Published in final edited form as:

Addict Behav. 2012 March ; 37(3): 327–330. doi:10.1016/j.addbeh.2011.10.011.

The dimensionality and measurement properties of alcohol outcome expectancies across Hispanic national groups

Britain Mills, Ph.D.^a, Raul Caetano, MD, Ph.D.^a, Suhasini Ramisetty-Mikler, Ph.D., M.P.H.^b, and Ira H. Bernstein, Ph.D.^a

^aUniversity of Texas School of Public Health, Dallas Regional Campus

^bTexas/Oklahoma AIDS Education and Training Center, Parkland Health & Hospital System, Dallas

Abstract

This study examines the psychometric properties of alcohol expectancies among Hispanic subgroups. Face-to-face interviews were conducted as part of the 2006 Hispanic Americans Baseline Alcohol Survey (HABLAS), which employed a multistage cluster sample design. A total of 5,224 individuals (18+ years of age) representing four Hispanic national groups (Puerto Ricans, Cuban Americans, Mexican Americans, and South/Central Americans) were selected at random from the household population in five metropolitan areas (Miami, New York, Philadelphia, Houston, and Los Angeles). Alcohol expectancies included 18 items covering positive (e.g., laugh more, become more talkative) and negative dimensions (e.g., become aggressive, lose control) when alcohol is consumed. Confirmatory factor models replicated a previously proposed three-factor dimensional structure with a substantial majority of items exhibiting measurement invariance across Hispanic national group and gender. Items covering social extroversion were an exception, showing a lack of invariance for female Cuban and South/Central Americans. Latent mean differences across groups were detected for expectancies concerning emotional fluidity, and the pattern of differences largely mirrored known differences in alcohol consumption patterns. Results suggest that caution should be exercised in interpreting differences in expectancies concerning social extroversion across Hispanic groups, and additional work is needed to identify indices of this construct with invariant measurement properties. However, measures of emotional/behavioral impairment and emotional fluidity expectancies can be validly compared across gender and Hispanic national groups.

Keywords

Hispanic groups; alcohol expectancies; measurement invariance; confirmatory factor analysis

© 2011 Elsevier Ltd. All rights reserved.

Send correspondence to: Britain Mills, PhD, 6011 Harry Hines Blvd. Room V8.106A, Dallas, Texas 75390-9128, Phone: (214) 648-1345, Fax: (214) 648-1081, britain.mills@utsouthwestern.edu.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Contributors

All authors contributed to and have approved the final manuscript.

Conflict of interest

All authors declare they have no conflicts of interest.

1. Introduction

Alcohol expectancies (AEs) reflect beliefs that individuals develop about the effects of alcohol on various aspects of behavior and cognition (Goldman, Brown, Christiansen, & Smith, 1991). These beliefs precede direct experience with alcohol and are influenced by social contexts and role models such as family, peers, and mass media (Christiansen, Goldman, & Inn, 1982). Once established, they influence various aspects of alcohol use (Goldman, et al., 1991; Leigh & Stacy, 1991), including current drinking behaviors (for a review, see Baer, 2002; Critchlow, 1987; Leigh, 1987, 1989; Leigh & Stacy, 1993), future alcohol and drug use (Christiansen, Smith, Roehling, & Goldman, 1989; Stacy, Newcomb, & Bentler, 1991; Stacy, Widaman, & Marlatt, 1990), and alcohol dependence symptoms (Wood, Sher, & Strathman, 1996). Differences in AEs have been observed between subtypes of drinkers (e.g., lone vs. group problem drinkers, restrained and unrestrained drinkers), genders, and ethnicities (Bensley, 1991; Gustafson, 1993; Jones & McMahon, 1992; McMahon, Jones, & O'Donnell, 1994). The bulk of AE research has relied on predominantly White populations, although several studies have linked expectancies to drinking behaviors and alcohol-related problems among Hispanics (primarily of Mexican background; e.g., Corbett, Mora, & Ames, 1991; Gilbert, Mora, & Ferguson, 1994; Marín, 1996). Similarly, studies of the measurement properties of expectancy instruments have been examined primarily in non-Hispanic populations. For example, Leigh and Stacy (1993) studied the factor structure and psychometric properties of AEs and their relationship to self-reported alcohol use, finding evidence for a general two-factor structure with positive and negative dimensions. One exception can be found in Marín et al. (1993), who found evidence for a three-dimensional solution using exploratory factor analysis (with emotional and behavioral impairment, emotional fluidity, and social extroversion factors) in a Hispanic sample of mixed national origin.

Because there is pronounced heterogeneity in drinking levels and problems across Hispanics of different national origin (Ramisetty-Mikler, Caetano, & Rodriguez, in press; Vaeth, Caetano, Ramisetty-Mikler, & Rodriguez, 2009), important differences in any alcohol-related construct may be obscured by treating Hispanics as a homogeneous group. With respect to expectancy research, potential measurement issues complicate such comparisons further. To the extent that the measurement properties (e.g., loadings, intercepts) of expectancy items differ across these groups, the items (or composite scales) are not comparable (Byrne, Shavelson, & Muthén, 1989; Meredith, 1993; Muthén & Muthén, 2007). Consequently, there is a need for more formal evaluations of expectancy measures for use in Hispanic populations. In the present study, confirmatory factor analysis was used to compare two proposed dimensional structures of alcohol expectancies and to test for various forms of measurement non-invariance across four major Hispanic national groups.

2. Methods

Using a multistage cluster design, the 2006 HABLAS sampled Puerto Rican, Cuban, Mexican, and South/Central Americans (aged 18 or older) from five selected metropolitan areas of the U.S. The present analyses are restricted to respondents who were current drinkers (N=2,773). Additional details concerning the survey methodology can be found in Caetano et al. (2008).

2.1. Alcohol Expectancy Measure

In Marín et al. (1993), preliminary analyses reduced a large set of expectancy items to a pool of 18, and further factor analyses of this item set identified 11 items that loaded on three factors interpreted as emotional/behavioral impairment (EBI), emotional fluidity (EF), and social extroversion (SE). To compare Marín et al.'s three-factor solution with alternative

structures proposed in the literature, the larger 18 item pool was used in the present study. Respondents rated how often alcohol would make them feel eight positive effects of alcohol consumption (laugh more^{SE}, become more talkative^{SE}, happier, relaxed^{EF}, romantic^{EF}, friendly^{EF}, sexually aroused^{EF}, and independent) and ten negative effects (become louder, aggressive, lose control^{EBI}, become careless^{EBI}, argumentative^{EBI}, lose coordination^{EBI}, become more emotional^{EBI}, sleepy, sad, and have difficulties thinking), where superscripts denote the 11 item configuration of Marin et al.'s (1993) three-factor solution. A Likert-type response format was used for each item, coded from 0 to 3 (almost never = 0, sometimes = 1, often = 2, almost always = 3).

2.2. Statistical analyses

Measurement and structural models were fit with *Mplus* 5.2 (Muthén & Muthén, 2007) using a robust maximum likelihood estimator. The complex sampling design used in the HABLAS was accounted for. Model fit was assessed with the comparative fit index (CFI; Bentler, 1990), root mean square error of approximation (RMSEA; Steiger, 1990), the standardized root mean square residual (SRMR), and the Tucker-Lewis Index (TLI; Bentler & Bonett, 1980; Tucker & Lewis, 1973). We have not relied on model χ^2 values (which were typically significant) because of the statistic's sensitivity to trivial misfits in large sample sizes (Cudeck & Browne, 1983). Following the specification of an acceptable configural invariance model, metric (loading), scalar (intercept), and strict measurement invariance (Steenkamp & Baumgartner, 1998; Vandenberg & Lance, 2000) in the factor structure of AEs was assessed across eight groups defined by the four Hispanic national identities and gender. Nested models were compared with scaled chi-square difference tests (Satorra & Bentler, 2001), which were computed using model log likelihoods and scaling correction factors following procedures described on the *Mplus* website (<http://www.statmodel.com/chidiff.shtml>).

3. Results

Demographic characteristics of the HABLAS sample can be found in Caetano et al. (2008). The average inter-item correlation was .38 with a range of $r=.12$ to $r=.79$. Preliminary correlated two- and three-factor CFA models fit to the overall sample and to individual subgroups consistently showed extreme modification indices (>10 ; the standard 3.84 value was not used to avoid capitalization on chance) for three residual covariances: "more romantic" with "sexually aroused," "become argumentative" with "more emotional," and "lose self control" with "become careless." Because it is sensible that these pairs of items would each share common influences beyond the presently modeled expectancy factors, these residual covariances were modeled and all others were constrained to zero for subsequent models.

For the reduced 11 item set of Marín et al. (1993), a two-factor solution (involving positive and negative dimensions; Leigh & Stacy, 1993) is nested within the Marin et al. three-factor solution (the EF and SE factors consist of exclusively positive items, whereas EBI items are exclusively negative). Consequently, we first compared the three-factor solution with a two-factor solution by constraining the correlation between the latent EF and SE factors to 1. Imposing this constraint significantly degraded model fit ($\chi^2_{\text{diff}}(1) = 122.5, p < .0001$; two-factor: CFI=.92, TLI=.90, RMSEA=.06, SRMR=.06; three-factor: CFI=.95, TLI=.93, RMSEA=.05, SRMR=.06). This finding was corroborated by examination of fit indices for group-specific models. Across all subgroups, indices consistently suggested better fit for the 11-item three-factor model. For example, CFI values ranged from .92 to .99 for the three-factor model (Table 1) and from .89 to .97 for the two-factor model. Other group-specific fit indices showed the same pattern, reflecting a small but consistently better fit for the three-factor model. To ensure the result was not an artifact of using a reduced item set, we

examined group-specific fit indices for the two-factor model using the full 18 item set (the 11-item three-factor solution is not defined for all 18 items, but the two-factor solution, which was derived from a larger item set, is). CFI values ranged from .77 to .92 for this model and other indices behaved similarly, again suggesting support for the 11-item three-factor solution.

Invariance testing began by specifying a three-factor configural invariance model with unrestricted parameters across all subgroups (model 1). Model fit statistics and hierarchical testing results from all invariance analyses are presented in Table 2. Fit indices for non-rejected models in Table 2 are within ranges generally considered “acceptable” (CFI/TLI $\geq$.90, RMSEA/SRMR $<$.10; Hu & Bentler, 1999; Kline, 2005). Subsequent discussion will therefore be directed towards discussion of scaled difference tests. Although constraining loadings to equality (Table 2; model 2 vs. model 1) did not significantly degrade model fit, constraining intercepts across groups (model 3 vs. model 2) did. Consequently, modification indices from model 3 were consulted for extreme values to identify the source of the invariance. Of 88 (8 groups $\times$ 11 items) possible group-specific intercepts, these suggested that three should be freely estimated: “more relaxed” for Puerto Rican males, and “laugh more” and “talk more” for Cuban and South/Central females. Puerto Rican males were less likely to endorse “more relaxed” than other groups, and Cuban American females and (to a slightly lesser extent) South/Central females were each less likely to endorse “laugh more” and “talk more” than other groups. The resulting model (model 4) did not differ significantly from model 2, and this model was retained. Note that because the SE factor is made up of only these two indicators, measurement invariance on this factor cannot be assumed for Cuban American and South/Central females. Consequently, latent SE means for these two groups were left constrained at zero for subsequent testing.

Stricter forms of invariance were examined next. Constraining residual variances to equality (model 5 vs. model 4) did not degrade model fit, but constraining the three estimated residual covariances to equality (model 6 vs. model 5) did. Although there was some variation across ethnic groups in extent, the three residual covariances (“lose self-control” with “become careless,” “become argumentative” with “become emotional,” and “more romantic” with “sexually aroused”) were stronger (more positive) tended to be stronger for females than for males. Finally, constraints on factor variances and covariances (model 7 vs. model 5) did not significantly degrade model fit. Parameter estimates for this final model appear on the right of Table 1. All estimates were significant ($p < .001$).

In sum, for the EBI and EF factors, strong conditions of measurement invariance were met fully for loadings and partially for intercepts (one of nine intercepts across the two factors), and all but one condition for strict invariance was met. For those factors, this pattern easily satisfies contemporary perspectives on the extent of partial invariance deemed acceptable for proceeding with mean difference testing (Byrne, et al., 1989; Labouvie & Reutsch, 1995; Steenkamp & Baumgartner, 1998). Model 8 – which constrained all latent means to equality across groups – was therefore compared with model 7, and a significant decrement in model fit was observed (Table 2). Inspecting the unconstrained mean estimates from model 7 revealed group differences in EF means, which were 1) consistently higher for males than females and 2) higher for Puerto Ricans and Mexican Americans than Cuban Americans and South/Central Americans. Furthermore, there was an interactive pattern. Gender differences were pronounced for Puerto Ricans, significant for South/Central Americans and trending in a similar direction for Cuban Americans, but there was no gender difference in emotional fluidity for Mexican Americans.

4. Discussion

Consistent with previous analyses of Hispanic AEs (Marín, et al., 1993), a three-factor structure with dimensions corresponding to emotional/behavioral impairment, emotional fluidity, and social extroversion fit this Hispanic data best. The properties of these measures were largely invariant across gender and ethnicity, although the social extroversion subscale was an exception. Comparisons of latent means revealed differences across Hispanic groups and gender in emotional fluidity expectancies. The direction of these differences were largely consistent with known differences in drinking behavior between these groups (although no gender differences were detected for Mexican Americans), suggesting that emotional fluidity may be a dimension of expectancies particularly relevant to drinking behavior in Hispanics.

One strength of the present study is that it formally confirmed a structure proposed through testing with Hispanic samples (Marín, et al., 1993) in a representative sample of Hispanic subgroups in the U.S. However, the small number of items indexing social extroversion limits the utility of this subscale. Additional work is needed to improve its measurement properties by examining items that may index this construct more consistently across all gender and Hispanic subgroups. Nevertheless, the present results suggest that measures of emotional/behavioral impairment and emotional fluidity expectancies can be validly compared across gender and Hispanic national groups. Because expectancies influence the maintenance of alcohol use behavior, the continued development and refinement of reliable, valid, and culturally appropriate measures of these constructs is important to understanding the cognitive antecedents of risky drinking and to research on prevention and risk-reduction strategies in Hispanic populations.

Research highlights

- > Measurement invariance in alcohol expectancies over gender and four Hispanic groups holds for emotional fluidity and emotional/behavioral impairment expectancies, but not social extroversion expectancies.

Acknowledgments

Role of funding sources

Work on this paper was supported by a grant (RO1-AA013642) from the National Institute on Alcohol Abuse and Alcoholism to the University of Texas School of Public Health.

References

- Baer JS. Student factors: Understanding individual variation in college drinking. *Journal of Studies on Alcohol*. 2002 Supplement No. 14:40–53.
- Bensley LS. Construct validity evidence for the interpretation of drinking restraint as a response conflict. *Addictive Behaviors*. 1991; 16:139–150. [PubMed: 2063701]
- Bentler PM. Comparative fit indexes in structural models. *Psychological Bulletin*. 1990; 107:238–246. [PubMed: 2320703]
- Bentler PM, Bonett DG. Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin*. 1980; 88:588–606.
- Byrne BM, Shavelson RJ, Muthen B. Testing for the equivalence of factor covariance and mean structures: The issue of partial measurement invariance. *Psychological Bulletin*. 1989; 105:456–466.

- Caetano R, Ramisetty-Mikler S, Rodriguez LA. The Hispanic Americans Baseline Alcohol Survey (HABLAS): Rates and predictors of alcohol abuse and dependence across Hispanic national groups. *Journal of Studies on Alcohol and Drugs*. 2008; 69:441–448. [PubMed: 18432387]
- Christiansen BA, Goldman MS, Inn A. Development of alcohol-related expectancies in adolescents: separating pharmacological from social-learning influences. *Journal of Consulting and Clinical Psychology*. 1982; 50:336–344. [PubMed: 7096736]
- Christiansen BA, Smith GT, Roehling PV, Goldman MS. Using alcohol expectancies to predict adolescent drinking behavior after one year. *Journal of Consulting and Clinical Psychology*. 1989; 57:93–99. [PubMed: 2925979]
- Corbett K, Mora J, Ames G. Drinking patterns and drinking-related problems of Mexican-American husbands and wives. *Journal of Studies on Alcohol*. 1991; 52:215–223. [PubMed: 2046371]
- Critchlow B. A utility analysis of drinking. *Addictive Behaviors*. 1987; 12:269–273. [PubMed: 3661280]
- Cudeck R, Browne MW. Cross-validation of covariance structures. *Multivariate Behavioral Research*. 1983; 18:14–167.
- Gilbert MJ, Mora J, Ferguson LR. Alcohol-related expectations among Mexican-American women. *Substance Use and Misuse*. 1994; 29:1127–1147.
- Goldman MS, Brown SA, Christiansen BA, Smith GT. Alcoholism and memory: Broadening the scopes of alcohol-expectancy research. *Psychological Bulletin*. 1991; 110:137–146. [PubMed: 1891515]
- Gustafson R. Alcohol-related expected effects and the desirability of these effects for Swedish college students measured with the Alcohol Expectancy Questionnaire (AEQ). *Alcohol and Alcoholism*. 1993; 28:469–475. [PubMed: 8397529]
- Hu, Lt; Bentler, PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*. 1999; 6:1–55.
- Jones BT, McMahon J. Negative and positive expectancies in lone and group problem drinkers. *Addiction*. 1992; 87:929–930.
- Kline, RB. *Structural Equation Modeling*. 2nd ed.. New York: Guilford Press; 2005.
- Labouvie E, Reusch C. Apples aren't oranges and squares aren't rectangles but. *Multivariate Behavioral Research*. 1995; 30:107–111.
- Leigh BC. Evaluations of alcohol expectancies: do they add to prediction of drinking patterns? *Psychology of Addictive Behaviors*. 1987; 1:135–139.
- Leigh BC. In search of the seven dwarves: issues of measurement and meaning in alcohol expectancy research. *Psychological Bulletin*. 1989; 105:361–373. [PubMed: 2660178]
- Leigh BC, Stacy AW. On the scope of alcohol expectancy research: remaining issues of measurement and meaning. *Psychological Bulletin*. 1991; 110:147–154. [PubMed: 1891516]
- Leigh BC, Stacy AW. Alcohol outcome expectancies: scale construction and predictive utility in higher-order confirmatory models. *Psychological Assessment*. 1993; 5:216–229.
- Marín G. Expectancies for drinking and excessive drinking among Mexican Americans and non-Hispanic whites. *Addictive Behaviors*. 1996; 21:491–507. [PubMed: 8830907]
- Marín G, Posner SF, Kinyon JB. Alcohol expectancies among Hispanics and non-Hispanic whites: Role of drinking status and acculturation. *Hispanic Journal of Behavioral Sciences*. 1993; 15:373–381.
- McMahon J, Jones BT, O'Donnell P. Comparing positive and negative alcohol expectancies in male and female social drinkers. *Addiction Research & Theory*. 1994; 1:349–365.
- Meredith W. Measurement invariance, factor analysis and factorial invariance. *Psychometrika*. 1993; 58:525–543.
- Muthén, L.; Muthén, B. *Mplus (5.2)*. Los Angeles: Muthén & Muthén; 2007.
- Ramisetty-Mikler S, Caetano R, Rodriguez LA. The Hispanic Americans Baseline Alcohol Survey (HABLAS): alcohol consumption and sociodemographic predictors across Hispanic national groups. *Journal of Substance Use*. (in press).

- Satorra A, Bentler PM. A scaled difference chi-square test statistic for moment structure analysis. *Psychometrika*. 2001; 66:507–514.
- Stacy AW, Newcomb MD, Bentler PM. Cognitive motivation and drug use: a 9-year longitudinal study. *Journal of Abnormal Psychology*. 1991; 100:502–515. [PubMed: 1757664]
- Stacy AW, Widaman KF, Marlatt GA. Expectancy models of alcohol use. *Journal of Personality and Social Psychology*. 1990; 58:918–928. [PubMed: 2348377]
- Steenkamp JBEM, Baumgartner H. Assessing measurement invariance in cross-national consumer research. *Journal of Consumer Research*. 1998; 25:78–90.
- Steiger JH. Structural model evaluation and modification: an interval estimation approach. *Multivariate Behavioral Research*. 1990; 25:173–180.
- Tucker LR, Lewis C. Reliability coefficient for maximum likelihood factor-analysis. *Psychometrika*. 1973; 38:1–10.
- Vaeth, PAC.; Caetano, R.; Ramisetty-Mikler, S.; Rodriguez, LA. The Hispanic Americans Baseline Alcohol Survey (HABLAS): Alcohol-related problems across Hispanic national group [Poster]; 32nd Annual Scientific Meeting of the Research Society on Alcoholism; San Diego, CA: 32nd Annual Scientific Meeting of the Research Society on Alcoholism; 2009.
- Vanderberg RJ, Lance CE. A review and synthesis of the measurement invariance literature: suggestions, practices, and recommendations for organizational research. *Organizational Research Methods*. 2000; 3:4–70.
- Wood MD, Sher KJ, Strathman A. Alcohol outcome expectancies and alcohol use and problems. *Journal of Studies on Alcohol*. 1996; 57:283–288. [PubMed: 8709587]

NIH-PA Author Manuscript

NIH-PA Author Manuscript

	Unconstrained Models						Constrained Multiple Group	
	Females			Males				
	PR (N=271)	Cuban-Am. (N=233)	Mex-Am. (N=218)	SC-Am. (N=287)	PR (N=453)	Cuban-Am. (N=427)	Mex-Am. (N=442)	SC-Am. (N=442)
Model								
Laugh	(.09)	(.11)	(.11)	(.09)	(.07)	(.08)	(.08)	(.08)
	1.57	1.06	1.54	1.14	1.77	1.38	1.70	1.62
Talkative	(.10)	(.10)	(.12)	(.10)	(.07)	(.08)	(.08)	(.08)
	1.54 (.08) [†]							
Lose self control	0.74	0.57	0.80	0.62	0.77	0.69	0.75	0.71
	(.10)	(.10)	(.11)	(.10)	(.07)	(.09)	(.07)	(.07)
	0.73	0.70	0.92	0.65	0.89	0.81	0.90	0.81
Careless	(.10)	(.10)	(.10)	(.10)	(.08)	(.10)	(.08)	(.08)
	0.86	0.86	1.06	0.75	1.13	0.97	0.93	0.93
Lose coordination	(.11)	(.11)	(.10)	(.09)	(.08)	(.09)	(.07)	(.09)
	0.91 (.09)							
Argumentative	0.77	0.61	0.87	0.63	0.85	0.77	0.85	0.76
	(.10)	(.09)	(.10)	(.09)	(.08)	(.10)	(.07)	(.09)
	0.74 (.08)							
Emotional	1.10	0.86	1.26	0.97	1.03	0.91	1.11	1.13
	(.10)	(.10)	(.10)	(.09)	(.07)	(.09)	(.07)	(.08)
	1.01 (.07)							
Relaxed	1.10	0.99	1.45	1.02	1.41	1.14	1.44	1.34
	(.09)	(.11)	(.11)	(.08)	(.07)	(.09)	(.08)	(.09)
	1.19 (.07) [‡]							
Romantic	1.09	0.90	1.09	0.84	1.47	0.98	1.28	1.24
	(.10)	(.11)	(.12)	(.08)	(.08)	(.09)	(.08)	(.08)
	1.04 (.08)							
Friendly	1.08	0.76	1.34	0.81	1.57	0.92	1.26	1.22
	(.10)	(.12)	(.11)	(.08)	(.07)	(.09)	(.08)	(.08)
Sexually aroused	0.95	0.73	0.88	0.79	1.35	0.85	1.16	1.13
	(.10)	(.10)	(.11)	(.08)	(.08)	(.09)	(.07)	(.08)
	0.94 (.06)							
CFI	.93	.93	.93	.92	.99	.97	.96	.96
TLI	.89	.90	.90	.88	.99	.95	.94	.94
RMSEA	.06	.06	.08	.07	.02	.05	.05	.05
SIRM	.07	.08	.09	.06	.05	.06	.06	.07
								.09

Note. PR=Puerto Rican, Am=American, SC=South/Central, EBI=Emotional/behavioral impairment, EF=emotional fluidity, SE=social extroversion; Fit indices defined in text.

* Freed for Cuban [1.15 (.11)] and S/C females [1.26 (.09)];

[†] Freed for Cuban [1.06 (.10)] and S/C females [1.14 (.10)];

[‡] Freed for Puerto Rican males [.94 (.10)].

Table 2

Fit indices and scaled difference tests for nested comparisons of models with increasingly restrictive measurement constraints across gender and ethnic groups.

Mode 1	Group equality constraints	Fit Indices			Comparison		X ² Difference	
		CFI	TLI	RMSEA	SRMR	Value	df	p
1	None	.95	.93	.05	.06	-		
2	Item loadings	.95	.94	.05	.07	Model 1	57.0	5 .44
3	Item loadings, intercepts	.95	.94	.05	.07	Model 2	101.2	5 <.001
4	Item loadings, 8/11 intercepts	.95	.95	.05	.07	Model 2	64.8	5 .13
5	Item loadings, 8/11 intercepts, & residual variances	.95	.96	.04	.08	Model 4	93.1	7 .10
6	Item loadings, 8/11 intercepts, residual variances & covariances	.94	.95	.05	.08	Model 5	56.9	2 <.000
7	Item loadings, 8/11 intercepts, & residual variances; factor variances & Covariances	.95	.96	.04	.09	Model 5	52.6	4 .13
8	Item loadings, 8/11 intercepts, & residual variances; factor variances, covariances, & means	.94	.95	.04	.10	Model 7	83.9	1 <.000
							9	1

Note 1. CFI=Comparative Fit Index, TLI=Tucker-Lewis Index, RMSEA=Root Mean Square Error of Approximation, SRMR=Standardized Root Mean Square Residual.

Note 2. Factor scales were set with unit loading identification (ULI) constraints (constraining one loading per factor to unity across groups). To ensure items with ULI constraints themselves had invariant loadings, the Model 2 vs. Model 1 comparison was repeated with ULI constraints on different items: The same result was observed.

Note 3. Because models with unconstrained intercepts and unconstrained latent means are not identified, standard constraints for identifying the models were imposed: When all intercepts for a given factor were free across groups, means were constrained to zero; when intercepts were constrained, factor means were estimated by constraining the mean to zero in one group (Puerto Rican females) and estimating mean differences across the other seven groups.