International Journal of
IJCHP
Clinical and Health Psychology

The Leyton Obsessional Inventory-Child Version: Validity and reliability in Spanish non-clinical population[1]

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ABSTRACT. We assessed the factor structure, validity and reliability of the Spanish version of the Leyton Obsessional Inventory-Child Version (LOI-CV) and determined the optimal cut-off score for detecting obsessive-compulsive disorder (OCD). A total of 1,514 students (aged 8-12) participated in the first phase of the study and 562 of these participated in the second phase (participants at risk of mood and anxiety disorders and controls without risk). The LOI-CV was administered in both phases and the OCD diagnosis was made in the second phase. In the exploratory factor analysis, we obtained three factors that explained 45.84% of the variance: *Order/checking/ pollution*, *Obsessive concern* and *Superstition/mental compulsion*. The reliability was good (.79-.90). The cut-off scores selected were 21 for the total score and 10 for the interference score, both of which had a sensitivity of 82.4% and a specificity of 84.1% and 83.8%, respectively, for detecting OCD. LOI-CV scores were significantly higher in children with OCD diagnosis than in children with subclinical diagnosis and children without diagnosis. There were no gender or age differences in the LOI-CV scores. The results support the validity and reliability of the LOI-CV as a screening test for OCD in a non-clinical population.

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RESUMEN. El objetivo fue estudiar la estructura factorial, la validez y la fiabilidad de la versión española del *Leyton Obsessional Inventory-Child Version* (LOI-CV), así como determinar el mejor punto de corte para detectar el trastorno obsesivo compulsivo (TOC). Un total de 1.514 escolares (8-12 años) participaron en la primera fase del estudio y 562 de estos en la segunda (participantes con riesgo de trastornos del estado de ánimo y ansiedad y controles sin riesgo). El LOI-CV fue administrado en ambas fases y el diagnóstico de TOC se obtuvo en la segunda fase. Mediante análisis factorial exploratorio se obtuvieron tres factores que explicaron el 45,84% de la varianza: *Orden/ comprobación/contaminación*, *Preocupaciones obsesivas* y *Superstición/compulsión mental*. La fiabilidad fue buena (0,79-0,90). Para detectar TOC, los puntos de corte seleccionados fueron 21 para la puntuación total y 10 para la interferencia, presentando ambos una sensibilidad del 82,4% y una especificidad del 84,1% y 83,8% respectivamente. Las puntuaciones del LOI-CV fueron significativamente mayores en sujetos con diagnóstico de TOC que en sujetos con diagnóstico subclínico y sin diagnóstico. No hemos hallado diferencias según sexo y edad. Nuestros resultados apoyan la validez y fiabilidad del LOI-CV como herramienta de detección del TOC en población no clínica.

PALABRAS CLAVE. Leyton Obsessional Inventory-Child Version. Trastorno obsesivo compulsivo. Especificidad y sensibilidad. Propiedades psicométricas. Estudio instrumental.

Obsessive-compulsive disorder (OCD) is a chronic, neuropsychiatric disorder that significantly interferes with social, family, academic and work functioning. It is described by the World Health Organization as one of the most disabling medical alterations (Heyman, Mataix-Cols, and Fineberg, 2006). The age of onset for OCD seems to have a bimodal distribution, with one peak in childhood (10-11 years of age) and another in early adulthood (Geller, 2006). Roughly 40% of cases of childhood-onset OCD continue into adulthood, increasing to around 60% when sub-threshold presentations of OCD are also considered (Bloch *et al*., 2009; Stewart *et al*., 2008). Early recognition and treatment could prevent this chronic course from childhood-adolescence to adulthood (Micali *et al*., 2010).

Epidemiological data show that OCD is far more common among adolescents than was previously believed (Maggini *et al*., 2001). Nevertheless, few studies have been carried out on OCD prevalence in non-clinical adolescents and almost none in children. Moreover, the shame and reluctance of children/adolescents to talk about their symptoms, the failure to ask obsessive-compulsive screening questions in routine mental state examinations, the presence of co-existing conditions and the absence of adequate instruments can reduce the detection of OCD. Recognizing OCD symptoms in childhood and adolescence is very important for both children and their families and for the prognosis of the disorder, but this means that valid screening instruments are needed for this population. Most epidemiological studies have administered the Leyton Obsessional

Inventory-Child Version Survey Form (LOI-CV) as an instrument for screening symptoms or assessing subclinical OCD. The LOI-CV (Berg, Whitaker, Davies, Flament, and Rapoport, 1988) is a 20-item self-report questionnaire that takes up little management time and, unlike clinical interviews, does not require individual administration by trained interviewers. Furthermore, the fact that the test is self-administered could also reduce children's fears of explaining their thoughts and behaviors. However, few studies have investigated the validity and reliability of the LOI-CV. Empirical evidence on internal structure is a key aspect in test selection in psychological research (Carretero-Dios and Pérez, 2007). Pioneering studies by Berg *et al*. (1988) and Flament *et al*. (1988) reported good psychometric properties and good efficacy in predicting and screening OCD cases in two-phase epidemiological studies. On the other hand, test-retest reliability has been found to be higher in adolescents than in children (King, Inglis, Jenkins, Myerson, and Ollendick, 1995) and significant correlations have been shown with the Children's Yale-Brown Obsessive-Compulsive Scale (Yucelen, Rodopman-Arman, Topcuoglu, Yazgan, and Fisek, 2006). Apart from the study by Flament *et al*. (1988) in American adolescents, the only other study to assess the sensitivity and specificity of the LOI-CV was a study on Greek adolescents by Roussos *et al*. (2003), who reached a different conclusion regarding the best cut-off point.

Research into LOI factors can contribute to the analysis of dimensions of obsessive-compulsive symptoms in both clinical and non-clinical populations. OCD is considered a heterogeneous disorder with independent symptom dimensions that can be found in both adults and children/adolescents (Mataix-Cols, Nakatani, Micali, and Heyman, 2008; Nikolajsen, Nissen, and Thomsen, 2010). These OCD phenotypes have clinical and prognostic implications and may be useful in genetic and neuroimaging studies of OCD across all ages (Masi *et al*., 2010; Mataix-Cols *et al*., 2008; Stewart *et al*., 2008). Thus, factor analysis of LOI-CV can be used to investigate the stability of pediatric OCD manifestations over time. Three studies have explored factor analysis of the LOI-CV to obtain epidemiological data (Berg *et al*., 1988; Maggini *et al*., 2001; Rueda-Jaimes *et al*., 2007). The first of these found four factors related to obsessive concerns, pollution, numbers and luck, and school (Berg *et al*., 1988); the second identified three factors that were not labeled (Maggini *et al*., 2001); and the third found a single factor (Rueda-Jaimes *et al*., 2007).

To date, there are no Spanish data on the prevalence of OCD in a pediatric population, nor are there any validated instruments for assessing probable cases of OCD in this population. The main aim of this study is therefore to evaluate the psychometric properties and factor structure of the Spanish version of the LOI-CV Survey Form and to assess the sensitivity and specificity of possible cut-off points for OCD in a non-clinical child population.

Method

Participants

Beginning in 2007, children participated in a two-phase epidemiological study of anxiety and depressive disorders.

A total of 2,023 children in the 4th, 5th and 6th grades of primary school were invited to participate. In the first phase, 1,514 students (720 boys and 794 girls) between the ages of 8 and 12 ($M = 10.23$; $SD = 1.23$) participated in the study. The questionnaires of 20 children were excluded due to missing test data. Of the children participating in the study, 39.5% were from families with low socioeconomic status, 42.5% were from families with middle socioeconomic status, and 18% were from families with high socioeconomic status; 87.5% of the sample was born in Spain and 85.9% belonged to a nuclear family. The children came from 13 primary schools in Reus, Spain (a medium-sized town of 100,000 inhabitants) and were randomly chosen from the town's state schools and state-subsidized private schools. Children whose parents did not provide written informed consent did not participate in the study, and there were no differences among these children in terms of school or neighborhood.

In the second phase, 659 students (332 subjects at risk of emotional disorders and 327 controls) were selected and 562 students (235 at risk) participated. This sample consisted of 254 boys and 308 girls between the ages of 9 and 13 ($M = 11.25$; SD = 1.04). There were no differences in terms of socioeconomic status between the selected group and the participant group in this phase.

Instruments
– Leyton Obsessional Inventory-Child Version Survey Form (LOI-CV; Berg *et al.*, 1988) is a 20-item questionnaire derived from the 44-item LOI-CV (Berg, Rapoport, and Flament, 1986), which is primarily used as a screening tool for current OCD symptoms. The authors found the questionnaire to have good reliability (Cronbach's alpha = .81). Each item of the LOI-CV includes two responses: the presence/absence of the symptom described in the item (yes/no) and the interference of the symptom if it is present-from 0 (*no interference*) to 3 (*high interference*). Two scores can be obtained: the interference score (the sum of the interferences regardless of the «yes» responses) and the total score (the sum of the «yes» responses and their interferences). Flament *et al.* (1988) found that if the interference score was taken into account, the best cut-off score for detecting OCD was 25, whereas Roussos *et al.* (2003) found that if the total score was taken into account, the best score was 35. The Spanish version of the LOI-CV was developed using the back-translation method described by Hambleton (2005). The original items were first translated from English into Spanish by a native English speaker. The manuscript was independently translated back into English by another native English speaker. The original and back-translated versions were compared by the translators and two members of the research team, who did not find significant differences between the back-translations and the original versions.
– Mini-International Neuropsychiatric Interview for Kids (M.I.N.I.-Kid, Sheehan *et al.*, 1998) is a structured diagnosis interview for children between the ages of 6 and 17 on the basis of DSM-IV and ICD-10 criteria. With an administration time of approximately 30 minutes, it is a short instrument for diagnosing 23 Axis I disorders. The reliability and validity of M.I.N.I.-Kid was proven recently (Sheenan

et al., 2010). For this study, we used the OCD diagnosis and established one group of children with an obsessive-compulsive disorder diagnosis (OCD clinical diagnosis) and another group of children with a **s**ubclinical diagnosis. The latter group included children who had obsessive and compulsive symptoms but who did not satisfy the interference criteria.

Procedure

According to the classification of Montero and León (2007), this was an instrumental study. We used a two-phase epidemiological study design. In the first phase, we assessed the anxiety symptoms (SCARED-C; Birmaher *et al.*, 1997; Vigil-Colet *et al.*, 2009), depressive symptoms (CDI; Kovacs, 1985), OCD symptoms (LOI-CV; Berg *et al.*, 1988) and sociodemographic data of 1,514 schoolchildren. The sociodemographic data were collected using a questionnaire designed for this study, in which we asked children about their parents' jobs, family structure and other sociodemographic variables. In the second phase (the following academic year), we selected a sample of subjects at risk of mood and anxiety disorders and controls (not at risk) paired by age, gender and type of school. The subjects who in the first phase scored high on the SCARED-C questionnaire (32 cut-off point) and/or the CDI test (17 cut-off point) and/or the LOI-CV questionnaire (25 cut-off point in interference score) were selected as subjects at risk of mood or anxiety disorders.

In the second phase, we again administered the CDI, the SCARED-C and the LOI-CV and made psychopathological diagnoses using a structured interview (M.I.N.I.-Kid). The M.I.N.I.-Kid was administered to the child on the same day or, at the latest, one week after the questionnaires were completed, and the interviewers were blind to the test results. To make the diagnoses, we also took into account data from psychopathological tests completed by the parents: the CSI-4 (Gadow and Sprafkin, 1998), the SCARED-P and a questionnaire, developed for the present study, on OCD manifestations. We telephoned the children's parents whenever we needed clarification.

Children who participated in this study completed the questionnaires in groups of three or four. Professional child psychologists gave the children instructions on how to answer the test and helped them during the session. The M.I.N.I-Kid (Sheehan *et al.*, 1998) was individually administered by the same trained child psychologists, who had demonstrated consistency in their diagnoses.

Before beginning the study, we obtained permission from the Catalan Department of Education. We then contacted the 13 school boards, all of which agreed to participate. Finally, we sent all of the parents a letter informing them about the study and asking for their written informed consent. After being assessed, each child was given an envelope containing a questionnaire on the child's psychological problems, which the parents completed and returned to the school.

Data analysis

We obtained three LOI-CV scores for the statistical analysis: the «yes» score, which is the sum of the number of «yes» responses; the interference score, which is the sum of the interferences regardless of the «yes» responses; and the total score, which is the sum of the «yes» score plus the interference scores.

Factor analysis was used to obtain the factor structure of the LOI-CV. This analysis was done using FACTOR 7.2 (Lorenzo-Seva and Ferrando, 2006) because software packages such as SPSS only allow the use of Pearson correlation matrices. For the factor analysis, we used the «yes» scores and the data from the first phase.

Reliability (consistency) was evaluated using Cronbach's alpha test.

ROC curves were used to study the accuracy of the LOI-CV, to establish the sensitivity and specificity of the various cut-off points, and to determine the optimal cut-off point. We built two ROC curves: one taking into account the interference score and another taking into account the total score. Both curves were built according to the diagnosis of OCD obtained by the M.I.N.I.-Kid. Predictive accuracy was assessed using the area under the curve (AUC) and assuming the following values: AUC < 0.5: non-predictive; AUC from 0.5 to 0.7: less predictive; AUC from 0.7 to 0.9: moderately predictive; AUC from 0.9 to 0.99: highly predictive; and AUC of 1.0: perfectly predictive (Greiner, Pfeiffer, and Smith, 2000).

Discriminant validity was assessed by analyzing the variance of the LOI-CV scores between children with clinical or subclinical diagnosis and children without diagnosis. The Scheffé correction was applied by means of post-hoc analysis.

Descriptive statistics and a Student's t-test were used to summarize the demographic and clinical characteristics of the children.

Results

Factor analysis and reliability of LOI-CV

Exploratory factor analysis (EFA) was conducted using half of the total sample (n = 718). Given that 14 items showed skewness or kurtosis greater than one in absolute values, we conducted the EFA using polychoric correlations. As the Kaiser-Meyer-Olkin index was .86, we concluded that the correlation matrix was suitable for factor analysis. We chose unweighted least squares as the factor extraction method. The root mean square of residuals (RMSR) was .0534 (Kelly criterion: .0359), which suggests that the data had an underlying three-dimensional factor structure. To obtain a rotated solution, we used the direct oblimin procedure to apply an oblique rotation procedure. To confirm the stability of the factor structure, we performed factor analysis on the other half of the sample (cross-validity). The structure was similar, but there were three items with loadings of two factors or with loadings of less than .3 (items 3, 9 and 17).

TABLE 1. Factor structure of the LOI-CV survey form.

| Items	Factors		
	Order/ checking/ pollution	*Obsessive concern*	*Superstition/mental compulsion*
3. Do you have to check things several times?	.27		
4. Do you hate dirt and dirty things?	.68		
7. Do you ever worry about being clean enough?	.77		
8. Are you fussy about keeping your hands clean?	.70		
9. When you put things away at night, do they have to be put away just right?	.37		.31
11. Do you spend a lot of extra time checking your homework to make sure that it is just right?	.55		
12. Do you ever have to do things over and over a certain number of times before they seem quite right?	.35		
2. Do thoughts or words ever keep going over and over in your mind?		.60	
6. Do you have trouble making up your mind?		.71	
10. Do you get angry if other students mess up your desk?		.36	
14. Do you ever have trouble finishing your school work or chores because you have to do something over and over again?		.35	
16. Do you often have a bad conscience because you've done something even though no one else thinks it is bad?		.52	
17. Do you worry a lot if you've done something not exactly the way you like?	.33	.35	
18. Do you go over things a lot that you have done because you aren't sure that they were the right things to do?		.47	
1. Do you often feel like you have to do certain things even though you know you don't really have to do?			.49
5. Do you ever feel that if something has been used or touched by someone else it is spoiled for you?			.37
13. Do you ever have to count several times or go through numbers in your mind?			.58
15. Do you have a favorite or special number that you like to count up to a lot or do things just that number of times?			.77
19. Do you move or talk in just a special way to avoid bad luck?			.67
20. Do you have special numbers of words you say, because it keeps bad luck away or bad things away?			.73

We obtained three factors that explained 46.30% of the variance. These factors were labeled *Order/checking/pollution*, *Obsessive concern* and *Superstition/mental compulsion* (30.15%, 8.53% and 7.62% of the variance, respectively). The first factor contained seven items that referred to compulsive manifestations and obsessions around cleaning. The second factor contained seven items that referred to worries, and the third factor contained six items that referred to luck and numbers. In general, factor loading ranged from .35 to .77. Items with loadings greater than 0.30 in two factors were included in the factor with higher clinical congruence and loading (see Table 1).

According to the «yes» score, the reliabilities (Cronbach's alpha) for each factor were .66, .64 and .58, respectively, and .79 for the total scale. According to the interference score, the reliabilities for each factor were .79, .73 and .64, respectively, and .87 for the total scale. Finally, according to the total score, the reliabilities for each factor were .82, .81 and .77, respectively, and .90 for the total scale.

Cut-off scores of LOI-CV

When the total score was taken into account, the AUC of the LOI-CV ROC curve was .909 (CI 95%: .87-.93), and when the interference score was taken into account, it was .912 (CI 95%: .88-.93). Both AUC scores are considered highly predictive (see Figure 1).

Table 2 shows the sensitivity and specificity of all possible cut-off scores for these two possible LOI-CV scores. For the total score, a cut-off point of 21 is the most appropriate, providing a sensitivity of 82.4% and a specificity of 84.1% for differentiating between children with and without OCD diagnosis. This cut-off point shows a positive predictive value (PPV) of 18.2% and a negative predictive value (NPV) of 99.1%. For the interference score, a cut-of point of 10 is the most accurate, providing a sensitivity of 82.4% and specificity of 83.3%. This cut-off point shows a PPV of 17.7% and an NPV of 99.1%.
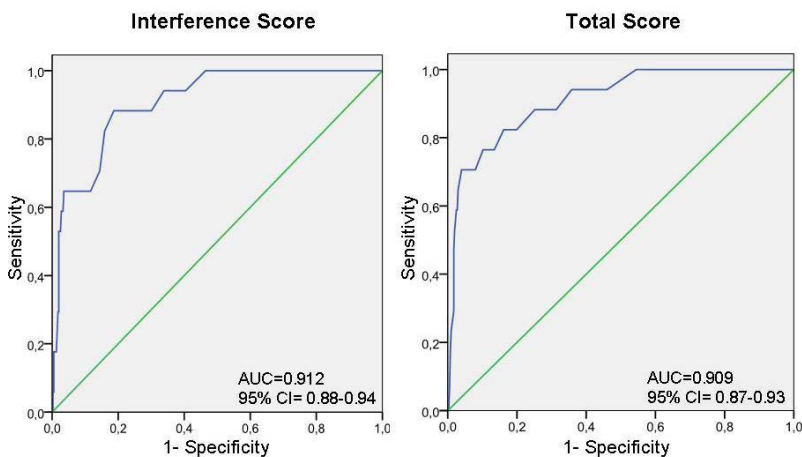
FIGURE 1. ROC curves of the LOI-CV.

TABLE 2. Sensitivity and specificity of the LOI-CV cut-off for total score and for interference score.

	For total score		For interference score		
Score	Sensitivity	Specificity	Sensitivity	Specificity	Score
1	100	2	100	27.4	1
2	100	4.8	100	37.6	2
3	100	7.6	100	45.5	3
4	100	9.8	94.1	54	4
5	100	13.6	94.1	59.5	5
6	100	18.7	94.1	64.2	6
7	100	23	88.2	68.7	7
8	100	27.5	88.2	74.9	8
9	100	33.6	82.4	80.1	9
10	100	37.7	**82.4**	**83.8**	**10**
11	100	43.2	76.5	86.6	11
12	100	48.0	76.5	89.8	12
13	100	53.5	70.6	92	13
14	94.1	59.6	70.6	94	14
15	94.1	61.6	70.6	96	15
16	94.1	66.2	64.7	97	16
17	88.2	69.9	58.8	97.3	17
18	88.2	72.5	58.8	97.5	18
19	88.2	75.8	52.9	98	19
20	88.2	81.3	47.1	98.3	20
21	**82.4**	**84.1**	41.2	98.3	21
22	70.6	85.6	-	-	22
23	64.7	88.4	29.4	98.3	23
24	64.7	90.9	23.5	99	24
25	64.7	91.9	17.6	99.3	25
26	64.7	93.9	-	-	26
27	64.7	94.9	-	-	27
28	64.7	96.5	5.9	99.5	28
29	58.8	96.7	-	-	29
30	58.8	97.2	-	-	30
31	52.9	97.5	-	-	31
32	52.9	97.7	-	-	32
33	52.9	98	-	-	33
34	35.3	98	0	99.8	34
35	29.4	98	-		35
36	29.4	98.2	-		36
37	23.5	98.5	-		37
38	17.6	98.7	-		38
39	17.6	99.5	-		39
40	11.8	99.5	-		40
41	5.9	99.5	-		41
42	5.9	99.7	-		42
43	0	99.7	-		43
44	0	100	-		44

In our sample, the interference score of 10 and the total score of 21 were in the 80th percentile.

Descriptive clinical data

The mean of the «yes» score was 8.55 ($SD = 3.75$), and boys ($M = 8.02$, $SD = 4.22$) scored significantly lower ($t = 2.27$; $p = 0.02$) than girls ($M = 8.51$, $SD = 4.06$), although no difference was found by age. The mean interference score was 6.03 ($SD = 6.10$) and no difference was found between age and gender. The mean total score («yes» plus interference) was 14.62 ($SD = 8.92$) and no difference was found between age and gender.

Our results showed that 3.5% of the children had a clinical diagnosis of OCD and 8.5% had a subclinical diagnosis.

We computed a score for each LOI-CV factor using the interference and total scores (see Table 3). These LOI-CV scores were significantly higher in children with clinical diagnosis, lower in children with subclinical diagnosis, and lowest in children without diagnosis. Moreover, both the interference and total scores for the LOI-CV were significantly higher in children with clinical OCD than in children with subclinical OCD. In relation to the LOI-CV factors, children with clinical or subclinical diagnosis obtained higher scores than children without diagnosis, and there were also significant differences between children with clinical diagnosis and children with subclinical diagnosis in the *Order/checking/pollution* and *Obsessive concerns* factors, but not in the *Superstition/ mental compulsion* factor.

TABLE 3. Mean interference and total scores by factors and according to OCD diagnosis.

	OCD clinical diagnosis[a] n = 20 Mean (SD)	OCD subclinical diagnosis[b] n = 46 Mean (SD)	Non-OCD diagnosis[c] n = 353 Mean (SD)	F	p adjusted by Scheffé
Order/checking/pollution					
Interference score	8.24 (3.8)	3.89 (3.1)	2.09 (2.4)	55.35***	ab*** ac*** bc***
Total score	13.12 (5.1)	8.2 (4.1)	6.11 (3.3)	35.45***	ab** ac*** bc***
Obsessive concern					
Interference score	7.76 (2.7)	4.97 (4.1)	2.29 (2.6)	45.24***	ab** ac*** bc***
Total score	12.5 (3.7)	9.8 (5.0)	6.04 (3.5)	38.33***	ab* ac*** bc***

TABLE 3. Mean interference and total scores by factors and
according to OCD diagnosis. (Cont.)

	OCD clinical diagnosis[a] n = 20 Mean (SD)	OCD subclinical diagnosis[b] n = 46 Mean (SD)	Non-OCD diagnosis[c] n = 353 Mean (SD)	F	p adjusted by Scheffé
Superstition/mental compulsion					
Interference score	2.41 (2.7)	1.92 (2.7)	0.44 (1.1)	34.02***	ac*** bc***
Total score	5.38 (3.2)	4.08 (3.4)	1.98 (1.9)	33.40***	ac*** bc***
Total score					
Interference score	18.41 (7.5)	10.79 (7.8)	4.96 (4.8)	63.62***	ab*** ac*** bc***
Total score	31.18 (10.2)	22.21 (10.1)	13.03 (7.4)	69.12***	ab*** ac*** bc***

Note. *** $p < .001$, ** $p < .01$, * $p < .05$

Discussion

This is the first study in Spain to investigate epidemiological data on pediatric OCD. Clinical diagnosis of OCD is often missed by pediatricians and family doctors, and mental health specialists are sometimes unaware of the misleading symptoms of this disorder. It is therefore important to detect OCD at an early stage in both clinical and non-clinical populations. The first step in any epidemiological study is to have screening instruments that are valid and reliable but also quick and easy to administer. After the Children's Yale-Brown Obsessive-Compulsive Scale semi-structured interview, the most widely used instrument in clinical and non-clinical populations is the LOI-CV. Only recently has a new scale, the Obsessive-Compulsive Inventory: Child Version (OCI-CV; Foa *et al.*, 2010), been published. Other scales have been published that assess specific aspects such as impairment (Child Obsessive-Compulsive Impact Scale—Child and Parent Versions (COIS-C and COIS-P; Piacentini, Peris, Bergman, Chang, and Jafer, 2007) or hoarding behaviors reported by parents (Children's Saving Inventory [CSI]; Storch *et al.*, 2010). Our study was conducted in a school sample and obtained psychometric data on the LOI-CV that allow us to determine its usefulness in a non-clinical population.

Factor analysis produced a three-factor solution that represents three distinct but related areas: *Order/checking/pollution*, *Obsessive concern* and *Superstition/mental compulsion*. The factors were clearly defined and easily labeled according to the clinical

consistency of the items. These factors do not coincide with the four factors identified by Berg *et al*. (1988). We also found a factor that was related to obsessive concerns, which we have labeled general obsessive; a factor related to pollution; and a factor related to numbers and luck, which we have called superstition/mental compulsion. However, we did not find a fourth factor related only to school. In contrast, Maggini *et al*. (2001) did identify three factors in a non-clinical Italian population, but their statistical analysis was different and they did not label the aspects. In Colombia, Rueda-Jaimes *et al*. (2007) found a single factor that accounted for 80.2% of the variance. The lack of a stable factor structure across the various studies may be the reason that none of them included a confirmatory factor analysis. For this reason, we decided to carry out two exploratory factor analyses using the cross-validity method to assess the stability of the factor structure found. The three factors identified in our study explained 45.8% of the variance, which is similar to the figure found in the original version of Berg *et al*. (1988). Our findings support a three-factor structure and suggest that the LOI-CV factor structure can be useful in studying the evolution of OCD phenomenology in both epidemiological and clinical studies of children and adolescents, as reported by Nikolajsen *et al*. (2010).

Total internal consistency of the LOI-CV was good (.79, .87 and .90 for the various scores) and higher than that found by Berg *et al*. and by Brinska and Wolanczyk (2005). In this sense, we support suggestion made by Sánchez-Meca *et al*. (2011) that the erroneous practice of inducing reliability from previous studies should be avoided in psychological research. The three factors had different reliabilities depending on the score taken into account. The score that gave the best reliabilities (.82, .81, and .77 in the three factors, respectively) was the total score, because it takes into account both the presence of OCD symptoms («yes» score) and the interference of these symptoms (interference score). The score that gave the worst reliabilities (.66, .64, and .58 in the three factors, respectively) was the «yes» score, probably because it considers only the presence of symptoms but not their interference. This score was not used in other epidemiological studies (Maggini *et al*., 2001; Roussos *et al*., 2003). All these data suggest that the best score is the total score because it is a combination of the «yes» score and the interference score.

Our results related to the sensitivity and specificity of LOI-CV scores indicate that this questionnaire shows a good screening capacity. The AUC for both the total score and the interference score was .91, which is highly predictive of OCD (Greiner *et al*., 2000). We suggest cut-off points lower than those indicated by Flament *et al*. (1988) and by Roussos *et al*. (2003). The sensitivities found for both the total score of 21 and the interference score of 10 were good and higher than those reported by Roussos *et al*. (2003) (79% for a total score of 35) and by Flament *et al*. (75% for an interference score of 25). Our specificities were similar to those given by Flament *et al*. (1988) (84%) and higher than those given by Roussos *et al*. (2003) (73%). Also, the PPV (18%) and the NPV (99%) were comparable to those indicated by the aforementioned studies (17.6% and 18% for PPV, 98% for NPV).

With regard to gender differences, Maggini *et al*. (2001) and Brynska and Wolanczyk (2005) reported that girls scored significantly higher than boys on the «yes» score,

whereas we found no differences in the interference score or in the total score. Our mean scores were lower than those found by Roussos *et al*. (2003) for both the «yes» score (8.28 *vs*. 12.3) and interference score (5.88 *vs*. 16.3).

Children with OCD diagnosis obtained significantly higher total mean scores and interference scores than children without diagnosis, which supports the discriminative capacity of the LOI. Likewise, interference and total scores were significantly higher in clinical diagnoses than in subclinical diagnoses for order/checking/pollution and obsessive concerns, which also confirms that the higher the score the more severe the disorder. The order/checking/pollution factor obtained higher interference and total scores in clinical diagnosis, which indicates that these manifestations were the most frequent and interfering symptoms in our sample. Also, this factor accounted for the highest percentage of variance in the LOI. In the study by Maggini *et al*. (2001), item 4 (hate dirt and dirty things) was the most common and interfering symptom. Other studies in various countries and cultures have reported dirt phobia and checking behavior as the most frequent obsessive-compulsive phenomena in children (Berg *et al*., 1988; Honjo *et al*., 1989; Thomsen, 1993). Scores in the superstition/mental compulsion factor indicated that these symptoms were the least frequent and interfering in our sample.

Although we are able to conclude that the LOI is a reliable and valid instrument, the present study does have some limitations. In obtaining a diagnosis, the M.I.N.I.-Kid was only administered to the child without the parents present, and the parents' information was collected by tests or by telephone when necessary. Also, the M.I.N.I.-Kid did not assess the thematic content of the OCD symptoms; it only assessed the minimum DSM-IV criteria. Furthermore, the LOI-CV does not have items for hoarding, aggression, or religious or somatic behaviors, which are frequently found in children/ adolescents (Mataix-Cols *et al*., 2008; Stewart *et al*., 2008; Storch *et al*., 2010).

In conclusion, our data indicate that the LOI-CV is a useful instrument for detecting OCD in children from a non-clinical population and could also be useful in pediatric primary care. The three factors found by factor analysis may have implications for research and clinical practice. We suggest that both the total score of 21 and the interference score of 10 are sensitive and specific enough for the identification of OCD. More data on the use of the LOI-CV in clinical settings and on the use of other instruments for detecting OCD are required.

References

Berg, C.Z., Rapoport, J.L., and Flament, H. (1986). The Leyton Obsessional Inventory-Child Version. *Journal of the American Academy of Child and Adolescent Psychiatry*, *25*, 84-95.

Berg, C.Z., Whitaker, A., Davies, M., Flament, H., and Rapoport, J.L. (1988). The survey form of Leyton Obsessional Inventory-Child Version: Norms from an epidemiological study. *Journal of the American Academy of Child and Adolescent Psychiatry, 27*, 759-763.

Birmaher, B., Khetarpal, S., Brent, D., Cully, M., Balach, L., Kaufman, J., and Neer, S.M. (1997). The Screen for Child Anxiety Related Emotional Disorders (SCARED): Scale construction and psychometric characteristics. *Journal of the American Academy of Child and Adolescent Psychiatry, 36*, 545-553.

Bloch, M.H., Craiglow, B.G., Landeros-Weisenberg, A., Dombrowski, P.A., Panza, K.E., Peterson, B.S., and Leckman, J.F. (2009). Predictors of early adult outcomes in pediatric-onset obsessive compulsive disorder. *Pediatrics*, *124*, 1085-1093.

Brynska, A. and Wolanczyk, T. (2005). Epidemiology and phenomenology of obsessive-compulsive disorder in non-referred young adolescents. A Polish perspective. *European Child & Adolescent Psychiatry*, *14*, 319-327.

Carretero-Dios, H. and Pérez, C. (2007). Standards for the development and review of instrumental studies: Considerations about test selection in psychological research. *International Journal of Clinical and Health Psychology, 7,* 863-882.

Flament, M.F., Whitaker, A., Rapoport, J.L., Davies, M., Berg, C.Z., Kalikow, K., Sceery, W., and Shaffer, D. (1988). Obsessive-compulsive disorder in adolescence: An epidemiological study. *Journal of the American Academy of Child and Adolescent Psychiatry, 27*, 764-771.

Foa, E.B., Coles, M.E., Huppert, J.D., Pasupuleti, R., Franklin, M.E., and March, J.S. (2010). Development and validation of a child version of the Obsessive Compulsive Inventory. *Behavior Therapy, 41*, 121–132.

Gadow, K.D. and Sprafkin, J. (1998). *Child Symptom Inventory-4 screening manual*. New York: Checkmate Plus Stony Brook.

Geller, D.A. (2006). Obsessive-compulsive and spectrum disorders in children and adolescents. *Psychiatric Clinics of North America*, *29*, 353-370.

Greiner, M., Pfeiffer, D., and Smith, R.D. (2000). Principles and practical application of the receiver-operatic characteristic analysis for diagnostic tests. *Preventive Veterinary Medicine*, *45*, 23-41.

Hambleton, R.K. (2005). Issues, designs, and technical guidelines for adapting tests into multiple languages and cultures. In R.K. Hambleton, P.F. Merenda, and C. Spielberger (Eds.), *Adapting educational and psychological tests for cross-cultural assessment* (pp. 3-38). London: L.E.A.

Heyman, I., Mataix-Cols, D., and Fineberg, N.A. (2006). Obsessive Compulsive Disorder. *British Medical Journal, 333*, 424-429.

Honjo, S., Hirano, C., Murase, S., Kaneko, T., Sugiyama, T., Ohtaka, K., Aoyama, T., Takei, Y., Inoko, Y., and Wakabayashi, S. (1989). Obsessive-compulsive symptoms in childhood and adolescence. *Acta Psychiatrica Scandinavica*, *80*, 83-91.

King, N., Inglis, S., Jenkins, M., Myerson, N., and Ollendick, T. (1995). Test-retest reliability of the Survery Form of the Leyton Obsessional Inventory Child Version. *Perceptual and Motor Skills*, *80*, 1200-1202.

Kovacs, M. (1985). The Children's Depression Inventory (CDI). *Psychopharmacological Bulletin*, *21*, 995–998.

Lorenzo-Seva, U. and Ferrando, P.J. (2006). FACTOR: A computer program to fit the exploratory factor analysis model. *Behavior Research Methods, Instruments, & Computers*, *38*, 88-91.

Maggini, C., Ampollini, P., Gariboldi, S., Cella, P.L., Pelizza, L., and Marchesi, C. (2001). The Parma High School Epidemiological Survey: Obsessive-compulsive symptoms. *Acta Psychiatrica Scandinavica*, *103*, 441-446.

Masi, G., Millepiedi, S., Perugi, G., Pfanner, C., Berloffa, S., Pari, C., Mucci, M., and Akiskal, H.S. (2010). A naturalistic exploratory study of the impact of demographic, phenotypic and comorbid features in pediatric obsessive-compulsive disorder. *Psychopathology*, *43*, 69-78.

Mataix-Cols, D., Nakatani, E., Micali, N., and Heyman, I. (2008). Structure of Obsessive-Compulsive Symptoms in Pediatric OCD. *Journal of the American Academy of Child and Adolescent Psychiatry*, *47*, 773-778.

Micali, N., Heyman, I., Pérez, M., Hilton, K., Nakatani, E., Turner, C., and Mataix-Cols, D. (2010). Long-term outcomes of obsessive compulsive disorder: Follow-up of 142 children and adolescents. *British Journal of Psychology*, *197*, 128-134.

Montero, I. and León, O.G. (2007). A guide for naming research studies in Psychology. *International Journal of Clinical and Health Psychology, 7*, 847-862.

Nikolajsen, K.H., Nissen, J.B., and Thomsen, P.H. (2010). Obsessive-compulsive disorder in children and adolescent symptoms dimensions in a naturalistic setting. *Nordic Journal of Psychiatry*, *65*, 244-250.

Piacentini, J., Peris, T.S., Bergman, R.L., Chang, S., and Jaffer, M. (2007). Functional impairment in childhood OCD: Development and psychometrics properties of the Child Obsessive-Compulsive Impact Scale-Revised. *Journal Clinical Child and Adolescent Psychology*, *36*, 645–653.

Roussos, A., Francis, K., Koumoula, A., Richardson, C., Kabakos, C., Kiriakidou, T., Karagianni, S., and Karamolegu, K. (2003). The Leyton Obsessional Inventory-Child Version in Greek adolescents. *European Child & Adolescent Psychiatry*, *12*, 58-66.

Rueda-Jaimes, G.E., Díaz, L.A., Escobar, M., Franco, J.A., Navarro, A., and Cadena, L.P. (2007). Validación del Inventario de Obsesiones de Leyton, versión corta, en niños y adolescentes de Bucaramanga (Colombia). *Atención Primaria*, *39*, 75-80.

Sánchez-Meca, J., López-Pina, J.A., López-López, J.A., Marín-Martínez, F., Rosa-Alcázar, A.I., and Gómez-Conesa, A. (2011). The Maudsley Obsessive-Compulsive Inventory: A reliability generalization meta-analysis. *International Journal of Clinical and Health Psychology, 11*, 473-493.

Sheehan, D., Lecrubier, Y., Sheehan, K., Amorim, P., Janavs, J., Weiller, E. Hergueta, T., Baker, R., and Dunbar, G.C. (1998). The Mini-International Neuropsychiatric Interview (M.I.N.I.): The development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. *Journal of Clinical Psychiatry*, *59* (Suppl 20), 22–33.

Sheehan, D.S., Sheehan, K.H., Shytle, DR., Janavs, J., Bannon, Y., Rogers, J.E., Milo, K.M., Stock, S.L., and Wilkinson, B. (2010). Reliability and validity of the Mini International Neuropsychiatric Interview for Children and Adolescents (MINI-KID). *Journal of Clinical Psychiatry, 71*, 313-326.

Stewart, S.E., Rosario, M.C., Baer, L., Carter, A.S., Brown, T.A., Scharf, J.M., Illmann, C., Leckman, J.F., Sukhodolsky, D., Katsovich, L., Rasmussen, S., Goodman, W., Delorme, R., Leboyer, M., Chabane, N., Jenike, M.A., Geller, D.A., and Pauls, D.L. (2008). Four-factor of obsessive-compulsive disorder symptoms in children, adolescents, and adults. *Journal of the American Academy of Child and Adolescent Psychiatry*, *47*, 763-772.

Storch, E.A., Muroff, J., Lewin, A.B., Geller, D., Ross, A., McCarthy, K., Morgan, J., Murphy, T.K., Frost, R., and Steketee, G. (2011). Development and preliminary psychometric evaluation of the Children's Saving Inventory. *Child Psychiatry & Human Development, 42*, 166-182.

Thomsen, P.H. (1993). Obsessive-compulsive disorder in children and adolescents. Self-reported obsessive-compulsive behavior in pupils in Denmark. *Acta Psychiatrica Scandinavica*, *88*, 212-217.

Vigil-Colet, A., Canals, J., Cosi, S., Lorenzo-Seva, U., Ferrando, P.J., Hernández-Martínez, C., Clautre, M.C., Viñas, F., and Domènech, E. (2009). The factorial structure of the 41-item version of the Screen for Child Anxiety Related Emotional Disorders (SCARED) in a Spanish population of the 8 to 12 years-old. *International Journal of Clinical and Health Psychology*, *9*, 313-327.

Yucelen, A.G., Rodopman-Arman, A., Topcuoglu, V., Yazgan, M.Y and Fisek, G. (2006). Interrater reliability and clinical efficacy of Children's Yale-Brown Obsessive-Compulsive Scale in an outpatient setting. *Comprehensive Psychiatry*, *47*, 48-53.