HHS Public Access

Author manuscript

Eval Health Prof. Author manuscript; available in PMC 2023 March 08.

Published in final edited form as:

Eval Health Prof. 2021 December ; 44(4): 348–361. doi:10.1177/0163278720910470.

Cumulative Lifetime Adversity in a National Sample of Hispanic/Latino Immigrants: Exploring Construct Validity Across Six Hispanic/Latino Groups Using data from the HCHS/SOL Sociocultural Ancillary Study

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Abstract

Hispanic/Latino immigrants often experience significant adversity before, during, and after migrating to the U.S. However, no extant studies have tested the construct validity of a cumulative measure of lifetime adversities with Hispanic/Latino immigrants. Our objective was to assess the construct validity of a comprehensive measurement model of lifetime adversities (i.e., adverse childhood experiences, adult chronic stress, adult perceived stress, adult acculturation stress, and lifetime ethnic discrimination) with a national sample of Hispanic/Latinos born outside the mainland U.S. Guided by the life course perspective, we examined (a) the dimensionality of cumulative lifetime adversity, (b) the extent to which the functioning of this measurement model differed across various Hispanic/Latino subgroups, including Mexicans, Cubans, Puerto Ricans, Dominicans, Central Americans, and South Americans, and (c) the association between cumulative lifetime adversity and other constructs (e.g., anxiety and depression). We used existing data from the HCHS/SOL – Sociocultural Ancillary Study, a national survey of Hispanic/Latinos living in the United States (N = 3,296). Results from confirmatory factor analyses indicated that a five-factor bifactor measurement model for cumulative lifetime adversities fit the data adequately (e.g., CFI = .91, RMSEA = .04, SRMR = .07). Results from multigroup confirmatory factor analyses suggested that the measurement model functioned similarly across Hispanic/Latino subgroups, providing evidence for measurement invariance. The model also displayed convergent and discriminant validity based on associations with other constructs. We discuss implications for advancing the precision of assessment instruments for lifetime adversities with populations with high within-group diversity.

It is well-known that lifetime adversities can negatively affect the health of Hispanic/Latino immigrant populations living in the United States (U.S.). First- and second-generation Hispanic/Latinos are disproportionately exposed to certain lifetime adversities, including traumatic events, compared to non-Hispanic/Latino Whites (Burton & Kinney, 2016; Llabre et al., 2017). One study, comprised mainly of first-generation Hispanic/Latino immigrants, found that 77% of individuals reported experiencing an adverse childhood event; 29% of

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these individuals experienced four or more adverse childhood events (Llabre et al., 2017). First-generation Hispanic/Latino immigrants (i.e., Hispanic/Latinos born outside the U.S.) may be particularly at risk for experiencing adversity based on the challenges associated with the migration process (Cleary et al., 2018; Dillon, De La Rosa, & Ibañez, 2013; Gallo et al., 2014b; Li, Liddell, & Nickerson, 2015). For example, a recent study found that approximately 30% of first-generation Hispanic/Latino immigrants experienced traumatic events during the migration process (Perreira & Ornelas, 2013). Another study found that higher levels of pre-migration trauma were associated with higher reports of acculturation stress after migrating to the U.S (Li et al., 2015). *Acculturation stress* is defined as distress caused from two cultures coming into contact with one another and includes challenges such as difficulty learning a new language, loss of home culture and loved ones, and difficulty finding a job (Lorenzo-Blanco & Unger, 2015).

These types of stressors can have a cumulative effect on individual and family functioning (Green et al., 2014; Myers et al., 2015; Seery, Holman, & Silver, 2010; Singh, et al., 2011). However, few studies have assessed cumulative lifetime adversity - the total adversity that an individual has experienced - within Hispanic/Latino immigrant populations in the U.S. Instead, most studies assessing cumulative lifetime adversity have focused (a) on the adversity experienced in childhood (e.g., Felitti et al., 1998) and (b) have been conducted with majority White samples (e.g., Merrick et al., 2019). There is a significant need for a cumulative measure of adversity to assess the types of stressors commonly experienced by Hispanic/Latino immigrant populations across the lifespan. To address this need, this study aimed to test the construct validity of a cumulative assessment of lifetime adversity in a national sample of U.S. Hispanic/Latino immigrants. We decided to focus on first-generation Hispanic/Latino immigrants due to their unique exposure to migration-related stressors in addition to general life stressors. We used the term Hispanic/Latino based on recommendations from the HCHS/SOL Publications Committee.

The *life course perspective* (Elder & Rockwell, 1978) informed our study's design and methods. One of this perspective's core assumptions is that the life course of individuals is embedded in and shaped by historical times and places. In accordance with the life course perspective, we believe that understanding the impact of adversity on human health and development requires an assessment of adversity across the lifespan. As such, we examined the validity of an assessment of cumulative adversity that included adverse events occurring across different periods of life (e.g., childhood, adolescence, and adulthood). Our literature review also follows a lifespan approach. First, we will review the literature assessing cumulative childhood adversity, followed by a review of the literature on cumulative adult adversity, and finally, we will discuss the few studies that assessed these adversities together.

A Lifespan Approach to Assessing Cumulative Lifetime Adversity

For the purposes of this study, we defined *lifetime adversity* as a lived experience that typically causes psychological distress. This could include a discrete event, such as getting into a car accident, or an ongoing experience, such as long-term emotional abuse. *Traumatic events* are specific types of lifetime adversity, often life-threatening, that are associated with the development of posttraumatic stress disorder (PTSD; Pai et al., 2017). We use the term

lifetime adversity interchangeably with *stressor* because we believe that these terms have substantial overlap and are often hard to differentiate from one another. In this paper, we focus on c*umulative lifetime adversity* (also known as lifetime cumulative adversity), which refers to experiencing multiple types of adversity across the lifespan.

Cumulative Childhood Adversity

Most extant literature on cumulative lifetime adversity focused on adversity experienced in childhood using the adverse childhood adversities (ACEs) scale (Felitti et al., 1998). This measure focused on a variety of adverse events experienced in the first 18 years of life, such as child maltreatment (e.g., physical abuse, sexual abuse, neglect) and household dysfunction (e.g., parental divorce, caregiver substance use, caregiver mental illness). The original ACEs study and most of the subsequent research on ACEs has been conducted with predominantly White samples. For example, 80% of the participants in the original ACEs study were White (Felitti et al., 1998). Studies have only recently expanded the ACEs scale to include additional stressors relevant to ethnically diverse and at-risk populations, such as discrimination, neighborhood violence, bullying, and foster care (e.g., Cronholm et al., 2015; LaBrenz et al., 2019). One study found that 89% of first-generation Hispanic/Latinos reported experiencing at least one of the expanded ACEs (LaBrenz et al., 2019). This suggests that traditional ACEs measures might not fully capture the range of stressors that first-generation Hispanic/Latino immigrants commonly experience.

Cumulative Adult Adversity

Despite the considerable research conducted assessing cumulative childhood adversity, few studies have examined cumulative adult adversity. This is problematic because research suggests that exposure to adverse childhood experiences is associated with adversity in adulthood (Mersky et al., 2018; Roos et al., 2013). Existing measures of adult adversity have assessed for adult exposure to various stressors, such as intimate partner violence, financial problems, homelessness, discrimination, or living with a spouse/partner who had mental health problems (e.g., Mersky et al., 2017; 2018). Despite recent growth in the study of adult adversity, few studies focused on Hispanic/Latino populations.

Cumulative Lifetime Adversity and Hispanic/Latino Immigrants

There is limited research using assessments of cumulative adult and childhood adversity within the same measurement framework. Even less research has been conducted with Hispanic/Latino immigrant samples. One study, with a random sample of U.S. individuals, measured cumulative lifetime adversity with 37 items targeting seven categories of lifetime adversity: personal illness/injury, loved one's illness/injury, violence, bereavement, social/environmental stress, relationship stress, and disaster (Seery et al., 2010; 2013). One of the only comprehensive efforts to measure cumulative lifetime adversity among Hispanic/Latinos used 66 items that assessed discrimination, adverse childhood experiences, child sexual traumas, severe child traumas, chronic life stresses, and adult traumas (Myers et al., 2015). To our knowledge, no studies have conducted a robust assessment of the construct validity of cumulative lifetime adversity for U.S. Hispanic/Latino immigrants. This is a major limitation because construct validity serves as the foundation from which we make our study inferences.

Cumulative lifetime adversity is particularly relevant for first-generation Hispanic/Latino immigrants who often experience adversity prior to migration (e.g., poverty, war, political instability), during migration (e.g., traumatic events), and post-migration (e.g., loss of relationships, learning a new language, discrimination) (Cleary et al., 2018; Li et al., 2015; Perreira & Ornales, 2013). First-generation Hispanic/Latino immigrants may experience *cultural stressors*, such as discrimination or acculturation stress, in addition to general stressors, such as traumatic events or daily life stressors (Gallo et al., 2014b; Li et al., 2015; Lorenzo-Blanco & Unger, 2015; Schwartz et al., 2015; Zeiders et al., 2016). One study of primarily first-generation immigrants found that Hispanic/Latinos' self-reported experiences of traumatic events, perceived stress, and chronic stress were associated with one another (Gallo et al., 2014b). Another study found that first-generation Hispanic/Latino and Asian immigrants who experienced traumatic events prior to migration were more likely to experience acculturation stress after migration (Li et al., 2015). These studies suggest that assessments of first-generation Hispanic/Latino immigrants' stress should include cultural and general adversity in order to fully capture the range of adversity commonly experienced by this population.

Within-group Diversity Among U.S. Hispanic/Latino Immigrants

Hispanic/Latino immigrants come from over 20 different countries, each with its own culture and contextual background. Hispanic/Latino immigrants vary in sociodemographic characteristics, such as age of immigration, race, years lived in the U.S., reason for migration, educational outcomes, and relationship status. Demographic differences, such as differences in racial composition and citizenship status, may influence Hispanic/Latinos experiences of lifetime adversity, namely, acculturation stress and discrimination. For example, evidence suggests that Mexican immigrants may experience greater acculturation stress than other Hispanic/Latino immigrants (e.g., Alarcón et al., 2016). They have more encounters with immigration officials and migrate at younger ages than other subgroups (Alarcón et al., 2016; Guarnaccia et al., 2007). Puerto Ricans were granted U.S. citizenship in 1917. Consequently, they have higher English competency and experience lower levels of acculturation stress than other Hispanic/Latino immigrants (Guarnaccia et al., 2007; Lopez & Patten, 2015). Nonetheless, Puerto Ricans tend to experience greater financial hardship (Lopez & Patton, 2015) and report higher rates of discrimination (Molina et al., 2013) and mental health problems compared to other subgroups (Cooper et al., advance online publication; Rivera et al., 2008). Cuban migration to the U.S. is often politically motivated. Cubans tend to be older and have higher educational attainment than other Hispanic/Latino immigrants (Guarnaccia et al., 2007). Until 2017, the "wet foot, dry foot" policy protected Cubans from deportation and allowed them to work legally after arriving in the U.S. (Labott et al., 2017). As a result, Cubans tend to have higher yearly incomes and may experience less cultural stressors than other subgroups (Alarcón et al., 2016; Ai et al., 2017). Dominican immigrants often live in ethnic enclaves, allowing them to preserve their culture by speaking in Spanish and having access to neighborhood cultural activities (Dawson, 2009). These ethnic enclaves may be protective against discrimination and acculturation stress and make their experience distinct to other subgroups that are more likely to live in neighborhoods in

which they are an ethnic minority. These types of subgroup differences may influence the ways in which Hispanic/Latino subgroups perceive and experience lifetime adversity.

Past research has shown that psychological measures may perform differently across diverse ethnic and cultural groups due to true differences or differences in the ways in which groups interpret, experience or define a particular phenomenon (Allen & Walsh, 2000; Geisinger, 1994; Groth-Marnat, 2009). For example, studies suggest that two common measures of PTSD, the PTSD Checklist and the PTSD Reaction Index, function differently across ethnic groups (Contractor et al., 2019). Likewise, researchers cannot assume that psychological instruments perform equivalently across all Hispanic/Latino populations.

Construct Validity

A contemporary model for understanding construct validity, called the *unified construct-based model of validity*, defines construct validity as the extent to which test scores can be interpreted based on evidence and theory (Messick, 1995). This model specifies various dimensions of construct validity including: content, substantive, structural, generalizability, external, and consequential. The *content aspect* of validity determines the boundaries of a construct – which items align with the definition of the construct and which fall outside of that definition. The *substantive aspect* of validity determines the degree to which theory and evidence support the observed response patterns in the survey. The *structural aspect* of validity determines the internal structure of the construct. The *generalizability aspect* of validity determines the degree to which the measure functions the same across different groups and occasions. The *external aspect* of validity determines the degree to which the construct relates to other constructs in the way we would expect (i.e., convergent and discriminant validity). Finally, the *consequential aspect* of validity examines the unintended consequences of taking the assessment, such as causing psychological distress.

Measurement Invariance

The generalizability element of construct validity involves testing measurement invariance, an element that has been left out of past assessments of cumulative lifetime adversity. Evaluating measurement invariance (also known as factorial invariance) answers the question: Am I measuring the construct in a similar way for each group? Establishing measurement invariance allows researchers to have confidence that group differences in a given construct are based on true group differences rather than differences in the way measures were interpreted (Dimitrov, 2010). Without testing for measurement invariance, it is impossible to determine the accuracy of a measure across all members of a population. This is particularly problematic when conducting research with populations that have large within-group diversity, such as Hispanic/Latino immigrants.

The Present Study

The purpose of this study was to assess the construct validity (i.e., structural, generalizability, and external aspects) of a comprehensive measurement model of lifetime adversity with a national sample of U.S. Hispanic/Latino adults. We focused primarily on first-generation Hispanic/Latino immigrants, who experience migration-related stressors in

addition to general life stressors. We included Puerto Ricans (who are U.S. citizens) in our analyses because they tend to experience many of the same adversities as Hispanic/Latino immigrant groups after moving to the mainland U.S., such as acculturation stress and discrimination (Overstreet et al., 2016).

Our study had three aims. Aim 1 was exploratory in nature and involved determining the extent to which various types of lifetime adversity relevant to Hispanic/Latino immigrants could be grouped together into one global assessment (structural validity). Specifically, we wanted to know if cumulative lifetime adversity was most appropriately structured as a unidimensional, multidimensional or bifactor model using five possible types of adversity: adverse childhood experiences, adult chronic stress, adult perceived stress, adult acculturation stress, and lifetime discrimination. Based on the best fitting structure (i.e., unidimensional, multidimensional, or bifactor), Aim 2 focused on determining the extent to which cumulative lifetime adversity functioned equivalently across Hispanic/Latino groups (generalizability). We tested Aim 2 by assessing configural, weak, and strong invariance across six Hispanic/Latino subgroups (Mexicans, Cubans, Puerto Ricans, Dominicans, Central Americans, and South Americans). Aim 3 examined the extent to which the scale was externally valid by assessing convergent and discriminant validity with four mental health constructs.

We hypothesized that a multidimensional model of cumulative lifetime adversity will be a better fit to the data than a unidimensional model. Our approach builds off the methodological framework used by Myers et al. (2015). Based on our literature review, we hypothesized that any source of measurement non-invariance will be primarily due to differential functioning within the acculturation stress and discrimination items. Additionally, we expected to find moderate positive associations of cumulative lifetime adversity with depression and anxiety, and moderate negative associations with life engagement and self-esteem. Selection of these comparison constructs was based on past literature documenting the associations between these constructs (Kinderman et al., 2013; Overstreet et al., 2016; Reiland & Lauterbach, 2008; Ward et al., 2018).

Method

Sample

We used data from the Hispanic Community Health Survey/Study of Latinos (HCHS/SOL), conducted from 2009–2011 (Gallo et al., 2014a). The HCHS/SOL study is one of the largest and most comprehensive surveys of U.S. Hispanic/Latino health and associated risk and protective factors in existence (N = 16,415). Researchers identified potential participants by randomly selecting households in four of the largest Hispanic/Latino metropolitan areas including San Diego, the Bronx, Chicago, and Miami. They oversampled participants in older age groups as this aligned with the goals of the original study. This epidemiological cohort study involved anthropometric assessment, fasting blood draw, and self-report measures related to sociodemographic characteristics and health problems. The sampling, design, and methodology have been previously documented (LaVange et al., 2010; Sorlie et al., 2010).

The Sociocultural Ancillary Study was launched to examine cultural, economic, and psychological factors in a representative subsample (n = 5280) of the HCHS/SOL parent study (Gallo et al., 2014a). Refer to Gallo et al. (2014a) for further information regarding the study design and procedure. Only participants born outside the mainland U.S. (n = 3296) were included for the purpose of our study. Participants were individuals aged 18 – 75 (M = 49.0, SD = 12.7) from various birth locations: Mexico (n = 1232), Puerto Rico (n = 372), Central America (n = 400), Cuba (n = 599), Dominican Republic (n = 426), and South America (n = 267). Participants had lived in the U.S. an average of 19.4 years (SD = 14.1). The majority of participants were female (62%), above the age of 45 (68%), married or living with a partner (53%), had completed high school (61%), and had a yearly household income of less than $30,000 (71%). Interviews were conducted by bilingual staff and were offered in English or Spanish - the majority of which were completed in Spanish (92%).

Measures

We assessed cumulative lifetime adversity using 59 self-report items from the following scales: (a) the adverse childhood experiences (Felitti et al., 1998) scale; (b) the perceived stress scale-10 (Cohen et al., 1983); (c) the chronic stress scale (Bromberger & Matthews, 1996); (d) the perceived ethnic discrimination questionnaire (Kwok et al., 2011); and (e) the Hispanic Stress Inventory (Cavazos-Rehg et al., 2006). We modeled these subscales as factors of the overarching latent construct of cumulative lifetime adversity. Individual items within each subscale were modeled as indicators of the subscale. The rationale for this model comes from the findings of past studies examining the factor structure of lifetime adversities (e.g., Ford et al., 2015; Myers et al., 2015).

Adverse Childhood Experiences—Adverse childhood experiences were assessed using the adverse childhood experiences (ACEs) scale. This scale is composed of 10 self-report items assessing exposure to various adverse events including: emotional abuse, emotional neglect, physical abuse, physical neglect, sexual abuse, witnessing female parent being abused, living with a substance abuser, living with a mentally ill person, imprisonment of a household member, and parental divorce or separation. The ACEs scale has been shown to be psychometrically sound in other populations (Felitti et al., 1998).

Perceived Stress—Perceived stress was assessed using the perceived stress scale (PSS). This scale is composed of 10 self-report rating scale items (0 = *never*, 1 = *almost never*, 2 = *once in a while*, 3 = *often*, 4 = *very often*) assessing the global perceived stress experienced in the past month. Sample items include: “How often have you found that you could not cope with all the things that you had to do?” and “How often have you felt that difficulties were piling up so high that you could not overcome them?” We reversed coded four items because they were positively worded (e.g., “How often have you felt that things were going your way?”). We removed three items based on poor factor loadings.

Chronic Stress—Chronic stress was evaluated with an 8-item scale that assesses the number of current ongoing problems in an individual’s life (e.g., financial, work, relationship, health problems). Participants reported “yes” or “no” to experiencing a certain type of ongoing stressor (e.g., “Have you had a serious ongoing health problem?” or “Have

you had ongoing difficulties with your job and ability to work?"). Those who denied experiencing the ongoing stressor were given a score of 0. Those who responded "yes" were then asked to rate the duration of this stressor (0 = *less than six months*, 1 = *greater than six months*). This scale has been used in several multiethnic cohort studies (Bromberger & Matthews, 1996; Shivpuri et al., 2012).

Perceived Ethnic Discrimination—Perceived ethnic discrimination was assessed using the 17-item Brief Perceived Ethnic Discrimination Questionnaire-Community Version (PEDQ; Brondolo et al., 2005). The scale focuses on lifetime experiences of discrimination based on race and ethnicity in several contexts, such as at school or the workplace. Widely used with Hispanic/Latino populations (e.g., Molina et al., 2013), the PEDQ examines four elements of perceived ethnic discrimination: threat/aggression, work/school discrimination, exclusion/rejection, and stigmatization/evaluation. Participants reported how often they had been discriminated against because of their race or ethnicity on a 5-point scale (1 = *never*, 3 = *sometimes*, 5 = *very often*).

Acculturation Stress—Acculturation stress was assessed using a 17-item version of the Hispanic Stress Inventory (HSI; Cavazos-Rehg et al., 2006). Response items focused on stressful life events associated with the migration process, such as parental and familial stress (e.g., "I have felt that my children's ideas about sexuality are too liberal" or "My spouse and I have disagreed on how to bring up our children"), immigration stress (e.g., "I have felt pressured to learn English"), and occupational/economic stress (e.g., "My income has not been sufficient to support my family or myself" or "I have been forced to accept low paying jobs"). Participants reported whether or not they experienced a particular type of acculturation stress in the past three months (0 = *no*, 1 = *yes*), and rated the level of stress caused by the experience (1 = *not at all*, 2 = *a little*, 3 = *moderately*, 4 = *very*, 5 = *extremely*).

Analytic Plan

Our analysis included: (a) preliminary data analysis, (b) identifying and evaluating a baseline measurement model, (c) testing for measurement invariance, and (d) assessing convergent and discriminant validity. Conducted in R (v3.5.1; R Core Team, 2019), the preliminary data analysis was an examination of descriptive statistics (e.g., mean, standard deviation). The remaining steps utilized confirmatory factor analysis using the lavaan package (v0.6.4; Rosseel, 2012) in R. We used listwise deletion to handle missing data resulting in sample sizes of 3296 for steps a, b, and c, and 3289 in step d.

Baseline Measurement Model—First, a separate one factor confirmatory factor analysis model was run for each of the five scales (ACEs, chronic stress, perceived stress, perceived discrimination, acculturation stress) to evaluate their functionality in the current sample. Three measurement models were then fit to evaluate the dimensionality of the five scales and inform the interpretability of a single cumulative lifetime adversity score. The first model was the unidimensional model specifying all 59 items from the five scales loading on a single factor. The second model - the multidimensional model - included a separate factor for the items from each scale and allowed the five factors to correlate. The third model was

a bifactor model with all 59 items loading on to a general cumulative lifetime adversity factor as well as on to one of the five specific factors corresponding to the five scales. For an overview of the bifactor model see Chen and Zhang (2018) or Rodriguez, Reise, and Haviland (2016a; 2016b).

Each measurement model was estimated using diagonally weighted least squares. We selected this estimator because it is the most accurate method for estimating model parameters when dealing with ordinal data (Bowen & Masa, 2015). For model identification purposes, the factor variances were fixed to 1. We used the following indices to assess adequate model fit: non-significant mean and variance adjusted χ^2 value for model fit ($p >$ .05), comparative fit index (CFI) > .95, root mean square error of approximation (RMSEA) < .06, and standardized root mean square residual (SRMR) < .08 (Kline, 2016). These guidelines, however, were derived using continuous indicators and maximum likelihood estimation. Recommendations have not yet been clearly delineated for models with ordinal indicators and weighted least squares estimators (Nye & Drasgow, 2011). To determine the best fitting model, we compared the unidimensional and multidimensional models to the bifactor model using the Satorra-Bentler (2001) scaled χ^2 difference test statistic.

We assessed the internal consistency of each model using omega (ω). While alpha is the more commonly reported reliability measure, it assumes equal factor loadings for all items (essential tau equivalence) which is unrealistic in most practical applications. Omega has less restrictive assumptions (congeneric) but is interpreted similarly. Values represent the proportion of variance in a total score that is systematic variance rather than error variance (Rodriguez et al., 2016a).

Regardless of whether it is the best fitting model, the bifactor model provides additional avenues for assessing the viability of a single total score to summarize cumulative lifetime adversity. To assess the potential of using a single score, a variety of indices were calculated from the bifactor results (Rodriguez et al., 2016a, 2016b). We used omega (ω) to test the reliability for the overall bifactor model and omega hierarchical (ω_h) to test the reliability of the general factor representing cumulative lifetime adversity. We used omega hierarchical subscale (ω_{hs}) to test the reliability of the specific factors for each of the five subscales after accounting for the cumulative lifetime adversity factor. Of the reliability estimates, ω_h is best suited for assessing the interpretability of a raw total score as a measure of cumulative lifetime adversity. Specifically, ω_h represents the proportion of total score variance attributable to a single general factor. For example, a high ω_h reliability (> .80) for the cumulative lifetime adversity factor would indicate the reliability of total scores was primarily due to the cumulative lifetime adversity factor. This would suggest that a single total score is a sufficient summary of cumulative lifetime adversity and reporting multiple subscores is unnecessary. On the other hand, ω_{hs} reliabilities represent the remaining variance attributable uniquely to a subscale after partialling out the cumulative lifetime adversity factor. Low reliabilities for the five specific factors (ω_{hs} < .60) would provide additional evidence for the use of a single total score.

We evaluated dimensionality in the bifactor model by calculating explained common variance (ECV) and the percent of uncontaminated correlations (PUC). ECV is the

proportion of common variance explained by the cumulative lifetime adversity factor rather than the five specific factors. PUC is the percent of all correlations in the model that solely inform the cumulative lifetime adversity factor instead of jointly the cumulative lifetime adversity and a specific factor. For both ECV and PUC, higher values indicate greater unidimensionality. However, the magnitude of ECV becomes less important as PUC approaches 1, which indicates that the bifactor model is practically indistinguishable from the unidimensional model.

For the interpretation and use of the bifactor model in a subsequent structural equation model, or factor scores from the model, evidence comes from calculating factor determinacy and construct reliability (H) indices. Factor determinacy is the correlation between factor scores and the factor. Determinacy is stronger (i.e., less ambiguity in the factor scores) as values get closer to 1 with a recommended minimum of .90. Similarly, construct reliability is the correlation between the optimally weighted total scores and the factor. With H > .70 as a recommendation, values close to 1 indicate the factor is well defined by the items in the model, and thus, more likely to replicate across studies.

Measurement Invariance—Using the best fitting baseline measurement model, we utilized multigroup confirmatory factor analysis to test measurement invariance. This is a recommended strategy for determining the extent to which an instrument functions differently across groups (Dimitrov, 2010). Multigroup confirmatory factor analysis entailed comparing parameter estimates and model fit between the six Hispanic/Latino groups after setting various equality constraints. Equality constraints forced parameter estimates to be equal for each group, consistent with the null hypothesis that no group differences existed (Kline, 2016). The constrained model was then compared to a model where the parameters were freely estimated for each group. Improvement in model fit when parameters were freely estimated indicated measurement non-invariance, or that the model's fit to the data differed by group membership. Conversely, no change in model fit was interpreted as measurement invariance (i.e., the model fit the data similarly across groups).

Based on Bowen and Masa's (2015) approach to measurement invariance with ordinal data, we assessed for configural, weak, and strong invariance. Configural invariance demonstrates that the association between items and factors is the same for all groups. All parameters are freely estimated in this model so the magnitude of the factor loadings may differ between groups. Configural invariance establishes whether the cumulative lifetime adversity construct is organized the same way in different Hispanic/Latino immigrant groups. If configural invariance is met, then weak (metric) invariance is tested by constraining the factor loadings to be equal across groups and comparing the model fit between the constrained and freely estimated models. Assessing for weak invariance determines whether items are linked to the construct similarly across groups. Lastly, if weak invariance is met, strong (scalar) invariance is tested by adding equality constraints to the item thresholds and comparing model fit to the less constrained weak invariance model. Strong invariance, if achieved, implies that differences in cumulative lifetime adversity scores between Hispanic/Latino groups is a reflection of true differences between the groups rather than variation in item functioning.

Based on recommendations from Chen (2007) and Rutkowski and Svetina (2014), the criteria for significant change in model fit consisted of ΔCFI ≥ −.02, ΔRMSEA ≤ .03, and ΔSRMR ≤ .03, between configural and weak invariance models and ΔCFI ≥ −.01, ΔRMSEA ≤ .01, and ΔSRMR ≤ .01 between weak and strong invariance models. Additionally, we used the Satorra-Bentler (2001) scaled difference test statistic (i.e., $\Delta \chi^2$) to test for significant differences between the configural and weak, and between the weak and strong invariance models. However, there is evidence that the fit indices should be relied on more heavily for decision-making (Cheung & Rensvold, 2002; Rutkowski & Svetina, 2014).

Finally, we assessed the convergent and discriminant validity of cumulative lifetime adversity by examining its correlations to other constructs, which were added as single indicator factors to the best fitting measurement model. Convergent validity was supported if cumulative lifetime adversity was positively associated with anxiety and depression. Discriminant validity was supported if cumulative lifetime adversity was negatively associated with self-esteem and life engagement.

Results

Preliminary Analyses

In the full sample, participants' average score on the cumulative lifetime adversity scale was 54.02 (*SD* = 23.34) on a scale from 17 – 216. Out of a possible range of 0 to 10, the average number of adverse childhood experiences reported by Hispanic/Latino immigrants was 2.31 (SD = 2.26); the most common were parent separation/divorce (41%), being sworn at, insulted, or physically harmed (30%), being pushed, grabbed, slapped (29%), and living with a drinker or drug user (29%). The average composite score for perceived stress was 10.53 (*SD* = 5.54) on a scale from 0 – 28. Chronic stress had a mean composite score of 3.61 (*SD* = 3.65) with a range of 0 – 8. The sample of Hispanic/Latino immigrants reported a discrimination mean composite score of 24.55 (*SD* = 8.16) from a possible range of 17 – 85 and an acculturation stress mean composite score of 15.08 (*SD* = 13.81) on a scale from 0 – 85. The mean and standard deviation of the full sample and by each Hispanic/Latino group for each of the adversity measures is shown in Table 1. A one-way ANOVA revealed a significant difference between the 6 groups on each of the measures. The effect size, η^2, measured the variance in the adversity measure explained by Hispanic/Latino group. For all of the measures the effect size was small (.01 - .02). Therefore, although the difference in average raw score was statistically significant across the groups, the overall distribution of scores was similar.

About 92% of participants completed the surveys in Spanish. This percentage was similar across Mexicans, South Americans, Central Americans, Dominicans, and Cubans. However, only 71% of Puerto Ricans completed Spanish surveys. In order to determine that cumulative lifetime adversity group differences were not due to language differences, we performed invariance testing between the Spanish and English versions of the survey using the procedures and criteria presented in the methods section. Results are discussed in the measurement invariance section below.

Baseline Measurement Model

To accomplish the first objective of our study, we fit separate one factor models to each of the five scales and three measurement models to evaluate their collective dimensionality (Table 2). Unsurprisingly given the large sample size (n = 3296), the χ^2 was significant for all models (Kline, 2016). For the separate one factor models, factor loadings were adequate (> .30) for all but the perceived stress scale. We iteratively removed the three poorly performing items for our final perceived stress model. The fit indices suggested the adverse childhood experiences scale fit the data well while the acculturation scale demonstrated poor fit. The other 3 one factor models had various levels of ambiguity in their fit. Regarding reliability of scores from the scales, all of the scales showed adequate reliability (ω > .70) except for the measure of chronic stress (ω = .586). Overall, the results of the separate one factor models indicated that using the five scales independently on this sample of Hispanic/Latino immigrants could be problematic.

In contrast, the unidimensional, multidimensional, and bifactor models attempted to harness their collective information. As expected, given the added information, the reliability estimates for the unidimensional (ω = .922), multidimensional (ω = .936), and bifactor (ω = .937) models were higher than any of the one factor models. Regarding fit, although the multidimensional model had improved fit over the poor fitting unidimensional model, both were inferior to the bifactor model when compared either indirectly through the change in fit statistics or directly via the χ^2 difference tests. The fit indices suggested the bifactor model was an adequate fit for the data with CFI = .912, RMSEA = .039, and SRMR = .068. Thus, the bifactor model was chosen as the best fitting baseline measurement model for assessing cumulative lifetime adversity in the present sample of Hispanic/Latino immigrants.

Consider dimensionality as a spectrum with unidimensionality and multidimensionality on the extremes. The model comparisons suggested that the cumulative lifetime adversity scale was somewhere in the middle. Investigation of the bifactor model statistics aids in determining to which end the cumulative lifetime adversity scale leans and how to most appropriately interpret the resulting scale score (see Appendix A). Omega hierarchical (ω_h) revealed that 77% of the total variation in item responses was attributable to the general cumulative lifetime adversity factor. The omega hierarchical subscale estimates for the specific factors (i.e., the reliability of the specific factor after partialling out the cumulative lifetime adversity factor) were low (ω_{hs}: .20 - .62). Thus, the reliability estimates suggest that a single total score is favored over reporting multiple subscores for summarizing cumulative lifetime adversity.

Additionally, the factor determinacy (FD = .96) and construct reliability (H = .95) were high for the cumulative lifetime adversity factor. These indices indicate the factor was well defined by the items and likely to replicate in future studies. Although the majority of the correlations in the bifactor model (PUC = .79) inform the cumulative lifetime adversity factor directly rather than the specific factors, only 44% of the common variance was explained by the cumulative lifetime adversity factor whereas 56% was explained by the five specific factors. Even for high values for PUC, ECV is expected to be > .50. The influence of the specific factors over the cumulative lifetime adversity factor was also evident in the factor loadings. For a strongly unidimensional scale, every item would have a larger loading

on the general factor than its corresponding specific factor. For the cumulative lifetime adversity scale, however, the loading on the general factor was higher for only 20 of 59 items (see Appendix A). Thus, while a majority of the evidence supports the interpretation of a single cumulative lifetime adversity score as essentially unidimensional, there is also some evidence of potential biasing due to multidimensionality.

Measurement Invariance

Our second objective for this study was to test the equivalency of measurement functioning between Hispanic/Latino groups by conducting a multigroup confirmatory factor analysis (see Table 3). The configural model produced adequate fit (CFI = .930, RMSEA = .030, and SRMR = .093), suggesting that the bifactor model fit reasonably enough for each of the six Hispanic/Latino groups. When constraining the factor loadings to be equal across groups, the fit actually slightly improved with respect to CFI (Δ = .013) and RMSEA (Δ = −.004) and did not substantially worsen for SRMR (Δ = .008), although the χ^2 difference test was statistically significant ($\Delta\chi^2$ (560) = 641.60; p = .009). With weak invariance satisfied, strong invariance was tested by constraining the item thresholds to be equal across Hispanic/Latino groups. Compared to the weak invariance model, the strong invariance model produced a non-significant χ^2 difference test ($\Delta\chi$2 (595) = 644.00; p = .081) and did not differ substantially on RMSEA (Δ = .002) nor SRMR (Δ = −.003), but CFI was notably worse (Δ = −.011). Overall, the results suggest, albeit with some ambiguity, that the bifactor model functions similarly across the six Hispanic/Latino groups, and thus, any difference in a cumulative lifetime adversity score can be (cautiously) interpreted as true group differences in cumulative lifetime adversity.

Measurement invariance on the bifactor model by language preference followed a similar pattern. The overall model fit for the configural model was adequate (CFI = .927, RMSEA = .030, and SRMR = .073). By comparison, the weak invariance model with equality constraints on the factor loadings produced little change in RMSEA (Δ = −.004) and SRMR (Δ = .001) along with improvement in CFI (Δ = .017) and a non-significant χ^2 difference test ($\Delta\chi$2 (112) = 123.00; p = .225). Although weak invariance was satisfied, strong invariance was more ambiguous with significant χ^2 difference test ($\Delta\chi^2$ (132) = 299.00, p < .001) and lower CFI (Δ = −.009), but no difference in in RMSEA (Δ = .001) and SRMR (Δ = .000). Thus, interpretation of differences in a cumulative lifetime adversity score based on language preference as true differences between English and Spanish dominant speakers is partially, but not strongly, supported.

Convergent and Discriminant Validity

To complete the third objective of this study, we assessed convergent and discriminant validity by correlating cumulative lifetime adversity derived from the bifactor model with four mental health constructs. We also correlated the four mental health constructs with the raw summed scores from the five separate adversity measures (ACE, perceived stress, chronic stress, discrimination, and acculturation stress). As expected, the cumulative lifetime adversity factor was strongly positively correlated with both depression (r = .611) and anxiety (r = .603; see Appendix B). Also as expected, albeit smaller in magnitude, cumulative lifetime adversity was negatively correlated with both self-esteem (r = −.300)

and life engagement (r = −.242). The direction of the correlations was consistent across the five separate adversity measures. The magnitudes of the correlations with the mental health measures were smaller for ACE ($r < .27$), chronic stress ($r < .35$), discrimination ($r < .27$), and acculturation stress ($r < .41$) than for cumulative lifetime adversity and perceived stress. With regards to predicting mental health outcomes, this indicates the composite cumulative lifetime adversity is more informative than the other measures on their own with the possible exception of perceived stress.

Discussion

There is substantial evidence linking cumulative lifetime adversity to negative individual and family health outcomes (Myers et al., 2015; Seery et al., 2010; Gallo et al., 2014). First-generation immigrants are often exposed to migration-related stressors, such as discrimination and acculturation stress, in addition to general life stressors (Li et al., 2015). Identifying a comprehensive measure of lifetime adversity that reflects the range of stressors commonly experienced by Hispanic/Latino immigrants is critical for promoting the mental health of Hispanic/Latino immigrant populations.

Guided by the life course perspective (Elder & Rockwell, 1978), the present exploratory study provides initial evidence to support the interpretation and use of a cumulative measure of lifetime adversities among several Hispanic/Latino groups. Items assessed for the presence of past, current, and ongoing stressors, including adverse childhood experiences, adult perceived stress, adult chronic stress, adult acculturation stress, and lifetime perceived discrimination. Using five previously developed measures of lifetime adversity, we found that a bifactor model was a better fit to the data than a unidimensional model or multidimensional five factor model. Additionally, results provided cautious support for equivalent functioning of the bifactor model across six Hispanic/Latino groups, including Mexicans, Cuban, Puerto Ricans, Dominicans, South Americans, and Central Americans as well as across English and Spanish language preference. Nonetheless, there were ambiguities in the results for both the baseline measurement model and when testing for measurement invariance. Therefore, it is absolutely necessary for these results to be replicated in subsequent samples of Hispanic/Latino immigrants and for additional investigations of psychometric scale properties (e.g., Rasch modeling) before strong conclusions can be made about the adequacy of interpreting and using a single score from the bifactor model as a summary of cumulative lifetime adversity.

Structural Validity of Cumulative Lifetime Adversity

Using confirmatory factor analysis, we found that a five-factor bifactor model, including adverse childhood experiences, adult chronic stress, adult perceived stress, adult acculturation stress, and lifetime ethnic discrimination was the best fit to the data. This finding provides support for the structural aspect of construct validity (Messick, 1995). Our hypothesis that cumulative lifetime adversity would be better represented by a multidimensional model than a unidimensional model was supported. This aligns with past research studies that have found support for multidimensional models of lifetime adversity (Abravanel & Sinha, 2015; Myers et al., 2015). One of the only studies examining the factor

structure of cumulative lifetime adversity with a Hispanic/Latino sample found support for a five-factor model which included childhood trauma, adult trauma, chronic stress, childhood adversities, and discrimination (Myers et al., 2015). Our finding that a bifactor model was the best fit to the data suggests that for the purpose of interpreting and reporting scores, there may be greater evidence for the utility of a single composite score rather than reporting five subscores. Said differently, although stressors from multiple sources contribute to cumulative lifetime adversity, support for a bifactor model indicates a single total score can be interpreted as adequately summarizing the information from the multiple dimensions when working with Hispanic/Latino subgroups.

Generalizability of Cumulative Lifetime Adversity

We found that the bifactor measurement model met the criteria for configural and weak invariance across six Hispanic/Latino groups along with cautious support for strong invariance. This indicates that Hispanic/Latino subgroups interpreted these survey items in a similar way and provides evidence for the generalizability aspect of construct validity (Messick, 1995). These findings correspond with past studies assessing measurement invariance for mental health constructs within Hispanic/Latino populations (Merz et al., 2014; Perera et al., 2017). However, a meta-analysis examining the invariance of posttraumatic stress disorder (PTSD) reported partial equivalence in several measures of PTSD (Contractor et al., 2019). Authors reported numerous studies in which PTSD assessments did not function equivalently across ethnic groups. Testing measurement functioning across additional Hispanic/Latino groups can help improve the precision of the measure and increase the validity of subsequent research findings (Hsiao & Lai, 2018). If measurement invariance is not assessed, researchers cannot be sure that their results are accurate or generalizable across Hispanic/Latino populations.

External Validity of Cumulative Lifetime Adversities

Findings from this study supported the convergent and discriminant validity of cumulative lifetime adversities. We found that cumulative lifetime adversity was positively linked with anxiety and depression and negatively linked with self-esteem and life engagement. Moreover, the composite cumulative lifetime adversity scale had the largest association with mental health outcomes as compared to each adversity subscale alone. This suggests that a holistic measure of adversity may be more useful for assessing the impact of lifetime adversities on mental health. Our findings were expected because the literature documents that increases in anxiety and depression are linked with increases in exposure to stress and psychological trauma (Ellis et al., 2008; Myers et al., 2015). Likewise, past literature suggests that higher levels of lifetime adversities are linked with lower levels of self-esteem and life engagement (Krause, 2004; Reiland & Lauterbach, 2008). Establishing convergent and discriminant validity provides support for the external aspect of construct validity (Messick, 1995).

Assessing Cumulative Lifetime Adversity in Research and Clinical Practice

Overall, the results from this study provide initial evidence for the use of a cumulative measure of lifetime adversities with first-generation Hispanic/Latino immigrants from Mexico, Cuba, Dominican Republic, South American and Central America as well as first-

generation Puerto Ricans living in the mainland U.S. Individuals working with Hispanic/Latino immigrants could benefit from adopting a lifespan approach to assessing adverse experiences. It could also be beneficial to researchers exploring the effects of lifetime adversities on Hispanic/Latino health or health professionals working with trauma-affected Hispanic/Latino immigrants. Health workers could use a cumulative measure of lifetime adversity to broadly assess individuals' overall exposure to adversity across the lifespan. If individuals score high on the total composite score, health workers could examine the different subscores of lifetime adversity to obtain a more detailed view of their experiences. The use of a total lifetime adversity score could be more representative of individuals' experience of cumulative lifetime adversity than examining the five subscores separately.

Limitations

It is important to note several limitations of this study. First, we tested only one indicator of within-group difference – geographic region of origin. Future studies could benefit from using more intricate measures of within-group diversity, such as by using latent class or latent profile analysis to assess many overlapping individual characteristics. Second, this study included an older adult immigrant population in four large Hispanic/Latino metropolitan areas in the U.S. This limits the generalizability of the findings across all locations and age groups. Third, it was necessary to combine people from Central and South American countries into composite groups because there were not enough participants from these countries to allow for separate analyses. We recognize that there is immense variability in these populations. However, we believe it is important to include individuals from as many backgrounds as possible to better represent the range of experiences within Hispanic/Latino groups. Therefore, one should refrain from making definite conclusions about the validity of this scale for all immigrants from Central and South America. Fourth, future studies would benefit from assessing cumulative lifetime adversities with formative indicators. Formative indicators are seen as causing rather than being caused by the latent variable (Diamantopoulos & Winklhofer, 2001). Accordingly, one may not expect certain adverse events to be associated with one another because many adverse events occur at random, or independently of one another (e.g., health problem, unexpected accident). Fifth, findings from this study should be interpreted with caution as this represents the first effort to provide construct validity for cumulative lifetime adversities among Hispanic/Latino subgroups. Additional studies are needed to substantiate these findings. Finally, it is worth noting that the political climate has changed since the time these data were collected. Several studies suggest that Hispanic/Latino immigrants may be experiencing greater distress and fear of deportation (regardless of citizenship status) due to the recent increases in anti-immigration policy and rhetoric (e.g., Lopez et al., 2018).

Conclusion

Despite these limitations, the present study is the first to examine the construct validity of a cumulative measure of lifetime adversities among U.S. Hispanic/Latino subgroups. Examining multiple indicators of lifetime adversities within the same methodological approach may improve the understanding of lifetime adversities and our ability to accurately evaluate the effects of lifetime adversities on mental health. Researchers can improve the

conclusion validity and generalizability of their findings by assessing for measurement invariance of the constructs they are assessing. Measurement invariance is particularly relevant when doing research with heterogeneous groups. Additionally, the measure tested in this study can serve as an important tool for health professionals focused on improving the mental health of Hispanic/Latino immigrant populations. Future studies are needed with Hispanic/Latino immigrant populations in different geographic areas. Findings from this study provide preliminary evidence supporting the use of a cumulative measure of lifetime adversities with U.S. Hispanic/Latino immigrant populations.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Funding

This secondary data analysis (Daniel Cooper) was supported by the Prevention and Methodology Training Program (T32 DA017629); PI: L. M. Collins) with funding from the National Institute on Drug Abuse. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute on Drug Abuse or the National Institutes of Health.

The Hispanic Community Health Study/Study of Latinos is a collaborative study supported by contracts from the National Heart, Lung, and Blood Institute (NHLBI) to the University of North Carolina (HHSN268201300001I / N01-HC-65233), University of Miami (HHSN268201300004I / N01-HC-65234), Albert Einstein College of Medicine (HHSN268201300002I / N01-HC-65235), University of Illinois at Chicago - HHSN268201300003I / N01-HC-65236 Northwestern Univ), and San Diego State University (HHSN268201300005I / N01-HC-65237). The following Institutes/Centers/Offices have contributed to the HCHS/SOL through a transfer of funds to the NHLBI: National Institute on Minority Health and Health Disparities,National Institute on Deafness and Other Communication Disorders, National Institute of Dental and Craniofacial Research, National Institute of Diabetes and Digestive and Kidney Diseases, National Institute of Neurological Disorders and Stroke, NIH Institution-Office of Dietary Supplements.

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Table 1

Raw Score Mean (Standard Deviation) and One-Way ANOVA For Adversity Measures By Hispanic/Latino Group

	n	ACE	Perceived	Chronic	Discrimination	Acculturation	CLA
Full Sample	3296	2.31 (2.26)	10.30 (5.48)	1.82 (1.61)	24.55 (8.17)	15.04 (13.74)	54.02 (23.34)
Mexico	1232	2.47 (2.34)	10.04 (5.40)	1.68 (1.61)	24.92 (8.15)	15.02 (14.15)	54.13 (24.12)
Puerto Rico	372	2.72 (2.39)	11.14 (5.72)	2.41 (1.73)	26.17 (9.80)	10.42 (11.01)	52.86 (22.34)
Central America	400	2.47 (2.36)	11.02 (5.32)	1.75 (1.53)	25.64 (7.78)	19.01 (14.76)	59.89 (23.40)
Cuba	599	1.97 (2.12)	10.17 (5.59)	1.86 (1.53)	22.67 (6.58)	14.95 (12.76)	51.62 (21.74)
Dominican	426	1.97 (1.99)	9.82 (5.68)	1.81 (1.61)	23.42 (7.87)	14.96 (13.21)	52.00 (22.88)
South American	267	2.08 (2.05)	10.28 (4.98)	1.70 (1.55)	24.93 (9.01)	15.98 (14.72)	54.97 (23.84)
Possible Range		0 – 10	0 – 28	0 – 8	17 – 85	0 – 85	17 – 216
$F(df = 5)$		9.27*	4.37*	12.70*	13.20*	15.70*	7.30*
η^2		0.01	0.01	0.02	0.02	0.02	0.01

Note. ACE = Adverse Childhood Experiences; CLA = Cumulative Lifetime Adversity

* $p < .01$.

Table 2

Confirmatory Factor Analysis Fit Statistics and Comparison of the Bifactor to the Uni- and Multidimensional Models (n = 3296)

Model	χ^2 (*df*)	CFI	RMSEA	SRMR	ω	$\Delta\chi^2$ (*df*)	ΔCFI	ΔRMSEA	ΔSRMR
ACE	508.04 (35)*	.958	.064	.072	.757				
Perceived Stress	515.55 (14)*	.979	.104	.033	.857				
Chronic Stress	273.61 (20)*	.879	.062	.075	.586				
Discrimination	2885.65 (119)*	.903	.084	.098	.901				
Acculturation	6008.80 (119)*	.793	.123	.141	.861				
Unidimensional	35755.36 (1652)*	.613	.079	.122	.922	11738.40 (59)*	−.299	.041	.055
Multidimensional	12536.08 (1642)*	.876	.045	.079	.936	1572.70 (49)*	−.035	.006	.011
Bifactor	9374.71 (1593)*	.912	.039	.068	.937	-	-	-	-

Note. ACE = Adverse Childhood Experiences. Mean and variance adjusted χ^2 used for fit and Satorra-Bentler (2001) scaled difference test statistic ($\Delta\chi^2$) used for model comparisons.

* $p < .001$.

Table 3

Measurement Invariance Model Fit and Comparison Statistics across Ethnic and Language Groups (n = 3296)

Model	χ^2 (*df*)	*p*	CFI	RMSEA	SRMR	Δ χ^2 (*df*)	*p*	ΔCFI	ΔRMSEA	ΔSRMR
Latinx Group										
Configural	14349.73 (9558)	< .001	.930	.030	.093					
Weak	13989.58 (10118)	< .001	.943	.026	.101	641.60 (560)[a]	.009	.013	−.004	.008
Strong	15359.50 (10713)	< .001	.932	.028	.098	644.00 (595)[b]	.081	−.011	.002	−.003
Language										
Configural	7864.12 (3186)	< .001	.927	.030	.073					
Weak	6868.55 (3298)	< .001	.944	.026	.074	123.00 (112)[a]	.225	.017	−.004	.001
Strong	7566.80 (3430)	< .001	.935	.027	.074	299.00 (132)[b]	.000	−.009	.001	.000

Note. Mean and variance adjusted χ^2 used for fit and Satorra-Bentler (2001) scaled difference test statistic ($\Delta\chi^2$) used for model comparisons.

[a]Difference between weak and configural models.

[b]Difference between strong and weak model.