Obsession and compulsion in mobile phone use/abuse: OCDUS-ICT

Obsesión y compulsión en el uso/abuso del móvil: el OCDUS-TIC

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Abstract

Compulsiveness has been considered one of the core characteristics of addictive behaviours. One of the abusive behaviours that has acquired importance in recent times involves the use of mobile phones. The aim of this study is to obtain a version of the Obsessive-Compulsive Drug-Use Scale (OCDUS) to study the compulsivity associated with mobile phone abuse, its basic psychometric properties and the results of its application. The OCDUS-ICT was created and administered over the Internet, through instant messaging programs, social networks and e-mail, and anonymous and voluntary participation was requested. Additionally, MULTICAGE-ICT and the Inventory of Prefrontal Symptoms were administered. A sample of n=748 subjects, 33% males and 94% born and resident in Spain was obtained. The test obtained adequate values of internal consistency, applying different estimators. Confirmatory factor analysis of the theoretical scales yielded adequate fit indices. Obsessive-compulsive components were observed to become stronger as mobile phone use increased and approached abuse levels. OCDUS-ICT scales showed large correlations with prefrontal malfunction symptoms, especially Thoughts-Interference (r>0.80). In conclusion, OCDUS-ICT explores with psychometric accuracy the obsessive-compulsive components of mobile use/abuse, which are closely related to malfunctions in daily life attributable to the prefrontal cortex. If impulsivity has so far been the focus in the study of mobile phone abuse, the data from the present study suggest that greater attention should be paid to compulsivity as a factor in maintaining abuse.

Keywords: opioids, Compulsivity; Smartphone Addiction; OCDUS; Prefrontal symptoms in daily life; Behavioural addictions.

Resumen

La compulsividad ha sido considerada una de las características nucleares de las conductas adictivas. Uno de los comportamientos abusivos que ha adquirido importancia en tiempos recientes es el uso del teléfono móvil. El objetivo del presente trabajo es obtener una versión de la Escala de Uso Obsesivo-Compulsivo de Drogas (OCDUS) para estudiar la compulsividad asociada al abuso del móvil, conocer sus propiedades psicométricas básicas y resultados de su aplicación. Se creó y administró el OCDUS-TIC por Internet, mediante mensajería instantánea, redes sociales y correo electrónico, solicitándose la participación anónima y voluntaria. Adicionalmente se administraron el MULTICAGE-TIC y el Inventario de Síntomas Prefrontales (ISP). Se obtuvo una muestra de n=748 sujetos, 33% varones y 94% nacidos y residentes en España. El test obtuvo adecuados valores de consistencia interna, aplicando diferentes estimadores. Se realizó un análisis factorial confirmatorio sobre las escalas teóricas, alcanzando adecuados estimadores de ajuste. Se observó que los componentes obsesivo-compulsivos son de mayor magnitud a medida que se incrementa la implicación en el uso y su progresión al abuso del móvil. Las escalas del OCDUS-TIC mostraron correlaciones de gran magnitud con los síntomas de mal funcionamiento prefrontal, especialmente la de Pensamiento-Interferencia (r>0,80). En conclusión, el OCDUS-TIC explora con garantías psicométricas los componentes obsesivo-compulsivos del uso/abuso del móvil, que se relacionan estrechamente con fallos cotidianos de origen prefrontal. Si la impulsividad ha centrado el interés en el estudio del abuso del móvil, los datos del presente estudio aconsejan prestar mayor atención a la compulsividad como factor de mantenimiento del abuso.

Palabras clave: Compulsividad; Adicción al Móvil; OCDUS; Sintomatología prefrontal; Adicciones comportamentales.

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Introduction

Although in everyday usage they are often treated as synonyms, the terms "impulsivity" and "compulsivity" present important differences at the conceptual level which are crucial in the context of addictive behaviours. Impulsivity was initially defined as the tendency to act quickly when triggered by both internal and external stimuli, without assessing all available information before carrying out an action and, therefore, without calculating its consequences (Eysenck & Eysenck, 1978). Impulsive behaviour is maintained by positive reinforcement, oriented towards the achievement of a hedonic goal, and ego-syntonic to the extent that these goals are in harmony with or acceptable to the needs of the individual and consistent with his or her self-image. Compulsive behaviour, meanwhile, is maintained by negative reinforcement, is aimed at reducing distress and is ego-dystonic since the subject knows that he or she should not perform it but feels compelled to do so (Cabrini et al., 2009; Koob, 2013).

While impulsivity is linked to initial consumption and drug abuse episodes, compulsivity seems to be the central element of addiction maintenance (Baker, Piper, McCarthy, Majeskie & Fiore, 2004). Everitt and Robbins (2005) outlined the issue as follows in their neuropsychological model of transition between impulsivity and compulsive habits: "*Drug addiction is increasingly viewed as the endpoint of a series of transitions from initial drug use—when a drug is voluntarily taken because it has reinforcing, often hedonic, effects—through loss of control over this behavior, such that it becomes habitual and ultimately compulsive (…) We hypothesize that the change from voluntary drug use to more habitual and compulsive drug use represents a transition at the neural level from prefrontal cortical to striatal control over drug seeking and drug taking behavior as well as a progression from ventral to more dorsal domains of the striatum, involving its dopaminergic innervation. These neural transitions may themselves depend on the neuroplasticity in both cortical and striatal structures that is induced by chronic self-administration of drugs.*" (p. 1481). This starting hypothesis has been further refined by important accumulated empirical evidence (Everitt & Robbins, 2016).

Impulsivity has been widely studied in its relationship with the development of addictive behaviours (Verdejo-García, Lawrence & Clark, 2008), although compulsivity has not been the subject of the same volume of research, mainly due to the lack of evaluable theories and instruments. The existence of an axis has been posited with an impulsive and a compulsive pole, and addictive behaviours playing out between these two extremes. This would allow subjects to be classified at some point on the continuum and treatments to be adjusted to their needs (Fernández Serrano et al., 2012). It has been found that impulsivity precedes and predicts compulsivity in samples of people with addictive behaviours (Baker et al., 2004; Belin-Rauscent et al., 2016).

However, with the emergence and rise of so-called behavioural addictions, new challenges have appeared. As noted above, Everitt and Robbins (2016) attribute the changes in behavioural control to *"chronic self-administration of drugs"*, but with these behavioural addictions there is no substance to be held responsible. And yet, prefrontal hypofunction has been identified, both at the structural level (e.g., Zsidó et al., 2019) and in performance in neuropsychological tests (p. ej., Brand, Young & Laier, 2014; Van Timmeren, Daams, Van Holst & Goudriaan, 2018), and also in activities of daily living (e. g., Pedrero-Pérez et al., 2018). Tthey also have in common the compulsive nature of the behaviour, so that, although the term "addiction" has not been officially accepted, except in the case of pathological gambling, the literature usually refers to these problems as compulsive Internet use (Gmel, Khazaal, Studer, Baggio & Marmet, 2019), compulsive shopping (de Mattos, Kim, Filomensky & Tavares, 2019) or compulsive sexual behaviour (Efrati & Mikulincer, 2018), among others, with instruments for the measurement of each of the disorders being developed, as in the case of the works cited. However, if compulsivity is indeed a type of behaviour associated with addiction, it should be possible to measure it in all addictive modalities, with or without substances, as the basic substrate of addictive behaviour, regardless of the phenomenology associated with each modality.

One of the addictions or compulsive behaviours which has grown in importance over recent years is the use of the smartphone (mobile phone with Internet connection), precisely because this device permits access to sources with stimulants which facilitate the development of multiple addictive behaviours, be it to shopping, sex, gambling, video games or the Internet itself (Pedrero-Pérez, Rodríguez-Monje & Ruiz-Sánchez de León, 2012). Avoidance in this case also seems to largely explain compulsive use and maintenance over time (Ruiz-Ruano, López-Salmerón & López, 2020). Although there are a large number of instruments proposed for the assessment of mobile addiction or problematic use, no studies have been found which explore the compulsivity which underlies this behaviour in terms comparable to its presence in other addictive modalities involving substances.

The Obsessive Compulsive Drug Use Scale (OCDUS) was initially validated for the measurement of the obsession-compulsion cycle in people dependent on heroin (Franken, Hendriks & van den Brink, 2002). Simply by modifying the drug mentioned in each item, it was subsequently adapted and validated for users of cocaine (Lievaart et al., 2015) and cannabis (Machielsen et al., 2012; Machielsen, Veltman, van den Brink & de Haan, 2018). The OCDUS is one of the tests put forward by a committee of international experts to measure the compulsive dimension in addictive behaviours

within the neuroscientific scope of the RDoC project (Yücel et al., 2018). However, no research has been found which applies this test with a behavioural addiction focus. The objective of this study is to develop an OCDUS-ICT version to investigate compulsivity associated with the abuse of information and communication technologies, to reveal its basic psychometric properties and the results of its application, as well as provide evidence of concurrent and discriminant validity.

Method

Participants

A sample of n = 764 subjects was obtained. After an outlier detection analysis, 16 subjects with atypical scores were excluded, leaving a reduced final sample of n = 748 subjects. Table 1 presents the descriptive analysis of the final sample, of which 93.6% were born and resident in Spain.

Table 1. *Descriptive variables of the sample.*

	Men	Women	Total
n	**245**	**503**	**748**
Age			
18 - 24	28	90	118
25 - 30	38	67	105
31 - 45	67	133	200
46 - 60	86	158	244
› 60	26	55	81
Education			
Primary or less	8	10	18
Compulsory secondary	13	5	18
Higher secondary	52	57	109
University student	18	55	73
University graduate	154	376	530

Process

Since the target population was one of regular ICT users, a survey was prepared through Google Docs® (available on https://goo.gl/Y3t3rr), and anonymous and voluntary participation was requested through instant messaging programs (WhatsApp®), social networks (Facebook®, Instagram®) and email. At the same time, a chain sampling technique was employed by asking participants to forward the survey to contacts. Data collection began on January 2 and stopped on February 12, 2019.

Tools

The Obsessive-Compulsive Drug Use Scale (OCDUS) is a 12-item self-report questionnaire. The validation study (Franken et al., 2002) found three factors: thoughts and interference (6 items), desire and control (4 items) and resistance to thoughts and intention (2 items). Responses are given on a 7-point analogue scale (typically ranging from Not at all to All the time). Items 6 and 12 will have to be reversed to ensure that all items point in the same direction. For the present study, a version called OCDUS-ICT was created following the usual translation-back translation procedure from the original version (Franken et al., 2002), and replacing the name of the drug with "the mobile phone or its applications" without changing the rest of the question in any way. Studies with previous versions showed adequate evidence of internal consistency and validity (Lievaart et al., 2015; Machielsen et al., 2012; Machielsen, Veltman, van den Brink & de Haan, 2018). Since the OCDUS-ICT is a new version, it has been validated.

The MULTICAGE-ICT is a 20-item questionnaire consisting of 5 scales designed to investigate problems related to the use of the Internet, mobile phone, videogames, instant messaging and social networks (Pedrero-Pérez et al., 2018). It is based on MULTICAGE CAD-4, a compulsive behaviour screening questionnaire, with and without substances (Pedrero-Pérez et al., 2007), which has been used in primary care (Garrido-Elustondo, Reneses, Navalón, Martín, Ramos & Fuentes, 2016; Reneses et al., 2015; Rodríguez-Monje, Pedrero-Pérez, Fernández-Girón, Gallardo-Alonso & Sanz-Cuesta, 2009), behavioural addictions (Estevez, Herrero-Fernández, Sarabia & Jauregui, 2015; Estévez Gutiérrez, Herrero Fernández, Sarabia Gonzalvo & Jáuregui Bilbao, 2014; Megías et al., 2018) and substance addiction (Martínez-González, Munera-Ramos & Becoña-Iglesias, 2013; Navas, Torres, Cándido & Perales, 2014; Navas, Verdejo-García, Lopez-Gomez, Maldonado & Perales, 2016; Pedrero-Pérez, 2010). A mobile phone use/abuse scale was subsequently included (Rodríguez-Monje et al., 2019). The MULTICAGE-ICT asks four questions with a dichotomous answer (yes/no) for each problem behaviour, focusing on: item 1, estimated time of own excessive use; item 2, estimated time of excessive use by significant others; item 3, difficulty in not performing the behaviour; item 4, difficulties in voluntarily interrupting the behaviour. The psychometric study yielded adequate internal consistency of all scales ($0.74 < \omega < 0.93$) and evidence of structural validity.

The screening version of the Prefrontal Symptom Inventory (PSI-20; Pedrero-Pérez, Ruiz-Sánchez de León, Morales-Alonso, Pedrero-Aguilar & Fernández-Méndez, 2015) explores symptoms of malfunction in daily life related to neuropsychological disorders attributable to the prefrontal cortex. This is a 20-item scale with a 5-point Likert-type response format (0: never or almost never; 1: rarely; 2: sometimes yes and sometimes no; 3: many times; 4: always or almost always). Factorial analysis revealed a three-factor solution: problems in behavioural control, problems in emotional control and problems in social behaviour. Adequate internal consistency of all subscales was reported in validation both in the general population and in addicts under treatment reported ($0.87 < \alpha_s < 0.89$); this was also the case in clinical validity tests (Ruiz-Sánchez de León,

Pedrero-Pérez, Gálvez, Fernández-Méndez & Lozoya-Delgado, 2015), ecological (Pedrero-Pérez et al., 2016) and cross-cultural validity (González Roscigno, Mujica Díaz, Terán Mendoza, Guerrero Alcedo & Arroyo Alvarado, 2016; Mendoza, Cuello & López, 2016). In the sample of the present study, the multivariate consistency of the complete test was $\alpha_s = 0.91$ and that of the scales $0.81 < \alpha_s < 0.90$.

Data analysis

The Mahalanobis distance was applied for outlier detection, considering a probability of $p < 0.001$ as a limit; sixteen subjects were thus excluded (2.09% of the total sample). Descriptive statistics of the items and their distributions were obtained. A confirmatory factor analysis with unweighted least squares was performed on the theoretical three-factor model proposed for previous versions. To analyze the fit of the theoretical model to the data we used absolute (Goodness-of-fit statistic GFI, Adjusted goodness-of-fit statistic AGFI and Root mean square residual RMR), incremental (Normed fit index NFI and Relative fit index RFI) and parsimonious indices (Parsimony Goodness-of-Fit Index PGFI and Parsimonious Normed Fit Index PNFI), comparing their values in two alternative models and applying the currently accepted values for their interpretation (Schreiber, Nora, Stage, Barlow & King, 2006). Several indicators were reported for internal consistency (regular and standardized Cronbach's alpha, and McDonald's omega), as recommended for dichotomous or Likert-type scales (Trizano-Hermosilla & Alvarado, 2016). For multivariate comparisons, multivariate analysis of variance was used, applying omega squared (ω^2) as an estimator of effect size; to interpret this, Cohen's rule of thumb was observed, where 0.01 is considered a low effect, 0.03 a moderate effect and 0.6 a large effect (Cohen, 1988). In the correlational analysis, the Bonferroni correction was applied to avoid committing Type I error. The AMOS 18.0 program was used for the confirmatory factor analysis, and the SPSS 17.0 statistical package for the rest (ω^2 was calculated manually from the ANOVA table).

Results

Univariate descriptions

Table 2 shows the descriptive data for OCDUS-ICT items.

Tabla 2. *Descriptivos univariados de los ítems del OCDUS-TIC.*

Item	Mean	CI 95%	Variance	Asymmetry	Kurtosis (centred at 0)
1	2.08	(1.97 - 2.20)	1.50	1.34	1.42
2	2.01	(1.90 - 2.12)	1.36	1.45	2.07
3	1.85	(1.73 - 1.96)	1.42	1.74	2.95
4	1.61	(1.52 - 1.70)	1.01	2.06	4.54
5	1.81	(1.70 - 1.92)	1.42	1.77	3.00
6	3.44	(3.22 - 3.65)	5.18	0.47	-1.31
7	2.90	(2.76 - 3.03)	2.05	0.48	-0.39
8	2.91	(2.77 - 3.04)	2.07	0.57	-0.26
9	2.96	(2.81 - 3.11)	2.63	0.52	-0.72
10	2.21	(2.08 - 2.33)	1.73	1.17	0.97
11	2.55	(2.42 - 2.69)	2.10	0.81	-0.17
12	3.11	(2.94 - 3.27)	3.21	0.59	-0.66

Confirmatory Factor Analysis

Figure 1 shows the structure yielded by the application of confirmatory factor analysis on the theoretically proposed scales for OCDUS-ICT. This structure generally produced adequate fit indices. We also studied the hypothetical structure of two factors (obsession and compulsion, merging factors 2 and 3 of the three-factor model the latter), but the fit indices did not improve significantly (Table 3).

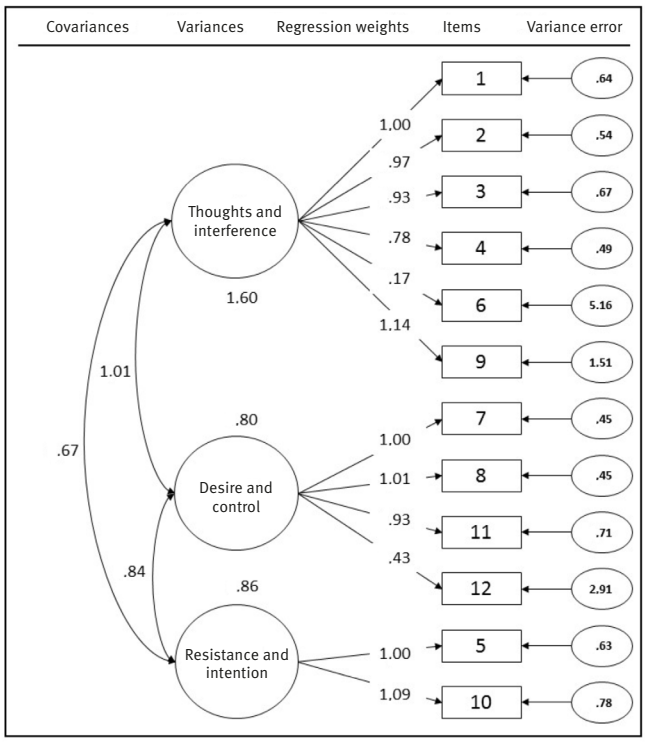

Figure 1. Confirmatory factor analysis of the OCDUS-ICT.

Table 3. *Fit indices of OCDUS-ICT three-factor and two-factor models.*

	GFI	AGFI	NFI	RFI	RMR	PGFI	PNFI
Better fit	**› 0.95**	**› 0.90**	**› 0.95**	**› 0.90**	*	**› 0.50**	**› 0.50**
3 factors	0.96	0.95	0.94	0.92	0.19	0.63	0.72
2 factors	0.96	0.95	0.93	0.92	0.19	0.65	0.75

Note. * The closer to 0 the better.

The thoughts and interference scale showed adequate consistency (α= 0.69; ω= 0.87; α_s= 0.84), as did desire and control (α= 0.89; ω= 0.86; α_s= 0.84) and resistance and intention (α= 0.71).

Scores obtained on the OCDUS-ICT scales

Table 4 shows the means and scatter of the scores obtained on the OCDUS-ICT by the total sample and by sex. The differences were not significant in any of the cases (λ= 0.99; p= 0.18).

Table 5 shows the scores obtained by each age group on the OCDUS-ICT scales. This variable did show an interaction effect (λ= 0.87; p< 0.01; ω^2=0.13) and in this case the differences were significant in all three scales (thoughts and interference F_4= 6.4; ω^2= 0.03; desire and control F_4= 16.1; ω^2= 0.08; resistance and intention F_4= 24.6; ω2= 0.12; p< 0.001 in all three cases). As can be seen, the scores on all three scales fall as age increases.

OCDUS-ICT and MULTICAGE-ICT

The correlations between the scales of both questionnaires are shown in Table 6. After applying the Bonferroni correction, all correlations are significant, although the effect size is larger with the desire/control scale and all the MULTICAGE-ICT scales, except for videogames.

Table 7 shows the scores obtained on the OCDUS-ICT in each of the mobile phone use categories. It is clear that as the use of mobile phones becomes more problematic, scores on all OCDUS-ICT scales increase, with a small effect size, except in the case of desire/control, in which effect size is moderate.

Table 4. *Average scores and standard deviation of scores obtained on the OCDUS-ICT scales.*

OCDUS-ICT	Men	Women	Total	F_1	p
Thoughts/interference	7.30 (3.6)	6.92 (3.4)	7.05 (3.5)	1.96	0.16
Desire/control	11.18 (4.6)	11.60 (4.8)	11.46 (4.7)	1.27	0.26
Resistance/intention	4.01 (2.0)	4.01 (2.3)	4.01 (2.2)	0.00	0.99

Table 5. *Means (and confidence interval) on the OCDUS-ICT scales by age.*

	OCDUS-ICT					
	Thoughts/interference		Desire/control		Resistance/intention	
Age	M	CI95%	M	CI95%	M	CI95%
18 - 25	8.33	(7.7 - 8.9)	13.46	(12.6 - 14.3)	5.47	(5.1 - 5.9)
25 - 30	7.17	(6.5 - 7.8)	12.35	(11.5 - 13.2)	4.54	(4.1 - 4.9)
30 - 45	6.98	(6.5 - 7.5)	11.91	(11.3 - 12.5)	3.90	(3.6 - 4.2)
45 - 60	6.75	(6.3 - 7.2)	10.65	(10.1 - 11.2)	3.51	(3.2 - 3.8)
›60	6.09	(5.3 - 6.8)	8.80	(5.3- 6.8)	3.00	(2.6 - 3.5)

Tabla 6. *Correlaciones entre las escalas del OCDUS-TIC y del MULTICAGE-TIC.*

	OCDUS-ICT		
MULTICAGE-ICT	Thoughts/interference	Desire/control	Resistance/intention
Internet	0.18*	0.63*	0.44*
Mobile phones	0.19*	0.58*	0.41*
Video games	0.13*	0.19*	0.14*
Instant messaging	0.13*	0.51*	0.40*
Social networks	0.23*	0.46*	0.38*
PSI-20			
Problems in the control of social behaviour	0.31*	0.17*	0.06
Problems in the control of emotions	0.56*	0.27*	0.17*
Problems in executive control	0.87*	0.24*	0.20*
Total prefrontal symptoms	0.86*	0.29*	0.21*

Note. * Significant correlations after Bonferroni correction (p< 0.0033).

Table 7. *Scores obtained on the OCDUS-ICT in each of the mobile use categories.*

	MULTICAGE-ICT (Mobile)					
OCDUS-ICT	Non-problematic use	Risky use	Problematic use			
	M (SD)			F_2	p	ω^2
Thoughts/interference	6.45 (3.4)	7.20 (3.3)	7.87 (3.5)	10.760	‹ 0.001	0.03
Desire/control	8.84 (3.6)	12.05 (4.1)	15.24 (4.4)	157.420	‹ 0.001	0.30
Resistance/intention	3.15 (1.7)	4.25 (2.1)	5.20 (2.5)	61.550	‹ 0.001	0.14

OCDUS-ICT and PSI-20

Table 6 shows the correlations found between the OCDUS-ICT scales and those of the PSI-20, as well as with their total prefrontal symptom score. In this case, it is the thoughts/interference scale which presents the strongest correlations, in particular with the problems in executive control scale and total prefrontal symptoms. Scale items showing extreme correlations are shown in Figure 2.

Discussion

The present study has adapted a questionnaire measuring the components of obsession and compulsion in substance use and abuse in order to investigate the use/abuse of mobile phones. Hypothetically, since these behavioural components are involved in the maintenance of addictive behaviours involving substances (Yücel et al., 2018), they should also be core components of so-called behavioural addictions. The structure of the questionnaire we have named OCDUS-ICT largely matches that used in previous versions of the scale, and is therefore applicable to the study of behavioural addictions. Factorially derived scales have adequate internal consistency values, especially when multivariate estimators are applicable, which are appropriate to the uneven distribution of items.

No differences by sex were observed in the scores obtained on the different scales of the questionnaire, a result which is not comparable with previous studies, given their usually exclusively (Mokri, 2016; Yang et al., 2016) or predominantly male samples, where gender differences were not analyzed (Dekker et al., 2012; Dijkstra, De Jong, Bluschke, Krabbe & Van Der Staak, 2007; Franken et al., 2002; Franken, Kroon & Hendriks, 2000; Lievaart et al., 2015). However, there were some differences according to age groups, with the strength of obsession-compulsion components decreasing as age increased, although the effect size of these differences is very low.

When the scores on the OCDUS-ICT scales are compared to those of the MULTICAGE-ICT, it can be seen that there is a significant relationship between all of them, that

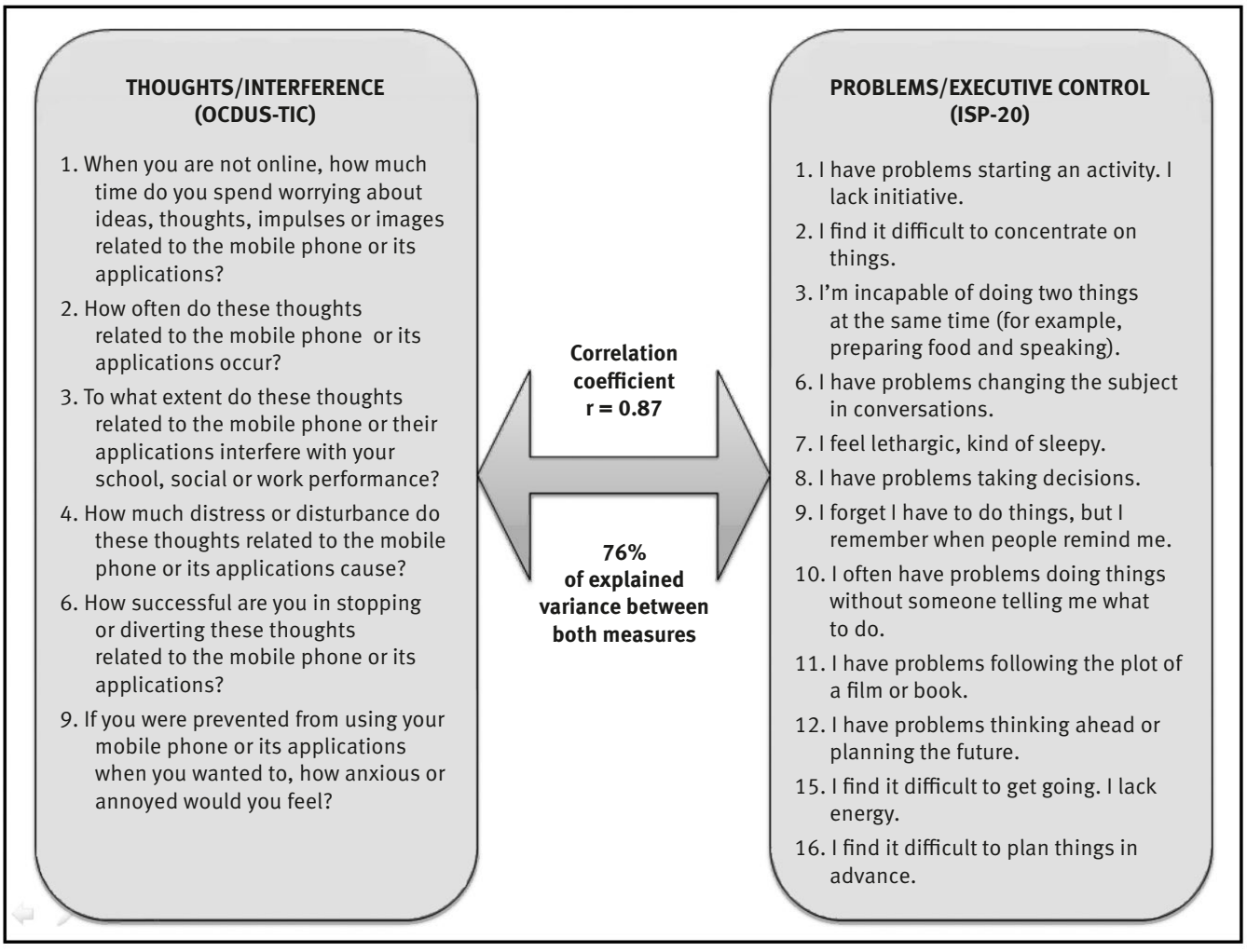

Figure 2. Items of the OCDUS-ICT Thoughts/Interference scale presenting extreme correlations with items of the PSI-20 Executive Control Problems scale.

is, all the behaviours explored in the different ICT use/abuse scales have a significant relationship with the obsessive-compulsive components. However, the effect size of these relationships is noticeably larger with the compulsive components and less so with the interference of obsessive thoughts. This difference is likely the result of the ease with which these devices and applications can be accessed; obsessive ideas are thus rapidly neutralised because the user can trigger a neutralising response before such ideas reach high levels of anxiety. All this is valid for access to the Internet, mobile phones or instant messaging applications and social networks, although the effect size is much smaller in the case of video games, probably because the involvement in this type of activity requires greater levels of preparation, concentration and involvement.

A revealing finding is the fact that obsessive-compulsive components are stronger as the degree of use of the smartphone becomes greater and moves towards abuse. The MULTICAGE-ICT allows subjects to be classified according to the negative consequences of their use, from non-problematic to problematic use, with a range of risk levels in between (Pedrero-Pérez et al., 2018). The values on all OCDUS-ICT scales are at their lowest when use is non-problematic, rise with risky use and reaches maximum levels for those people who can be classified as problematic mobile phone users. Once again, however, the strongest association is presented by the scale for desire and control, so that this seems to be the main component linking mobile phone abuse with the obsession-compulsion cycle. Again it seems that neutralising behaviours are triggered by low levels of intrusive thoughts, pointing to the ease of use of mobile phones and access to their applications, unlike the findings in studies of drug abuse behaviours (Kuo-Lun, 2017).

When comparing the scores of the OCDUS-ICT scales to those of prefrontal symptoms in daily life (PSI-20), significant correlations are found in almost all cases. However, the strength of these correlations is greatest in the case of the thoughts/interference scale, which presents an index of mutual determination with the scale of problems in the control of social behaviour (r^2= 0.10), the problems in emotional control scale (r^2= 0.31) and, surprisingly, with the problems in executive control scale (r^2= 0.76), as well as with the total prefrontal symptoms score (r^2= 0.74). Figure 2 shows the extremely strong relationship between the presence of intrusive thoughts or obsessions (items 1, 2, 3, 4, 6 and 9 of OCDUS-ICT) and executive problems as measured with PSI-20 combining motivational problems (items 1, 7, 10 and 15), selective, sustained, alternating and divided attention (items 2, 11, 6 and 3, respectively), as well as decision-making (item 8), prospective memory (item 9) and planning in activities of daily living (items 12 and 16).

Previous studies have shown that the distribution of prefrontal symptomatology in general and problems with executive control in particular in the general population has a classic normal curve (Pedrero-Pérez et al., 2011; Ruiz Sánchez de León et al., 2012) and that this deficit is closely related to addictive phenomena (Méndez Gago et al., 2018; Pedrero-Pérez et al., 2015). What the results suggest in this case is that, at the same time, individuals with weaker executive capacity tend to present obsessive ideas and that such obsessive ideas tend to block executive functioning, but it is difficult to determine cause and effect in what appears to be a characteristic dysfunctional loop. This is fully congruent with the conclusions of a recent meta-analysis (Norman et al., 2018) which notes that the brains of patients with obsessive compulsive disorder (OCD) get stuck in an "error" loop, in which they cannot stop even when they know they should. It is clear that this OCD formulation is fully applicable to compulsive substance use and also to behavioural addictions.

Given the parallelism proposed by Everitt and Robbins (2005, 2016) of addiction as a special form of OCD, perhaps this population could provide a finding similar to that of the present study. However, in OCD, executive dysfunctions - in general - do not seem to be linked to the presence of obsessions, which depend exclusively on cognitive inhibition; on the other hand, there does seem to be a relationship between compulsions and a global deficit in executive functions (Harsányi et al., 2014). Moreover, the study of executive functions in patients with obsessive-compulsive disorder is characterized by the variety of inconclusive results, from research showing their relative conservation to that showing significant deficits or even adding an amnestic picture to dysexecutive syndrome (Abramovitch & Cooperman, 2015; Aycicegi et al., 2003).

Since the study of OCD does not provide conclusive results in this field, the study of obsessions as behavioural components involved in the maintenance of addiction, either to substances or behaviours, is of special interest in the syndromic description in light of results. The OCDUS in its different substance-centred versions and the OCDUS-ICT used in this paper are tools of clinical and research utility to describe the three related factors: thoughts and interference, desire and control, and resistance to thoughts and intention.

The main limitation of this study is, without doubt, the sampling method. Diffusion via social networks does not allow the quality of participation, the motivation, or the sincerity of the participants to be controlled, nor, of course, the generalizability of results. The only way to control response quality, at least globally, is to obtain a large enough sample so that the percentage of inappropriate responses has a lower specific weight in the overall results. The ratio of the number of participants and the number of items

APPENDIX I

OCDUS-ICT

1	When you are not online, how much time do you spend worrying about ideas, thoughts, impulses or images related to the mobile phone or its applications?						
	NOT AT ALL						ALL THE TIME
	1	2	3	4	5	6	7
2	How often do these thoughts related to the mobile phone or its applications occur?						
	NOT AT ALL						ALL THE TIME
	1	2	3	4	5	6	7
3	To what extent do these thoughts related to the mobile phone or their applications interfere with your school, social or work performance?						
	NOT AT ALL						ALL THE TIME
	1	2	3	4	5	6	7
4	How much distress or disturbance do these thoughts related to the mobile phone or its applications cause you?						
	NONE						A GREAT DEAL
	1	2	3	4	5	6	7
5	How much effort do you make to resist these thoughts related to your mobile phone or its applications, or try to ignore or divert your attention from these thoughts?						
	NONE						A GREAT DEAL
	1	2	3	4	5	6	7
6	How successful are you in stopping or diverting these thoughts related to the mobile phone or its applications?						
	NOT AT ALL						COMPLETELY
	1	2	3	4	5	6	7
7	If you are not connected, how often do you feel the need or the urge to use your mobile phone or its applications?						
	NOT AT ALL						CONSTANTLY
	1	2	3	4	5	6	7
8	If you are not connected, how much time a day do you feel the need or the urge to use your mobile phone or its applications?						
	NONE						ALL THE TIME
	1	2	3	4	5	6	7
9	If you were prevented from using your mobile phone or its applications when you wanted to, how anxious or annoyed would you feel?						
	NOT AT ALL						EXTREMELY
	1	2	3	4	5	6	7
10	How much effort do you make to resist the use of mobile phones or their applications?						
	NONE						A GREAT DEAL
	1	2	3	4	5	6	7
11	How intense was the impulse to use the mobile phone or its applications last week?						
	NOT AT ALL						EXTREMELY
	1	2	3	4	5	6	7
12	How much control do you have over your mobile phone use or its applications?						
	NONE						TOTAL
	1	2	3	4	5	6	7

(764/12=63.7/1) is much greater than the most restrictive demands of a 10/1 ratio. In addition, detection of atypical scores was carried out so that random responses or inconsistent completion could be eliminated. In any case, the chain sampling technique is recommended in cases where the target population is difficult to reach or when very large samples are required, but, like all sampling methods, it presents risks which must be taken into account (Bowling,

2005). The internal consistency of the evidence, at both item and scale levels, is the main proof that the data was obtained, at least to a large extent, in a manner suitable for the realization of a structural study and correlational analysis. Future studies should look for sampling methods which allow generalizability of results.

Consequently, the OCDUS version for the study of obsessive-compulsive components of mobile phone use/abuse, which we have called OCDUS-ICT, is shown to be a consistent test with adequate structural validity for clinical application. The size of the correlations found with mobile use/abuse categories makes it possible to affirm that obsessive-compulsive components are central to this behaviour, as is likely to be the case in all addictive behaviours. It is possible that a great deal of attention has been paid to impulsivity as a predictor of abuse and much less to compulsivity as a factor in maintaining abuse and addiction. The use of exposure therapy with response prevention, which is difficult to apply in substance addictions, has shown its usefulness in the treatment of OCD (Hezel & Simpson, 2019) and in behavioural addictions, such as pathological gambling (Echeburúa, Fernández-Montalvo & Báez, 1999) and could be part of the therapeutic menu, thereby avoiding more aggressive interventions such as pharmacological ones, a crucial argument especially in the case of adolescents and young people. The present study offers an instrument to explore these and related issues.

Conflicts of interest

The authors declare no conflict of interest.

References

Abramovitch, A. & Cooperman, A. (2015). The cognitive neuropsychology of obsessive-compulsive disorder: A critical review. *Journal of Obsessive-Compulsive and Related Disorders, 5*, 24-36. doi:10.1016/j.jocrd.2015.01.002.

Aycicegi, A., Dinn, W.M., Harris, C.L. & Erkmen, H. (2003). Neuropsychological function in obsessive-compulsive disorder: effects of comorbid conditions on task performance. *European Psychiatry, 18*, 241-248. doi:10.1016/S0924-9338(03)00065-8.

Baker, T. B., Piper, M. E., McCarthy, D. E., Majeskie, M. R. & Fiore, M. C. (2004). Addiction motivation reformulated: an affective processing model of negative reinforcement. *Psychological Review, 111*, 33-51. doi:10.1037/0033-295X.111.1.33.

Belin-Rauscent, A., Daniel, M. L., Puaud, M., Jupp, B., Sawiak, S., Howett, D., ... Everitt, B. J. (2016). From impulses to maladaptive actions: The insula is a neurobiological gate for the development of compulsive behavior. *Molecular Psychiatry, 21*, 491-499. doi:10.1038/mp.2015.140.

Bowling, A. (2005). Mode of questionnaire administration can have serious effects on data quality. *Journal of Public Health, 27*, 281-291. doi:10.1093/pubmed/fdi031.

Brand, M., Young, K. S. & Laier, C. (2014). Prefrontal control and Internet addiction: a theoretical model and review of neuropsychological and neuroimaging findings. *Frontiers in Human Neuroscience, 8*, 375. doi:10.3389/fnhum.2014.00375.

Cabrini, S., Baratti, M., Bonfà, F., Cabri, G., Uber, E. & Avanzi, M. (2009). Preliminary evaluation of the DDS-PC inventory: A new tool to assess impulsive–compulsive behaviours associated to dopamine replacement therapy in Parkinson's disease. *Neurological Sciences, 30*, 307. doi:10.1007/s10072-009-0101-3.

Cohen, J. (1988) *Statistical power analysis for the behavioral sciences* (2ª ed.). Hillsdale, NJ: Erlbaum.

Dekker, N., Koeter, M., Van Den Brink, W. & GROUP Investigators. (2012). Craving for cannabis in patients with psychotic disorder, their non–affected siblings and healthy controls: Psychometric analysis of the obsessive compulsive drug use scale. *International Journal of Methods in Psychiatric Research, 21*, 286-300. doi:10.1002/mpr.1362.

de Mattos, C. N., Kim, H. S., Filomensky, T. Z. & Tavares, H. (2019). Development and validation of the compulsive-buying follow-up scale: A measure to assess treatment improvements in compulsive buying disorder. *Psychiatry Research, 282*, 112009. doi:10.1016/j.psychres.2018.12.078.

Dijkstra, B. A., De Jong, C. A., Bluschke, S. M., Krabbe, P. F. & Van Der Staak, C. P. (2007). Does naltrexone affect craving in abstinent opioid–dependent patients?. *Addiction Biology, 12*, 176-182. doi:10.1111/j.1369-1600.2007.00067.x.

Echeburúa, E., Fernández-Montalvo, J. & Báez, C. (1999). Prevención de recaídas en la terapia del juego patológico: Eficacia diferencial de tratamientos. *Análisis y Modificación de Conducta, 25*, 375-403.

Efrati, Y. & Mikulincer, M. (2018). Individual-based Compulsive Sexual Behavior Scale: Its development and importance in examining compulsive sexual behavior. *Journal of Sex & Marital Therapy, 44*, 249-259. doi:10.1080/0092623X.2017.1405297.

Estevez, A., Herrero-Fernández, D., Sarabia, I. & Jauregui, P. (2015). The impulsivity and sensation-seeking mediators of the psychological consequences of pathological gambling in adolescence. *Journal of Gambling Studies, 31*, 91-103. doi:10.1007/s10899-013-9419-0.

Estévez Gutiérrez, A., Herrero Fernández, D., Sarabia Gonzalvo, I. & Jáuregui Bilbao, P. (2014). El papel mediador de la regulación emocional entre el juego patológico, uso abusivo de Internet y videojuegos y la sintomatología disfuncional en jóvenes y adolescentes. *Adicciones, 26*, 282-290. doi:10.20882/adicciones.26.

Everitt, B. J. & Robbins, T. W. (2005). Neural systems of reinforcement for drug addiction: From actions to habits to compulsion. *Nature Neuroscience, 8*, 1481-1489. doi:10.1038/nn1579.

Everitt, B. J. & Robbins, T. W. (2016). Drug addiction: updating actions to habits to compulsions ten years on. *Annual Review of Psychology, 67*, 23-50. doi:10.1146/annurev-psych-122414-033457.

Eysenck, S. B. & Eysenck, H. J. (1978). Impulsiveness and venturesomeness: Their position in a dimensional system of personality description. *Psychological Reports, 43*, S1247-S1255. doi:10.2466/pr0.1978.43.3f.1247.

Fernández Serrano, M. J., Perales López, J. C., Moreno López, L., Santos-Ruiz, A., Pérez García, M. & Verdejo García, A. (2012). Impulsividad y compulsividad en individuos dependientes de cocaína. *Adicciones, 24*, 105-114. doi:10.20882/adicciones.102.

Franken, I. H., Hendriks, V. M. & van den Brink, W. (2002). Initial validation of two opiate craving questionnaires: the Obsessive Compulsive Drug Use Scale and the Desires for Drug Questionnaire. *Addictive Behaviors, 27*, 675-685. doi:10.1016/S0306-4603(01)00201-5-

Franken, I. H., Kroon, L. Y. & Hendriks, V. M. (2000). Influence of individual differences in craving and obsessive cocaine thoughts on attentional processes in cocaine abuse patients. *Addictive Behaviors, 25*, 99-102. doi:10.1016/S0306-4603(98)00112-9.

Garrido-Elustondo, S., Reneses, B., Navalón, A., Martín, O., Ramos, I. & Fuentes, M. (2016). Capacidad de detección de patología psiquiátrica por el médico de familia. *Atención Primaria, 48*, 449-457. doi:10.1016/j.aprim.2015.09.009.

Gmel, G., Khazaal, Y., Studer, J., Baggio, S. & Marmet, S. (2019). Development of a short form of the compulsive internet use scale in Switzerland. *International Journal of Methods in Psychiatric Research*, e1765; doi:10.1002/mpr.1765.

González Roscigno, E. A., Mujica Díaz, A. L., Terán Mendoza, O. E., Guerrero Alcedo, J. M. & Arroyo Alvarado, D. J. (2016). Sintomatología frontal y trastornos de personalidad en usuarios de drogas ilícitas. *Drugs and Addictive Behavior, 1*, 17-28. doi:10.21501/24631779.1755.

Harsányi, A., Csigó, K., Rajkai, C., Demeter, G., Németh, A., Racsmány, M. (2014). Two types of impairments in OCD: Obsessions, as problems of thought suppression; compulsions, as behavioral-executive impairment. *Psychiatry Research, 215*, 651-658. doi:10.1016/j.psychres.2013.11.014.

Hezel, D. M. & Simpson, H. B. (2019). Exposure and response prevention for obsessive-compulsive disorder: A review and new directions. *Indian Journal of Psychiatry, 61*, 85-92. doi:10.4103/psychiatry.IndianJPsychiatry_516_18.

Hooper, V. & Zhou, Y. (2007). Addictive, dependent, compulsive? A study of mobile phone usage. *BLED Proceedings, 38*, 272-285.

Koob, G. F. (2013). Negative reinforcement in drug addiction: the darkness within. *Current Opinion in Neurobiology, 23*, 559-563. doi:10.1016/j.conb.2013.03.011.

Kuo-Lun, H. (2017). Compulsive mobile application usage and technostress: the role of personality traits. *Online Information Review, 41,* 1-34. doi:10.1108/OIR-03-2016-0091.

Lievaart, M., Erciyes, F., van der Veen, F. M., van de Wetering, B. J., Muris, P. & Franken, I. H. (2015). Validation of the cocaine versions of the Obsessive Compulsive Drug Use Scale and the Desires for Drug Questionnaire. *American Journal of Drug and Alcohol Abuse, 41*, 358-365. doi:10.3109/00952990.2015.1043210.

Machielsen, M., Scheltema Beduin, A., Dekker, N., Kahn, R. S., Linszen, D. H., … Myin-Germeys, I. (2012). Differences in craving for cannabis between schizophrenia patients using risperidone, olanzapine or clozapine. *Journal of Psychopharmacology, 26,* 189-195. doi:10.1177/0269881111408957.

Machielsen, M. W., Veltman, D. J., van den Brink, W. & de Haan, L. (2018). Comparing the effect of clozapine and risperidone on cue reactivity in male patients with schizophrenia and a cannabis use disorder: A randomized fMRI study. *Schizophrenia Research, 194*, 32-38. doi:10.1016/j.schres.2017.03.030.

Martínez-González, J. M., Munera-Ramos, P. & Becoña-Iglesias, E. (2013). Drogodependientes vs. usuarios de salud mental con trastornos de personalidad: Su relación con la calidad de vida, la psicopatología en Eje I, el ajuste psicológico y dinámica familiar. *Anales de Psicología, 29*, 48-54. doi:10.6018/analesps.29.1.161901.

Megías, A., Navas, J. F., Perandrés-Gómez, A., Maldonado, A., Catena, A. & Perales, J. C. (2018). Electroencephalographic evidence of abnormal anticipatory uncertainty processing in gambling disorder patients. *Journal of Gambling Studies, 34*, 321-338. doi:10.1007/s10899-017-9693-3.

Méndez Gago, S., González Robledo, L., Pedrero-Pérez, E. J., Rodríguez-Gómez, R., Benítez-Robredo, M. T., Mora-Rodríguez, C. & Ordoñez-Franco, A. (2018). *Uso & abuso de las Tecnologías de la Información y la Comunicación por adolescentes: un estudio representativo de la ciudad de Madrid*. Madrid: Universidad Camilo José Cela.

Mendoza, Y., Cuello, P. & López, V. (2016). Análisis psicométrico del inventario de sintomatología prefrontal (ISP) en sujetos adictos y no adictos. *Revista Chilena de Neuropsicología, 11,* 24-29. doi:10.5839/rcnp.2016.11.01.05.

Mokri, A. (2016). Validation for Persian Versions of "Desire for Drug Questionnaire" and "Obsessive Compul-

sive Drug Use Scale" in heroin dependents. *Archives of Iranian Medicine, 19*, 659.

Navas, J. F., Torres, A., Cándido, A. & Perales, J. C. (2014). ¿'Nada' o 'un poco'? ¿'Mucho' o 'demasiado'? La impulsividad como marcador de gravedad en niveles problemático y no problemático de uso de alcohol e Internet. *Adicciones, 26*, 146-158. doi:10.20882/adicciones.19.

Navas, J. F., Verdejo-Garcia, A., Lopez-Gomez, M., Maldonado, A. & Perales, J. C. (2016). Gambling with rose-tinted glasses on: Use of emotion-regulation strategies correlates with dysfunctional cognitions in gambling disorder patients. *Journal of Behavioral Addictions, 5*, 271-281. doi:10.1556/2006.5.2016.040.

Norman, L. J., Taylor, S. F., Liu, Y., Radua, J., Chye, Y., De Wit, S. J., ... Mathews, C. (2018). Error processing and inhibitory control in obsessive-compulsive disorder: A meta-analysis using statistical parametric maps. *Biological Psychiatry, 85,* 713-725. doi:10.1016/j.biopsych.2018.11.010.

Pedrero-Pérez, E. J. (2010). Detección de adicciones comportamentales en adictos a sustancias en tratamiento. *Trastornos Adictivos, 12*, 13-18. doi:10.1016/S1575-0973(10)70005-2.

Pedrero-Pérez, E. J., Rodríguez-Monje, M. T., Gallardo-Alonso, F., Fernández-Girón, M., Pérez-López, M. & Chicharro-Romero, J. (2007). Validación de un instrumento para la detección de trastornos de control de impulsos y adicciones: El MULTICAGE CAD-4. *Trastornos Adictivos, 9*, 269-278. doi:10.1016/S1575-0973(07)75656-8.

Pedrero-Pérez, E. J., Rodríguez-Monje, M. T. & Ruiz-Sánchez de León, J. M. (2012). Adicción o abuso del teléfono móvil. Revisión de la literatura. *Adicciones, 24*, 139-152. doi:10.20882/adicciones.107.

Pedrero-Pérez, E. J., Ruiz-Sánchez de León, J. M., Morales-Alonso, S., Pedrero-Aguilar, J. & Fernández-Méndez, L. M. (2015). Sintomatología prefrontal en la vida diaria: Evaluación de cribado mediante el inventario de síntomas prefrontales abreviado (ISP-20). *Revista de Neurología, 60*, 385-393. doi:10.33588/rn.6009.2014545.

Pedrero-Pérez, E.J., Ruiz-Sánchez de León, J.M., Lozoya-Delgado, P., Llanero-Luque, M., Rojo-Mota, G., Puerta-García, C. (2011). Evaluación de los síntomas prefrontales: Propiedades psicométricas y datos normativos del cuestionario disejecutivo (DEX) en una muestra de población española. *Revista de Neurología, 52*, 394-404. doi:10.33588/rn.5207.2010731.

Pedrero-Pérez, E. J., Ruiz Sánchez de León, J. M., Rojo Mota, G., Morales Alonso, S., Pedrero Aguilar, J., Lorenzo Luque, I. & González Sánchez, Á. (2016). Inventario de Síntomas Prefrontales (ISP): Validez ecológica y convergencia con medidas neuropsicológicas. *Revista de Neurología, 63*, 241-251. doi:10.33588/rn.6306.2016143.

Pedrero-Pérez, E. J., Ruiz-Sánchez de León, J. M., Rojo-Mota, G., Llanero-Luque, M., Pedrero-Aguilar, J., Morales-Alonso, S. & Puerta-García, C. (2018). Tecnologías de la Información y la Comunicación (TIC): Uso problemático de internet, videojuegos, teléfonos móviles, mensajería instantánea y redes sociales mediante el MULTICAGE-TIC. *Adicciones, 30*, 19-32. doi:10.20882/adicciones.806.

Pedrero-Pérez, E. J, Ruiz-Sánchez-de-León, J.M. & Winpenny-Tejedor, C. (2015). Dysexecutive Questionnaire (DEX): Unrestricted structural analysis in large clinical and non-clinical samples. *Neuropsychological Rehabilitation, 25*, 879-894. doi:10.1080/09602011.2014.993659.

Reneses, B., Garrido, S., Navalón, A., Martín, O., Ramos, I., Fuentes, M., ... López-Ibor, J. J. (2015). Psychiatric morbidity and predisposing factors in a primary care population in Madrid. *International Journal of Social Psychiatry, 61*, 275-286. doi:10.1177/0020764014542815.

Rodríguez-Monje, M. T., Pedrero-Pérez, E. J. P., Fernández-Girón, M., Gallardo-Alonso, F. & Sanz-Cuesta, T. (2009). Detección precoz de conductas adictivas en atención primaria: utilización del MULTICAGE CAD-4. *Atención Primaria, 41*, 25-32. doi:10.1016/j.aprim.2008.04.004.

Rodriguez-Monje, M. T., Pedrero-Perez, E. J., Rodriguez-Alonso, E., Fernandez-Girón, M., Pastor-Ramos, V., Mateo-Madurga, A., ... Ana Escriva-Ferrairo, R. (2019). MULTICAGE CAD-4 for behavioral addiction screening: Structural validity after inclusion of a scale on smartphone abuse. *Anales de Psicología, 35*, 41-46. doi:10.6018/analesps.35.1.324311.

Ruiz-Ruano, A. G., López-Salmerón, M. D. & López, J. P. (2020). Experiential avoidance and excessive smartphone use: A Bayesian approach. *Adicciones, 32,* 116-127. doi:10.20882/adicciones.1151.

Ruiz-Sánchez de León, J. M., Pedrero-Pérez, E. J., Gálvez, S., Fernández-Méndez, L. M. & Lozoya-Delgado, P. (2015). Utilidad clínica y propiedades psicométricas del inventario de síntomas prefrontales (ISP) en el daño cerebral adquirido y las demencias degenerativas. *Revista de Neurología, 61*, 387-394. doi:10.33588/rn.6109.2015252.

Ruiz-Sánchez de León, J.M., Pedrero-Pérez, E.J., Lozoya-Delgado, P., Llanero-Luque, M., Rojo-Mota, G. & Puerta-García, C. (2012). Inventario de síntomas prefrontales para la evaluación clínica de las adicciones en la vida diaria: proceso de creación y propiedades psicométricas. *Revista de Neurología, 54*, 649-663. doi:10.33588/rn.5411.2012019.

Schreiber, J. B., Nora, A., Stage, F. K., Barlow, E. A. & King, J. (2006). Reporting structural equation modeling and confirmatory factor analysis results: A review. *Journal of Educational Research, 99*, 323-338. doi:10.3200/JOER.99.6.323-338.

Trizano-Hermosilla, I. & Alvarado, J. M. (2016). Best alternatives to Cronbach's alpha reliability in realistic conditions: congeneric and asymmetrical measurements. *Frontiers in Psychology, 7*, 769. doi:10.3389/fpsyg.2016.00769.

Van Timmeren, T., Daams, J. G., Van Holst, R. J. & Goudriaan, A. E. (2018). Compulsivity-related neurocognitive performance deficits in gambling disorder: A systematic review and meta-analysis. *Neuroscience & Biobehavioral Reviews, 84*, 204-217. doi:10.1016/j.neubiorev.2017.11.022.

Verdejo-García, A., Lawrence, A. J. & Clark, L. (2008). Impulsivity as a vulnerability marker for substance-use disorders: Review of findings from high-risk research, problem gamblers and genetic association studies. *Neuroscience & Biobehavioral Reviews, 32*, 777-810. doi:10.1016/j.neubiorev.2007.11.003.

Yang, C., Wei, W., Vrana, K. E., Xiao, Y., Peng, Y., Chen, D., ... Wang, Z. (2016). Validation of the obsessive compulsive drug use scale (OCDUS) among male heroin addicts in China. *International Journal of Mental Health and Addiction, 14*, 803-819. doi:10.1007/s11469-016-9635-9.

Yücel, M., Oldenhof, E., Ahmed, S. H., Belin, D., Billieux, J., Bowden–Jones, H., ... Daglish, M. (2019). A transdiagnostic dimensional approach towards a neuropsychological assessment for addiction: An international Delphi consensus study. *Addiction, 114*, 1095-1109. doi:10.1111/add.14424.

Zsidó, A. N., Darnai, G., Inhóf, O., Perlaki, G., Orsi, G., Nagy, S. A., ... Janszky, J. (2019). Differentiation between young adult Internet addicts, smokers, and healthy controls by the interaction between impulsivity and temporal lobe thickness. *Journal of Behavioral Addictions, 8,* 35-47. doi:10.1556/2006.8.2019.03.