

**A validation study of the Spanish version of the Hypersexual Behavior Inventory
(HBI): Paper-and-pencil versus Online administration**

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Authors' contribution

R.B.A. & M.D.G.L. contributed to the design of the study, obtaining funding, and study supervision.

R.B.A., M.D.G.L., J.C.C., B.G.J. & C.G.G. participated in recruiting participants, collecting data, analysis/interpretation of data, and writing of the paper.

Conflict of interest

The authors declare no conflict of interest.

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Abstract

Hypersexuality is a problematic behavior characterized by the combination of an excessive sexual desire and the pathological inability to control it. This study presents the psychometric properties of the Spanish paper-and-pencil and online versions of the Hypersexual Behavior Inventory (HBI), one of the most popular scales to assess this issue. 2250 participants (1070 men) completed a translated version of the HBI (1450 in paper-and-pencil; 800 online). The EFA yielded three factors that explained 67.53% of total variance for the HBI paper-and-pencil version. This factor structure was confirmed in the HBI online version through CFA. Factorial, structural, scalar and error variance invariance according to gender was also confirmed through multigroup CFA. Reliability of the total score and subscales ranged between .89-.96. Likewise, correlations with other related scales were positive and significant (r between .511-.743). Temporal stability 1-year after the first application was .77 (paper-and-pencil format) and .68 (online version). These results support the reliability and validity of the HBI and justify its use in the assessment of hypersexuality in Spanish-speaking countries.

Keywords: Hypersexual Behavior Inventory (HBI), Spanish translation, psychometric properties, administration format invariance, gender invariance.

INTRODUCTION

Hypersexuality –also labelled as sexual compulsivity or sex addiction– is a problematic behavior characterized by an excessive and out-of-control normophilic sexual desire (Kafka, 2010; Winters, Christoff, & Gorzalka, 2010). According to the initial proposal for the inclusion of this clinical condition in the DSM-5, individuals must meet at least four of the following criteria to be diagnosed with Hypersexual Disorder (hereafter, HD): (1) time consumed by sexual activities interferes with other important (non-sexual) goals, activities and obligations; (2) repetitively engaging in sexual fantasies, urges or behaviors in response to dysphoric mood states (e.g., anxiety, depression, irritability, etc.) or (3) in response to stressful life events (work problems, bereavement, divorce, etc.); (4) repetitive but unsuccessful efforts to control or significantly reduce these sexual fantasies, urges or behaviors and; (5) repetitively engaging in sexual behaviors while disregarding the risk for physical, social or emotional harm to self or others (Kafka, 2010, 2013, 2014). A field study has been conducted to assess the reliability and clinical validity of these criteria (Reid, Carpenter, et al., 2012). In this study, HD criteria demonstrate high reliability, validity and time stability when applied to clinical samples. Specifically, these researchers found an inter-rater reliability of .95 and a diagnostic stability of .82; moreover, sensitivity and specificity of diagnostic criteria was .88 and .93 (percentage of true negative and false positive was 12% and 7%, respectively). These figures are much more promising than those obtained in the diagnosis of other potentially problematic behaviors (e.g., problematic buying or excessive Internet use) (Maraz, Király, & Demetrovics, 2015).

Despite the robustness of these findings and the myriad of studies that support HD diagnosis in clinical samples (for a review, Derbyshire & Grant, 2015; Karila et al., 2014; Kraus, Voon, & Potenza, 2016), the DSM-5 board of trustees decided not to

include this clinical condition in the new version of the manual (nor in section III – conditions for further study–). On the contrary, the World Health Organization’s ICD-11 has recently included compulsive sexual behavior (CSB) as a diagnosis in the category of impulse control disorders (Kraus et al., 2018; World Health Organization, 2018). The main symptoms comprised under the CSB diagnosis are equal to those described in HD; however, in comparison to HD criteria, CSB diagnosis emphasizes lack of control and functional impairment as key criteria and downplays the use of sex as a coping mechanism and the role of sexual desire in displaying the clinical condition.

One criticism that supported the rejection of HD in DSM-5 and the reluctance of many experts to recognize CSB in the ICD-11 was related to the absence of large-scale epidemiological studies that allow to establish the prevalence of this clinical conditions with rigor (Kraus et al., 2018; Reid & Kafka, 2014). In this regard, different studies report a prevalence between 3-6% in general population (Yoon, Houang, Hirshfield, & Downing, 2016), although this estimation greatly varies depending on the diagnosis criterion. Based on the results of questionnaires and screening scales, prevalence of HD ranges from 3-17.4% in men and 1.2-32.2% in women (Odlaug et al., 2013; Odlaug & Grant, 2010; Rettenberger, Klein, & Briken, 2015; Seegers, 2003). This wide range reflects the enormous variability between scales in terms of construct conceptualization, items development and psychometric properties.

Problems in the assessment of hypersexuality through screening scales

Hook, Hook, Davis, Worthington and Penberthy (2010) pointed out some of the problems that compromise the reliability of available screening scales in the diagnosis of HD and CSB. Among others, these authors highlighted the problems derived from the use of tools without previous validation studies or validated only in their original form (not in each version or format employed for clinical or empirical purposes).

Additionally, some of these scales are outdated or validated only in very specific contexts, hindering their use in community settings. Recently, Castro-Calvo, Ballester-Arnal, Billieux, Gil-Juliá and Gil-Llario (2018) evidenced an additional shortcoming: the lack of consensus in the factorial structure of some of the most popular scales to assess HD and CSB. In particular, these authors highlighted that more than four different factorial structures has been proposed for the Sexual Addiction Screening Test (SAST), hindering the comparability of the empirical results obtained through this scale.

These limitations explain the discouraging results obtained from some of these scales. In a study in which 120 patients previously diagnosed with HD completed the Sexual Compulsivity Scale (SCS), Reid, Carpenter, Spackman and Willes (2008) found that 30% of them did not exceed the cut-off point for the diagnosis of this clinical condition. If we consider that patients who attend a clinical center are generally those who show a higher degree of functional impairment (Reid, Carpenter, et al., 2012), then the diagnostic sensitivity of this instrument in the most favorable scenario barely reaches 70%. Similarly, Wéry et al. (2016) found that 95.8% of a sample of self-identified sexually addicted patients seeking treatment in an outpatient clinic met the criteria for the diagnosis of this clinical condition according to the SAST, whereas this figure dropped to 56.9% and 52.8% when other diagnostic thresholds were applied. Finally, Castro-Calvo, Ballester-Arnal and Gil-Llario (2015) found that whereas diagnostic convergence between three popular scales to assess HD and CSB (the Hypersexual Behavior Inventory –HBI–, the SAST and the SCS) was, at best, 46.3% (i.e., more than half of the hypersexual patients identified through one of these questionnaires did not match the diagnostic thresholds in the other two scales). The authors attributed their findings to the scarcity of validated scales to assess HD and

CSB: when the study was carried out, only one of the scales was previously adapted and validated in the Spanish context.

Language limitation is especially relevant given the lack of instruments for the evaluation of HD and CSB in languages different from English (Scanavino et al., 2016). Only three of the 32 scales cited by Womack, Hook, Ramos, Davis and Penberthy (2013) in their review of HD assessment instruments have a translated, adapted and validated version in the Spanish context: the SCS (Ballester-Arnal, Gómez-Martínez, Gil-Llario, & Salmerón-Sánchez, 2013), the SAST (Castro-Calvo et al., 2018) and the Internet Sex Screening Test (ISST) (Ballester-Arnal, Gil-Llario, Gómez-Martínez, & Gil-Juliá, 2010). Likewise, most of the current research (especially epidemiological and descriptive studies) recruit and assess their participants through the Internet, without considering the fact that scales properties (factorial structure, reliability, and scores) of an online administered questionnaire may not be totally equivalent to its paper-and-pencil use (Alfonsson et al., 2014). The increasing acknowledgement of this limitation has led to the recent publication of a meta-analysis examining the psychometric properties of the most used online instruments in clinical assessment (such as the HADS and the BDI) (van Ballegooijen, Riper, Cuijpers, van Oppen, & Smit, 2016). However, this acknowledgement is not still in the field of hypersexuality. Despite the fact that the majority of recent studies in this field have been total or partially carried out through the Internet (Jardin et al., 2017; Jerome, Woods, Moskowitz, & Carrico, 2016; Parsons, Rendina, Ventuneac, Moody, & Grov, 2016; Štulhofer, Jurin, & Briken, 2016; Vaillancourt-Morel et al., 2016) or computer-assisted (Graham, Walters, Harris, & Knight, 2016), only one of the screening instruments often used for the assessment of sexual addiction symptoms (i.e., the SAST) has compared its reliability, validity and

clinical utility during paper-and-pencil and online application (Castro-Calvo et al., 2018).

The present study

The main objective of this research was to translate and explore the psychometric properties of the Spanish paper-and-pencil and online versions of one of the most popular scales for the screening of HD: the Hypersexual Behavior Inventory (HBI) (Reid, Garos, & Carpenter, 2011). This screening tool is one of the few in line with the proposed criteria for the diagnosis of HD in DSM-5 and comprises an average of 3 items for the assessment of each criterion (Womack et al., 2013). Coherent with this theoretical approach, authors obtained a three-factor solution when they tested the scale in a sample of 203 treatment-seeking hypersexual men (more details regarding the psychometric properties of the scale are provided in the instruments section) (Reid et al., 2011). Indeed, the HBI is one of the few scales validated in clinical population. These aspects explain why the HBI has become popular and many researchers are using this scale instead of (or in addition to) other classical tools such as the SCS or the SAST. Translations of this scale have been validated in different languages, such as German (Klein, Rettenberger, Boom, & Briken, 2013) or Hungarian (Bóthe, Kovács, et al., 2018). Additionally, its emphasis in the assessment of symptoms related to the failure to control sexual impulses and behaviors places this scale as optimal in exploring the main symptoms of the recently recognized CSB condition by the ICD-11 (Kraus et al., 2018; World Health Organization, 2018).

Although the HBI have been successfully employed in research conducted in multiples countries, contexts and different populations (Montgomery-Graham, 2017), none of the studies performed so far has evaluated its long-term temporal stability (at least, for a period longer than 2 weeks) or the psychometric properties of its online

application in comparison to its paper-and-pencil administration. Furthermore, only one study has demonstrated the equivalence of the factorial solution in men and women (Bóthe, Bartók, et al., 2018), highlighting the need to replicate this initial findings in different cultural contexts. Accordingly, the specific goals of the current study were to (1) translate the HBI from English to Spanish, (2) explore its psychometric properties (factor structure, internal consistency, long-term test-retest stability, and convergent validity); (3) test the goodness of fit of the HBI paper-and-pencil factorial solution during its online administration, and (4) analyze the metric, structural, scalar and error variance invariance according to gender.

METHOD

Participants

2,250 individuals (1,070 men; 1,180 women) distributed in two groups participated in this study. The first group (paper-and-pencil administration) was made up of 1,450 young people (665 men; 785 women) aged between 18-27 years ($M=20.61$; $SD=2.20$). The second one (online administration) included 800 youths (405 men; 395 women) whose age range was 18-40 years ($M=24.20$; $SD=5.37$). Table 1 shows the main sociodemographic and sexual behavior characteristics of the participants. Differences between the two groups were practically non-existent except for age ($d=0.87$) and sexual orientation ($V=0.30$).

INSERT TABLE 1

Procedure

According to the recommendations of the main translation protocols of questionnaires (Harkness, Penell, & Schoua-Glusberg, 2004), the English to Spanish HBI translation was conducted through group methodology. Four members of the research team with experience in both the translation and validation of questionnaires

and the study of HD performed independent translations. Then, they were put together in order to agree on a preliminary version of the questionnaire. This version was then back-translated into English by a bilingual researcher familiar with sexual terminology (not involved in previous step) and compared with the original one. After solving translation discrepancies, a final version of the HBI was administered to 30 young people to check whether the items were well understood. After making the suggested improvements, the final version was ready and employed in the two validation studies (A-Table 1, Appendices).

In the face-to-face study, the translated HBI with the rest of the instruments (SCS and SAST) were administered to young people at information desks, which were located at the main entrance of different higher education centers. Students received information about HD and were asked to collaborate altruistically with the research. Those who agreed, completed an informed consent and the evaluation instruments in paper-and-pencil format. A small percentage of these students were given the opportunity to continue collaborating. Those who accepted were asked to include an email address and a contact number. One year later, 200 of these students were randomly selected to complete the HBI again in order to calculate the test-retest reliability of the instrument. In this second assessment, 50% of the participants completed the paper-and-pencil version of the HBI (as previously did); the other 50% completed the online version of the HBI through the ADISEX online assessment platform. The sample was balanced according to gender and application format: i.e., 50 males and 50 females completed the paper-and-pencil version of the HBI and the other 50 males and 50 females the online version.

In the non-face-to-face study (online group), the HBI together with other related measures (convergent validity) were administered through the ADISEX online platform

(<http://adiccionalsexouji.es/>). This website was accessible through any search engine under terms like “sexual addictions”, “sex addiction assessment” or “sex addiction treatment”. In order to enrich the profile and increase the number of users who went through with the evaluation, a campaign requesting the collaboration on a study was initiated through the Facebook advertising system (suggested publications). The specific objective of the investigation was not mentioned as a mean of not to bias sampling. The information provided was only referred to the fact that this was a study on sexual behavior. The campaign was focused on young people aged between 18 and 30 years, so that the profile would be coincident with the study in paper-and-pencil format. The data derived from the online platform was processed to avoid duplicitous responding and only participants who completed at least 85% of the assessment tools (considered “motivated participants”) were included in the study.

Instruments

In addition to a short *Ad-Hoc* questionnaire on basic socio-demographic data (sex, age, partner, and religious beliefs), participants completed the following questionnaires:

Hypersexual Behavior Inventory (HBI, Reid et al., 2011).

HBI is a 19 item Likert-type scale (1= Never / 5= Very frequently) designed to measure the three basic dimensions of hypersexuality. The HBI was originally validated in male clinical population. In this sample, the resulting factor structure replicated the theoretical criteria under which HBI was designed. Firstly, a factor named “Coping” (items 1, 3, 6, 8, 13, 16 and 18) was obtained and reflected the use of sex in response to dysphoric mood states; the second one, named “Control” (items 2, 4, 7, 10, 11, 12, 15 and 17) showed problems to control or reduce their sexual thoughts, urges, and behaviors; and the third factor called “Consequences” (items 5, 9, 14 and 19) explored

the persistence of sexual fantasies, urges, and behaviors despite their negative consequences. The authors obtained strong relationships among factors and the reliability for each scale ranged between .89 and .95. The German and the Hungarian versions of the scale supported the original three-factor structure (Bóthe, Kovács, et al., 2018; Klein et al., 2013). An additional validation study of the original English scale also supported the three-factor structure, even after the deletion of several items cross-loading in more than one factor (Yeagley, Hickok, & Bauermeister, 2014).

Sexual Compulsivity Scale (SCS, Kalichman & Rompa, 1995) in its validated Spanish version (SCS, Ballester-Arnal et al., 2013).

The SCS consists of 10 items answered on a 4-point Likert-type scale ranging from 1 ("Not at all like me") to 4 ("Very much like me"). It is used to determine the impact of sexual thoughts on daily functioning and the inability to control sexual thoughts and behaviors. In a sample equivalent to the one used in the present study, the authors obtained a factorial solution according to which the 10 items may be grouped in two dimensions ("Sexual Behavior Interference" and "Lack of Control"). The authors of the Spanish version report a reliability of .83 and a temporal stability (test-retest correlation) of .72. In the present study, reliability for the overall scale and subscales ranged from .76-.86 for the paper-and-pencil group and from .78-.87 for the online group.

Sexual Addiction Screening Test (SAST, Carnes, 1983) in its validated Spanish version (Castro-Calvo et al., 2018).

The SAST is a 25-item measure. All items are scored dichotomously (yes/no) and their sum allows to obtain a severity index ranging from 0 to 25. In the original validation, a single factor explained 50% of its variance, although no subsequent study has met the same factorial solution (Marshall & Marshall, 2010). In a recent validation study in a

sample of 2,528 participants, Castro-Calvo et al. (2018) obtained a factorial structure comprised by four first-order factors grouped under a second-order factor. These authors also demonstrated that the SAST is equally applicable in men and women without changes in its factorial structure (metric, scalar and configural invariance). In the Spanish validation study, the authors reported an internal consistency of between .82 and .85 for the total score and the subscales. In the current study, the reliability for the overall scale was .82 in the paper-and-pencil group and .88 in the online group.

Those instruments that were only part of the online evaluation and were used to calculate the convergent validity are listed below. To select them, an exhaustive revision of different hypersexuality studies was made, choosing only those constructs that had proved to be related in one or another way with sexual impulses control:

Sexual Sensation Seeking Scale (SSSS, Kalichman & Rompa, 1995) in its validated Spanish version (Ballester-Arnal, Ruiz-Palomino, Espada-Sánchez, Morell-Mengual, & Gil-Llario, 2018).

The SSSS is an 11-item Likert-type scale that allows to evaluate the propensity to seek out novel or risky sexual stimulation regardless of the risk involved. Hence, some studies show its relationship with certain risky sexual practices (Voisin, Hotton, Tan, & Diclemente, 2013) as well as with hypersexuality symptoms (Gullette & Lyons, 2005). Psychometric studies support its use in young people (Gray & Wilson, 2007). and adolescents (Ballester-Arnal et al., 2018). Internal consistency (Cronbach's alpha) for this scale was .82 in its Spanish adaptation. The reliability for the overall scale in the present study is .81.

Internet Addiction Test (IAT, Young, 1998).

The IAT comprises 20 items answered on a 5-point Likert scale (1=Never; 5=Always). It measures to what extent the Internet use is problematic or not in accordance with

those traditionally established criteria for substance abuse or pathological gambling. These criteria include the following issues: loss of control over one's own behavior, saliency, persistence despite the negative consequences derived, use of the Internet as an emotional regulation mechanism, and deception of family members or friends. The IAT is one of the most used scales to assess the Internet impulses control (Boysan et al., 2017). An study carried out with the Spanish version of this instrument showed a highly robust internal consistency ($\alpha=.91$) (Castro-Calvo, Ballester-Arnal, Gil-Llario, & Giménez-García, 2016). In the present study, the reliability for the overall scale was .91. *Internet Sex Screening Test (ISST, Delmonico, 1997) in its validated Spanish version (Ballester-Arnal et al., 2010).*

The ISST is a 25-item measure. The items are scored dichotomously (True/False) and assess the extent to which the online sexual behavior is problematic or not. The sum of the items provides a global index about cybersex addiction and scores in 5 subscales: 1) online sexual compulsivity (that is, symptoms of cybersex addiction), 2) isolated online sexual behavior (mainly pornography viewing), 3) social online sexual behavior (use of chat for sexual purposes), 4) online sexual spending (money spent to support the use of cybersex) and 5) Perception of severity (to what extent the online sexual behavior is considered hazardous). Ballester et al. (2010) reported a reliability of .88 for the overall scale. The temporal stability (r test-retest) was .82. In the present study, the reliability for the overall scale was .82 while ranged from .63-.72 for the different subscales.

Data Analysis

First, descriptive analyzes were carried out to characterize the samples of this research in terms of sociodemographic data and sexual behavior. Statistical software SPSS 25.0 version and G*Power software 3.1 version (to calculate effect size) were used. In order to compare participants of both groups (paper-and-pencil and online

format), Student's *t* tests (continuous variables) and Chi square tests (categorical variables) were performed. The size effect of these contrasts was estimated from Cohen's *d* and Cramer's *V* (which in Chi Square tables 2xk is equivalent to Cohen's *W* index for effect size) (Sheskin, 2007). For Cohen *d*, effect sizes of about .20 were considered small, close to .50 moderate and greater than .80 large (Cohen, 1988); in Cramer's *V*, these sizes corresponded to values of .10, .30 and .50 respectively (Ellis, 2010).

In order to identify the internal structure of the HBI, an Exploratory Factor Analysis (EFA) was carried out taking into consideration only participants of the paper-and-pencil group (considered as validation sample). FACTOR software (version 9.2) was employed to perform the EFA (Lorenzo-Seva & Ferrando, 2013). The main advantage of FACTOR in comparison to other statistical software is the possibility of performing the EFA on the basis of the tetrachoric/polychoric correlation matrix; this option is preferable when modeling non-normally distributed data (such as in the case of the HBI) (Ferrando & Lorenzo-Seva, 2017). We employed Parallel Analysis (PA) to determine the number of factors to retain; this analysis was conducted on the basis of the polychoric correlation matrix using optimal implementation function (Timmerman & Lorenzo-Seva, 2011). Factors were extracted through Robust Diagonally Weighted Least Squares (RDWLS) and applying an oblique rotation (Direct Oblimin).

Subsequently, a Confirmatory Factor Analysis (CFA) was conducted with the participants of the online group (confirmation sample); its objective was to evaluate whether the factor structure of the HBI paper-and-pencil version was replicated during its online use and its accuracy compared with the structure proposed by the original authors. Likewise, the adjustment of two factorial models was compared and a multi-group CFA was carried out to test the hypothesis of configural, metric, scalar and error

variance invariance according to gender. The software used to perform these analyses was the EQS 6.2. The normality violation was addressed using robust methods. The goodness of fit of the different factorial models was analyzed with the following indexes: Satorra-Bentler Chi-Square (X^2), Relative Chi-Square (X^2/df), general significance of the model (p), Root Mean Square Error of Approximation (RMSEA) and the Comparative and Incremental Fit Indexes (CFI and IFI, respectively). An appropriate fit was considered when X^2 was not significant ($p > .05$), X^2/df was between 1 and 2, the CFI and the IFI were $\geq .95$ and the RMSEA $\leq .05$ (Bagozzi & Yi, 2011). According to less restrictive criteria, values between 2 and 3 for $X^2/df \geq .90$ for CFI and IFI, and $\leq .08$ for RMSEA could also be considered acceptable (Hooper, Coughlan, & Mullen, 2008).

Finally, the general mean score of the items, subscales and total score of the HBI were explored, as well as the magnitude of the differences according to the application format. Different reliability indices were calculated: ordinal Cronbach's alpha and Ω (userfriendly science, R package) (Peters, 2014), item-scale and item-test correlations. We also estimated temporary stability under two conditions: one in which both, the initial application of the HBI and the retest, were completed in paper-and-pencil format ($r_{\text{paper-paper}}$); and another one in which the retest was made online ($r_{\text{paper-online}}$). The last one is used to confirm the degree of relationship between completing the HBI in paper-and-pencil format and online. The convergent validity was explored by correlating (Pearson's r) the HBI total score and its subscales with related measures. Finally, percentile distribution of the HBI scores was obtained and included as an additional content in the appendices (A-Table 2).

RESULTS

Exploratory Factor Analysis of the HBI: paper-and-pencil group

The Kaiser-Meyer-Olkin index (KMO=.950; 95% CI [.950-.954]) and Bartlett's test for sphericity ($\chi^2(171)=12,573.7$; $p<.001$) were first calculated to verify the feasibility of the Exploratory Factor Analysis to HBI. Both tests indicated that the questionnaire allowed a factorial solution. The analysis of the anti-image correlation matrix (all anti-image correlations $>.94$) and the determinant of the correlation matrix ($>.00001$) let us also verify the adequacy of the Exploratory Factor Analysis to the 19 items of the HBI. After parallel analysis of the polychoric correlation matrix, it was estimated that the appropriate number of factors to be retained was 3. The factorial solution derived from the RDWLS factor analysis revealed that this three-factor structure explained 67.53% of the scale variance. Table 2 includes the factor loadings obtained.

INSERT TABLE 2

The resulting factor structure almost exactly replicated the original questionnaire (Reid, Garos, & Carpenter, 2011), although one of the items that originally belonged to the second factor (item 15) was placed in the third factor. The first factor consisted of seven items (items 1, 3, 6, 8, 13, 16 and 18) and had an eigenvalue of 10.14. It explained the highest percentage of variance (53.39%). This factor included items related to the use of sex in response to a dysphoric mood states (anxiety or depression) or as a mean to manage negative emotions. Following the original article nomenclature, this factor was called "Coping". The second factor was composed of seven items (items 2, 4, 7, 10, 11, 12 and 17) and its eigenvalue was 1.69. It explained 8.89% of the variance and was called "Control", showing problems to voluntarily control one's sexual impulses, thoughts, or behaviors. Finally, the third factor consisted of five items (items 5, 9, 14, 15 and 19). This factor showed a lower eigenvalue (1.07) and also explained a

lower percentage of variance (5.24%). Those items grouped in this factor reflected problems derived from the sexual behavior and was called “Consequences”.

Confirmatory Factor Analysis of the HBI: online group

To confirm empirically that the factor structure of the HBI in paper-and-pencil format was replicated in its online application, a Confirmatory Factor Analysis was conducted using the EQS structural equations modeling program (6.2 version) (Bentler, 2006). For this purpose, the robust Maximum Likelihood (ML) method was applied. Based on the results obtained in the EFA, two models were compared: the first (M1) replicated the factor structure derived from the EFA (three correlated first order factors) while the second (M2) mirrored the original factorial solution obtained by Reid et al. (2011) (i.e., the same factorial solution but placing item 15 in the control factor). Table 3 shows goodness of fit indexes for the different models.

INSERT TABLE 3

As table 3 indicates, the first model (M1) showed the most satisfactory fit indexes. In this model, the Satorra-Bentler χ^2 value of significance (corrected χ^2 for samples that did not follow the normality assumption) did not exceed the .05 value in order to consider a satisfactory fit for the model. However, it has been shown that this statistic is highly conditioned by the size of the sample (Jöreskog & Sörbom, 1993; Markland, 2007), which far exceeds the standard required for this type of analysis in our study (Hair, Black, & Babin, 2010). For this reason, it may be more appropriate to pay attention to other indexes considered as less sensitive to sample size. In this sense, the value of the relative χ^2 (χ^2/df) was 2.93, being considered as acceptable fit those values below 3. The RMSEA was below the .05 value, which is required by the strictest criteria to consider a model as parsimonious. Finally, the CFI and the IFI reached a

value of .91, near the cut-off point established to consider as excellent the fit of the model. M1 was superior to the original factorial structure (M2).

INSERT FIGURE 1

The resulting factorial model (M1) is illustrated in Figure 1. Correlations between factors ranged between .54-.82. All factor loadings were significant ($p < .001$), with values ranging from .70-.85 for factor 1, .62-.83 for factor 2 and between .66-.84 for factor 3. Likewise, factor 1 explained between 49-73% of the variance of its items, factor 2 between 38-69% and factor 3 between 43-70%.

To confirm whether the factor structure of the first model (M1) was applicable to both men and women, four multi-group CFA were performed according to the gender. In the first, the hypothesis of the factor structure invariance (configural invariance) was tested whereas invariance of the factor loadings (metric invariance) was analyzed in the second. Additionally, we tested the hypothesis of intercepts invariance (scalar invariance) and the equality of measurement error for each item (error variance invariance). As table 3 shows, all the models showed an acceptable goodness of fit, although configural invariance indexes were slightly better. Specifically, the value of the relative χ^2 was in all the cases below 3, around 0.05 the RMSEA value and near 0.90 the CFI and IFI indexes. In brief, these results demonstrate that factor structure of the HBI is equivalent in men and women, as well as the factor loadings do not vary significantly according to gender. In addition, the hypothesis of equality of intercepts and measurement error according to gender are also confirmed.

Descriptive data, reliability and temporal stability of the HBI

INSERT TABLE 4

Mean scores of in the HBI items and factors are reported in table 4. Regarding internal consistency, ordinal Cronbach's alpha and Ω for the factors and especially for

the overall score of the HBI far exceeded the Henson criterion of .80 to consider a scale as reliable (Henson, 2001). According to the application format, the internal consistency was slightly higher for the HBI online format ($\alpha/\Omega_{\text{Total-HBI}}=.96$; $\alpha/\Omega_{\text{coping}}=.94$; $\alpha/\Omega_{\text{control}}=.94$; $\alpha/\Omega_{\text{consequences}}=.93$). Internal consistency was also supported by item-scale (between .60-.84), item-test (.54-.85) and scale-test correlations (.84-.89).

Concerning the temporal stability of the HBI, test-retest correlation one year after the first paper-and-pencil application was .77 when the retest was performed in the same format and .68 in online format. The temporal stability of the factors ranged between .33-.60 ($r_{\text{paper-paper}}$) and between .36-.50 ($r_{\text{paper-online}}$). All correlations were significant at $p < .001$.

Convergent validity of the HBI

In order to determine the validity of the HBI, the overall score and its three factors were correlated with other instruments that also captured the same construct or similar dimensions.

INSERT TABLE 5

As expected, the correlation between HBI and other screening measures of sexual impulse control, such as SCS or SAST, was high, positive and significant (all $>.48$ and significant at $p < .001$). The higher correlations were found with the SAST and there were hardly any differences depending on the application format. Considering the HBI factors, the one that correlated more positively with the other two screening questionnaires was “Consequences” (r between .625-.743).

In addition, the online participants completed other scales, which showed high, positive and significant correlations with the overall score and the factors of the HBI. Specifically, the correlations between HBI and the SSSS ranged between .245-.348 and between .406-.498 with the IAT. Finally, an important relationship was found between

the HBI and the ISST, and more specifically with the online sexual compulsivity factor (r between .423-.530).

CONCLUSIONS

The main objective of this study was the adaptation and validation in the Spanish context of the Hypersexuality Behavior Inventory (HBI), which is considered one of the most used instruments in clinical and empirical fields for the screening of hypersexuality. Our main conclusion is that the HBI is a reliable, valid and effective tool to assess hypersexuality and their symptoms, which can be applied to men and women without changes in factor structure, which is equally appropriate in any of its application formats (online or paper-and-pencil) and that their results are stable over time.

Regarding its factor structure, it has been demonstrated that the 19 items of the HBI load in three correlated subscales that represent the main symptoms of HD and CSB. Among the three factors, “Coping” is the scale with greater explanatory power over the whole questionnaire (53.39% of the scale variance) and with a higher average score. Their items (e.g., “Sex provides a way for me to deal with emotional pain I feel”) correspond to two of the proposed criteria for HD diagnosis in DSM-5 (Kafka, 2010, 2013) and represent the use of sex as an emotional regulator. Many hypersexual patients are characterized by using sex in response to dysphoric mood states (anxiety, depression, etc.) or as an escape valve (Reid, Carpenter, et al., 2012); nevertheless, the clinical significance of these symptoms is usually lower than others (such as problems related to sexual impulses control) as it was shown in the original validation of the HBI, whose authors found a greater weight of impulse control symptoms over the emotional regulation ones (Reid et al., 2011). Similarly, CSB diagnosis in the ICD-11 does not include the use of sex as a coping mechanism as a symptom of this clinical condition

(Kraus et al., 2018). The difference between our results and those found in the original study may be due to the type of participants evaluated: the sample of the original study consisted of men undergoing treatment for hypersexuality problems, whereas our participants were university students (paper-and-pencil study) or general population (online study). Supporting this hypothesis, Bóthe, Kovács, et al. (2018) also found higher mean scores in the coping subscale when they applied the HBI to a large nonclinical sample of 18,034 participants. Together, these results would support the idea that the use of sex in order to regulate dysphoric mood states is relatively common in general population and does not necessarily imply the presence of sexual problems (Bancroft, Janssen, Strong, Carnes, et al., 2003; Bancroft, Janssen, Strong, & Vukadinovic, 2003). On the other hand, displaying symptoms related in one or another way to the loss of control over sexual behavior is more typical of clinical pictures with certain severity. Thus, the next important factor is “Control”, which includes items that refer to the ability to voluntarily control sexual behavior (“Even though my sexual behavior is irresponsible or reckless, I find it difficult to stop”). This factor would let us to discriminate between people who simply show greater sexual desire and those who actually suffer from HD (showing an unreasonable sexual desire in combination with a pathological inability to control it) (Walters, Knight, & Långström, 2011). Finally, the last factor, “Consequences”, explores the interference in different areas derived from the symptoms of this pathology and that represents one of the main criteria in the diagnosis of any mental disorder. Specifically, from the six areas on which McBride, Reece, and Sanders (2008) argue that hypersexual behavior has a negative impact, this factor explores the psychological (“My sexual behavior controls my life”) and work ones (“My sexual activities interfere with aspects of my life such as work or school”).

Another aspect that supports the factor structure validity is the fact that the distribution of the items by each of the three subscales coincides almost exactly with the one obtained by the authors of the original version (Reid et al., 2011). These researchers carried out the validation of this scale in clinical population. In this sense, obtaining an equivalent factor structure in general population, not only is a proof of the dimensional and non-categorical conception of this problem (as previous studies about its nosological entity stated) (Graham et al., 2016; Walters et al., 2011), but also supports its use in contexts beyond those for which the questionnaire was originally designed.

Regarding its psychometric properties, this work demonstrates that HBI is a reliable and valid instrument to assess hypersexuality in the general population. Cronbach's alpha of the subscales and the total score ranged between .89-.96, being these data very similar to those obtained during the original validation of the scale (Reid et al., 2011) and subsequent validations (Bóthe, Kovács, et al., 2018; Yeagley et al., 2014). Depending on the application format, its reliability is slightly higher in the online administration. Likewise, the HBI score was stable one year after the initial administration, regardless of the format in which the retest was administered. This finding would be in line with those theories that consider the control of sexual impulses as a stable dimension, which hardly varies in time (similar to a personality trait) (Kalichman & Cain, 2004). Finally, correlations with the other two screening instruments for sexual impulses control (in all cases $r > .48$), as well as with other measures such as the sexual sensation seeking ($r > .24$), internet addiction ($r > .40$) and above all cybersex addiction ($r > .42$) support the validity of HBI to evaluate the clinical construct of HD.

In the validation of the HBI, three aspects have received special attention. One is related to the population that could most benefit from its application. The available

clinical information suggests that there are two sensitive periods in the development of the HD. The first one comprises the stage between 18-27 years and is considered the period in which the first symptoms of this disorder appear (prodromal stage) (Kafka, 1997; Reid, Carpenter, et al., 2012). During this period, the clinical picture becomes more severe and increases its interference. At around the age of 30-45 the second sensitive period begins, which corresponds to the time when patients tend to seek for therapeutic help (Kafka, 2014). According to these clinical considerations, it would be convenient to have a screening instrument for the first period, which let us to adequately identify people with higher risk of developing the clinical picture, while an instrument to assess thoroughly its severity and consequences would be ideal for the second period (Karila et al., 2014; Womack et al., 2013). Taking into account this consideration, the HBI was initially validated in young people aged 18-27 years (those who could benefit most from its application as a screening tool) and then it was confirmed its factor structure in a slightly older population (aged between 18-40 years). Thus, the two critical periods in the development of the HD were taken into consideration.

The second aspect to which we paid special attention was the contrast of its applicability in men and women. The available evidence on HD suggests that although some symptoms and clinical manifestations are similar in men and women, some issues such as its etiology, severity and consequences vary (Dhuffar & Griffiths, 2014, 2016; Ferree, 2001; Mckeague, 2014; Reid, Dhuffar, Parhami, & Fong, 2012; Vaillancourt-Morel et al., 2016). However, the HBI was originally designed considering only typical manifestations of male HD, and original data on its psychometric properties came from two studies conducted only among hypersexual men (Reid et al., 2011). Even though this questionnaire has been frequently used in the evaluation of the clinical picture in women (Dhuffar & Griffiths, 2014; Klein, Rettenberger, & Briken, 2014), only one

study demonstrated the equivalence of its factor structure in men and women (Bóthe, Bartók, et al., 2018). In this sense, our work confirms the results obtained by this previous study: i.e. factor structure of HBI is equivalent in men and women. Moreover, the weight of the items on the factors under which they are grouped does not vary significantly according to gender.

The third and final aspect considered during the validation of the HBI was the application format. Many of the recent studies and some of the classical researches have been carried out, completely or partially, through the Internet. This would imply to administer online scales originally designed for paper-and-pencil application, assuming their equivalence (Alfonsson et al., 2014; van Ballegooijen et al., 2016). In this sense, this study allows us to affirm that both, the factor structure and the psychometric properties of the HBI are equivalent regardless of whether it is applied in classical format (paper-and-pencil) or through the Internet. Furthermore, it seems to be that in some issues such as the reliability of scales and scores, the online application yields better result. This fact would support the theory that anonymity on the Internet leads to some disinhibition, and as a consequence, the recruitment and data collection processes would be better especially in sensitive researches (such as those related to sexuality) (Griffiths, Pontes, & Kuss, 2015, 2016). As far as we know, this is the first study in which the equivalence between online and paper-and-pencil administration of a hypersexuality scale has been tackled.

The relevance of the results does not prevent the recognition of some limitations of our study. The main one would have to do with the nature of the sample used for the validation of the HBI. Since the study did not consider the participation of men and women with clinical problems of hypersexuality, it is not possible to determine with true certainty the diagnostic validity of the HBI in the detection of the clinical picture.

Given the relationship between the HBI and the other two screening instruments used in the research (SCS and SAST), we can assume that the scale presents good sensitivity and diagnostic specificity. However, previous studies with a very similar methodology indicated that a high correlation between scales does not have to result in a high diagnostic convergence (Castro-Calvo et al., 2015). In any case, this is the first time in which the HBI has been translated into Spanish, which is an important step forward in expanding the limited scales supply to evaluate the control of sexual impulses in other different languages than English (Hook et al., 2010; Karila et al., 2014; Scanavino et al., 2016; Womack et al., 2013). In this sense, this validation may be used in any Spanish-speaking country from both Europe (Spain) and Latin America (Mexico, Colombia, Argentina, etc.).

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Table 1. Sociodemographic characteristics, sexual behavior and effect size of the differences between participants of both groups

	Paper-and-pencil group (n=1450) % o <i>M</i> (SD)	Online group (n=800) % o <i>M</i> (SD)	Effect size
Sociodemographic characteristics			
Gender (men)	45.9%	50.7%	<i>V</i> =0.04
Gender (women)	54.1%	49.3%	
Age	20.61 (2.20)	24.20 (5.37)	<i>d</i> =0.87
Regular partner (yes)	52.1%	66.3%	<i>V</i> =0.14
Religious beliefs (atheist)	56.3%	73.7%	<i>V</i> =0.18
Religious beliefs (Non-practicing believer)	38.1%	21.2%	
Religious beliefs (Practicing believer)	5.6%	5.1%	
Sexual orientation (heterosexual)	91.8%	68.4%	<i>V</i> =0.30
Sexual orientation (bisexual)	3.2%	15.8%	
Sexual orientation (homosexual)	4.8%	15.8%	
Sexual behavior			
Lifetime sexual relationships (yes)	96.6%	80.2%	<i>V</i> =0.21
Sexual relationships with a same sex partner (yes)	14.9%	30.5%	<i>V</i> =0.16
Masturbation (yes)	88.5%	94.4%	<i>V</i> =0.10
Mutual masturbation (yes)	89.7%	89%	<i>V</i> =0.01
Oral sex (yes)	90%	90.2%	<i>V</i> =0.01
Vaginal sex (yes)	90%	79.8%	<i>V</i> =0.12
Anal sex (yes)	35%	52.6%	<i>V</i> =0.16

Table 2. Factor loadings of the HBI

ITEMS	Factor loadings		
	Factor 1 (CI)	Factor 2 (CI)	Factor 3 (CI)
Factor 1: Coping			
1. I use sex to forget about the worries of daily life.	.81 (.73; .90)		
3. Doing something sexual helps me feel less lonely.	.58 (.49; .70)		
6. I turn to sexual activities when I experience unpleasant feelings (e.g., frustration, sadness, anger).	.81 (.75; .88)		
8. When I feel restless, I turn to sex in order to soothe myself.	.69 (.63; .76)		
13. Doing something sexual helps me cope with stress.	.66 (.58; .73)		
16. Sex provides a way for me to deal with emotional pain I feel.	.79 (.71; .86)		
18. I use sex as a way to try to help myself deal with my problems.	.76 (.68; .84)		
Factor 2: Control			
2. Even though I promised myself I would not repeat a sexual behavior, I find myself returning to it over and over again.		.67 (.58; .75)	
4. I engage in sexual activities that I know I will later regret.		.73 (.65; .82)	
7. My attempts to change my sexual behavior fail.		.70 (.61; .79)	
10. I do things sexually that are against my values and beliefs.		.55 (.42; .67)	
11. Even though my sexual behavior is irresponsible or reckless, I find it difficult to stop.		.61 (.50; .69)	
12. I feel like my sexual behavior is taking me in a direction I don't want to go.		.76 (.66; .84)	
17. Sexually, I behave in ways I think are wrong.		.66 (.55; .75)	
Factor 3: Consequences			
5. I sacrifice things I really want in life in order to be sexual.			.32 (.20; .43)
9. My sexual thoughts and fantasies distract me from accomplishing important tasks.			.65 (.52; .76)
14. My sexual behavior controls my life.			.69 (.60; .79)
15. My sexual cravings and desires feel stronger than my self-discipline.			.70 (.62; .79)
19. My sexual activities interfere with aspects of my life, such as work or school.			.73 (.64; .83)

Table 3. Indexes of Goodness of fit of the different factorial models of the HBI

	χ^2	<i>df</i>	p	χ^2/df	RMSEA (CI)	CFI	IFI
CFA							
Model derived from the EFA (M1)	431.95	147	<.001	2.93	.049 (.044 ; .055)	.91	.91
Original factor structure (M2)	588.09	147	<.001	4.00	.061 (.056 ; .066)	.49	.51
Multi-group CFA							
Configural invariance	569.85	294	<.001	1.93	.049 (.042 ; .054)	.90	.90
Metric invariance	616.42	315	<.001	1.95	.049 (.043 ; .055)	.88	.89
Scalar invariance	680.05	331	<.001	2.05	.051 (.045 ; .057)	.89	.89
Error variance invariance	709.27	313	<.001	2.26	.056 (.051 ; .062)	.87	.87

Note: χ^2 = Satorra-Bentler χ^2 ; χ^2/df = relative χ^2 ; RMSEA= Root Mean Square Error of Approximation; CFI= Comparative fit index; IFI= Incremental fit index.

Table 4. Descriptive statistics, effect size of the differences depending on the application format and reliability of the HBI

	Range	Total (n=2250) M (SD)	Paper-and-pencil (n=1450) M (SD)	Online (n=800) M (SD)	<i>d</i>	Paper-and-pencil reliability				Online reliability			
						α (CI)	Ω (CI)	I-S <i>r</i>	I-T <i>r</i>	α (CI)	Ω (CI)	I-S <i>r</i>	I-T <i>r</i>
Overall score (Total-HBI)	19-95	30.52 (11.55)	30.78 (11.35)	30.05 (11.88)	0.06	.95 (.95, .95)	.95 (.95, .95)			.96 (.96, .97)	.96 (.96, .97)		
Factor 1: Coping	7-35	13.01 (5.68)	12.92 (5.44)	13.16 (6.10)	0.04	.92 (.91, .93)	.92 (.91, .93)		.89	.94 (.94, .95)	.94 (.94, .95)		.86
Item 1	1-5	2.23 (1.09)	2.19 (1.08)	2.29 (1.10)	0.09			.76	.65			.78	.64
Item 3	1-5	1.90 (1.09)	1.80 (1.04)	2.07 (1.16)	0.24			.71	.65			.76	.68
Item 6	1-5	1.64 (0.96)	1.61 (0.92)	1.71 (1.03)	0.10			.75	.66			.83	.73
Item 8	1-5	1.95 (1.12)	1.99 (1.12)	1.89 (1.13)	0.08			.80	.72			.82	.70
Item 13	1-5	2.21 (1.16)	2.27 (1.16)	2.12 (1.17)	0.12			.76	.65			.80	.66
Item 16	1-5	1.60 (0.95)	1.60 (0.92)	1.60 (1.00)	0.00			.80	.73			.84	.75
Item 18	1-5	1.47 (0.88)	1.46 (0.85)	1.48 (0.93)	0.02			.75	.71			.82	.76
Factor 2: Control	7-35	10.26 (4.42)	10.29 (4.19)	10.21 (4.82)	0.01	.89 (.88, .90)	.89 (.88, .90)		.85	.94 (.93, .94)	.94 (.93, .94)		.84
Item 2	1-5	1.85 (1.11)	1.87 (1.11)	1.82 (1.11)	0.04			.75	.75			.79	.79
Item 4	1-5	1.54 (0.92)	1.50 (0.90)	1.59 (0.95)	0.09			.68	.68			.76	.76
Item 7	1-5	1.46 (0.87)	1.46 (0.84)	1.46 (0.92)	0.00			.70	.70			.82	.83
Item 10	1-5	1.31 (0.81)	1.31 (0.82)	1.31 (0.80)	0.0			.60	.54			.67	.68
Item 11	1-5	1.42 (0.85)	1.45 (0.86)	1.37 (0.84)	0.09			.71	.71			.74	.75
Item 12	1-5	1.33 (0.76)	1.32 (0.72)	1.35 (0.82)	0.03			.72	.73			.82	.83
Item 17	1-5	1.36 (0.78)	1.38 (0.78)	1.32 (0.77)	0.07			.69	.69			.75	.75
Factor 3: Consequences	6-30	7.24 (3.26)	7.56 (3.38)	6.67 (2.94)	0.28	.90 (.90, .91)	.90 (.90, .91)		.87	.93 (.92, .93)	.93 (.92, .93)		.86
Item 5	1-5	1.27 (0.67)	1.29 (0.69)	1.24 (0.64)	0.07			.69	.70			.74	.74
Item 9	1-5	1.76 (1.02)	1.87 (1.08)	1.55 (0.88)	0.32			.79	.80			.77	.78
Item 14	1-5	1.29 (0.68)	1.34 (0.72)	1.21 (0.57)	0.20			.78	.78			.83	.83
Item 15	1-5	1.44 (0.85)	1.49 (0.86)	1.37 (0.81)	0.14			.81	.81			.83	.83
Item 19	1-5	1.48 (0.87)	1.58 (0.93)	1.31 (0.72)	0.32			.81	.82			.84	.85

Note: I-S *r*= Corrected item-scale correlation; I-T *r*= Corrected item-test correlation

Table 5. Correlations between HBI and other measures depending on the application format

	Paper-and-pencil group				Online group			
	Total-HBI	Coping	Control	Consequences	Total-HBI	Coping	Control	Consequences
SCS (<i>n</i> =2250)								
Total score	.742***	.593***	.644***	.743***	.713***	.572***	.598***	.714***
Factor 1: Control	.617***	.511***	.595***	.683***	.620***	.485***	.528***	.631***
Factor 2: Consequences	.675***	.577***	.579***	.664***	.678***	.553***	.562***	.669***
SAST (<i>n</i> =2250)								
Total score	.716***	.553***	.700***	.654***	.717***	.536***	.707***	.625***
SSS (<i>n</i> =800)								
Total score					.348***	.333***	.245***	.313***
IAT (<i>n</i> =800)								
Total score					.498***	.409***	.406***	.460***
ISST (<i>n</i> =800)								
Total score					.511***	.411***	.470***	.441***
Online sexual compulsivity					.530***	.423***	.472***	.490***
Cybersex-isolated					.360***	.317***	.297***	.307***
Cybersex-social					.305***	.257***	.283***	.237***
Money spent					.121***	.103***	.104***	.106***
Perception of severity					.348***	.194***	.422***	.311***

Note: SCS= Sexual Compulsivity Scale; SAST= Sexual Addiction Screening Test; SSSS= Sexual Sensation Seeking Scale; IAT= Internet Addiction Test; ISST= Internet Sex Screening Test; **p*<.05; ***p*<.01; ****p*<.001

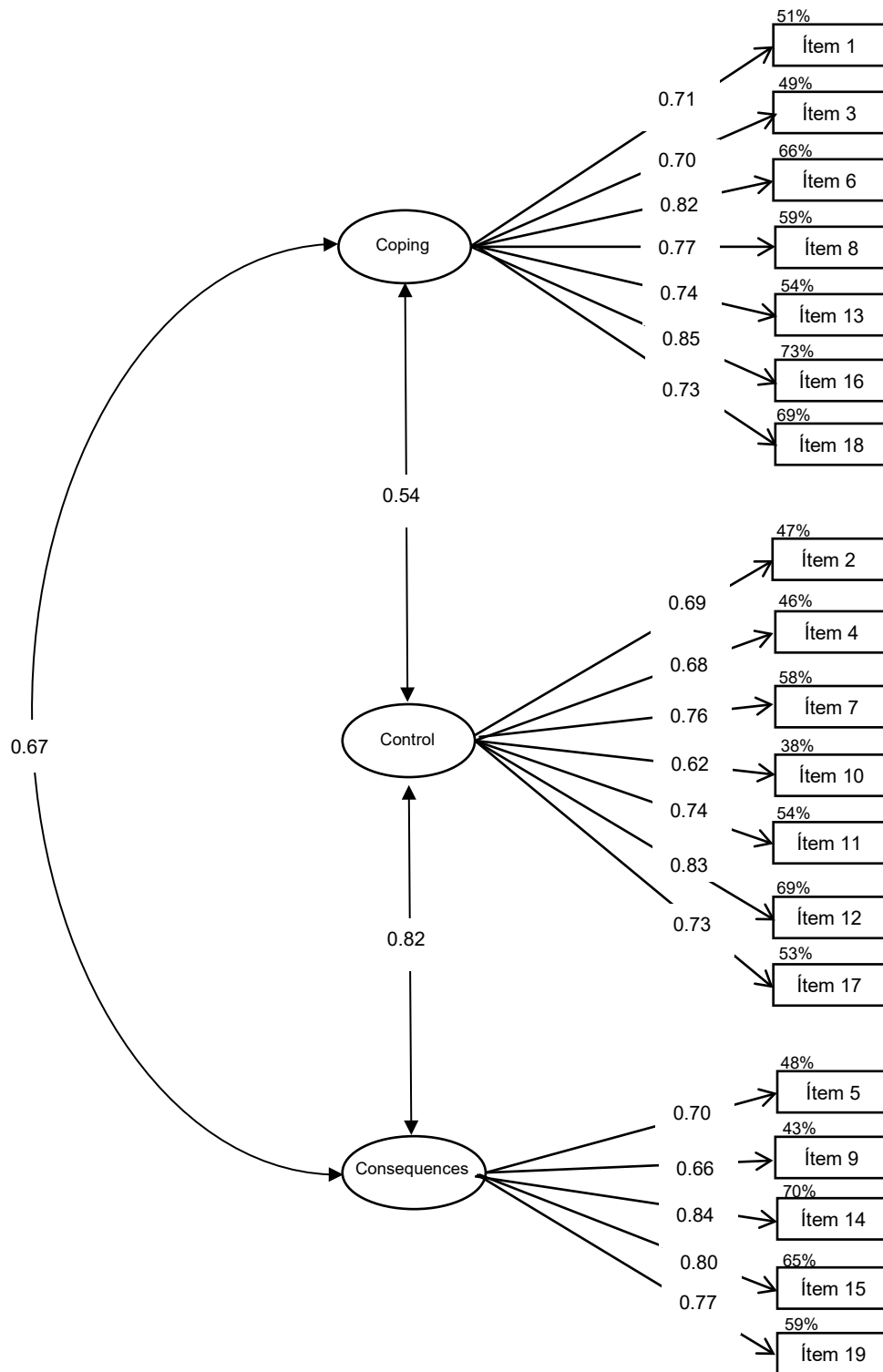


Figure 1. Factorial solution corresponding to model 1 (M1). The percentage of explained variance (R^2) is expressed as a percentage outside the endogenous variables included in the model. Factorial loadings and correlations are expressed in standardized format. All parameters are significant at $p < .001$ level. Error coefficients are omitted to facilitate their interpretation.