Psychometric properties of the Anxiety Sensitivity Index-3-PT: Examining the factorial structure, reliability, validity and discriminatory accuracy of the ASI-3-PT

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Abstract

Anxiety Sensitivity – the degree of fear of anxiety related symptoms – is a central construct for understanding anxiety related disorders and has been assessed by a number of different scales. The most reliable and used assessment tool is the Anxiety Sensitivity Index-3 (ASI-3). Here, we explored the first Anxiety Sensitivity measure for a European Portuguese population - the ASI-3-PT. We evaluated its factorial structure, tested its invariance across gender and method of completion (paper-and-pencil and online) and estimated its reliability and validity in a nonclinical sample (N = 603). Additionally, we tested the predictive accuracy of the ASI-3-PT in discriminating between a clinical (N = 63) and a nonclinical subsample (N = 53) using Receiver Operating Characteristic (ROC) analysis. Confirmatory factor analysis was consistent with a 3-factor hierarchical structure and was invariant across gender and method of completion. Our psychometric analysis showed high levels of reliability and validity, and suggested that a cut-off value of 21 best discriminates between participants with and without psychopathological symptoms. In sum, the ASI-3-PT is a reliable measure to assess Anxiety Sensitivity, useful for practitioners and researchers alike, and equally effective across gender and method of completion.

Keywords: Anxiety Sensitivity Index-3, confirmatory factor analysis, factorial structure, reliability, validity, criterion validity, anxiety screening.

1. Introduction

Individuals who are highly sensitive to anxiety symptoms are expected to experience an increased fear of becoming anxious and of its related sensations. Anxiety Sensitivity mirrors the degree of fear of becoming anxious, and modulates our tendency to avoid an aversive stimulus (Reiss & McNally, 1985). Importantly, Anxiety Sensitivity is an index of an individual's proneness to develop anxiety and mood disorders (McNally, 1989; Taylor, 1995, 1996), and is at the etiology of diverse psychopathological diagnoses. In addition, Anxiety Sensitivity seems to distinguish between anxiety disorders and non-anxiety disorders, and clinical and nonclinical samples (Kemper, Lutz, Bähr, Rüddel, & Hock, 2012). Anxiety Sensitivity is then a central construct for the assessment of anxiety in clinical and experimental settings, and, as such, it is necessary to develop adequate assessment tools. Amongst the measures that have been proposed to assess Anxiety Sensitivity, the Anxiety Sensitivity Index - 3 (ASI-3) is the most consistent measure (Olatunji & Wolitzky-Taylor, 2009). Here we present the first Anxiety Sensitivity measure for a European Portuguese speaking population – the ASI-3-PT. We compare the factorial structure of the ASI-3-PT against the original ASI-3 proposed by Taylor and colleagues (2007), and test its invariance over particular psychometric properties (e.g., method of completion). Moreover, we present a comprehensive study of the reliability of the ASI-3-PT, as well as its construct validity and concurrent validity by distinguishing between Anxiety Sensitivity and other anxiety-related constructs. Finally, we establish a cut-off criterion to support researchers and clinicians in distinguishing clinical and nonclinical samples.

One of the most debated aspects of the Anxiety Sensitivity construct is its relationship with other anxiety-related constructs. Anxiety Sensitivity mirrors how

much an individual believes that the experience of anxiety provokes physical illness, social embarrassment or increases anxiety. That is, high scores on any Anxiety Sensitivity measure correspond to the degree of fear of experiences regarded as having potential physical, social or cognitive harmful implications, (as in panic evoking situations) (Reiss & McNally, 1985). As such, the feared stimulus is linked to the belief that undesired byproduct symptoms or embarrassing situations will happen and these will ignite anxiety symptoms (Reiss, Peterson, Gursky, & McNally, 1986). Anxiety Sensitivity is then independent of the personal history of experiencing anxious symptoms. This is in contrast with another anxiety-related construct – "fear of fear". "Fear of fear" results from the personal experience of a panic attack and relates to the fear of its consequences (Chambless & Gracely, 1989; Reiss, 1997). Therefore, although both constructs relate to fear, "fear of fear" is an associative learning that leads to the recognition of a stimulus as the source of anxious sensations, whereas Anxiety Sensitivity is a propensity to respond fearfully to the anxious sensations (Reiss & McNally, 1985). Another important anxiety-related construct is Anxiety Trait. Anxiety Sensitivity and Anxiety Trait are associated with one another but are different in nature. Both are anxiety proneness factors, but Anxiety Sensitivity is the degree of fear of anxiety symptoms, whereas Trait Anxiety is the propensity to experience anxiety symptoms (Reiss, 1997). That is, someone who scores high on an Anxiety Sensitivity measure can simultaneously score low on a Trait Anxiety measure, because it is possible to be fearful of anxious symptoms while seldom experiencing them. Anxiety Sensitivity is then a unique anxiety-construct that figures critically in our general understanding of anxiety and its related disorders.

The latent structure of the Anxiety Sensitivity construct has also been heatedly debated. When the first measures of Anxiety Sensitivity were developed (e.g. Anxiety Sensitivity

Index – ASI; Reiss et al., 1986), different factorial structures were proposed to explain the construct that ranged from one to four dimensions (Cox, Enns, Walker, Kjernisted, & Pidlubny, 2001; Cox, Parker, & Swinson, 1996). However, these different factorial solutions were obtained by different research teams testing different types of populations from different countries, and using different factorial analytic strategies (Zinbarg, Mohlman, & Hong, 1999). Furthermore, the ASI also presented issues in item adequacy, structure and wording (Taylor, 1996; Taylor & Cox, 1998a, 1998b). Because of this, new instruments to measure Anxiety Sensitivity were created, and amongst them the Anxiety Sensitivity Index-Revise (ASI-R, Taylor & Cox, 1998b) and the Anxiety Sensitivity Profile (ASP, Taylor & Cox, 1998a). Despite each of these instruments showing moderate-to-high construct validity (Taylor & Cox, 1998a, 1998b), the results of their factorial analysis were still inconsistent with one another (for an overview see Olatunji, 2009).

The most recent version of the ASI - the Anxiety Sensitivity Index-3 (ASI-3, Taylor and colleagues, 2007) overcomes some of these limitations and sets to replicate the theoretical hierarchical model of the Anxiety Sensitivity construct (Taylor et al., 2007; Zinbarg et al., 1999). Originally, the Anxiety Sensitivity construct was supposed to follow a hierarchical structure with a high-order factor – the Global Index – and three low-order factors that relate to anxiety sensitivity dimensions focusing on cognitive, social and physical Concerns (Taylor et al., 2007). The development of the ASI-3 followed a meticulous and balanced selection of items among its 3 subscales, and exhaustive confirmatory factor analyses revealed a structure in line with the proposed structure of the construct. Importantly, these analyses were performed over six different samples, across clinical (mixed and homogeneous diagnoses) and nonclinical groups (Taylor et al., 2007). Later confirmatory analysis using clinical and nonclinical samples

supported the same factorial solution (Kemper et al., 2012; Petrocchi, Tenore, Couyoumdjian, & Gragnani, 2015; Wheaton, Deacon, McGrath, Berman, & Abramowitz, 2012), demonstrating that the ASI-3 is the most consistent instrument to assess Anxiety Sensitivity. Moreover, the ASI-3 seems to be a good predictor of the clinical course of anxiety and mood disorders, and has sufficient discriminative accuracy to distinguish between clinical and nonclinical samples, anxiety and non-anxiety related disorders, and between different types of anxiety disorders (Kemper et al., 2012; Plehn & Peterson, 2002).

Anxiety Sensitivity and the associated ASI-3 have strong diagnostic potential, and in fact have been used widely in clinical practice and experimental research settings to complement traditional diagnostic tools for anxiety disorders. As such, the availability of the ASI-3 for different populations and countries is of the utmost importance. Here we establish the first Anxiety Sensitivity measure in European Portuguese – the ASI-3-PT – and assess its factorial structure through confirmatory factor analysis. Moreover, we perform a comprehensive psychometric analysis of this novel tool, and assess construct reliability and validity of the ASI-3-PT. Finally, we define a cut-off criterion to distinguish between clinical and nonclinical samples using the ASI-3-PT, allowing for its use in research and clinical settings in Portugal.

2. Methods

We investigated the psychometric properties of the ASI-3-PT following the criteria proposed by Cicchetti (1994) for the construction of reliable instruments in psychology. Namely, we tested the factorial structure of the ASI-3-PT through confirmatory analysis procedures and invariance testing. We examined its construct reliability, and in particular its internal consistency and its intraclass coefficient for

estimating temporal stability. We examined its construct validity by estimating 1) its content and face validity using small subsamples; 2) its concurrent validity by correlating subscales of the ASI-3-PT with the Brief Symptoms Inventory (BSI), an instrument with a set of subscales that assesses anxiety related symptoms (Derogatis, 1982 ; Portuguese version Canavarro, 2007); 3) its discriminant validity by examining the associations between the ASI-3-PT total score and the BSI global indices of psychopathology; and finally 4) its criterion validity using ROC curve analysis (Swets, 1988) to test the discriminatory accuracy of the ASI-3-PT and to define its optimal cut-off point for differentiating clinical and nonclinical samples.

2.1. Sample

Two groups of participants were recruited – a nonclinical and a clinical group. The nonclinical group was a convenience plus snowball sample of college students and general population, using a broad recruitment strategy. First layer participants were recruited through university advertisement boards, advertisement during classes, email and social media networks. Then, these participants were asked to enroll their closest contacts. The participants from the nonclinical sample completed the protocol either using Qualtrics software (http://www.qualtrics.com) (n = 262, mean age = 35.09, *SD* = 8.9) or using pencil-and-paper (n = 341, mean age = 23.4, *SD* = 8.4). The only inclusion criterion was age (participants had to be 18 years old or older). There were no exclusion criteria so that the sample would be representative of the target population. The final nonclinical group had a total of 603 participants (65,3% women). A subsample from the nonclinical group was defined (n = 53; 39,6% women; mean age = 32.3, *SD* = 9.9), such that there was no self-reported clinical and subclinical criteria (previous psychiatric disorder or psychological condition that lead to inpatient or outpatient professional health care services). The clinical group was recruited from mental health units, based

on referral by experienced psychologists and psychiatrists. Inclusion criterion was the presence of primary diagnosis of axis I mood or anxiety disorders, according to the Diagnostic and Statistical Manual of Mental Disorders 5th ed. *(Association, 2013)*. Exclusion criteria included the presence of comorbidity with axis I disorders (e.g. substance use disorder, feeding and eating disorders, bipolar II syndrome) or axis II personality disorders. The clinical group completed the protocol only with pencil-and-paper method (n = 51, mean age = 36.49, *SD* = 14.4). Table 1 presents descriptive statistics for each group.

2.2. Procedure

Participants were fully informed of the goals and procedures of the study and signed a consent form according the appropriate ethics committees. All participants completed the same protocol, regardless of the method of completion (paper-and-pencil and online platform), which included a short socio demographic and clinical questionnaire, the Portuguese version for Brief Symptom Inventory (BSI, Canavarro, 2007) and the Portuguese Anxiety Sensitivity Scale – 3 (ASI-3-PT). To estimate the stability over time of the ASI-3-PT, a subsample from the nonclinical group (n = 30) was asked to repeat its completion two months after the first application.

2.3. Measures

Demographic and clinical form: We used a short demographic questionnaire to collect data on the participants (gender, age, marital status, education, work status and profession). Clinical information was self-reported for the nonclinical group and reported by clinicians for the clinical group. Clinical information included present or past history of psychological, psychiatric or other mental health treatment. Participants were also asked to report any phobic reaction and the degree of their anxiety.

Brief Symptoms Inventory – BSI (Derogatis, 1982), Portuguese version by Canavarro (2007). The BSI is a scale with 53 items, where participants are asked to evaluate with which frequency they have experienced specific symptoms during the past week on a 5-point Likert scale, ranging from 0 (*Never*) to 4 (*Very often*). The items are organized into 9 primary dimensions – Somatization, Depression, Anxiety, Phobic Anxiety, Obsessions-compulsions, Interpersonal Sensitivity, Paranoid Ideation, Hostility and Psychoticism – and three global indexes.

Anxiety Sensitivity Index 3 - Portuguese version

The ASI-3-PT, was adapted from its original version, and followed the International Test Commission Guidelines (ITC, 2005) for test development and adaptation. Translation and adaptation respected the original structure, instructions, answering modality and item content. We adopted a back-translation method (Hambleton, 2005), where we first translated the English version to Portuguese, followed by a back-translation from Portuguese to English. Independent translators, Portuguese native speakers with certified proficiency in English, performed both translations. Finally, both were compared and reviewed by two researchers in clinical psychology. We conducted face and content validity for the ASI-3-PT during a three-phase pilot study to assure that the instrument measures and covers the construct and its content. During phase one, 10 participants completed the ASI-3-PT and gave feedback on difficulty, wording and meaning, both on the instructions and the individual items. During phase two, 10 participants completed the revised version in order to confirm the changes that were implemented to the ASI-3-PT. The third phase was a pilot field study with 10 other participants, which allowed for final adjustments to the content and meaning of the items.

3. Analytic strategy

The analyses of the factorial structure, reliability and construct validity of the ASI-3-PT were conducted using the nonclinical group. Criterion validity analysis was conducted using the clinical group and a subsample from the nonclinical group without clinical and subclinical criteria.

3.1. Factorial structure

To examine the factor structure of the ASI-3-PT, we performed confirmatory factor analysis (CFA) using AMOS (Version 20.0, IBM Corporation, Meadville, PA). We estimated the models using the Maximum likelihood method (ML). To assess the overall model we used chi-square statistics; however, because chi-square has several limitations related to sensitivity to multivariate non-normality and sample size (Hooper, Coughlan, & Mullen, 2008), we also used other goodness of fit indices: the comparative fit index (CFI), the Tucker Lewis index (TLI) and the Root Mean Square Error of Approximation (RMSEA). Values above .90 or .95 on the CFI and TLI, respectively, are considered adequate or good fit. A value of .06 or lower on the RMSEA indicates a good fit and values up to .08 indicate an acceptable fit (Browne & Cudeck, 1993)

To examine measurement and structural invariance across gender and method of completion, we followed Vanderberg and Lance (2000) and successfully tested increasingly restrictive models. First, we examined *configural invariance*, where the same factor structure was tested simultaneously for both groups, with no equality constrains imposed on any of the parameters. The fit of this model served as the baseline model to which the more restrictive models were compared. Second, we examined *measurement invariance,* and analyzed whether factor loadings contributing

to each construct were equal across groups. If the factor loadings are equal, then the items contribute equally to the conceptual meaning of the scale across groups. Lastly, we examined *structural invariance*, which tested the invariance in the conceptual associations between latent scores. Significant chi-square changes indicate non-invariance of the models. However, because chi-square is highly sensitive to sample size, ratio of sample size, model complexity and small differences in the model, we have also examined changes in fit indices for testing invariance, as suggested by Chen (2007).

3.2. Reliability

Internal consistency, or the degree to which the ASI-3-PT items measure the same construct, was estimated by the Cronbach's alpha coefficients for the total score and for the different subscales. To assess *stability over time*, we used intraclass correlation analysis on a subsample of 30 participants, who filled out the ASI-3 in two different time points.

3.3. Validity

We observed possible limitations over the range of the data collected – i.e., *floor* and *ceiling* effects – to check for any assessment constraints in the ASI-3-PT. In clinical assessment, a floor effect means that most subjects' scores fall around the minimum possible values; a ceiling effect means that most subjects' scores fall around the maximum possible values. Both phenomena, lead to low variance and, consequent poor discriminatory capability.

Concurrent validity was estimated by correlating the subscales of the ASI-3-PT with the subscales of the BSI that measured anxiety related constructs. The ASI-3-PT Social Concerns subscale aims to access the degree of fear of symptoms regarding real or

imaginary interpersonal contexts (e.g., item 6. "When I tremble in the presence of others, I fear what people might think of me"). As such, we hypothesized that ASI-3-PT Social Concerns subscale would be positively associated with BSI scales that also assess symptomatology related to anxiety and evaluation of others in interpersonal contexts, as is BSI Anxiety (e.g., item 49. "Feeling so restless you couldn't sit still"), BSI Interpersonal Sensitivity (e.g. item 42. "Feeling very self-conscious with others"), BSI Paranoid ideation (e.g. item 24. "Feeling that you are watched or talked about others") and BSI Obsessive-compulsive (e.g. item 27. "Difficulty making decisions"). The ASI-3-PT Physical Concerns subscale assesses the degree of fear of the harmful consequences of physical symptoms (e.g., item 8. "When I feel pain in my chest, I worry that I'm going to have a heart attack"). We hypothesized that the ASI-3-PT Physical Concerns subscale would be associated with BSI subscales that also assess physical symptoms as is BSI Anxiety (e.g., item 38. "Feeling tense or keyed up") and BSI Somatization (e.g., item 7. "Pains in heart or chest") subscales. Finally, the ASI-3-PT Cognitive Concerns subscale assesses the degree of fear about cognitive related anxiety symptoms (e.g. item 5. "It scares me when I am unable to keep my mind on a task"). As such, we expected the ASI-3-PT Cognitive Concerns subscale to be associated with BSI subscales that assess cognitive symptoms as is the BSI Anxiety (e.g. item 49. "Feeling so restless you couldn't sit still"), the BSI Depression (e.g. item 16. "Feeling lonely"), and the BSI Obsessive-compulsive (e.g. item 36. "Trouble concentrating") subscales.

To estimate *discriminant validity*, we examined the association between the total score on the ASI-3-PT and the BSI indexes – the Global Severity Index (GSI), the Positive Symptom Distress Index (PSD) and the Positive Symptoms Total (PST). The GSI represents the symptom' intensity by the number of symptoms; the PSD is the

mean of intensity for all scored symptoms; and the PST is the total of scored symptoms, regardless its intensity. Since the ASI-3 is assumed to be associated with the vulnerability to psychopathology in general, rather than a measure of severity or distress, we expected to have higher correlations between the total score on the ASI-3-PT and the BSI – PST, and lower correlations between the total score on the ASI-3-PT and the GSI or the PSD.

Criterion validity was assessed using ROC curves analysis (Swets, 1988) between the clinical group (n = 51) and a subsample from our nonclinical group (n = 53). This subgroup was composed by participants who reported not having past or present psychiatric diagnoses, who had scored below 1.7 in the BSI-GSI and reported not having phobic reactions. The ROC curve is a popular graphical method of displaying the discriminatory accuracy of a marker for distinguishing between two populations. As required for this procedure, clinical diagnosis by experienced clinical psychologists or psychiatrists was the golden standard adopted.

4. Results

4.1. Item analysis

Preliminary analysis on the ASI-3-PT was performed and items inspected for normality. Skewness and kurtosis values were within the acceptable ranges (West, Finch, & Curran, 1995) (see Table 2). Note that missing values per item were low (<10%) and therefore were not replaced.

4.2. Confirmatory factor analysis

Confirmatory factor analysis was performed on the ASI-3-PT hierarchical model, where three latent factors (physical, cognitive and social stress) loaded on an overall score – the Anxiety Sensitivity Global Index (see Figure 1).

This model (Model 1) revealed an adequate fit to the data, with χ^2 (132) = 584.24. p<.001; CFI = .91; TLI = 88; RMSEA = .07 [90% Confidence interval (CI): .07; 0.08]. All factor loadings were statistically significant with $p < .001$. However, the inspection of the modification indices revealed that the inclusion of correlations between some item residuals would increase the model fit. A detailed analysis for the suggested correlations revealed highly overlapping item content (e.g., between item 1: "It is important for me not to appear nervous" and item 9: "I worry that other people will notice my anxiety"). Therefore, we included five error covariances between those items identified has having content overlapping (Item 11 – Item 13; Item 6 – Item 9; Item 2 – Item 5; Item 1 – Item 9; Item 10 – Item 14) and ran the model again. This model (Model 2) revealed an adequate fit to the data, with χ^2 (127) = 450.14, $p < .001$; the CFI = .94; TLI = 91; RMSEA = .07 [90% CI: .06; .07], and the chi-square difference revealed that this improvement was statically significant ($\Delta\chi^2$ (5) = 134.10, $p < .001$). Item loadings are depicted in Figure 1 and ranged between .50 and .82.

4.3. Measurement and structural invariance

Measurement and structural invariance were examined over two main factors: Gender (male vs. female) and method of completion (paper-and-pencil and online).

Measurement and structural invariance across gender

Results of the configural model, where no equality constraints were included, confirmed a well-fitting model (χ^2 (254) = 671.85, $p < .001$; CFI = .92; TLI = .89; RMSEA = .05

[90% CI: .05; .06]). We proceeded with estimating measurement invariance, by constraining factor loadings to equality. The results are suggestive of measurement invariance, as the chi-square difference between this model and the configural model is not significant ($\Delta\chi^2(15)=17.16$, $p=0.310$) and all other fit indices did not change. The same pattern of results was found regarding structural invariance ($\Delta\chi^2(1)=0.06$, $p=0.815$), confirming the invariance in the factorial structure of the ASI-3-PT between men and women (see Table 3).

Measurement and structural invariance across method of completion

The same testing steps were used for comparing the factorial structure of the ASI-3-PT across online and paper-and-pencil groups. Results of the configural model, where no equality constraints were included, confirmed a well-fitting model (χ^2 (254) = 613.59, $p < .001$; CFI = .93; TLI = .91; RMSEA = .05 [90% CI: .04 - .05]). We proceeded with estimating measurement invariance, by constraining factor loadings of both groups to equality. The chi-square difference tested between the measurement model and the configural model was significant ($\Delta\chi^2(15)=29.27$, $p=0.015$), which indicates non-invariance. However, the analysis of the fit indices revealed changes in the CFI and RMSEA within the acceptable range (CFI = .003, RMSEA = .001). Therefore, we concluded that the measurement model was invariant. We then proceeded with testing structural invariance, by constraining structural covariances. Chi-square difference test ($\Delta\chi^2(1)=2.78$, $p=0.096$) revealed no differences between the measurement model and the structural model. Fit indices did not differ, confirming the invariance in the factorial structure of the ASI-3-PT, between online and paper-and-pencil methods of completion (see Table 4).

4.4. Reliability

The ASI-3-PT presented high internal consistency, with a Cronbach alpha of .91 for the total scale. Alpha values per item deletion are all-equal or below .91 (see Table 5), and corrected-item total correlations ranged between .40 and .67, suggesting that every item is measuring the same construct. Alpha values per subscale were .87, .81 and .87 for the cognitive, social and physical subscales, respectively.

Test-retest reliability was conducted using intraclass coefficient (ICC). Obtained values suggested high temporal stability, with .85 for the global score and .84, .83 and .83 for the, cognitive, social and physical subscales, respectively.

4.5. Validity

The ASI-3-PT global score and the three subscales were inspected for *floor* and *ceiling* effects. Measures meet the standards of acceptability if less than 15% of respondents achieve the lowest or highest possible score (McHorney & Tarlov, 1995). In the present study, no *floor* and *ceiling* effects were found regarding the global score, Physical and Social subscales. About 20.7% of the participants scored zero on the cognitive subscale, indicating a *floor* effect in this subscale.

Concurrent validity was assessed using six BSI subscales of interest (somatization, depression, anxiety, obsessive-compulsive, interpersonal sensitivity and paranoid ideation), which were expected to correlate with the subscales of the ASI-3-PT. Table 6 depicts the descriptive statistics and the associations of all observed correlations, between the ASI-3-PT subscales and the BSI subscales, as well as between the ASI-3-PT subscales and the BSI global indexes. When correlating each ASI-3-PT subscale with the BSI subscales, we used partial correlations, in order to control for the other ASI-3-PT subscales and therefore to find the unique variance shared by the subscales. The ASI-3-PT Social Concerns subscale was positively associated with the BSI

Interpersonal Sensitivity subscale (r = .15, p < .001), and with the BSI Obsessive-Compulsive subscale (r = .10, p = .015). Contrary to our hypothesis, the correlations between the ASI-3-PT Social Concerns subscale and the BSI Anxiety as well as the BSI Paranoid Ideation subscales were not statistically significant (r = .009, p = 0.833; r = .072, p = .093, respectively). As expected, the ASI-3-PT Physical Concerns subscale was correlated with the BSI Somatization subscale (r = .19, p < .001) and with the BSI Anxiety subscale (r = .08, p < .001). The ASI-3-PT Physical Concerns subscale was unexpectedly correlated with the BSI Paranoid Ideation (r = .14, p < .001). The ASI-3-PT Cognitive Concerns subscale was positively associated with the BSI Depression subscale (r = .40, p < .001), the Anxiety subscale (r = .38, p < .001), and the Obsessive Compulsive subscale (r = .45, p < .001). The associations between the ASI-3-PT Cognitive Concerns subscale and the other three BSI subscales were also positive and statistically significant (BSI Somatization, r = .34, p < .001; BSI Interpersonal Sensitivity, r = .32, p < .001; and BSI Paranoid Ideation (r = .28, p < .001). Finally, as anticipated, the ASI-3-PT total score was associated with the PST (r = .50; p < .001) and PSD (r = .27, p < .001) but not with the GSI (r = -0.56, p = .234).

Criterion validity

A ROC curve was calculated to assess the discriminatory accuracy of the ASI-3-PT in distinguishing between a nonclinical subsample (i.e. all nonclinical participants with no past or present psychopathology) and a small clinical sample (i.e., patients diagnosed with anxiety and/or depressive disorders). The ROC curve was calculated for the global score of the ASI-3-PT. The ROC area under the curve (Figure 2) was 0.852 (95% Confidence Interval 0.771-0.929) for the global score (p < .01), which suggests a good discriminative ability (Swets, 1988). The cut-off of 21 for the ASI-3-PT total score

corresponded to the best balance of Sensitivity (.70) and Specificity (.98), which differs from the proposed 23, suggested by Taylor et al. (2007) for the original version.

5. Discussion

Here we examined the factorial structure and the psychometric properties of the ASI-3-PT. To our knowledge, this is the first study to adapt the ASI-3 to a European Portuguese speaking sample. Because Anxiety Sensitivity and its associated measures have high diagnostic power for distinguishing between clinical and non-clinical populations, as well as between anxiety and non-anxiety disorders, we believe that developing such measure is an important effort. In this effort to develop the ASI-3-PT, we selected the ASI-3 due to its validity and reliability consistency, its diagnostic potential and its short administration time.

We showed that the factorial structure of the ASI-3-PT fits perfectly with the theoretical model underlying the Anxiety Sensitivity construct (Taylor et al., 2007). Confirmatory factor analysis demonstrates that the ASI-3-PT follows a hierarchical structure with one high-order dimension (the Anxiety Sensitivity Global Index) and three low-order factors (the Physical, Social and Cognitive concerns subscales). Moreover, the ASI-3-PT has good internal consistency, as demonstrated by its global score and its subscales, supporting its robustness as an assessment tool. As suggested by Taylor and colleagues (2007), our results also confirm that the Cognitive Concerns subscale is the most influential low-order factor loading to the Anxiety Sensitivity Global Index. This suggests that the discriminative power of the ASI-3-PT (and the ASI-3) is mainly dependent on the Cognitive Concerns subscale.

Our data also suggests that the factorial structure of the ASI-3-PT is equivalent across men and women and therefore valid to be used with both genders. Moreover,

structure invariance was also found across two different methods of completion – paper-and-pencil and online. This is in line with previous research on the reliability of online and paper-and-pencil measures on the evaluation of anxiety related constructs(Carlbring et al., 2007; Herrero & Meneses, 2006; Vallejo, Jordán, Díaz, Comeche, & Ortega, 2007).

Our results also demonstrated that the ASI-3-PT shows high construct validity, as its subscales assess what they are expected to. We found positive correlations between the ASI-3-PT subscales and most of the expected anxiety related BSI subscales. Namely, the Cognitive Concerns subscale of the ASI-3-PT correlated with the BSI Depressive, the Anxiety and the Obsessive-Compulsive subscales. Additionally, the ASI-3-PT Cognitive Concerns subscale correlated with the remaining BSI Somatization, the Interpersonal Sensitivity and the Paranoid Ideation subscales. This is probably due to the fact that the items of the ASI-3-PT Cognitive Concerns focus on typical ruminative thinking about the possibility of an unavoidable onset of a mental disorder. Hence, the experience of hopelessness (experience of uncontrollability) is associated with an increased sensitivity to depressive and anxiety-related symptoms, present in somatization processes, social ruminative thinking and in paranoid ideation. Furthermore, the dominant correlations between the ASI-3-PT Cognitive Concerns subscale and the BSI symptomatology may help to explain the floor effect on the ASI-3-PT. Because in our study the psychometric analysis were conducted with a nonclinical sample, and only a reduced number of participants related to the experiences depicted on its items (e.g, “When my thoughts seem to speed up, I worry that I might be going crazy.”), a concentration of the scores around the minimum ranges occurs. Conversely, the few participants who scored in these items correspond to the ones with a pre-

morbid-to-morbid status. Presumably, these are the same participants that scored higher in symptoms frequency for the BSI subscales as well.

The ASI-3-PT Social Concerns subscale also showed important correlations with the BSI. This subscale correlated positively with the BSI Obsessive-Compulsive and with the Interpersonal Sensitivity subscales but did not correlate with the BSI Anxiety or with the BSI Paranoid Ideation subscales. The BSI Anxiety subscale is a composite of six items, three of which narrowly related to panic disorder symptoms (e.g, "Spells of terror or panic") which may help explain why the ASI-3-PT Social subscale appears as non-significantly correlated with the BSI Anxiety. The BSI Paranoid Ideation is a composite of items that are closely associated with interpersonal contexts but are also related with the frequency of symptoms. Furthermore, because some of these items are about the frequency of extreme situations of pathological suspiciousness regarding actions and thoughts of others (e.g., "Feeling that you are watched or talked about others"), the subscale shows weak or no correlation with the ASI-3-PT Social subscale that refers to sensitivity to the fear or worry about interpersonal relationships rather than to its frequency or severity.

Moreover, the ASI Physical Concerns subscale correlated positively with the expected BSI Somatization and Anxiety subscales that assess physical symptoms. However, the ASI Physical Concerns subscale was found to be associated with the BSI Paranoid Ideation as well, despite these two subscales unrelated semantic contents. This can be explained by the impaired cognitive functioning depicted by the BSI Paranoid Ideation items which in turn seem to be associated with the mechanics of ASI Physical Concerns excessive concerns, irrespective of its content.

Finally, the ASI-3-PT Global Index was positively correlated with the experience of symptoms, and only to a limited extent with its intensity (indexed by the

PSD) or its severity (indexed by the GSI), confirming Anxiety Sensitivity as a construct that indexes vulnerability to concerns about the possible occurrence of symptoms.

We also wanted to test diagnostic sensitivity of the ASI-3-PT in discriminating between a clinical and a nonclinical sample, and wanted to find a cut-off point that could help professionals to identify psychopathological vulnerability for an European Portuguese speaking population. In line with what was demonstrated by Kemper and Colleagues (2012) on the diagnostic potential of the ASI-3, our ROC curve analysis show that the scores of the ASI-3-PT can accurately distinguish between clinical and nonclinical groups with good sensitivity and high specificity. This means that the ASI-3-PT is better at identifying individuals who do not have clinical diagnosis of anxiety or mood disorders (the true negatives), than at identifying individuals who do have those diagnoses (the true positives). As such, these results support Anxiety Sensitivity as being a proneness factor for the development of psychopathology instead of a diagnostic criterion. Moreover, because of its increased specificity, our results support the use of the ASI-3-PT as a complementary tool for researchers in clinical and experimental settings to distinguish between participants vulnerable to emotional distress and healthy controls.

6. Conclusion

To our knowledge this is the first study that assesses the validity and reliability of an anxiety sensitivity measure for a European Portuguese speaking population – the ASI-3-PT. This study extends the previous ASI-3 confirmatory factor analysis and adds to the existing literature by examining its adequacy across gender and method of completion. We confirmed the structure of the ASI-3-PT is invariant across gender and method of completion, supporting both its utility for men and women, and the quality of

the data irrespective to the method of completion. Moreover, this study used a comprehensive approach to examine the validity and reliability of the ASI-3-PT. The concurrent validity analysis supports the ASI-3-PT as a valid measure to assess Anxiety Sensitivity. Finally, we further explored the association of Anxiety Sensitivity and psychopathology. We included a group of participants with anxiety and mood disorders diagnosed by experienced clinicians, which is the golden Standard for ROC analysis in psychiatry (Kapur, Phillips, & Insel, 2012). Our data suggests a cut-off point for the Portuguese population, different from the one proposed for the original ASI-3. Note, however, that the clinical sample size was small, limiting the scope of the analysis on the discriminatory accuracy of the ASI-3-PT. Nevertheless, this result is of great value regarding the use of the ASI-3-PT as a tool for research and clinical practice in Portugal – i.e., the ASI-3-PT can be used as a screening tool to distinguish individuals regarding their vulnerability to anxiety and mood disorders, in both research, clinical and experimental settings.

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