College Alcohol Beliefs: Measurement Invariance, Mean Differences, and Correlations with
Alcohol Use Outcomes across Sociodemographic Groups

P. Priscilla Lui

Southern Methodist University

Author Note:

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Correspondence concerning this manuscript should be addressed to P. Priscilla Lui, Department of Psychology, Southern Methodist University, PO Box 750442, Dallas, TX 75275-0442. Email: plui@smu.edu.

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Abstract

Undergraduate students who believe that alcohol plays a central role in college life are prone to drink more frequently, in larger quantity, and experience more drinking problems. The College Life Alcohol Salience Scale (CLASS) measures individuals' college-related alcohol beliefs, but has been used predominantly in Euro American and freshman student samples. Emerging research suggests mean differences in college alcohol beliefs by gender and years in college, and measurement nonequivalence across nations. It remained unclear whether the CLASS functioned the same way across segments of the U.S. college population, whether students across sociodemographic groups differed in their college alcohol beliefs, and the extent to which these beliefs predicted their drinking-related outcomes. This study included 1,148 undergraduates ($M_{age} = 19.95$; 65.0% women; 44.9%, 19.9%, 10.3%, and 16.7% Euro, Asian, African, and Latinx Americans, respectively). Most students lived on campus (69.9%) and were not affiliated with the Greek system (65.7%). Multigroup confirmatory factor analyses supported scalar invariance of the CLASS scores across gender, years in college, and campus residence. The scale data achieved metric invariance and partial scalar invariance for ethnicity and Greek membership status. Associations between college alcohol beliefs and alcohol consumption, and drinking problems, were equivalent across sociodemographic categories, but differences in latent mean scores were found across gender, ethnicity, and Greek affiliations. Clinical utility of the CLASS and implications for considering college alcohol beliefs as a risk factor for hazardous alcohol use are discussed.

Keywords: cognition, college drinking culture, diversity, factorial invariance, social norms

Public Significance Statement: Believing alcohol plays a central role in college life is linked to greater alcohol consumption and drinking problems among undergraduate students. The College Life Alcohol Salience Scale can be used to assess college alcohol beliefs and detect students' risks for hazardous drinking, and men, Greek students, and some ethnic groups are more likely to endorse permissive college drinking beliefs and practices.

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Rates of hazardous alcohol use are the highest among adults aged 18 to 25 across the lifespan (SAMHSA, 2017). Alcohol misuse is the most common health risk behavioral concern for college-attending individuals who present to counseling services (CCMH, 2017). More college-attending (58%) than non-college-attending (48%) young adults report past-month alcohol use and binge drinking (SAMHSA, 2014). Whereas Euro Americans have higher rates of alcohol use and heavy drinking than African, Asian, and Latinx Americans (SAMHSA, 2017), ethnic minorities are likely to experience more negative alcohol-related consequences (Chartier & Caetano, 2010; Iwamoto, Kaya, Grivel, & Clinton, 2016; Zapolski, 2014).

The beliefs surrounding the centrality of alcohol in college life have been shown to predict students' motives to drink, alcohol consumption, and drinking-related problems in cross-sectional and longitudinal studies (Bravo et al., 2018; Crawford & Novak, 2006; Osberg, Insana, Eggert, & Billingsley, 2011). Reduced alcohol use during the last year in college also is associated with greater probability of graduating (Radomski, Read, & Bowker, 2015). Thus, a reliable and robust measure of college alcohol beliefs could be instrumental in identifying students who are at risk for poor mental health and academic adjustment during college and as they transition out of college. Building on existing research on social norms theory and interventions (Lewis & Neighbors, 2006), a valid measure that identifies students most at risk for alcohol use and drinking problems can be instrumental in targeting them in prevention and counseling services. Evidence suggests systematic differences in the cultural narratives about the roles of alcohol in college across gender, ethnic groups, years in college, and nations (Bravo, Pearson, et al., 2017; Russell & Arthur, 2016; Tan, 2012). The College Life Alcohol Salience

Scale (CLASS; Osberg et al., 2010) is one ideal measure that assesses individual differences in college alcohol beliefs. This brief, 15-item measure has the potential of understanding permissive drinking-related cognitions as proximal risk factors for hazardous alcohol use among diverse college students. Although the CLASS has been validated and used in predominantly Euro American and freshman student samples, it remains unclear whether it functions the same across segments of the college population. Establishing measurement invariance of the CLASS scores across sociodemographic groups is an essential prerequisite for making valid comparisons of the levels of college alcohol beliefs and examining these beliefs as important risk factors of hazardous alcohol use. The goal of this study was to test invariance of the factor structure, mean levels, and correlates of college alcohol beliefs among students of various gender, ethnic groups, years in college, campus residence, and Greek membership statuses.

College Alcohol Beliefs: Determinants of Alcohol Use Outcomes

College drinking culture includes expectations that alcohol is readily available on campus, and beliefs that parties and drinking events are typical to the college experience (Osberg et al., 2010; Russell & Arthur, 2016; Savic, Room, Mugavin, Pennay, & Livingston, 2016). Beliefs about the centrality of alcohol in college life often are internalized by college-bound adolescents and college-attending undergraduates. For example, many individuals believe that “drinking is considered to be a desirable activity on [a college] campus,” “to become drunk is a college rite of passage,” and “the chance to drink and party in college is just as important as the academic experience” (Crawford & Novak, 2006, p. 73; Osberg et al., 2010, p. 6). Consistent with social norms theory and research on college alcohol interventions (Lewis & Neighbors, 2006; Perkins, 2002), similar-aged peers become more influential than parents on individuals’ behaviors during adolescence and emerging adulthood, hence socializations about the college

drinking culture can impact students' alcohol-related attitudes and behaviors (Borsari & Carey, 2001). Through observations or imaginations of peers' drinking behaviors, internalizing positive college alcohol beliefs can promote individuals' identification with their social networks and college campuses, enhance their pressure to conform to others' drinking behaviors and/or perceived social norms, and in turn reinforce higher levels of alcohol consumption and drinking problems (Johnson, 2012; Livingstone, Young, & Manstead, 2011; Russell & Arthur, 2016; Tan, 2012).

Personal attitudes toward drinking are more robust predictors of alcohol use outcomes than perceived alcohol-related social norms (Sheppard, Usdan, Higginbotham, & Cremeens-Matthews, 2016). College alcohol beliefs not only predict alcohol use outcomes above and beyond personality, alcohol expectancies, and drinking motives (Bravo et al., 2018; Osberg et al., 2010; Osberg et al., 2011), but also mediate the relations between sensation seeking and alcohol consumption, and in turn drinking problems (Bravo et al., 2018). Students' beliefs about their drinking environment likely predict college alcohol use by way of drinking motives (Read, Wood, Kahler, Maddock, & Palfai, 2003). These findings highlight the importance of measuring college alcohol beliefs as a personal, cognitive risk factor that precedes alcohol use and misuse.

Possible Group Variations in College Alcohol Beliefs

College alcohol beliefs reflect individual differences, but how students develop their group identities and navigate social relationships in college can influence individual and group variations in drinking-related cognitions and behaviors (Real & Rimal, 2007). Many sociodemographic factors such as gender, ethnicity, year in college, and micro-level (residential and social) environments can shape individuals' college alcohol beliefs. These sociodemographic factors may promote students' perception that alcohol plays a central role in college life by

reinforcing stereotypes and situating them in high-risk drinking contexts. For example, over the course of undergraduate experience, students have been found to drink increasingly frequently but engage in decreasing binge drinking episodes (Harford & Muthén, 2001). More junior college students may be more likely to model peers' alcohol use patterns through an experiential learning process, whereas more advanced students may be more likely to redefine their college identity and drinking habits as they mature and prepare for adult roles after they graduate (Radomski et al., 2015; Russell & Arthur, 2016).

Within a social norms approach, research on college alcohol use has highlighted the importance of considering reference group effect on students' drinking behaviors. College students living on campus usually are more connected to others who also live on campus, and therefore are most likely to develop drinking norms by referencing their peers in residence halls (Hummer, LaBrie, & Pedersen, 2012). Similarly, gender differences in prevalence of college alcohol use and misuse have been discussed in the context of biological variability in how alcohol is processed, social sanctions against drinking among women, and gendered drinking motives (see Holmila & Raitasalo, 2005; Nolen-Hoeksema, 2004 for review). Specifically, men who subscribe to traditional masculine ideologies (e.g., being dominant, willing to take risks, seek social status) have been shown to believe that alcohol makes them more aggressive and courageous; they also are inclined to confirm their masculine status when their sense of "manhood" is threatened (Fugitt & Ham, 2018; Iwamoto, Cheng, Lee, Takamatsu, & Gordon, 2011; Mahalik et al., 2003; Wells et al., 2014).

Additionally, research suggests that ethnic differences in alcohol consumption can be explained by cultural differences in descriptive norms and alcohol expectancies, and thus differences in cultural values are expected to yield group variations in conceptualizations and

internalization of college alcohol beliefs. For example, African Americans have been found to perceive their close friends to consume less alcohol than Euro Americans; African American students also are less likely to endorse positive expectations from drinking (i.e., feeling more confident or relaxed; Antin, Lipperman-Kreda, Paschall, Marzell, & Battle, 2014).

Within certain communities, alcohol may be more likely to be considered a vehicle for friendship and social activity. For example, students in the Greek system engage in more risky health behaviors including alcohol use than those not affiliated with fraternities or sororities (Scott-Sheldon, Carey, & Carey, 2008). The Greek community may not necessarily promote health risk behaviors (e.g., binge drinking, calorie counting on drinking days), but maintain greater acceptance of high-risk drinking behaviors (Baer, 1994; Ward, Galante, Trivedi, & Kahrs, 2015). Nevertheless, consistent with social impact hypothesis, people embedded in these social networks and affiliations are more likely to perceive their peers to consume more alcohol and feel pressured to engage in higher levels of alcohol consumption (Pedersen, LaBrie, & Lac, 2008; Weitzman, Nelson, & Wechsler, 2003). Whereas the conceptualizations, and subsequent development of a measure, of college alcohol beliefs have intended for generalization to individuals from diverse sociodemographic backgrounds, whether the survey questionnaire functions similarly across these groups remain understudied.

Currently there were two measures constructed specifically to measure college alcohol beliefs in the U.S.: College Life Alcohol Salience Scale (CLASS) and Beliefs about Alcohol and the College Experience (BACE). Across the six items in BACE, only four of them tapped individuals' thoughts about how alcohol plays a role in their college experience (see Crawford & Novak, 2006). By contrast, all 15 items in CLASS explicitly tapped individuals' expectations and beliefs concerning the role of alcohol in college; the measure has been used and cross-

validated in a number of independent samples (Bravo, Pearson, et al., 2017; Osberg et al., 2010).

Psychometric Properties of the College Life Alcohol Salience Scale (CLASS)

The CLASS was developed in collaboration by a practicing clinical psychologist and undergraduate students, and tested via focus group sessions and factor analyses (see Osberg et al., 2010 for detail). CLASS scores measuring college alcohol beliefs robustly predicted weekly alcohol consumption and drinking consequences (Osberg & Boyer, 2018). Although initial results showed that the simple single-factor structure fit student self-report data well (Osberg et al., 2010), one study on the psychometric properties of the CLASS indicated that the 15-item scale scores from three countries did not fit the single-factor adequately (Bravo, Pearson, et al., 2017). Across drinker status and sex, 12 of the 15 items showed measurement invariance; however, only 5 items demonstrated invariance across samples from the U.S., Argentina, and Spain (see Bravo, Pearson, et al., 2017). It was unclear whether the partial measurement invariance concerning drinker status and sex, and national noninvariance, were attributed to true group differences or confounded by linguistic variations across these countries. Existing studies also have not systematically examined group similarities and differences in the measurement, true levels, and correlates of college alcohol beliefs across other sociodemographic segments of the college population.

The Present Study

Ensuring that the CLASS functions the same way across sociodemographic groups is a critical prerequisite not only for making accurate group comparisons, but also identifying students who are most at risk for hazardous alcohol use. Although previous research has shown the impact of sociodemographic group membership on drinking attitudes and behaviors, there are no theories that inform specific hypotheses about whether the factor structure and psychometric

properties of the CLASS scores would differ across groups. Thus, this study was designed to explore measurement invariance of the CLASS scores, compare the latent means of college alcohol beliefs, and examine the relations between these beliefs and alcohol use outcomes across gender, ethnic groups, years in college, Greek affiliations, and campus residence.

Method

Participants and Procedures

Undergraduate students aged 18 years or above ($N = 1,148$, 65.0% women, $M_{age} = 19.95$, $SD_{age} = 2.22$) at a mid-sized private and predominantly White university in the Southwestern region participated in this study. The present sample included domestic American students of Euro (44.9%), Asian (19.9%), African/Black (10.3%), Latinx/Hispanic (16.7%), and mixed or other ethnic backgrounds (8.3%). Most participants were born in the U.S. (86.9%). Among non-U.S.-born participants, Mexico and China were the most frequently reported countries of birth and on average individuals lived in the U.S. for 9.30 years. There were slightly more freshman students (32.9%) than those in their sophomore (25.1%), junior (23.8%), or senior years (18.1%). Two-thirds of the students lived on campus (69.9%), while others lived off campus alone, with their parents, or shared an apartment with roommates (30.1%). Among those who lived on campus, most were in a residence hall (86.6%). Additionally, about a third of the students reported being a member of a sorority or a fraternity (34.3%). Most students identified as a drinker over the past six months (81.7%).

Participants were recruited either from a psychology subject pool or via mass emails directed to all undergraduate students. Interested students provided informed electronic consent prior to completing a series of self-report measures online. Study participation was anonymous and voluntary. Completing all measures in the larger study took 50-60 minutes. Participants from

the subject pool received research credits whereas participants recruited from the mass emails received \$15 in cash.

Measures

Participants completed a demographic survey and provided information about their age, gender, ethnic background, year in college, Greek affiliation, and reported whether they lived on or off campus. Participants also completed the College Life Alcohol Salience Scale (CLASS; Osberg et al., 2010) to indicate their personal college-related alcohol beliefs. All CLASS items were rated on a scale from 1 (*strongly disagree*) to 5 (*strongly agree*). Validation and prospective survey research showed adequate psychometric properties of the CLASS data, particularly among Euro American and freshman college students (Osberg et al., 2011). The present CLASS data with the full sample showed excellent internal consistency reliability ($\alpha = .92$). Finally, participants provided information on their drinking behaviors in the past six months by completing the Alcohol Use Disorders Identification Test (AUDIT; Saunders, Aasland, Babor, & de la Fuente, 1993). Specifically, participants reported their level of drinking intensity on the first three items in the AUDIT. Alcohol consumption scores demonstrated adequate internal consistency reliability in this sample ($\alpha = .85$). Participants who consumed alcohol in the past six months also reported negative alcohol-related consequences on the last seven items in the AUDIT. These scores demonstrated adequate internal consistency reliability ($\alpha = .72$).

Data Analytic Plan

All data analyses were conducted using Mplus v8. I first conducted confirmatory factor analyses (CFA) to cross-validate the structure underlying the CLASS data in the present sample. I used maximum likelihood estimator using geomin rotation. Consistent with previous research, I expected the scale data to fit well with the single-factor solution. I examined χ^2 , comparative fit

index (CFI), Tucker-Lewis index (TLI), root mean square of approximation (RMSEA), and standardized root mean square residual (SRMR) for the overall model fit. Models were considered to be an excellent fit to the data if CFI and TLI $\geq .95$, RMSEA $\leq .06$, and SRMR $\leq .08$, and an adequate fit if CFI and TLI $\geq .90$, RMSEA $\leq .08$, and SRMR $\leq .10$ (Hu & Bentler, 1999). Using multigroup structural equation modeling (SEM), standard constraint imposition procedures were followed to determine the extent to which the CLASS functioned equivalently across sociodemographic groups (Meredith, 1993). For each grouping variable (i.e., gender, years in college, ethnicity, Greek affiliation, campus residence), I tested configural, metric, and scalar invariance. For configural invariance, I examined the equivalence of structural pattern while allowing factor loadings and item intercepts to be freely estimated across groups. For metric invariance, I imposed equality constraints on factor loadings but allowed item intercepts to be freely estimated in each group. For scalar invariance, I constrained both factor loadings and item intercepts to be equal across groups. At each level, changes in fit indices were evaluated to determine whether adding equality constraints resulted in a worse-fitting model. I used a number of tests: χ^2 -based likelihood ratio test (LRT), change in CFI (Δ CFI), and bias-corrected bootstrap confidence interval procedure. First, larger $\Delta\chi^2$ with $p < .01$ would suggest measurement noninvariance. This method was heavily influenced by large sample sizes and thus tended to reject null hypothesis of measurement invariance even in the absence of important group differences (Putnick & Bornstein, 2016). Second, larger Δ CFI would indicate a misfit between observed data and the more restrictive model specifications. The most common recommendation of Δ CFI $\leq -.010$ paired with Δ RMSEA $\leq .015$ was used (Chen, 2007; Cheung & Rensvold, 2002). Whereas newer simulation studies recommended a more conservative cutoff value of Δ CFI $\leq -.002$ (Meade, Johnson, & Braddy, 2008), this threshold has been criticized to be overly

stringent and unrealistic with real world data (Little, 2013). Third, direct group comparisons of item parameter(s) would be shown in confidence intervals not containing zero, but this bias-corrected bootstrap confidence interval method is only applicable to pairwise comparisons (Cheung & Lau, 2012).

Review of the literature has shown that there is no consensus about cutoff values for determining measurement (non)invariance, thus I considered results from all three approaches and erred on the principle of parsimony. In the event that full measurement invariance was not achieved, I used model modification indices to identify parameter estimates that contributed to the largest degree of model misfit (Byrne, Shavelson, & Muthén, 1989), as well as item sets that show noninvariance in the bias-corrected bootstrap confidence interval test (Cheung & Lau, 2012). To examine partial invariance, I relaxed equality constraints that yielded noninvariance. When full or partial scalar invariance was achieved, I compared factor mean scores of college alcohol beliefs across individuals across sociodemographic groups. Statistically significant results would indicate variations in college-related alcohol beliefs that are not attributed to differential scale functioning across groups.

Furthermore, I tested the degree to which college alcohol beliefs predicted alcohol consumption and negative drinking consequences similarly across sociodemographic groups. In separate multigroup SEM analyses, alcohol consumption scores and alcohol-related consequences scores respectively were regressed onto metrically invariant scores of college alcohol beliefs. Statistically nonsignificant change in model fit would indicate that the associations between college alcohol beliefs and alcohol use outcomes were similar by categories in each sociodemographic variable.

Results

Data Screening Results

There was only one missing value in our entire data set. I found 16 cases (1.39% of the sample) with Z-scores exceeding 3.00 (99.7% of the normal distribution) on Item 6 (“Missing class due to a hangover is part of being a true college student”). Results from Mahalanobis Distance technique suggested that 85 cases (7.37% of the sample) were likely to be multivariate outliers. These corresponding participants came from diverse sociodemographic backgrounds. Given that univariate outliers on this one item constituted only 1.39% of the sample, I included them to ensure that the data captured a range of responses. The present CLASS scores demonstrated normal distribution (skewness ranged from -.60 to 1.35; kurtosis = .14), which justified the use of maximum likelihood estimator for the confirmatory factor analyses.

Factor Structure of College Life Alcohol Salience Scale Scores

The present scale data demonstrated adequate fit for the single-factor structure of alcohol salience in college life, $\chi^2(90) = 617.22$, CFI = .92, TLI = .91, RMSEA = .08 (90% CI = .07, .08), SRMR = .04. All 15 items statistically significantly loaded onto the latent factor (loadings ranged from |.44| to .76). Supplemental Table 1 summarizes the mean, standard deviation, and standardized factor loading for each item.

Tests of Measurement Invariance

Table 1 summarizes model fit indices in our tests for configural, metric, and scalar invariance using LRT, Δ CFI, and Δ RMSEA across sociodemographic factors. Interested readers can refer to Supplemental Table 2 for a summary of model fit indices in each sociodemographic subgroup, and Supplemental Table 3 for a summary of bias-corrected bootstrap confidence intervals testing metric and scalar invariance. Except for Asian, African, and Latinx American groups, the single-factor structure fit the present data well across subgroups of each

sociodemographic dimension.

Invariance by gender, year in college, and campus residence. Using $\Delta\text{CFI} \leq -.010$ and $\Delta\text{RMSEA} \leq .015$, I found evidence for configural, metric, and scalar invariance for gender, year in college, and campus residence variables. Using the much more stringent $\Delta\text{CFI} \leq -.002$ criterion, however, results suggested rejecting the null hypothesis of metric invariance across years in college and scalar invariance across gender.

The bias-corrected bootstrap confidence interval test was available for two-group comparisons only. Our results suggested Item 13 might be differentially associated with the latent factor of college alcohol beliefs across men ($n = 368$) and women ($n = 639$). Furthermore, results from this approach suggested that 10 out of 15 item intercepts were different by gender. Between students who lived on campus ($n = 706$) and off campus ($n = 304$), direct parameter comparisons suggested that Item 6 yielded different factor loadings, and Items 5 and 6 yielded different intercepts.

Partial invariance by ethnicity and Greek affiliation. Although group-specific model fit was less than adequate for Asian, African, and Latinx Americans, using Euro Americans as the reference group ($n = 433$), data showed configural invariance across all four major ethnic groups. Whereas results with $\Delta\text{CFI} \leq -.002$ indicated metric and scalar noninvariance, results with $\Delta\text{CFI} \leq -.010$ and $\Delta\text{RMSEA} \leq .015$ cutoff guidelines demonstrated metric invariance, but showed ethnic differences in item intercepts. Euro Americans scored differently on Items 2 (“To become drunk is a college rite of passage”), 4 (“The reward at the end of a hard week of studying should be a weekend of heavy drinking”), and 14 (“It is okay to drink in college, even if you are under age”) than ethnic minority groups. African Americans also scored differently on Items 6 (“Missing class due to a hangover is part of being a true college student”) and 13 (“Blacking out

or forgetting part or all of the previous night's events is to be expected in college") than Euro Americans, whereas Asian Americans scored differently on Item 7 ("A college party is not a true college party without alcohol") than Euro Americans. Freeing these intercept parameters improved the model fit; however, the overall partial scalar invariance model barely approached adequate fit.

With regard to Greek affiliation, according to $\Delta CFI \leq .010$ and $\Delta RMSEA \leq .015$ thresholds, data demonstrated configural and metric invariance. Modification indices showed that intercepts for Item 3 ("I would prefer it if my college was not considered a party school") and Item 4 ("The reward at the end of a hard week of studying should be a weekend of heavy drinking") were noninvariant between Greek students ($n = 424$) and non-Greek students ($n = 728$). Bias-corrected bootstrap confidence intervals suggested that loadings for Items 3, 4, and 13 were noninvariant. Furthermore, results also suggested that five out of 15 items did not have equivalent intercepts between Greek or non-Greek students.

Latent Mean Comparisons of (Partially) Invariant Scale Scores

Using the most commonly reported cutoff values for measurement invariance, the present results indicated that items with differential group intercepts should not be used in analyses of latent mean comparisons across ethnic groups and Greek affiliations, but metric invariance of the CLASS scores permitted group comparisons of correlations between college alcohol beliefs and other variables across sociodemographic factors. Holding scale scores (partially) invariant, results showed statistically significant mean differences in individuals' college alcohol beliefs across gender, ethnic groups, and Greek membership statuses (see Table 2). Women reported lower levels of college alcohol beliefs than men. Asian and African Americans scored lower on college alcohol beliefs than their Euro and Latinx American counterparts. Greek students

reported greater college alcohol beliefs than non-Greek students. There were no differences in latent mean scores by year in college and campus residence.

Relations between College Alcohol Beliefs and Alcohol Use Outcomes

Overall, there were relatively low levels of alcohol consumption and negative drinking consequences among participants in this study (see Supplemental Table 4 for descriptive statistics of the observed scores of college alcohol beliefs and alcohol use outcomes). Summed scores on alcohol consumption in this sample did not meet threshold for risky drinking (DeMartini & Carey, 2012; Khadjesari et al., 2017). A simple structural equation model regressing the latent factor of alcohol consumption onto the latent factor of college alcohol beliefs ($\beta = .73$) was specified using data from the full sample. The model demonstrated adequate fit, $\chi^2(135) = 942.26$, CFI = .91, TLI = .89, RMSEA = .08 (95% CI [.07, .08]), SRMR = .05. As indicated in statistically nonsignificant $\Delta\chi^2$ and $\Delta\text{CFI} \leq -.01$, multigroup SEMs that specified equality constraints on the regression coefficient did not show statistically significant change in the model fit for all sociodemographic variables. Among participants who reported alcohol consumption in the past six months, the SEM regressing drinking problems onto college alcohol beliefs ($\beta = .30$) demonstrated adequate fit as well, $\chi^2(188) = 720.41$, CFI = .91, TLI = .90, RMSEA = .06 (95% CI [.05, .06]), SRMR = .05.¹ There also were no changes in the model fit indices in multigroup SEMs when the regression coefficient was constrained equal across sociodemographic groupings. These results showed that college alcohol beliefs predicted alcohol consumption and drinking problems similarly across gender, ethnicity, years in college, campus residence, and Greek affiliations.

¹ Data showed limited heterogeneity on Item 10 (“Has a relative, friend, doctor, or other health care worker been concerned about your drinking or suggested you cut down?”) in the Alcohol Use Disorders Identification Test, which resulted in nonconvergence of the SEMs. Thus, Item 10 was excluded as an indicator of drinking problems.

Discussion

Sound assessment—and ultimately efforts in changing—internalized beliefs surrounding the centrality of alcohol in college life have the promise of informing longer lasting and more effective alcohol interventions (Ahern, Galea, Hubbard, Midanik, & Syme, 2008; Cooper, 1999). The robustness and applicability of such assessment rest on the assumption that the scale functions the same across individuals of diverse sociodemographic groups. Previous research has indicated gender and Greek-affiliation differences in college alcohol beliefs and drinking patterns (e.g., Scott-Sheldon et al., 2008), and little work has focused on differences across ethnic groups. This was the first study that systematically evaluated measurement equivalence, mean differences, and correlates of a measure of college alcohol beliefs across five sociodemographic groups. Results shed light on the validity and limitations of the College Life Alcohol Salience Scale (CLASS) in measuring college alcohol beliefs that can predispose undergraduate students for greater risk for alcohol consumption and drinking problems. Observed group variations also suggest meaningful sociocultural variations in drinking attitudes.

The CLASS functioned equivalently across gender, years in college, and campus residence. It is appropriate to compare the magnitude of relations between college alcohol beliefs and other variables, as well as the mean levels of the item scores between men and women, students in different years of their undergraduate education, and people who live on and off-campus. I also found support for metric invariance pertaining to ethnicity and Greek affiliation; thus, any observed ethnic or Greek differences in the correlates of college alcohol beliefs likely reflect true group differences rather than confounding measurement bias effects. When comparing the levels of college alcohol beliefs between Greek and non-Greek students, it is important to recognize that students in these segments do not share the same perspective

regarding what it means to attend a party school and using alcohol as a reward for a hard week in school. Similarly, ethnic minority students who are against underage drinking, using alcohol as a reward, and do not believe that being drunk is a rite of passage in college are likely to engage in less hazardous drinking. These findings may reflect ethnically distinct drinking cultures and different levels of acculturation to the mainstream U.S. society (Lui & Zamboanga, 2018a, 2018b; Vaeth, Wang - Schweig, & Caetano, 2017). Nevertheless, despite item intercept and latent mean differences, college alcohol beliefs are strong predictors of alcohol consumption. Challenging these risky cognitions in prevention programs and wellness classes as well as introducing protective behavioral strategies (Bravo, Prince, & Pearson, 2017) can decrease alcohol consumption and drinking problems among college students of diverse backgrounds.

Strengths, Limitations, and Future Directions

There were a number of strengths to be noted. By holding constant the campus and broader cultural contexts, I controlled for possible variances associated with language and with college and national drinking (sub)culture (see Bravo, Pearson, et al., 2017). The use of a large and sociodemographically diverse group of undergraduates afforded the opportunity to examine measurement invariance of the CLASS and correlates of college alcohol beliefs across segments of the college population. I used common and recently-developed statistical methods to test the presence of measurement noninvariance. The new bias-corrected bootstrap confidence interval method was considered simultaneously with other fit indices cutoff values; this new approach had the advantage of directly comparing item parameters and identifying sets of items that might be noninvariant across two groups (Cheung & Lau, 2012).

Nonetheless, several limitations should be considered when interpreting the present results. First, despite using several state-of-the-art methods for testing measurement invariance,

there currently is no consensus on what thresholds are most appropriate under various conditions of factor analyses (e.g., model complexity, sample size, strength of factor loadings, size of group differences). I erred on the side of parsimony and focused on identifying nontrivial, important parameter differences across sociodemographic groups; still, more simulation studies are needed to help specify the functions of fit statistics across model conditions. Second, our results were based on students from one university. Students in four-year and residential universities are more likely to endorse permissive drinking culture than students in two-year commuter colleges (Benz et al., 2017; Presley, Meilman, & Leichliter, 2002). Third, the present sample showed relatively low levels of alcohol consumption and drinking problems, which may have affected the generalizability of our results to students who engage in high-risk drinking behaviors. Thus, future research should sample from other college campuses and student samples. With regard to ethnic measurement invariance, some of our multigroup analyses were conservative because all four major ethnic groups were considered simultaneously. Future pairwise comparison studies might find it helpful to conduct independent measurement invariance tests across selected groups. This approach may help retain more items that are equivalent across groups of interest, and hence ensure broader coverage of the construct of college alcohol beliefs. These pairwise comparisons will also take full advantage of the bias-corrected bootstrap confidence interval method for direct comparisons between two groups. Finally, it is recommended to further examine the structure and psychometric properties of the CLASS scores as a screening tool for risk factors for hazardous alcohol use in the college setting, and consider the malleability of college alcohol beliefs in interventions. Notably, it would be beneficial to examine the measurement invariance of the CLASS over time.

Clinical Utility

Systematic differences in the levels of college alcohol beliefs between men and women, Greek and non-Greek students, and among Euro, Asian, and African Americans mirror these sociodemographic differences in alcohol consumption and drinking problems. Consistent with social norms interventions, the present results reinforce that providing awareness of and changing college alcohol beliefs can shape students' drinking patterns (Lewis & Neighbors, 2006). Overall, college alcohol beliefs are similarly associated with alcohol consumption and drinking problems across segments of the college population. In addition to using college health interventions and personalized feedback to challenge (mis)perceived social norms around college drinking (Borsari & Carey, 2003; Neighbors, Larimer, & Lewis, 2004), this study suggests the potential of using the CLASS to evaluate individual differences in college alcohol beliefs as a key risk factor in hazardous drinking. Researchers can use the 15-item CLASS to predict alcohol use outcomes among college students, and compare how these relations may vary across sociodemographic groups. Clinicians can use all items to compare the degree to which individuals believe that alcohol plays an important role in their college experience across men and women, students in different years in college, and those who live on and off campus. Given the current findings, it would be important to consider systematic ethnic and Greek differences in some item mean scores. For example, when making direct comparisons between Greek and non-Greek students or among students of various ethnic backgrounds, it would be best to compute scale scores using only scalar invariant items. Social contexts in the Greek community and cultural norms around alcohol use likely shape how students from different sociodemographic backgrounds conceptualize the roles of alcohol in their college life. The present results provide information on limits and utility of the CLASS in measuring individual differences in college alcohol beliefs, and shed light on important group variations in these beliefs.

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Table 1

Summary of Fit Indices for Models Testing Measurement Invariance

Model	χ^2	df	RMSEA	90% CI	CFI	TLI	SRMR	$\Delta\chi^2$	Δdf	p	ΔCFI	$\Delta RMSEA$
Gender (man vs woman)												
Configural	724.415**	180	.078	[.072, .083]	.917	.903	.042					
Metric	743.966**	195	.075	[.069, .081]	.917	.910	.051	19.551	15	ns	.000	-.003
Scalar	817.687**	210	.076	[.070, .081]	.908	.908	.058	73.721*	15	< .0001	-.009	.001
Year in College (freshman vs sophomore, junior, and senior)												
Configural	910.956**	360	.078	[.072, .084]	.919	.905	.046					
Metric	976.179**	405	.075	[.069, .081]	.916	.912	.061	65.223	45	.0300	-.003	-.003
Scalar	1056.823**	450	.073	[.067, .079]	.910	.916	.062	80.644*	45	.0001	-.006	-.002
Campus Residence (on- vs off-campus)												
Configural	696.938**	180	.075	[.070, .081]	.923	.910	.041					
Metric	722.746**	195	.073	[.068, .079]	.921	.915	.048	25.808	15	.0401	-.002	-.002
Scalar	733.745**	210	.070	[.065, .076]	.922	.922	.048	10.999	15	.7527	.001	-.003
Ethnicity (Euro American vs Asian, African, and Latinx American)												
Configural	899.917**	360	.081	[.074, .087]	.910	.894	.051					
Metric	962.744**	405	.077	[.071, .083]	.907	.903	.073	62.827	45	.0405	-.003	-.004
Scalar	1132.896**	450	.082	[.076, .087]	.883	.891	.092	170.152*	45	< .0001	-.021	.005
Partial Scalar ^a	1115.249**	447	.080	[.075, .086]	.888	.895	.087	152.505*	42	< .0001	-.019	-.002
Partial Scalar ^b	1101.598**	444	.080	[.075, .086]	.888	.895	.087	138.854*	39	< .0001	-.017	.000
Partial Scalar ^c	1088.822**	443	.079	[.073, .085]	.892	.897	.086	126.078*	38	< .0001	-.015	-.001
Partial Scalar ^d	1077.89**	442	.079	[.073, .085]	.893	.899	.085	115.155*	37	< .0001	-.014	.000
Partial Scalar ^e	1077.899**	441	.078	[.072, .084]	.895	.900	.085	102.707*	36	< .0001	-.012	-.001
Partial Scalar ^f	1050.834**	438	.078	[.072, .084]	.897	.902	.084	88.090*	33	< .0001	-.010	-.001
Greek Affiliation (non-Greek vs Greek)												
Configural	751.794**	180	.079	[.073, .085]	.911	.896	.043					
Metric	791.762**	195	.078	[.072, .084]	.907	.900	.054	39.968*	15	.0005	-.004	-.001
Scalar	894.030**	210	.080	[.075, .086]	.894	.894	.088	102.268*	15	< .0001	-.013	.002
Partial Scalar ^g	880.071**	209	.080	[.074, .085]	.896	.895	.087	88.309*	14	< .0001	-.011	.000
Partial Scalar ^h	872.142**	208	.080	[.074, .085]	.897	.896	.085	80.380	13	.0230	-.010	.000

Note. ΔCFI in bold indicate that null hypothesis of measurement invariance should be rejected based on (Cheung & Rensvold, 2002) recommendations. ΔCFI in italics indicate that null hypothesis of measurement invariance should be rejected based on (Meade et al.,

2008) recommendations. ^a free intercept for Item 14 across Asian, African, and Latinx American groups. ^b free intercept for Item 4 across Asian, African, and Latinx American groups. ^c free intercept for Item 13 in African American group. ^d free intercept for Item 7 in Asian American group. ^e free intercept for Item 6 in African American group. ^f free intercept for Item 2 across Asian, African, and Latinx American groups. ^g free intercept for Item 4 in the Greek group. ^h free intercept for Item 3 in the Greek group.

Item 2: “To become drunk is a college rite of passage.” Item 3: “I would prefer it if my college was not considered a party school.” Item 4: “The reward at the end of a hard week of studying should be a weekend of heavy drinking.” Item 6: “Missing class due to a hangover is part of being a true college student.” Item 7: “A college party is not a true college party without alcohol.” Item 13: “Blacking out or forgetting part or all of the previous night’s events is to be expected in college.” Item 14: “It is okay to drink in college, even if you are under age.”

* $p < .01$, ** $p < .0001$

Table 2

Comparisons of College Life Alcohol Salience Scale Latent Mean Scores Across Sociodemographic Groups

	Contrast 1			Contrast 2			Contrast 3		
	Estimate	SE	p	Estimate	SE	p	Estimate	SE	p
Gender (RG = man)	-.316	.066	< .001						
Year in College (RG = freshman)	.096 ^a	.085	.260	.089 ^b	.086	.300	.097 ^c	.094	.303
Year in College (RG = sophomore)	-.066 ^b	.096	.944	.001 ^c	.099	.990			
Year in College (RG = junior)	.008 ^c	.102	.939						
Campus Residence (RG = on-campus)	-.034	.070	.630						
Ethnicity (RG = Euro American)	-.415 ^d	.090	< .001	-.345 ^e	.117	.003	.049 ^f	.095	.610
Ethnicity (RG = Asian American)	.070 ^e	.128	.585	.463 ^f	.110	< .001			
Ethnicity (RG = African American)	.393 ^f	.132	.003						
Greek Affiliation (RG = non-Greek)	.513	.070	< .001						

^a Sophomore, ^b Junior, ^c senior, ^d Asian American, ^e African American, ^f Latinx American

Note. RG = reference group for pairwise comparison with the latent mean specified as zero. All latent mean comparisons were conducted assuming scalar or partial scalar invariance for each sociodemographic variable as summarized in Table 1.