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Factorial Invariance of the Brief Symptom Inventory-18 (BSI-18) for Adults of Mexican Descent across Nativity Status, Language Format, and Gender

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Abstract: The cultural equivalence of psychological outcome measures remains a major area of investigation. The current study sought to test the factor structure and factorial invariance of the Brief Symptom Inventory-18 (BSI-18) with a sample of adult individuals of Mexican descent ($N = 923$) across nativity status (U.S. vs. Foreign-born), language format (English vs.

Spanish), and gender. The results show that one factor and three factor measurement models provided a good fit to the data; however, a single factor model was deemed more appropriate and parsimonious. Tests of measurement invariance and invariance of factor variances (i.e., structural invariance) indicated at least partial measurement invariance across gender, nativity status, and language format. These findings suggest that the BSI-18 operates in a similar fashion among adults of Mexican descent regardless of nativity status, language format of the survey, and gender. Clinical and practical implications for use of the BSI-18 with Latino populations are discussed.

Keywords: psychological distress, Latino/a, measurement invariance, factorial invariance

Latinos continue to be one of the fastest growing populations in the United States with individuals of Mexican descent constituting the majority of this group (U.S. Census, 2010). Latinos living in the United States are confronted with having to negotiate various cultural contexts including the mainstream and traditional Latino cultures. These unique and inherently stressful experiences pose challenges to understanding the circumstances that contribute to mental disorders and, more broadly, psychological distress (Alegria & Woo, 2009). Unfortunately, there is a paucity of research examining the psychometric properties of psychological distress measures with Latino samples and many instruments have been developed and validated with non-Hispanic White individuals (Prellow, Weaver, Swenson, & Bowman, 2005). The few studies that have investigated the properties of psychological distress measures have tended to aggregate all Latino ethnic groups despite the stark historical and sociopolitical differences across these groups. This strategy assumes – often without empirical support – that a given measure or instrument operates in an equivalent fashion across distinct Latino sub-groups (Miller & Lee, 2009). The current study sought to test the factor structure and factorial invariance of the Brief Symptom Inventory-18 (BSI-18; Derogatis, 2000) with a sample of adult individuals of Mexican descent across nativity status (U.S. vs Foreign-born), language format (English vs. Spanish), and gender.

The BSI-18, an abridged version of the 53-item BSI (Derogatis, 1993), was developed to identify psychological distress and psychiatric conditions within medical and community populations (Derogatis, 2000). The BSI-18 is comprised of three factors including 1)

Somatization, or distress caused by the perception of bodily dysfunction, 2) *Depression*, which includes dysphoric mood, anhedonia, and self-deprecation, and 3) *Anxiety*, namely symptoms of nervousness, tension, and apprehension. Initial principal components analysis with 1,134 participants revealed four factors including Depression, Somatization, Anxiety, and Panic (Derogatis, 2000). The fourth factor received marginal support (an eigenvalue of exactly 1.00) leading Derogatis to conclude that the panic items may likely blend with broader anxiety symptoms. Zabora and colleagues (2001) examined the factor structure of the BSI-18 using principal component analysis among 1,543 cancer patients. They reported four factors which included Depression, Somatization, Anxiety, and Suicidal Ideation. However, the Suicidal Ideation factor was comprised of only one item. Neither one of these studies reported the ethnic background of the participants. Findings examining the BSI-18 among 8,945 childhood cancer survivors of various ethnicities showed adequate fit to the data for both a three- and four-factor model but not a single factor model (Recklitis et al., 2006). The researchers concluded that a three factor model, consisting of Depression, Somatization, and Anxiety, was preferable.

A few reports have examined the factor structure of the BSI-18 with Latino groups. For instance, Prelow and colleagues (2005) examined the BSI-18 among an ethnically heterogeneous sample of 1,115 low-income Latina mothers. The researchers randomly split the sample into two groups and conducted an exploratory factor analysis (EFA) followed by a confirmatory factor analysis (CFA). They reported that although the EFA showed three factors with eigenvalues above 1.0, this solution was rejected because the third factor did not have factor loadings above 0.40. Furthermore, Prelow et al. indicated that a CFA of the three factor and the one factor model both showed relatively good fit of the data but concluded that the one factor model was preferable due to large factor intercorrelations. Using EFA, Asner-Self, Schreiber, and Marotta (2006) tested the factor structure of the BSI-18 among a fairly small group of Central American immigrants (53 women, 47 men). This study reported evidence for three factors with the first factor accounting for a bulk of the variance. They concluded that a single factor model was a good indicator of psychological distress. A major drawback to the study conducted by Asner and colleagues is the limited sample size possibly resulting in low power.

Wiesner and colleagues (2010) used a mean and covariance structures analysis (MACS) to examine the BSI-18 among a multi-ethnic sample of 4,711 mothers of fifth grade students (including 1,595 Latinas). The researchers found evidence for a three factor model (Somatization, Depression, Anxiety) for only the Black and non-Hispanic White participants. For the Latina group, Wiesner et al. indicated that the multifactor solution "exhibited substantial redundancy among several of the factors and inadmissible parameter estimates" (p. 919). As such, the researchers concluded that, among Latina women, the BSI-18 did not significantly distinguish between the three postulated factors supporting previous reports that a single factor was a better fit of the data.

These studies, some of which are hampered by small sample sizes, highlight the need for continued investigations into the factor structure of the BSI-18 with Latino groups. For example, considerations of measurement equivalence of the BSI-18 are needed that take into account key demographic factors likely to influence the expression of Latino psychological distress, namely nativity status, language format, and gender. Without evidence of measurement equivalence across these factors, interpretations of mean score variations can be problematic because it is not possible to determine whether the observed mean score difference represents a true population difference or construct-irrelevant variance due to measurement artifact (French & Finch, 2006).

In terms of disparities based on nativity status, it has been reported that foreign-born Latinos report lower rates of psychiatric disorders than their U.S.-born counterparts (Grant et al., 2004). Language preference, and subsequently fluency, impacts the assessment process given findings indicating that Latinos who preferred to be interviewed in Spanish reported lower levels of health than did those with greater English fluency (Kandula, Lauderdale, & Baker, 2007). In terms of gender differences, Latinas have higher rates of depressive and anxiety disorders compared to Latino men (Alegria, Shrout, et al., 2007). Of particular importance is investigating the invariance of the BSI-18 across Latino men and women given that the Latino participants of two of the three studies reviewed previously were all women. Minimal research exists regarding the BSI-18 among Latino men.

The present study sought to examine the a) factor structure and b) factorial invariance of the BSI-18 among adults of Mexican descent across nativity status, language format, and gender. Specifically, we assessed factorial invariance by determining whether the pattern of factor loadings and the magnitude of factor loadings, item intercepts, and factor variances varied across nativity status, language format, and gender groups by conducting increasingly stringent configural, metric, and scalar invariance tests (French & Finch, 2006; Vandenberg & Lance, 2000). We also examined the invariance of factor variances (often referred to as structural invariance). Configural invariance examines the pattern of factor loadings across independent samples while metric invariance assesses the equivalence of the magnitude of relationships of items to their corresponding factors across samples. Scalar invariance determines the equivalence of item intercepts and indicates the value of an item when the common factor is zero (Vandenberg & Lance, 2000). Finally, testing the invariance of factor variances (i.e., structural invariance) assesses the way in which the breadth of the latent factor is being operationalized equivalently (for a comprehensive discussion see Bontempo & Hofer, 2006; Cheung & Rensvold, 2002).

Method

Latino participants were recruited, as part of a larger study, from Latino community events ($n = 382$) and at a predominantly Latino-serving community health clinic ($n = 205$) in a moderately-sized Midwestern city. Data was also collected at university and community settings ($n = 375$) in a moderately-sized Southwestern city. Upon completion of the survey, each participant was compensated with a \$10 gift card. All participants had the option of completing the survey in English or Spanish; 53% chose to complete it in Spanish. A total of 962 individuals participated in the study; however, 39 participants were eliminated due to missing data. All of the 923 participants included in the current study identified their cultural heritage as Mexican, Mexican-American, or Chicano. The age of participants ranged from 18 to 85 years averaging approximately 36 years of age. Of the entire sample, 52% was foreign-born. The largest proportion of the sample (31%) earned an annual income between \$20,000 and \$50,000.

The Brief Symptom Inventory-18 (BSI-18; Derogatis, 2000) is a shortened version of the 53-item Brief Symptom Inventory which is adapted from the Symptoms Checklist-90-Revised (SCL-90-R). As originally constructed, the BSI-18 consists of three factors that include *Somatization* (e.g., Faintness or dizziness), *Depression* (e.g., Feeling no interest in things), and *Anxiety* (e.g., Feeling tense or keyed up). A global severity index (GSI) can be calculated which is the full-scale score across the three factors or domains. Items are summed with greater scores indicating more distress during the previous week. Item responses range from 0 (*Not at all*) to 4 (*Extremely*). A Cronbach's alpha of .89 was reported for the GSI among a community sample while the coefficients for Somatization, Depression and Anxiety were .74, .84, and .79, respectively (Derogatis, 2000). For the current sample, the Cronbach's alphas for the GSI, Somatization, Depression, and Anxiety subscale scores were .95, .86, .88, and .88, respectively.

Results

Analytic Strategy

Data analysis was conducted in two stages. In the first stage, we examined the factor structure of competing BSI-18 measurement models (three factor vs. one factor) in the total sample. In the second stage, we examined the configural, metric, scalar, and factor variance (structural) invariance of the BSI-18 across nativity status, language format, and gender subsamples. In instances of partial measurement invariance – the condition in which one or more model parameters identified via invariance tests are found to be variant across groups – we followed guidelines that state that a minimum of two invariant parameters per invariance test (e.g., at least 2 factors loadings equivalent in metric invariance tests) are required to conduct further invariance tests (Byrne et al., 1989).

Covariance and asymptotic covariance matrices were analyzed via LISREL 8.54. Following recommendations by Finney and DiStefano (2006) we used the Satorra-Bentler scaling method (Satorra & Bentler, 2001) given the violation of multivariate normality and the use of ordinal data with five scale points. Standardized root-mean-square residual (SRMR) value less than or equal to .09, root-mean-square

error of approximation (RMSEA) values less than .10, and comparative fit index (CFI) values greater than or equal to .90 were considered indicative of adequate model fit (Hu & Bentler, 1999). We also used the Hu and Bentler (1999) "combination rule" for assessing model fit where a CFI cutoff value close to .95 in combination with a SRMR cutoff value close to .09 is indicative of adequate fit.

Stage One: Testing Competing Models

Likelihood ratio tests using Satorra and Bentler's (2001) scaled chi-square difference test (T_d) were first used to compare the three factor model originally proposed by Derogatis (2000) and a one factor model as suggested in previous research (see Table 1). These comparisons were made for the total sample as well as for the sample groups based on gender, nativity status, and language format. As shown in Table 1, the three factor model exhibited better model fit compared to the one factor model for the total sample and other groups except for the foreign-born sample. However, given the large factor relationships (ranging from .806 to .998) that emerged for all samples, we decided that the three factor model was untenable – a conclusion consistent with prior factor analytic studies of the BSI-18 with Latino populations (Prelow et al., 2005). Ultimately we retained the one factor model for the invariance tests based on its adequate to good fit for all samples and the large factor relationships in the three factor model.

Table 1. Fit Statistics for Independent Tests of the BSI-18 Measurement Model

Model	SB χ^2	<i>p</i>	<i>df</i>	RMSEA	SRMR	CFI
<i>Total Sample (N = 923)</i>						
One Factor	893.041	< .01	135	.078 (.073; .083)	.049	.965
Three Factor	767.194	< .01	132	.072 (.067; .077)	.045	.970
<i>Foreign-Born (N = 472)</i>						
One Factor	535.855	< .01	135	.079 (.072; .087)	.054	.961
Three Factor	464.991	< .01	132	.073 (.066; .081)	.051	.964
<i>U.S.-Born (N = 423)</i>						
One Factor	466.838	< .01	135	.076 (.069; .084)	.053	.965
Three Factor	411.722	< .01	132	.071 (.063; .079)	.049	.970
<i>Spanish (N = 317)</i>						
One Factor	463.407	< .01	135	.087 (.079; .097)	.067	.945
Three Factor	386.316	< .01	132	.078 (.069; .087)	.062	.954

Model	SB χ^2	<i>p</i>	<i>df</i>	RMSEA	SRMR	CFI
<i>English (N = 606)</i>						
One Factor	593.988	< .01	135	.075 (.069; .081)	.047	.968
Three Factor	524.287	< .01	132	.070 (.064; .076)	.044	.971
<i>Women (N = 636)</i>						
One Factor	663.333	< .01	135	.079 (.073; .085)	.051	.964
Three Factor	560.541	< .01	132	.072 (.066; .078)	.047	.969
<i>Men (N= 269)</i>						
One Factor	347.897	< .01	135	.077 (.067; .087)	.057	.963
Three Factor	321.419	< .01	132	.073 (.063; .083)	.055	.965

Note. SB χ^2 = Satorra-Bentler scaled chi square; *df* = degrees of freedom; SRMR = Standardized Root Mean Square Residual; RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index; RMSEA values in parentheses represent 90% confidence intervals

Stage Two: Testing Measurement and Invariance of Factor Variances

The factorial invariance of the BSI-18 was assessed using a series of increasingly stringent model comparison steps. Likelihood ratio tests assessed whether constraining specified model parameters across groups resulted in a significant improvement or worsening of model fit. Given the number of tests required for invariance testing, a *p*-value of .01 was selected *a priori* to reduce the probability of experiment-wise error (French & Finch, 2006).

Configural Invariance

Nativity

The BSI-18 one factor measurement model exhibited adequate to good model fit for foreign-born and U.S.-born sample data (see One Factor Model in Table 1). All factor loadings and uniqueness terms were significant in both samples. The majority of intercept terms were non-significant for both samples. The one factor model accounted for 46 (R^2 ranging from .32 to .62) and 52 (R^2 ranging from .39 to .65) percent of the variance in items for foreign-born and U.S.-born samples, respectively.

Language

The one factor model exhibited adequate to good model fit for Spanish and English language sample data (see One Factor Model in Table 1). All factor loadings and uniqueness terms were significant in both samples. The majority of intercept terms were non-significant for both samples. The one factor model accounted for 46 (R^2 ranging from .32 to .49) and 53 (R^2 ranging from .39 to .64) percent of the variance in items for Spanish language and English language samples, respectively.

Gender

The one factor model exhibited adequate to good model fit for women and men (see One Factor Model in Table 1). All factor loadings and uniqueness terms were significant in both samples. The majority of intercept terms were non-significant for both samples. The one factor model accounted for 52 (R^2 ranging from .36 to .62) and 47 (R^2 ranging from .38 to .65) percent of the variance in items for women and men, respectively.

Metric Invariance

Nativity

A baseline model (Model 0), which simultaneously estimated all model parameters without any constraints for both samples was used for metric invariance tests. Constraining all factor loadings to be invariant (Model 1 vs. Model 0) across nativity samples resulted in a significant worsening of model fit $T_d(17, N = 895) = 44.98, p < .001$, compared to baseline model. Modification indices (MIs), which in this case provide an indication of improved model that will result from freeing a model parameter (e.g., factor loading) that is currently constrained to be invariant across groups, revealed that factor loadings for items 2 (MI = 6.857) and 18 (MI = 9.196) exceeded the critical value of 3.84 (for 1 *df*). These factor loadings were freed sequentially (starting with the largest MI value) in Model 1b which exhibited a non-significant difference in fit compared to Model 0, $T_d(15, N = 895) = 21.72, p = .115$.

Language

Constraining all factor loadings to be invariant (Model 1 vs. Model 0) across Spanish and English language samples resulted in a significant worsening of model fit $T_d(17, N = 923) = 55.25, p < .001$. MIs revealed that factor loadings for items 12 (MI = 5.355), 17 (MI = 9.531), and 18 (MI = 5.568) exceeded the critical value of 3.84. These factor loadings were freed sequentially in Model 1c which exhibited a non-significant difference in fit compared to Model 0, $T_d(14, N = 923) = 20.72, p = .109$.

Gender

Constraining all factor loadings to be invariant (Model 1 vs. Model 0) across gender resulted in a non-significant change in model fit $T_d(17, N = 905) = 31.05, p < .019$.

Scalar Invariance

Nativity

Scalar invariance was examined by comparing Model 1b (the baseline model for scalar invariance tests for nativity samples) to Model 2, which constrained all item intercepts to be invariant across nativity samples. Constraining all intercept terms to be invariant resulted in a significant worsening of model fit $T_d(17, N = 895) = 159.17, p < .001$. Intercepts for items 3 (MI = 7.183), 8 (MI = 24.536), 10 (MI = 3.974), 15 (MI = 7.794), and 17 (MI = 25.630) exceeded the critical value of 3.84 and were freed sequentially; the resulting Model 2e exhibited a non-significant difference in fit compared to Model 1b, $T_d(12, N = 895) = 19.52, p = .076$.

Language

Constraining all item intercepts to be invariant across language samples (Model 1c vs. Model 2) resulted in a significant worsening of model fit $T_d(17, N = 923) = 93.96, p < .001$. Intercepts for items 3 (MI = 9.181), 8 (MI = 19.511), 9 (MI = 6.896), 11 (MI = 5.989), and 13 (MI = 6.994) exceeded the critical value of 3.84 and were freed sequentially. The resulting Model 2e exhibited a non-significant

difference in fit compared to Model 1c, $T_d(12, N = 923) = 21.20, p = .047$.

Gender

Constraining all item intercepts to be invariant across gender samples (Model 1 vs. Model 2) resulted in a significant worsening of model fit $T_d(17, N = 905) = 61.07, p < .001$. Intercepts for items 5 (MI = 4.587), 7 (MI = 5.300), 8 (MI = 8.005), and 9 (MI = 3.878), exceeded the critical value of 3.84 and were freed sequentially; the resulting Model 2d exhibited a non-significant difference in fit compared to Model 1, $T_d(13, N = 905) = 20.04, p = .094$.

Invariance of Factor Variances

In order to examine the invariance of factor invariances of the BSI, factor variance terms were constrained to be equivalent (Model 4) in the nativity samples. Constraining the factor variance to be equal across nativity samples (Model 2e vs. Model 4) resulted in a non-significant change in model fit $T_d(1, N = 895) = 4.18, p = .040$. Constraining the factor variance across language groups (Model 2e vs. Model 4) resulted in a non-significant change in model fit $T_d(1, N = 923) = 5.89, p = .015$. Finally, constraining the factor variance across women and men (Model 2d vs. Model 4) resulted in a non-significant change in model fit $T_d(1, N = 905) = 3.62, p = .057$.

Discussion

The present study examined the factor structure and the factorial invariance of the BSI-18 with a sample of adults of Mexican descent. The current investigation contributes to the empirical research by comparing the equivalence of the BSI-18 across nativity status (Foreign-born vs. U.S.-born), language format (English vs. Spanish), and gender. In addition, this study extends prior BSI-18 research by focusing on one specific Latino group and thereby eliminating potential confounds due to the heterogeneity across Latino ethnic and cultural groups. The inclusion of a substantial number of Latino men adds to the existing BSI-18 research that has reported primarily on Latina respondents. Finally, this is the first study of its

kind to attend to the invariance of the BSI-18 across nativity status and language – key indicators in cultural psychology.

Total sample findings show that one factor and three factor measurement models of the BSI-18 provided a good fit to the data. However, consistent with prior factor analytic tests of the BSI-18 (e.g., Prelow et al., 2005) the large relationships between factors suggested that a single factor model was more parsimonious. Thus, for adults of Mexican descent, the BSI-18 may be better conceptualized as an instrument of general psychological distress. Expression of psychological symptoms, or *idioms of distress*, is considered a culturally prescribed phenomenon (Torres, 2010). As a culturally sanctioned indication of distress, Latinos may be more likely to endorse somatic complaints and a wider range of negative emotional states (Guarnaccia et al., 2005). Under this cultural rubric, a measure of general psychological distress may better encapsulate this experience for Latinos rather than the assessment of discrete psychological conditions, as conceptualized by the three BSI-18 factors.

Invariance tests of measurement and factor variances suggest at least partial measurement invariance across nativity status, language format, and gender. The findings based on gender showed that all the factor loadings were invariant suggesting that both Latino men and women were interpreting items in an equivalent manner. This was a bit unexpected given previously reported gender differences of psychiatric rates in which Latinas showed higher rates of depressive and anxiety disorders than men (Alegria, Shrout, et al., 2007). The current findings suggest that Latino men and women share a common understanding of psychological distress as measured by the BSI-18.

A majority of items were also interpreted equivalently across nativity status and language format. Based on the factor loadings, the two items that were not invariant based on nativity status asked about interest in doing things and feeling fearful. For language format, the non-invariant items assessed feelings of terror or panic, thoughts of suicide, and feeling fearful. As broad indicators of cultural exposure, the current findings revealed minimal differences based on nativity status and language format. More complex indicators of cultural adaptation, including *acculturation*, or the changes that occur when

different cultural groups come into continuous contact, and *enculturation*, or the maintenance and continuity of the traditional culture, may help to explain potential differences in item endorsement (Lara et al., 2005). These and other key cultural factors, including ethnic identity and cultural values, influence an individual's idioms of distress, conceptualization of the etiology of psychological problems, and subsequent help-seeking behavior.

As a first step toward disentangling the contribution of cultural constructs to Latino psychological distress, the compelling findings of the current study suggest that BSI-18 items are understood in a similar fashion among adults of Mexican descent regardless of nativity status, language chosen to complete the survey, and gender. Ultimately, these results provide evidence that the majority of factor loadings, item intercepts, and factor variances were invariant across groups in most instances and suggest that the BSI-18 is a viable measure of psychological distress among adults of Mexican descent across nativity status, language format, and gender.

As limitations to the current study, alternative models were not tested and, thus, cannot be ruled out. Additionally, the BSI-18 was not compared to other measures of psychological distress or mental health, which limits our ability to evaluate further construct validity evidence of the instrument. The current findings provide further evidence of the factor structure and factorial invariance of the BSI-18 across important cultural and demographic characteristics. This line of research can provide a roadmap for future research that seeks to test instruments that were not originally developed for members of ethnic minority groups. Future research should continue to examine the factor structure and invariance of the BSI-18 across diverse ethnic and cultural groups.

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