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Common etiological pathways between toxic substance use, Internet and cybersex addiction: The role of expectancies and antisocial deviance proneness

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ABSTRACT

This study examined Internet and cybersex addiction in adolescents and how such behaviour was associated with substance use (in particular, cigarettes, alcohol, and drug use). Participants were 312 adolescents, aged 14—16, who completed survey instruments. Study measures included demographic, toxic substance use, expectancies toward substances consumption, antisocial deviance proneness, Internet, and cybersex addiction variables. Descriptive, bivariate analyses, exploratory/confirmatory factor analyses, and structural Equation Modeling were performed. Nearly 60%, 26%, and 25% of adolescents reported having drunk alcohol, used drugs and smoked cigarettes respectively. Prevalence of Internet and cybersex risk scores was 23.3% and 6.8% respectively. Adolescents who reported having drunk alcohol, smoked cigarettes, or used drugs were more likely to report higher scores on both the Internet and the cybersex addiction scales. Proposed structural equation model explained between 25% and 42% of the variance of toxic substance use, 22% of the Internet addiction score, and 17% of cybersex addiction score. Expectancies toward substances consumption and antisocial deviance had a direct and significant influence on the study variables. Therefore, the overlap between substance use and Internet and cybersex addiction is the result of two common etiological pathways: positives expectancies toward substances consumption and a general tendency to antisocial behaviour.

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1. Introduction

There are several reasons to consider adolescence as a sensitive period in the development of an addictive behaviour pattern (Guttmannova et al., 2011). First, it has been identified as the period where first toxic substance use usually occurs. In a recent study among 5187 British pupils aged 11 to 15, 15% of participants said that they had smoked at least once, 39% had drunk alcohol, and 16% had ever used drugs (Fuller & Hawkins, 2013). Results from this survey indicate that "in England, around 100,000 pupils aged between 11 and 15 were regular smokers, around 280,000 had drunk

alcohol in the past week, around 190,000 had taken drugs in the last month, and around 350,000 had taken drugs in the last year (Fuller & Hawkins, 2013, p. 10, p. 10)". Similar results were reported in other European countries such as Norway (Mangerud, Bjerkeset, Holmen, Lydersen, & Indredavik, 2014) and Spain (Spanish Drug Observatory, 2014).

Second, the age at first toxic substance use is closely related to an increase in the risk of developing a Substance Use Disorder (SUD). Hingson, Heeren, and Winter (2006) found that compared with those who began drinking at 21 years or older, those who began before 14 years old were more likely to experience alcohol dependence 10 years after first drinking. Furthermore, it has been found that the association between first substance use and the risk of developing a SUD is not equal for all kind of drugs. In the case of marijuana, the lapse of time between first substance consumption and the development of an addiction is larger (more insidious) than that observed in the case of cocaine (Wagner & Anthony, 2002). Therefore, the delaying of first substance use has been a priority in

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the prevention of abuse and dependence problems in the later life (Kuntsche, Rossow, Engels, & Kuntsche, 2015).

Third, it has been found that age of onset of toxic substance use is a strong predictor of progression to other drugs, as well as to other non-chemical addictions (gateway hypothesis). According to this hypothesis, drug use involvement can be described as a progressive and hierarchical sequence depicting the order by which adolescents try drugs: the most common sequence starts with legal drugs (either alcohol or cigarettes), which are believed to increase the risk for trying illegal drugs (such as marijuana, cocaine, or ecstasy) (Kandel, Yamaguchi, & Klein, 2006). In this regard, results from a longitudinal study with 2019 adolescents in tenth grade (from age 15 to 16) demonstrated that both alcohol and cigarettes (legal drugs) served as a gateway drug for marijuana or cocaine (illegal drugs), and alcohol also served as a gateway drug for cigarette smoking (Maldonado-Molina & Lanza, 2010). Similarly, a recent study found an increased risk for Internet addiction (nonchemical addiction) in those adolescents who reported having smoked (OR = 1.203) or having used drugs (OR = 2.591) (Sik, Hyun, Mi, & Renshaw, 2013).

Consistent with these findings, several studies have reported an increased risk and a greater severity of behavioral addictions associated with the use, abuse or dependence upon a toxic substance during adolescence, especially in the case of video games (Rooij, Kuss, Griffiths, & Shorter, 2014) and Internet addiction (Bakken, Wenzel, Gotestam, Johansson, & Oren, 2009). In a study conducted among 2252 Connecticut high school students, Hammond et al. (2014) found a strong association between marijuana use and pathological gambling. Specifically, pathological gambling was more prevalent (35% vs. 22.1%) and more severe (increased engagement in different gambling types and across multiple localizations) in adolescents with lifetime marijuana use than in adolescents denying their use. Similar results were obtained in a research of 73,238 South Korean students ranging in age from 13 to 18 years (Sik et al., 2013). In this research, prevalence of students who drank alcohol (27.4%), smoked cigarettes (20.4%), or used drugs (6.5%) was greater among Internet addicted students than those observed among non-pathological Internet users (20.8%, 11.7%, and 1.7% respectively).

In terms of clinical course and symptoms, it has been highlighted that chemical and non-chemical addictions share a common clinical presentation, characterized by: salience, euphoria, tolerance, withdrawal, conflict, and relapse-reinstatement (Alavi et al., 2015). In this regard, results from a recent study supported the presence of addictive symptoms in cybersex addiction (in particular, craving and cue reactivity) as well as their relevance in the development and maintenance of the pathology (Laier, Pawlikowski, Pekal, Schulte, & Brand, 2013). Similarly, results from a study conducted among 186 college women in the USA suggested that the impact of the use of pornography is quite similar to those observed in the case of marijuana use (Pyle & Bridges, 2012). In this study, negative outcomes derived from the use of pornography and the use of marijuana were influenced by the same factors, such as frequency and secrecy.

Despite the strength of evidence suggesting an overlap between chemical and non-chemical addictions, there is not a clear explanation for this association. It has been proposed that both chemical and behavioral addictions may be due to similar psychological factors predisposing the development of an addictive behaviour pattern. In this regard, Yau and Potenza (2015) suggested that "the two sets of disorders may represent different expressions of one addiction entity (pp. 135)". Nevertheless, few studies have analyzed the contribution of psychological pathways typically proposed to understand SUDs in the explanation of behavioral addictions. On the contrary, a recent study concluded that non-chemical addictions (in particular Internet addiction) could be better understood as a consequence of chemical addictions than as a consequence of a common etiological pathway (Sik et al., 2013). Another limitation is that our current knowledge about behavioral addictions is derived from video games or Internet addiction studies, whereas other equal pathologies (such as cybersex addiction) have been often ignored (Robbins & Clark, 2015). This lack of empirical evidence has motivated the present research.

1.1. The present study

The purpose of the present study was to evaluate possible overlapping between substance use (in particular, cigarettes, alcohol, and drug use) and Internet/cybersex use in a sample of Spanish adolescents ranging in age from 14 to 16. Since we expected that adolescent substance users were more likely to be problematic Internet and cybersex users than non-substance users, we proposed a second aim: to describe if severity of Internet and cybersex use could be better understood either as a consequence of a previous toxic substance use (as Sik and colleagues proposed) or as we expected, as the consequence of common pathological pathways. The two hypothesized models were represented in Fig. 1.

To test the hypothesis that Internet and cybersex addiction could be explained either by a previous toxic substance use or by the same etiological pathways that in the case of tobacco, alcohol or drug use, we employed Sher, Grekin, and Williams (2005) aetiology model of alcohol use disorders. The degree of empirical support and the ability to integrate different aetiological pathways into a unified biopsychosocial model explain the election of this model instead of other theories in the field of substance use. This model takes into account 4 not mutually exclusive pathways to explain SUD onset: 1) positive expectancies toward toxic substance consumption (toxic substance use "to get high" and "because it makes you feel good"); 2) antisocial deviance proneness (toxic substance use as a part of a more general deviant behaviour pattern); 3) negative affect regulation (toxic substance use "to relax" or "because it helps me when I am feeling depressed") and; 4) pharmacological vulnerability (toxic substance use depending on sensitivity to their effects). Previous studies among young Spanish adults have found that positive expectancies toward substance consumption and deviance proneness pathways were more associated with recreational alcohol use than negative affect regulation or pharmacological vulnerability (Mezquita, Ibáñez, Moya, Villa, & Ortet, 2014). Consequently, the present study only focuses on the first two pathways of Sher and Colleagues model.

2. Method

2.1. Participants

The study sample included 312 adolescents (153 males and 159 females), aged 14–16 ($M = 14.79$; $SD = 0.749$). Sex distribution was equivalent among the three age groups ($\chi^2 = 0.964$; $p = 0.618$; $V = 0.056$). Practically all participants (99.7%) had a personal computer with Internet access at home. Coherent with local rates of immigrants, the vast majority of the participants were born in Spain (88.7%), followed by 7.8% of adolescents born in Romania.

2.2. Measures

Demographics: Demographic variables included sex, age, country of birth, and the availability of a personal computer from which to access the Internet (yes/no). Number of hours online per week and number of hours online for sexual pursuits were also asked.
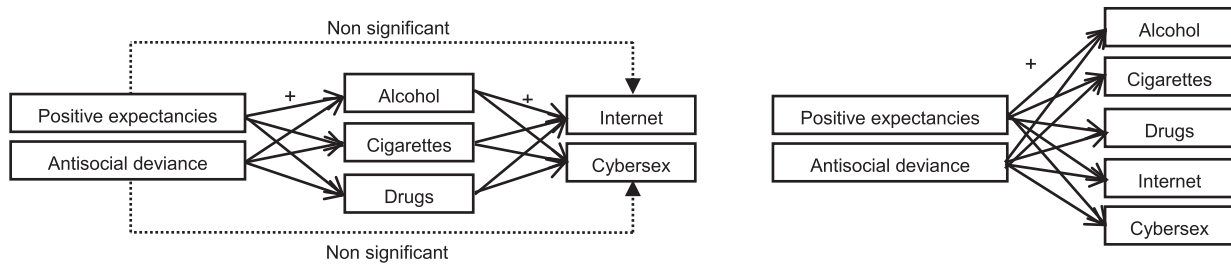
Fig. 1. Graphic depiction of Internet and cybersex use either as a consequence of previous toxic substance use (left) or as a consequence of common pathological pathways (right).

Cigarette, alcohol and drug use: Participants indicated if they had ever used drugs (without specifying the particular type of drug), drunk alcohol, and smoked cigarettes. These responses were dichotomized (yes/no). Those who answered "yes" to the drug use question were asked about the particular drug consumed (i.e. marijuana, cocaine, ecstasy, etc.) and the age at which they used the drug for the first time ("*How old were you the first time you used drugs?*"). The age at which they drank alcohol for the first time was also asked to those who claimed having drunk alcohol. Those who answered "yes" to smoking cigarettes were asked about how many cigarettes they smoked per day.

Expectancies Toward Toxic Substances Consumption Scale (ETTSC): Based on Leigh and Stacy (2004) definition of positive expectancies on the effects of alcohol and other published studies, we developed a brief scale (12 items) that assessed not only expectancies toward alcohol but also cigarettes and other drug use. For the scale construction, we only considered the inclusion of positive expectancies (i.e., "*If I use drugs, I will be friendly*") since it has been demonstrated that they are by far, more strongly associated with toxic substance consumption, severity, and negative outcomes in adolescents, both in cross-sectional (Pabst, Baumeister, & Kraus, 2010) and longitudinal studies (Corbin, Iwamoto, & Fromme, 2011). Positives expectancies were finally defined in the ETTSC as people's positive beliefs about the effects of toxic substances consumption on their behaviour, moods and emotions. Specifically, we included two types of positives expectancies: expectancies about social facilitation (social positive) and positive affect potentiation (fun) (Camacho et al., 2013).

We grouped the 12 items into three subscales: the first subscale was dedicated to alcohol expectancies (ETTSC-alcohol), the second to cigarettes expectancies (ETTSC-cigarettes) and the third to drugs expectancies (ETTSC-drugs). Items took the form of short phrases prefaced by "*When I drink alcohol …*", "*When I smoke cigarettes …*", or "*When I use drugs …*". Participants answered each question on a 4 point Likert scale that ranged from 0 (very unlikely) to 4 (very likely).

Antisocial Deviance Scale (ADS): Antisocial deviance is defined as the degree to which a person violates major social rules and expectations. This tendency does not necessarily involve crime (e.g., lying and deceit) but often includes aggressive acts, theft, vandalism, fire setting, or truancy. It is well-known that antisocial behaviour comprises an external dimension (related to the wide variety of behaviours that violate societal norms or laws) as well as an internal dimension (related to a difficulty in controlling violent impulses) (Murray, Farrington, & Sekol, 2012). In order to reflect this double component of antisocial proneness, we developed a 7-item measure that comprised 2 subscales: the antisocial behaviour scale (ADS-antisocial) and the aggressive impulse-control scale (ADS-Impulses control). Antisocial subscale includes 3 items describing different antisocial behaviours (such as "*I have broken,*

burned, or damaged public properties") whereas Impulse-control subscale includes 4 items related to the capacity to control aggressive impulses ("*I can hardly control myself when I get angry*"). Items from both scales were followed by a four-point Likert scale (never, seldom, sometimes, and often). Psychometric properties for both the ETTSC and the ADS are displayed on the results section.

Internet addiction: Participants completed the Spanish Adaptation of the Internet Addiction Scale (IAS, Young, 1998), a 20-item scale which assesses the extent to which respondents Internet use was problematic as based on criteria for substance dependence and pathological gambling. The criteria include loss of control, salience, negative outcomes (such as neglecting everyday life, relationships, and alternative recreation activities), mood regulation and deception. Participants respond to each question on a 5 point Likert scale that ranges from 1 (Rarely) to 5 (Always). Summation scores can range from 20 to 100, with higher values indicating greater likelihood of Internet Addiction. IAS total score allow the classification of users as recreational users (20–49), at risk (50–79) and pathological users (80–100). In our study, internal consistency for this measure was strong ($\alpha = 0.91$). The IAS is one of the most popular assessment measures in the field (Boysan et al., 2015) and several studies have demonstrated the accuracy of this measure in the assessment of adolescent problematic Internet use (Stavropoulos, Alexandraki, & Motti-Stefanidi, 2013).

Cybersex addiction: Participants completed the 25-item Spanish adaptation of the Internet Sex Screening Test (ISST, Ballester-Arnal, Gil-Llario, Gómez-Martínez, & Gil-Julià, 2010). This scale, originally developed by Delmonico (1997), evaluates the degree to which the online sexual behaviour of a person is, or is not, problematic. Participants answer each question on a dichotomous (True/false) scale. Responses were summed to provide a total severity score (ISST-total) ranging from 0 to 25. According to Carnes, Delmonico, and Griffin (2007), participants could be classified into three groups depending on their ISST-total score: Recreational users (0–8), at risk (9–18), and pathological users (19–25). Additionally, ISST allows the estimation of scores on 5 subscales: loss of control over online sexual behaviour and other pathological indicators (ISST-compulsivity), solitary cybersex (ISST-solitary), social cybersex (ISST-social), economic investment in online sexual activities (ISST-money), and concerns about the severity of cybersex consumption (ISST-severity). Ballester-Arnal et al. (2010) reported good internal consistency ($\alpha = 0.88$) and test-retest stability ($r = 0.82$) for the ISST-total score in a sample of college students between 18 and 25 years old. Internal consistency for the 5 ISST subscales ranged from 0.51 to 0.81. In our study, internal consistency for ISST-total score ($\alpha = 0.82$) as well as for each subscale (α between 0.50 and 0.80) was acceptable. The Spanish adaptation of the ISST was recently employed in the assessment of Spanish adolescents online sexual behaviour (Ballester-Arnal, Giménez-García, Gil-Llario, & Castro-Calvo, 2016), as well as in many other recent studies (Kühn & Gallinat, 2015; Tripodi et al., 2015).

2.3. Procedure

Of the 12 secondary schools located in Castellón de la Plana (Spain), three were randomly selected for their participation in the study. Headmasters were contacted and study procedure and goals were explained in order to ensure their collaboration. When interest in the study was expressed, members of the research team, together with the school psychologist, organized the classes that took part in the assessment. Six classes from each school were randomly selected depending on the education learning year (2 classes in Second Grade, 2 in Third Grade, and 2 in Fourth Grade). Taking into account that the average number of students per class was 25, we expected the participation of around 450 students. The final sample was composed by 312 students, so, the participation rate was above 69%.

Participants were recruited over a period of 6 months (between September 2013 and March 2014). Assessment measures were administered in paper and pencil format during teaching hours and lasted 25 min. In order to ensure confidentiality and maximize honest responses, teachers were not present in the classroom during the assessment. Instead, a member of the research team ensured the proper course of the assessment. The participants did not receive incentives for their participation.

2.4. Data analysis

Descriptive analyses (means and percentages) were first conducted to characterize participants in terms of alcohol, cigarettes, and drug consumption using SPSS statistic package (version 23). Descriptive analyses were also performed in order to describe participant's Internet and cybersex consumption (ISST and IAS average scores, hours spent per week and users category).

Then, t-tests were calculated to compare ISST and IAS scores between those who had ever used drugs, drunk alcohol, or smoked cigarettes and those who had not. The magnitude of the differences in this contrast was estimated by calculating Cohen's d effect size. Effect sizes of 0.2—0.49 were considered small, those between 0.5 and 0.79 were considered medium, and those greater than 0.8 were considered large (Cohen, 1988).

In order to identify the internal structure of the ETTSC and the ADS, an Exploratory Factor Analysis (EFA) was performed. Following Gaskin and Happell (2014) recommendations, we used principal axes analysis with oblimin rotation. Then, we conducted a Confirmatory Factor Analysis (CFA) to compare the adequacy of different factor models. EQS (Version 6.2) software was used to perform the CFA. Due to the non-normality in the data, Robust Methods were used. Within the CFA, we examined standard indicators of model fit, which included: the Satorra-Bentler chi-squared ($_{S.B.}\chi^2$), the general model significance (p), the normed chi-square (χ^2/df), the root mean square error of approximation (RMSEA), the comparative fit index (CFI), and the incremental fit index (IFI). For the CFA, as well as for the Structural Equation Model (SEM), a good fit is obtained when the $_{S.B.}\chi^2$ is nonsignificant (p > 0.05), the χ^2/df is between 1 and 2, the CFI and the IFI are 0.95 or higher, and the RMSEA is 0.05 or lower (Bagozzi & Yi, 2011). CFI and IFI values between 0.90 and 0.95 as well as RMSEA lower than 0.08 are also indicative of an acceptable model fit.

Using the resultant factors of the CFA, we next conducted a structural equation model (SEM) to examine the structural relationship among: 1) the ETTSC and the ADS (2 s order latent variables); 2) alcohol, cigarettes, and drugs consumption (3 dichotomous manifest variables) and; 3) the ISST and the IAS score (2 continuous manifest variables). The inclusion of categorical variables was handled following Finney and DiStefano (2013) recommendations when modeling categorical dichotomous data, as

well as Bentler (2006) implementation guidelines for EQS. Model adequacy was assessed through goodness of fit indices, regression weights, and percentage of variance explained for each endogenous variable (R^2). To test if the final model was invariant between sexes, a multi-group SEM was performed. No constraint was applied to test the hypothesis of configurational invariance.

2.5. Ethics

The study procedures were carried out in accordance with the Declaration of Helsinki. The Institutional Review Board of the Jaume I University approved the study. All subjects' parents were informed about the study in a common informative session. Only adolescents whose parents signed a parental consent completed the study.

3. Results

3.1. Descriptive analysis

Table 1 displays sample characteristics. The percentage of those who had ever drunk alcohol (59.4%) was more than double the percentage of those who had ever used other drugs (25.6%) or smoked cigarettes (25.1%). The most common drug participants had used was marijuana (80%) and the average age of the first consumption was 13 years for both alcohol ($SD = 3.85$) and other drugs use ($SD = 1.46$).

Participants spent an average of 11.44 h per week ($SD = 13.15$) on the Internet and an average of 40 min ($SD = 12.7$) searching for sexual materials. The sample mean for the IAS was 41.27 ($SD = 13.63$), whereas mean score for the ISST was 2.64 ($SD = 3.47$). None of the participants were classified as pathological cybersex user and only a little percentage (1.6%) were classified as pathological Internet users. 23.3% and 6.8% of the sample were classified as at risk users on the IAS and the ISST respectively.

3.2. Bivariate comparisons between cigarette/alcohol/drug use and Internet/cybersex addiction scores

As shown in Table 2, having drunk alcohol, smoked cigarettes, or used drugs were significantly related to higher scores on the IAS

Table 1
Sample characteristic.

	% or M (SD)
Drink alcohol	
Yes	59.4%
First time (age)	13.18 (1.41)
Smoke cigarettes	
Yes	25.1%
Cigarettes per day	3.36 (3.85)
Use drugs	
Yes	25.6%
Marihuana (only those who had ever used drugs)	80%
First time (age)	13.93 (1.46)
Internet addiction	
IAS Score (range 20—100)	41.27 (13.63)
Hours per week	11.44 (13.15)
Recreational users	75.2%
At risk	23.3%
Pathological Users	1.6%
Cybersex addiction	
ISST Score (range 0—25)	2.64 (3.47)
Minutes per week	40 (12.7)
Recreational users	93.2%
At risk	6.8%
Pathological users	0%

Table 2
Difference on the Internet and the cybersex addiction score between individuals who consumed or not alcohol, cigarettes, or drugs.

	Range	Drink alcohol				Smoke cigarettes				Use drugs			
		No M (SD)	Yes M (SD)	t-test	Cohen's D	No M (SD)	Yes M (SD)	t-test	Cohen's D	No M (SD)	Yes M (SD)	t-test	Cohen's D
IAS-total	20–100	36.63 (12.93)	43.57 (12.63)	4.579***	0.54	38.91 (12.38)	45.35 (14.03)	3.885***	0.50	39.15 (12.13)	45.84 (14.90)	3.721***	0.51
ISST-total	0–25	1.91 (2.83)	2.91 (3.55)	2.469***	0.31	2.09 (2.87)	3.73 (4.19)	3.755***	0.50	1.81 (2.23)	5.07 (4.84)	7.305***	1.05
ISST-Compulsivity	0–8	0.22 (0.68)	0.34 (1.02)	1.076	0.13	0.22 (0.70)	0.52 (1.35)	2.473**	0.32	0.13 (0.44)	0.86 (1.59)	5.815***	0.82
ISST-solitary	0–6	0.94 (1.41)	1.42 (1.87)	2.350*	0.28	1.04 (1.44)	1.76 (2.22)	3.275***	0.42	0.93 (1.35)	2.27 (2.29)	5.807***	0.81
ISST-social	0–6	0.43 (0.83)	0.71 (0.98)	2.488**	0.30	0.45 (0.83)	1.01 (1.09)	4.598***	0.65	0.45 (0.75)	1.02 (1.24)	4.948***	0.63
ISST-money	0–2	0.03 (0.22)	0.05 (0.25)	0.765	0.08	0.03 (0.21)	0.07 (0.31)	1.159	0.16	0.01 (0.09)	0.17 (0.45)	4.853***	0.66
ISST-severity	0–3	0.37 (0.69)	0.37 (0.68)	0.065	0.01	0.39 (0.68)	0.33 (0.69)	−0.622	0.08	0.32 (0.60)	0.68 (0.93)	3.590***	0.51

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.
IAS: Internet Addiction Scale; ISST: Internet Sex Screening Test.

total score, the ISST total score, and the ISST subscales. In particular, those adolescents who used drugs reported the highest scores on the Internet and cybersex addiction scales, with effect sizes above 0.50 (medium to large effect size) in all the cases. Especially remarkable is the fact that the ISST-total score in those who have ever used drugs was more than two times the score in drug abstinent adolescents. A similar pattern was observed in those who smoked or drank alcohol; however, the association is not as strong as in the case of drug use. The only non-significant relationships were found between having smoked cigarettes/drank alcohol and the ISST-money/ISST-severity scores.

3.3. Exploratory and confirmatory factor analyses of the expectancies toward toxic substances consumption scale and the antisocial deviance scale

In the case of ETTSC, Kaiser-Meyer-Olkin (KMO = 0.703) and Bartlett's test (χ^2 (66) = 882.87, p = 0.000) indicated that data met the requirements to perform an Exploratory Factor Analyses (EFA). Thus, a Maximum Likelihood factor analysis was conducted with oblique rotation, revealing a 3-factor solution that accounted for 69.38% of total variance. Item distribution among the three ETTSC subscales (4 items per scale) was identical to *a priori* theoretical distribution. ETTSC-alcohol, ETTSC-cigarettes, and ETTSC-drugs accounted for 39%, 19%, and 11% of the variance respectively. Internal consistency (Cronbach's alpha) for these three subscales ranged from 0.79 to 0.84.

Kaiser-Meyer-Olkin (KMO = 0.767) and Bartlett's test (χ^2 (21) = 647.42, p = 0.000) for the ADS indicated once again the adequacy to perform an EFA. In this case, results suggested retaining 2 factors, which accounted for 62.15% of total variance. As was expected, ADS-antisocial (45.37% of the total variance) included three items related to antisocial behaviours, whereas ADS-impulse control (16.78%) included 4 items related to the capacity or not to control aggressive impulses. Internal consistency for the ADS-antisocial ($\alpha = 0.77$) and the ADS-impulse control scale ($\alpha = 0.70$) was good.

Prior to the inclusion of ETTSC and ADS subscales into the Structural Equation Model (SEM), a Confirmatory Factor Analyses (CFA) was performed. For both scales, we tested the goodness of fit of two possible models: a model with two (In the case of ADS) or three (ETTSC) first order correlated factors (M1) and a model where a second order factor accounted for the shared variance between first order factors (M2). As can be seen in Table 3, the goodness of fit indices showed that the hierarchical model of a second order factor (M2) had a better fit to the data in both scales. It is noteworthy that significance in the case of ADS (0.81) was even higher than the strict criterion (p > 0.75) established by Hayduk and Glaser (2000) to consider that a model has reached a good data fit. In the ETTSC scale, second order factor accounted for 55%, 23%, and 50% of the variance of ETTSC-cigarettes, ETTSC-alcohol, and ETTSC-drugs respectively. The second order factor in the ADS scale accounted for 80% of the variance of ADS-antisocial and 38% of ADS-Impulse control. In the case of the ETTSC scale, item factor loadings were above 0.69, whereas in the ADS scale were above 0.43.

3.4. Structural equation model

Having confirmed the best-fitting structure for the three ETTSC and the two ADS subscales, we next sought to test the structural relationships between them, toxic substances consumption (in particular, alcohol, cigarettes, and drugs consumption), and internet/cybersex addiction scores. We first tested a structural model in which the relationship between expectancies, antisocial deviance and behavioral addictions (internet and cybersex) were

Table 3
Goodness of fit indices for the CFAs and the Structural Equation Model.

		$_{S.B.}\chi^2$	df	p	χ^2/df.	RMSEA	CFI	IFI
ETTSC	M1	56.81	48	0.17	1.17	0.025	0.91	0.92
	M2	50.95	47	0.32	1.08	0.017	0.96	0.96
ADS	M1	20.67	11	0.03	1.87	0.054	0.96	0.96
	M2	5.20	9	0.81	0.57	0.001	0.99	0.99
Structural Equation Model	M1	361.44	233	<0.001	1.55	0.07	0.546	0.606
	M2	493.21	229	<0.001	2.15	0.10	0.774	0.783
	M3	307.12	235	0.04	1.30	0.03	0.92	0.92
Multi-group SEM	M3_MG	454.51	470	0.68	0.96	0.02	0.99	0.99

Note: $_{S.B.}\chi^2$ = Satorra-Bentler chi-square; df = degrees of freedom; p = general model significance; χ^2/df = normed chi-square; RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index; IFI = Incremental Fit Index.

fully mediated by the consumption of toxic substances (Fig. 1, left). This model was encoded as M1. Based on the suggestions obtained from Lagrange Multiplier Test (LM), we tested an alternative model where use of toxic substances only partially mediated between ETTSC, ADS and behavioral addictions (M2). The main difference between M1 and M2 was the inclusion of a direct path between the ETTSC and the ADS second order factors and the Internet and cybersex addiction endogenous variables. After a detailed analysis of direct, indirect and total effects, we finally proposed a third model (M3). In this model, toxic substances consumption and indicators of behavioral addictions were at a same level, whereas expectancies and antisocial deviance had a direct influence on them (Fig. 1, right). The final model is presented in Fig. 2.

Goodness of fit indices for these three models can be seen in Table 3. In comparison with previous models, the third model showed better fit indices, especially when we pay attention to indices such as the normed chi-square or the RMSEA. Only the general model significance, CFI, and IFI were slightly below the criterion of perfect adjustment, in any case reaching an acceptable fit. As hypothesized, social deviance and expectancies toward toxic substances consumption were positively related to both toxic substance consumption (with regression weights ranging from 0.27 to 0.48) and internet/cybersex addiction severity (0.22−0.45). The percentage of variance accounted by the ETTSC and the ADS was

high for both the internet (21.9%) and the cybersex (16.5%) endogenous variables, but not as good as in the case of toxic substances consumption.

Multi-group SEM was performed in order to test the gender invariance of the third model (M3). As can be seen in Table 3, M3_MG model had an excellent fit to the data, in particular if we pay attention to the general model significance (0.68), the normed chi-square (0.96), and the RMSEA (0.02). These results suggest that the structure of the proposed model was invariable between boys and girls.

4. Discussion & conclusions

The present study sought to examine the influence of toxic substance use on the Internet and cybersex consumption, as well as to establish the nature of the relationship between them. As expected, Internet and Cybersex use is increased among those adolescents who have used alcohol, tobacco and especially drug. This overlap is the result of common etiological pathways (in particular, antisocial proneness and positives expectancies toward substance consumption) that increase the likelihood for both toxic substance and Internet and cybersex use and abuse in boys and girls.

The general pattern of substance use was similar to that observed in previous studies. The most common substance used
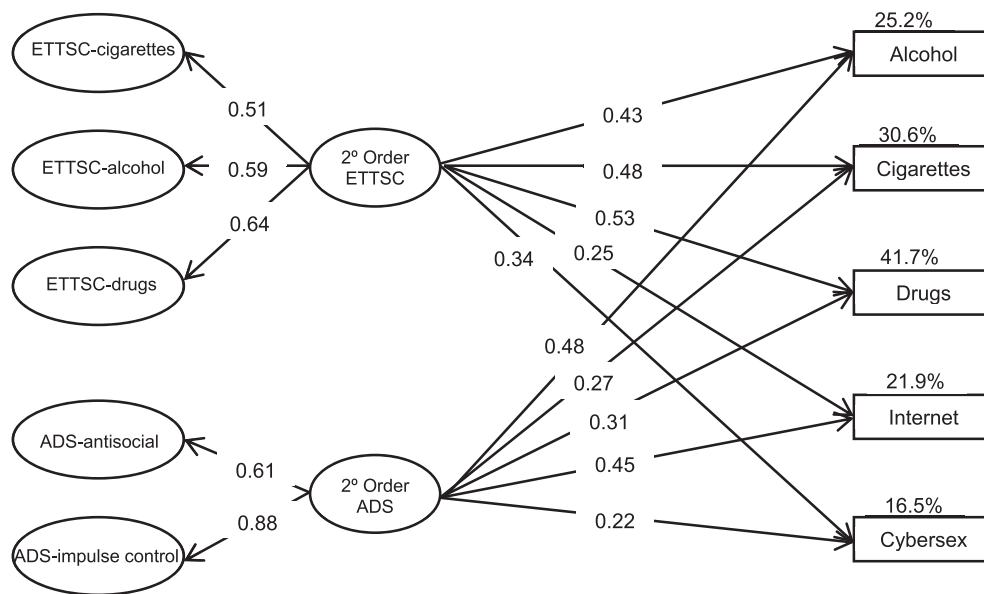
Fig. 2. Final Structural Equation Model depicting expectancies toward toxic substances, antisocial deviance, toxic substances consumption, and Internet/cybersex addiction (M3). R^2 is expressed as a percentage outside the main endogenous variables boxes. Coefficients are reported in standardized format. All parameters were significant at p < 0.001. Items of the ETTSC and the ADS, as well as error terms, are not included in the figure in order to facilitate its interpretation.

was alcohol (about 60%), followed by drug and tobacco (25.6% and 25.1%). These percentages were higher than those observed in previous studies such as the Fuller and Hawkins (2013) research among British pupils, but quite similar to those reported by the last Spanish Drug Observatory annual report (Spanish Drug Observatory, 2014). This increased use of toxic substances (especially alcohol) found among participants in our study in comparison to those observed in other western countries could be understood as the consequence of social and cultural context: permissiveness toward adolescents alcohol consumption together with less restrictive policies in the access to tobacco (Gallus et al., 2014; Pförtner et al., 2016) could explain the increased percentage of Spanish teenagers reporting both behaviours. Furthermore, these results go partially against the gateway hypothesis: whereas this hypothesis proposes that typical substance consumption sequence starts with the use of legal drugs (tobacco and alcohol) and then increases to illegal drugs (Kandel et al., 2006; Maldonado-Molina & Lanza, 2010), in our study illegal drug use was slightly more frequent than cigarettes consumption.

In contrast, the risk of Internet and cybersex addiction was lower than those reported by previous studies. Using validated self-report measures, it was found that only 1.6% of adolescents included were classified as Internet addicts, whereas none were classified as cybersex addicts. Given that prevalence of Internet addiction in European adolescents ranges from 1 to 9% (Spada, 2014), this figure falls into the more conservative end of typical range of estimated prevalence for this pathology. As far as we know, there is no studies that systematically research the prevalence of cybersex addiction in adolescents (Wéry & Billieux, 2015). In adults, Ross, Månsson, and Daneback (2012) found that between 1.7% (strict criteria) and 7.6% (lax criteria) of their sample showed problems in controlling their sexual behaviour online. Therefore, it is difficult to say whether the absence of cybersex addicted adolescent in our sample is the result of sampling problems or just the evidence of a very low prevalence of this pathology during this development period. Nonetheless, the percentage of adolescents classified as internet (23.3%) and cybersex risk users (6.8%) was considerable.

To the extent that time online has been considered strongly related to addictive Internet use (Adiele & Olatokun, 2014) as well as an indicator of pathological cybersex consumption (Laconi, Tricard, & Chabrol, 2015), we also examined this indicator among our study participants. In this regard, our results support not only the low prevalence of Internet and cybersex problems but also the lower use of both the Internet and cybersex. On average, adolescents in our study spend 11.44 h per week on the Internet as well as 40 min searching for porn or in sexual chats, figures that are far below the time reported by previous studies. In a research conducted among 3173 Dutch adolescents, the average time online per week was 20.72 h for non Internet addicted adolescents and 30,31 for pathological users. In the case of cybersex addiction, non-pathological users usually spend 1 h or less per week in online sexual activities (Cooper, Delmonico, & Burg, 2000), whereas cybersex addicts spend an average of 25 h (Laconi et al., 2015). Therefore, Internet and cybersex use among our study sample appears to be less problematic as well as less frequent than those found in previous studies.

As we expected, Internet and Cybersex use was increased among those adolescents who have used alcohol, tobacco, and drugs. This finding is consistent with previous studies linking toxic substance consumption and Internet addiction (Bakken et al., 2009; Hammond et al., 2014; Sik et al., 2013) but, as far as we know, this is the first time that a clear link between toxic substance use and an increased risk for cybersex addiction has been found. In particular, in our study drug use was the factor more strongly associated to an increase in both Internet and cybersex use, probably due to the especial relevance of certain personality traits (such as low self-control, impulsivity, and sensation seeking) in the use or not of illegal drugs (Kuss, Griffiths, Karila, & Billieux, 2014). Coherent with this explanation, the relationship between Internet and cybersex use among those adolescents who have smoked cigarettes or used alcohol (two behaviours where sensation seeking or impulsivity can play a less relevant role) was significant but not as strong as in the case of drug use (Leeman, Hoff, Krishnan-Sarin, Patock-Peckham, & Potenza, 2014).

The major contribution of the present study is to establish that cybersex and Internet use and severity share common etiological pathways with tobacco, alcohol, and drug use; in particular, it has been found that positive expectancies toward substance consumption and antisocial deviance proneness (two classical pathways associated with SUD) (Mezquita et al., 2014; Sher et al., 2005) have a direct influence on Internet and cybersex use and severity. Furthermore, we have demonstrated that this relationship is consistent both in boys and girls. Contrary to Sik et al. (2013) hypothesis, our results don't support the notion of toxic substance use as a precursor of Internet and cybersex. In comparison with antisocial deviance proneness, positive expectancies toward substance consumption has more predictive power over cigarette, drug and cybersex use. By contrast, antisocial deviance proneness has a major influence over alcohol and Internet use. A previous study suggested that "people who have expectancies that the Internet can be used to increase positive or reduce negative mood may be more likely to develop Generalized Internet Addiction (GIA) (Brand, Laier, & Young, 2014, p. 10, p. 10)". Additionally, it has been found that adolescents with Internet addiction are more likely to have aggressive behaviours prior to the onset of their pathology (Ko, Yen, Liu, Huang, & Yen, 2009). However, as far as we know, this is also the first time that expectancies, together with antisocial deviance, have been considered in order to explain not only the Internet but also cybersex use and abuse.

4.1. Limitations and future directions

The present study has several limitations. First, Alcohol, tobacco, and drug use was measured by self-report, so it is possible that factors such as social pressure of peers, characteristics of the adult examiner or perceived threat to confidentiality could have affected to the accuracy of the assessment. Second, despite having followed recommendations to the inclusion of dichotomous variables in SEM, it is always preferable to use continuous variables. Third, positive expectancies toward Internet and cybersex consumption have not been specifically addressed in this study. Instead, we employed the ETTSC. If we had included measures such as the Internet Use Expectancies Scale (Brand et al., 2014), probably we would have obtained better results, but at the time we started this study, this scale was not published yet. Finally, since this study is based on cross-sectional data, we were not able to determine whether ADS and ETTSC are the cause or consequence of Internet, cybersex, and toxic substance use. Thus, future studies (if possible, longitudinal studies) might benefit from incorporating new toxic substances measures with continuous variables (e.g., frequency of toxic substance use, severity, etc.) together with specific measures of Internet and cybersex positive expectancies.

To our knowledge, this is the first study to examine the overlap between two types of behavioral addictions (Internet and cybersex addiction) and toxic substance use in a sensitive population, adolescents between 14 and 16 years old. Furthermore, this study clarifies the role of two classical etiological pathways (antisocial deviance proneness and expectancies toward substance consumption) in the explanation of Internet and cybersex use and

severity. To the extent that it has been conducted among adolescents without SUDs and with a low proportion of pathological Internet and cybersex use, their results are generalizable to the broader population of Spanish adolescents.

Conflict of interest

The authors declare no conflict of interest.

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