationship	56.1%

$N = 182$.

(PANAS; assessing positive and negative affect) are reported in Table 2.

2.2. Measures

Questionnaires included in the online survey were selected to prioritize instruments that have been validated in the French language (adapted via traditional translation and back-translation procedures). The scales that were used and their internal reliability are reported in Table 3.

Table 2
Mean and range for the questionnaires used in the online survey.

Questionnaire	M (SD; range)
s-IAT-sex	23.13 (9.8; 12–59)
Loss of control/time management	12.21 (5.9; 6–30)
Craving/social problems	10.91 (4.8; 6–29)
UPPS-P	
Negative urgency	8.64 (2.7; 4–16)
Positive urgency	10.19 (2.6; 4–16)
Lack of perseverance	7.42 (2.5; 4–16)
Lack of premeditation	7.35 (2.3; 4–16)
Sensation seeking	10.66 (2.7; 4–16)
PANAS	
Negative affect	22.03 (7.3; 11–48)
Positive affect	34.68 (5.2; 13–50)

$N = 182$. s-IAT-sex = short Internet Addiction Test adapted for online sexual activities (OSA); UPPS-P = UPPS-P Impulsive Behavior Scale; PANAS: Positive and Negative Affect Schedule.

2.2.1. Short Internet Addiction Test adapted for cybersex

Problematic use of OSA was measured by using the French s-IAT-sex; [65]. The s-IAT-sex is a 12-item scale assessing an addictive pattern of use, with six items evaluating loss of control and time management (e.g., "How often do you neglect household chores to spend more time on Internet sex sites?") and the other six items measuring craving and social problems (e.g., "How often do you choose to spend more time on Internet sex sites over going out with others?"). All items are scored on a 5-point Likert scale ranging from *never* to *always*. Higher scores indicate higher levels of problematic use. As no valid cut-off currently exists for the s-IAT-sex, we decided to rely on latent class analysis (LCA) to distinguish between a group displaying addictive use of OSA and a group not displaying addictive use of OSA (see Data analytic strategy section).

2.2.2. Short UPPS-P Impulsive Behavior Scale

Impulsivity traits were assessed by using the French short UPPS-P Impulsive Behavior Scale (UPPS-P; [50]). This scale comprises 20 items evaluating five facets of impulsivity (four items per dimension), namely, negative urgency (e.g., "When I am upset I often act without thinking"), positive urgency (e.g., "When I am really excited, I tend not to think of the consequences of my actions"), premeditation (e.g., "Before making up my mind, I consider all the advantages and disadvantages"), perseverance (e.g., "I finish what I start"), and sensation seeking (e.g., "I sometimes like doing things that are a bit frightening"). The UPPS-P was scored using a 4-point Likert scale (1 = strongly disagree to 4 = strongly agree). Higher ratings on these different facets indicate higher levels of impulsivity. The short UPPS-P was found to have a robust factorial structure, high internal consistency, and elevated test-retest stability [50].

2.2.3. Positive and Negative Affect Schedule

Affect were measured by using the French version of the PANAS-trait; [66]. This self-reported adjective checklist contains 20 items measuring positive affect (10 items) and negative affect (10 items). All items ranged from 1 to 5 (1 = very slightly/not at all, 5 = extremely). The positive affectivity score and negative affectivity score varied from 10 (low level of positive or negative affectivity) to 50 (high level of positive or negative affectivity). Previous studies reported that the PANAS have elevated internal consistency for its two subscales [67].

2.3. Data analytic strategy

At an exploratory level, an LCA method was used to identify subgroups among the sample on the basis of reported addictive OSA symptoms. The multivariate method of LCA was used to identify groups (called "classes") among the sample on the basis of multivariate categorical data, here binary variables. Scores for each s-IAT-sex item were dichotomized, with frequency scores of 4 and 5 being recoded as 1 for "frequent presence of the behavior," and the

Table 3
Questionnaires used in the online survey.

Questionnaire	Scale	Scale description	Cronbach's alpha (α)
s-IAT-sex	Loss of control/time management	Failure to control or reduce the amount of time spent online in OSA	0.88
	Craving/social problems	Urgency for OSA usage and functional impairment associated with OSA use	0.79
UPPS-P	Negative urgency	Proneness to act rashly in intense negative emotional contexts	0.84
	Positive urgency	Proneness to act rashly in intense positive emotional contexts	0.79
	Lack of perseverance	Difficulties staying focused on an annoying or complicated task	0.92
	Lack of premeditation	Difficulties taking into account the consequences of the action	0.86
	Sensation seeking	Openness to new experiences and preferences for risky activities	0.82
PANAS	Negative affect	Proneness to experience negative affect states	0.88
	Positive affect	Proneness to experience positive affect states	0.75

s-IAT-sex = short Internet Addiction Test adapted for online sexual activities (OSA); UPPS-P = UPPS-P Impulsive Behavior Scale; PANAS: Positive and Negative Affect Schedule. Internal reliability coefficients (α) are those obtained in the current sample.

remaining frequencies being recoded as 0 for "less frequent or absence of the behavior" (see [68] for a similar approach). LCAs were performed by using all s-IAT-sex items to determine endorsement probabilities and co-occurrences for each behavior per latent class. The class assignment was based on the maximum posterior probability. LCAs were performed using the package poLCA [69] with the R software [70].

LCAs being exploratory, we tested models from 1 to 10 classes and compared them to find a more ideal solution. The Akaike information criterion (AIC) and the Bayesian information criterion (BIC) were computed to measure the quality of the model by identifying the most parsimonious one, penalizing the number of estimated parameters. Best solutions for both criteria are based on the smallest indices. The model homogeneity was measured with the entropy index, values close to 1 ensuring model accuracy. Identified latent classes were then compared in terms of each of the s-IAT-sex items. Because of non-normal distribution of s-IAT-sex items, a non-parametric Mann-Whitney U test was used.

To test our three a priori hypotheses, we conducted a logistic regression analysis (using the "glm" function in R, package "stats"; R Core Team, 2014) to evaluate the effects of impulsivity traits (negative urgency, positive urgency, premeditation, perseverance, sensation seeking), negative and positive affect, and their interactions on the problematic

Table 4
Fit indices for the latent class analyses.

Number of latent classes	AIC	BIC	Entropy
1	1650.28	1688.73	1
2	1291.79	1371.89	0.9630
3	1255.01	1376.76	0.8910
4	1245.36	1408.76	0.9828
5	1253.95	1459.01	0.9854
6	1261.85	1508.55	0.9644
7	1268.36	1556.72	0.9697
8	1279.75	1609.77	0.9723
9	1298.52	1670.18	0.9688
10	1314.63	1727.95	0.9494

AIC = Akaike information criteria; BIC = Bayesian information criteria.

use of OSA. All effects are reported as odds ratios (ORs), which represent a standard logarithmic transformation of regression coefficients [71]. ORs larger than 1.0 show that participants are more likely to be problematic OSA users. The variables considered for the moderation analyses were mean-centered to reduce possible collinearity with interaction terms. All analyses were conducted with a significance threshold of $\alpha = 0.05$.

3. Results

3.1. Latent class analyses (LCAs)

LCAs were performed on the basis of dichotomized scores of the s-IAT-sex items (0 = absent or occasional behavior; 1 = regular behavior). Table 4 shows AIC and BIC fit indices and entropy measures for the different models computed. For AIC, the model best fits with a four-class solution. For BIC, the best model is a two-class solution. Entropy measures also supported a two-class model. On the basis of the parsimony principle, the two-class model solution was selected and further supported by class comparisons.

The first class gathers the majority of the sample (83%) and corresponds to non-problematic users, i.e., those not displaying addictive use. Maximum endorsement probabilities (around 30%) for this class are related to item 1 (OSA use longer than intended) and item 10 (hiding the time spent on OSA). Several items (3, 6, 7, 11, and 12) are not endorsed by all participants of this class. These items pertain to neglecting grades/school/work, sleep interference, preoccupation, preference for OSA over social contacts, and withdrawal-like symptoms. The second class (17% of the sample), in contrast, regroups individuals presenting addictive use of OSA. In particular, it appears that individuals from class 2 have a near 100% probability of endorsing item 1 (OSA use longer than intended) and item 2 (neglecting household chores to spend more time on OSA). Fig. 1 shows the two classes in terms of the probability of endorsing each item (each subject belongs to only one class). The comparison between the two identified classes with

IAT-1 How often do you find that you stay on Internet sex sites longer than you intended?

IAT-2 How often do you neglect household chores to spend more time on Internet sex sites?

IAT-3 How often do your grades/school work and/or your work suffer because of the amount of time you spend on Internet sex sites?

IAT-4 How often do you become defensive or secretive when anyone asks you what you do on Internet sex sites?

IAT-5 How often do you snap, yell, or act annoyed if someone bothers you while you are on Internet sex sites?

IAT-6 How often do you lose sleep due to being on Internet sex sites late at night?

IAT-7 How often do you feel preoccupied with online sexual activities when off-line, or fantasize about being on Internet sex sites?

IAT-8 How often do you find yourself saying "just a few more minutes" when you are on Internet sex sites?

IAT-9 How often do you try to cut down the amount of time you spend on Internet sex sites and fail?

IAT-10 How often do you try to hide how long you have been on Internet sex sites?

IAT-11 How often do you choose to spend more time on Internet sex sites over going out with others?

IAT-12 How often do you feel depressed, moody or nervous when you are off-line, which goes away once you are back on Internet sex sites?

Note. The Y-axis indicates the conditional probability of item endorsement by latent class membership. All items are significantly different ($p<.05$).
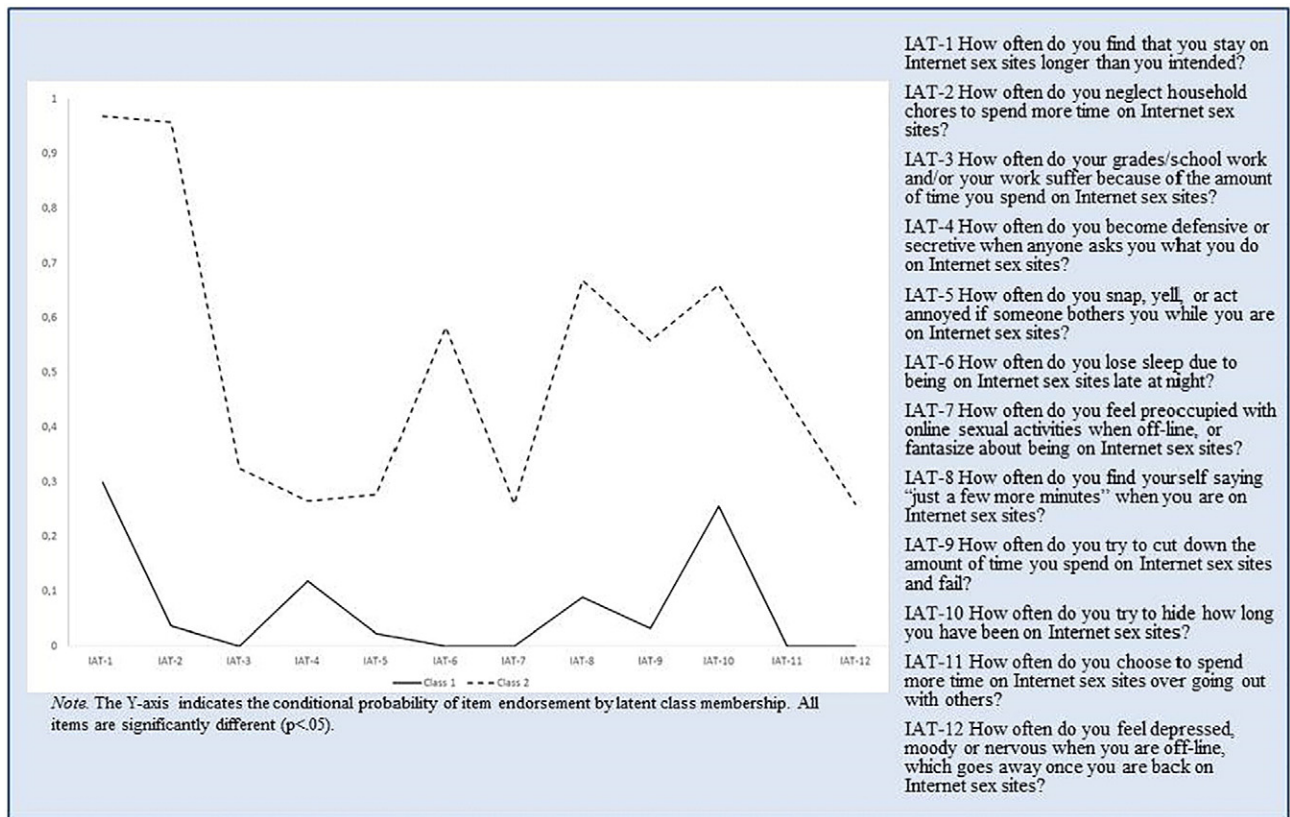
Fig. 1. Latent classes.

Mann-Whitney U test shows that members of the second class presented significantly higher scores for all items of the s-IAT-sex ($p < 0.05$).

3.2. Logistic regression analyses

As explained in the Data analytic strategy section, study hypotheses were tested by using logistic regression analyses. The reference category was "non-addictive OSA users" (see Table 5). Results revealed that individuals with high negative urgency were more likely to display addictive use of OSA. In

Table 5
Odds ratios (95% CI) for two classes.

	Addictive OSA users ($n = 31$)
Intercept	0.001 (0.0001–0.04)**
Negative urgency	1.23 (1.01–1.48)*
Positive urgency	0.94 (0.76–1.13)
Lack of premeditation	1.08 (0.87–1.34)
Lack of perseverance	1.08 (0.90–1.30)
Sensation seeking	1.01 (0,83–1.23)
Positive affect	1.04 (0.94–1.15)
Negative affect	1.09 (1.02–1.17)*
genR^2	0.14

Addictive OSA users: 0 = "no", 1 = "yes". CI = confidence interval; OSA = online sexual activity.

** $p < 0.01$.

* $p < 0.05$.

addition, individuals with higher levels of negative affect were also more likely to present addictive use of OSA. Conjointly, these results confirm H1. H2 is, however, not confirmed, as positive urgency failed to predict addictive use of OSA. Given the confirmation of H1, negative urgency and negative affect were identified as candidates for interaction effects in subsequent analyses. There was a positive interaction between negative urgency and negative affect for addictive use of OSA, confirming H3 (OR = 1.03, 95% confidence interval [CI] = 1.01, 1.06, $p < 0.05$; see Table 6). To probe the interaction effect, we performed tests of the simple slopes [72]. As can be seen in Fig. 2, follow-up analyses showed that participants with higher negative affect were more likely to be addictive OSA users when they also reported elevated negative urgency scores (OR = 1.48, 95% CI = 1.01, 2.18, $p < 0.05$). By contrast, participants with lower negative affect appeared to be less affected by their higher levels of negative urgency, as probed by a nonsignificant negative urgency–addictive use of OSA relationship (OR = 1.15, 95% CI = 0.71, 1.86, $p = 0.56$). We checked the improvement of the model (with and without interaction) with the χ^2 test on the basis of the deviance of the model and the AIC/BIC indices (Table 6). The interaction term significantly improved the model for being an addictive OSA user ($p(\Delta\chi^2) = 0.02$). From the AIC and BIC indices, the model presents a better fit when the interaction term is included. In addition, the amount of variance explained by this model is 16%, which is higher than the 12% variance accounted for by

Table 6
Odds ratios (95% CI) for two classes and model comparisons (with and without interaction term).

	Addictive OSA users ($n = 31$)	Model comparison		
		$p(\Delta \chi^2)$	AIC	BIC
Model 1			150.98	160.57
Intercept	0.005 (0.0007–0.03)***			
Negative urgency	1.23 (1.04–1.45)*			
Negative affect	1.08 (1.02–1.14)*			
genR^2	0.12			
Model 2		0.02	147.56	160.34
Intercept	0.13 (0.08–0.22)***			
Negative urgency	1.20 (1.01–1.43)*			
Negative affect	1.04 (0.98–1.11)			
Negative urgency × negative affect	1.03 (1.01–1.06)*			
genR^2	0.16			

Addictive OSA users: 0 = "no", 1 = "yes." CI = confidence interval; OSA = online sexual activity; AIC = Akaike information criteria; BIC = Bayesian information criteria.
  *** $p < 0.001$.
  * $p < 0.05$.

the model that does not include the interaction term. After the interaction term was introduced, the main effect of negative urgency remained significant, which is not the case for the main effect of negative affect.

4. Discussion

The aim of the current study was to clarify the role of impulsivity traits (in particular positive and negative urgency) and affect in the proneness to use OSA in an addictive manner. The main results of the study are as follows. First, both negative urgency and negative affect predict addictive use of OSA (H1 is confirmed). Second, positive urgency and positive affect do not predict addictive use of OSA (H2 is rejected). Third, negative urgency and negative affect interact in predicting addictive use of OSA (H3 is confirmed). When the interaction term is considered, the main effect of negative affect is no longer significant, yet negative urgency remains a significant predictor.

Negative urgency has been associated with a wide range of problematic behaviors and psychiatric disorders,
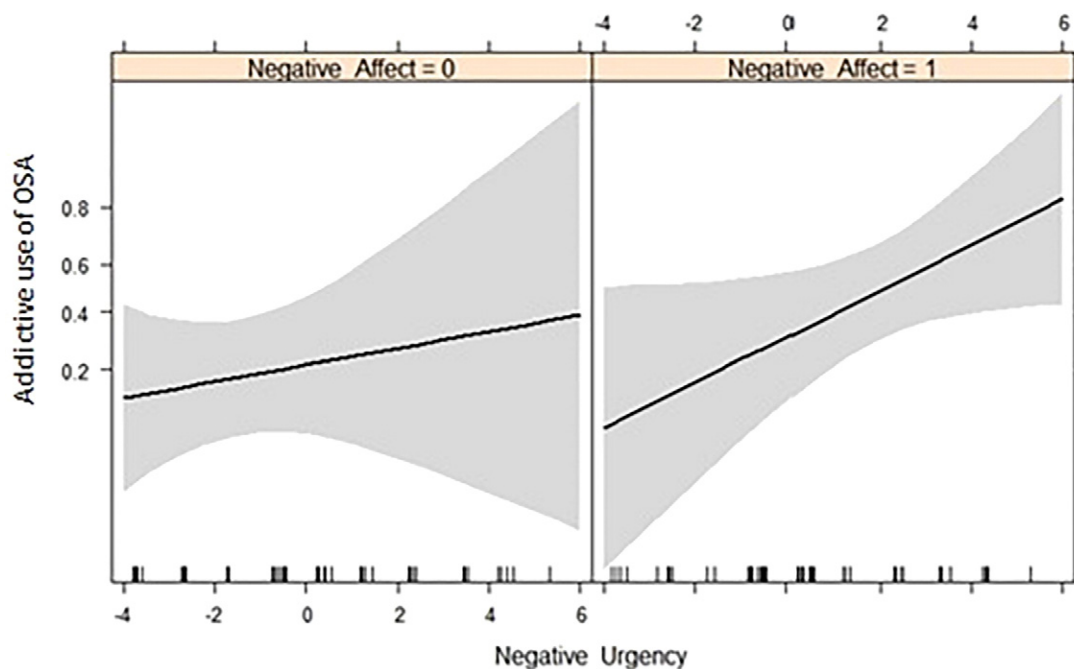
Fig. 2. Interaction plot for negative urgency (x-axis) and low (−1 *SD*; negative affect = 0) and high (+1 *SD*; negative affect = 1) levels of negative affect on addictive use of online sexual activity (y-axis). The 95% confidence intervals are presented in gray.

including (but not limited to) alcohol and drug abuse, eating disorders, borderline and antisocial personality, aggressive behaviors, compulsive buying, disordered gambling, and excessive involvement in online video gaming (see e.g., [52,53,55]). A growing corpus of data also linked heightened negative urgency with hazardous decision making [53,73] and impaired inhibitory control (e.g., [74,75]). Accordingly, it has been hypothesized that individuals with high urgency often engage in behaviors aimed at relieving negative affect in the short term, despite negative delayed consequences [44,60,61]. In relation to our findings, it is likely that individuals with high urgency are more prone to display an addictive and uncontrolled use of OSA, as for them this activity can constitute potentially dysfunctional coping used to relieve or suppress adverse emotional and affective states. This assumption is especially in accordance with previous studies showing that addictive OSA use is a way to cope with negative mood [3,5,16].

Our results suggest that a high level of negative urgency might promote addictive OSA use in relation to the regulation of negative emotions or affect (e.g., [44,61]). Subsequently, the interaction between negative affect and negative urgency appears to be of crucial importance; indeed, it has been established that emotional states impair executive control [76]. With specific regard to inhibition, several studies have demonstrated that emotional arousal interferes with the ability to deliberately control or suppress an automatic response [77,78]. Moreover, and crucially when considering our results, it seems that the interference effect is less pronounced when individuals are faced with positive stimuli than when faced with negative stimuli [79,80]. In accordance with these data, addictive use of OSA could be viewed as the consequence of a repeated failed attempt to inhibit the urge to use OSA to relieve adverse affective states in the short term through immediate positive and/or negative reinforcement (e.g., [62]). More precisely, it could be speculated that people with a high level of negative urgency are more at risk to develop addictive use of OSA as they become blocked in a vicious circle in which rash actions performed in emotional contexts result in negative consequences, creating, in turn, negative emotions that are also relieved by using OSA. It is worth noting that when the interaction between negative urgency and negative affect is considered, only negative urgency remains a significant predictor of addictive OSA use. This latter result suggests that the role of negative urgency is more important than that of negative affect, supporting the pivotal role of emotion dysregulation in general and negative urgency in particular as a crucial risk factor in the development of addictive OSA use.

The current study showed, contrary to our hypothesis, that positive urgency is not associated with addictive OSA use. This finding implies that positive affect (e.g., feeling happy) is unlikely to trigger repeated and potentially harmful OSA use. However, as suggested by some studies, we can suppose that positive expectancies (e.g., anticipated sexual pleasure) are related to addictive OSA [5,16,62], yet the scales used in the current study assessed only affect, not expectancies. Notably, our findings are in line with results obtained in a recent study concerning risky sexual behaviors that showed that positive urgency was uniquely related to intentions of engaging in risky sexual behaviors (but not with acting out), whereas negative urgency was associated with effective risky sexual behaviors [56]. An alternative explanation would be that if addictive OSA is considered a potentially genuine addiction, it is possible that at the initial steps of OSA use, positive affect and urgency facilitate consumption, but within the addiction process, the positive emotions progressively decrease and the negative consequences and negative affect become dominant, engendering a vicious circle.

Several limitations of the study have to be mentioned. First, although the sample size is adequate for the statistical analyses conducted and our objectives, it is relatively modest. Second, our sample is not representative of the general population, as it included self-selected participants [81]. Third, we used a cross-sectional design, which implies that the study provided no information regarding causality. Fourth, all of the measures were self-reported questionnaires that are known to be affected by potential bias (e.g., social desirability, lack of insight).

5. Conclusion

The current results support the view that a high level of negative urgency may result in addictive OSA use that serves to relieve intense negative emotions (e.g., [44,61]). These findings are in agreement with the recent proposal by Brand and colleagues [39] suggesting that individuals with both emotional vulnerability and impulsive coping strategies are more prone to react rashly by using OSA when they are exposed to a stressful situation. On a broader level, these results highlighted the importance of assessing impulsivity as a multidimensional concept and confirm that the facets of impulsivity are differently involved in diverse excessive behaviors. The results are important for researchers and clinicians and show the essential role played by negative urgency and negative affect in men with addictive OSA use. As a consequence, clinical work on emotional regulation seems to be fundamental for these men. For example, individuals with addictive OSA use may benefit from interventions aimed at reducing negative affect and from learning healthier strategies for coping with distress. Simultaneously, expectancies about OSA use may be reduced as other sources of pleasure and gratification are developed. Future studies need to confirm these results in a clinical population and include the role of expectancies in this process.

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