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Validation of the Drinking Motives Questionnaire-Revised across US and Portuguese college students

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HIGHLIGHTS

- Factor loadings, variances, and covariances of the DMQ-R demonstrated invariance.
- US students ranked all drinking motives higher than Portuguese students.
- The rank order of drinking motives were equivalent across countries.
- Drinking motives were significantly associated with alcohol use for both samples.

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ABSTRACT

The present study aimed to evaluate the invariance of the factor structure of the Drinking Motives Questionnaire Revised (DMQ-R) between Portuguese and US university students. Following tests of factor model invariance we further evaluated cross-cultural differences in (1) mean levels of the four motives, and (2) the association of the four motives with weekly drinking, peak drinking, and binge drinking among college students from the United States and Portugal. Participants were 983 undergraduate students (67% female) from the US (N = 515) and Portugal (N = 468). Participants completed a confidential online (US) or paper and pencil (Portugal) survey. Results of a CFA demonstrated that the four-factor model of the DMQ-R was invariant with respect to factor loadings, factor variances, and factor covariances across the two countries. Mean differences in ratings of drinking motives were found, with US students ranking all motives higher than Portuguese students. However, rank order of motives (social > enhancement > coping > conformity) were equivalent across countries. Support for convergent validity was demonstrated by significant associations between drinking motives and alcohol consumption for men and women of both samples. Results support the factorial invariance and convergent validity of the DMQ-R across US and Portuguese college students, making it a trustworthy means of assessing college students' drinking motives, and a useful instrument for clinical and research purposes, both within and across cultures.

1. Introduction

The majority of studies on alcohol use among college students have been conducted in the United States. Yet studies of European university students indicate that alcohol use, heavy episodic drinking, and alcohol-related problems occur at high rates on campuses there as well (see Wicki, Kuntsche, & Gmel, 2010 for a review). Studies among US and European college students find that drinking motives are a strong proximal predictor of alcohol use and alcohol-related problems (see Kuntsche, Knibbe, Gmel, & Engels, 2005, and Cooper, Kuntsche, Levitt, Barber, & Wolf, in press, for reviews).

As is well known, Cooper (1994) created the Drinking Motives Questionnaire-Revised (DMQ-R) to measure four distinct drinking motives: (a) coping (e.g., drinking to deal with negative emotions); (b) conformity (e.g., drinking to avoid social rejection); (c) enhancement (e.g., drinking to increase positive affect) and, (d) social (e.g., drinking to receive social benefits). Examination of the factor structure and invariance of the relationships between drinking motives and alcohol outcomes across college students from diverse countries would extend the generalizability of Cooper's (1994) four factor model and the utility of the DMQ-R in cross-cultural samples of college students. Further, examination of mean differences and associations between motives and drinking

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behaviors could shed light on similarities and differences in drinking patterns and practices across cultures, which could be used to inform culture-specific prevention and intervention strategies.

Several notable differences between US and Portuguese cultures underscore the importance of examining the validity and generalizability of drinking motives and their associations with alcohol use across these cultures. First, the substantial differences in legal drinking age (e.g., 21 years old in the US versus 16–18 years old in Portugal; World Health Organization, 2004) may influence rates of and reasons for college students' alcohol consumption. Second, differences in university culture between the US and Portugal likely influences the settings and contexts in which drinking takes place and hence, motives for consuming alcohol. For example, two risk factors for alcohol use among US college students are involvement in sororities/fraternities and college/university athletics (Ham & Hope, 2003), whereas involvement in these activities and the associated drinking culture are far less common in Europe (Wicki et al., 2010).

The purpose of the present study was to investigate cross-cultural differences in (1) the factor structure of DMQ-R; (2) the mean levels of four motives, and (3) the association of the four motives with weekly drinking, peak drinking, and binge drinking, among college students from the United States and Portugal. To accomplish these goals we conducted a standard series of invariance tests on the factorial structure of the DMQ-R (Vandenberg & Lance, 2000) in which we assessed the equality of the factor loadings, intercepts, latent variables variances and covariances, and item uniqueness across US and Portuguese samples of university students. We followed the invariance tests with tests of the validity of the factor structure for predicting drinking behaviors.

2. Method

2.1. Participants

Data were collected from 983 undergraduate students from two large, public, universities, one located in the northeastern US (N = 515) and one located in central Portugal (N = 468), after obtaining IRB approval from each university. The US sample was limited to participants who were at least 18 years old. Because of the lower legal drinking age in Portugal at the time of data collection, the Portuguese sample included 2 participants who were 17 years old.[2] Inclusion criterion for both samples was consumption of at least one alcoholic beverage in the previous 30 days. Individuals who reported no alcohol consumption were excluded from the analysis because neither drinking motives nor alcohol- related consequences could occur for participants who did not consume alcohol. The mean age of the total sample was 20.25 years old (SD = 1.72). The majority of participants (67%) were female.

2.2. Procedure

US participants were recruited entirely from undergraduate classrooms. Those interested in participating in the study provided their email address and received an email invitation explaining the nature of the study, participants' rights, incentives for participation (i.e., opportunity to enter a raffle for one of ten $100 Visa gift cards), and a link to the online survey. Portuguese participants were recruited from classrooms and informal study areas throughout the university. They completed paper and pencil versions of the questionnaires. Prior to completing the questionnaires, Portuguese participants were informed about the aim of the study, the voluntary nature of the study, and that no compensation would be provided. Responses from both samples were confidential.

[2] Decree-Law 106 which went into effect June 16, 2015 now prohibits the access to alcoholic beverages to individuals <18 years old.

2.3. Measures

2.3.1. Demographics

All participants completed a brief demographic questionnaire that assessed age, gender, and year in school.

2.3.2. Drinking motives

Motives for consuming alcohol were assessed using the 20-item Drinking Motives Questionnaire Revised (DMQ-R; Cooper, 1994) and a Portuguese translated, back-translated version of the measure. One of the most commonly used instruments to assess the drinking motives of college students, the DMQ-R measures the frequency with which individuals consume alcohol for four distinct reasons: Coping, Enhancement, Conformity, and Social. Each item is rated on a scale ranging from 1 (*almost never/never*) to 5 (*almost always/always*). Mean scores are computed for each subscale/motive. Research has supported the factor structure of the measure, and its associations with alcohol use and alcohol-related problems among US university students (e.g. Cooper, 1994; Martens, Rocha, Martin, & Serrao, 2008). Internal consistencies for the present study were adequate ranging from 0.82 to 0.86 for the US sample, and 0.78 to 0.85 for the Portuguese sample. The aforementioned values are similar to those reported for the English language DMQ-R in studies of US college students (e.g., Martens et al., 2008) and adolescents from Switzerland, Canada and the US (Kuntsche, Stewart, & Cooper, 2008).

2.3.3. Peak drinks, drinks per week and binge drinking

We measured three common indices of alcohol use for college participants. Participants were asked to report the greatest number of drinks they consumed in the past 30 days (peak drinks) and the number of binge drinking episodes (i.e., 5+/4+ drinks for men/women in one sitting) they engaged in during the previous 2 weeks. Drinks per week were calculated by based on the number of drinks participants consuming on each day of the week for the past 30 days using the Daily Drinking Questionnaire (Collins, Parks, & Marlatt, 1985). These three variables were treated as manifest indicators of a latent alcohol consumption variable.

3. Results

3.1. Confirmatory factor analysis for testing factorial invariance

The necessity to establish factorial invariance of instruments such as the DMQ-R becomes important when a comparison of absolute and/or relative amounts of alcohol consumption is to be tested across groups. If characteristics of the measurement model differ across groups, then any differences observed between groups on the variables in question could be attributable to more than one explanation, including underlying differences in the latent variable within groups (Bollen, 1989; Kline, 2011; Steenkamp & Baumgartner, 1998). If, on the other hand, it can be shown that the instrument measures the same latent construct across groups then between-group differences in standing on these constructs, or differences in correlations between these and other constructs within-groups can be accepted as trustworthy assessments of the constructs. To start, we tested differences between the covariance matrices of US and Portuguese samples. The change in CFI between freely estimated and equality constrained models was negligible (ΔCFI = -0.000) and well within the invariant limits suggested by Cheung and Rensvold (2002).

3.1.1. Configural invariance

Factorial invariance is typically described as a multi-stage process that seeks increasingly demanding evidence of invariance ranging from weak-to-strong conclusions (Steenkamp & Baumgartner, 1998; Vandenberg & Lance, 2000). The weakest, but most essential, evidence of invariance begins with establishing *configural* invariance wherein

the confirmatory factor analytic measurement model simultaneously and freely estimated in multiple groups provides a reasonable fit to the constructs within each group. Using maximum likelihood estimation as implemented in STATA (StataCorp, 2015) and Mplus (Muthén & Muthén, 1998-2012) we simultaneously estimated the multiple group, 4-factor, confirmatory measurement model of the DMQ-R consistent with the model depicted in Fig. 1. The factor covariances were freely estimated within groups and the measurement errors were freely estimated within groups, but the errors were not allowed to correlate within or across factors. Model fit in all of the analyses was evaluated by the χ^2 goodness of fit test (Bollen, 1989), the comparative fit index (CFI; Bentler, 1990), and the root mean square error of approximation (RMSEA; Steiger & Lind, 1980, May).

Each of the drinking motives was conceptualized as a latent variable responsible for the variation in the observed indicator variables. The configural measurement model requires that (1) the same factor structure is fitted to both groups of US and Portuguese participants; (2) the measured indicators were specified to load only on their own latent variable and loadings on the remaining three factors were constrained to zero; and (3) factor loadings, factor variances, factor correlations (covariances), and error variances of the measured indicators were simultaneously and freely estimated within each national group.

The standardized and unstandardized factor loadings of the fitted configural model for both US and Portuguese student samples are summarized in Table 1. The comparable factor loadings reported by the author of the DMQ-R have also been shown in Table 1 for comparison. The 4-factor model of the present study showed an adequate fit to the data: $\chi^2_{(328)} = 1517.86$, $p < 0.001$; CFI = 0.888; RMSEA = 0.086 [CI_{90} = 0.082–0.90]. Moreover, all factor loadings were strongly associated with their designated factor ($p < 0.0001$), while each item's loading on its non-parent factor were fixed to zero.

3.1.2. Metric invariance

A test of metric invariance requires that the fit of the measurement model in which factor loadings are freely estimated be compared to a model in which the factor loadings are constrained to be equal across comparison groups. The freely estimated and constrained model fits are shown in Table 2. The χ^2 difference test between the freely estimated and constrained models is $\Delta\chi^2_{(16)} = 74.04$, $p < 0.001$. Cheung and Rensvold (2002) show by Montecarlo evaluation that the χ^2 difference test, especially under conditions of high power (N = 983), overestimates the magnitude of the differences between nested models. They argue that a better criterion is to judge models to be invariant is if the value of the CFI changes less than −0.01 across nested samples. For the current data the ΔCFI = −0.006 (see Table 2) is well below this criterion and thus, we conclude that the loadings are substantively equivalent across groups. This is especially noticeable when comparing the standardized loadings of US and Portuguese samples in Table 1.

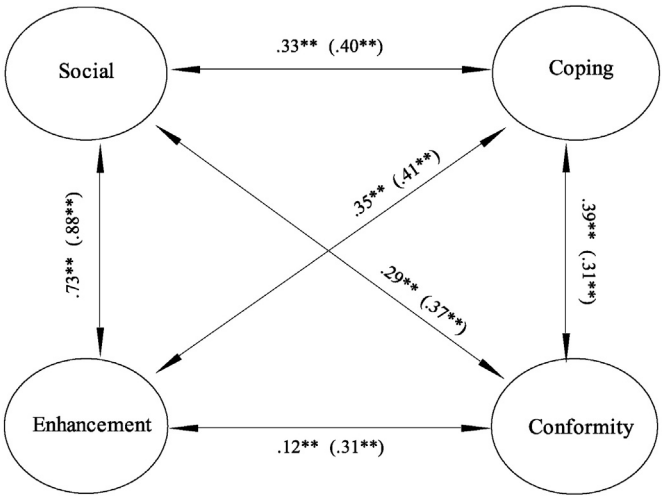

Fig. 1. Multiple group (US and PT samples) path diagrams of 4-factor drinking motives confirmatory factor analysis. Factor variances are standardized at 1.00 for all factors within both groups. Portuguese estimates are in parentheses. Factor correlations are shown on the double-headed arrows. Standardized measured indicator factor loadings (see Table 1) and error variances ($1-\lambda_s^2$) are not shown in order to reduce clutter in the diagram.

3.1.3. Scalar (intercept) invariance

The result of constraining the intercepts (item means) of the measured indicators to equality across groups revealed that the two groups are non-invariant with respect to item means. The CFI difference test (Table 2) that isolates the intercepts only resulted in ΔCFI = -0.053. In this sense, the differences in item means across the two national samples differ significantly. The Score Test as implemented in STATA v14 (StataCorp, 2015) applied to the items of the DMQ-R reveals that the non-invariance of the intercepts is observed in 13 of the 20 items and is spread across all four factors. Hence, strong invariance was not found and the invariance of the items across groups was limited to the factor loadings.

3.1.4. Invariance of factor variances and covariances

Factor variances and covariances were tested for invariance across multiple groups by constraining the four variances and six covariances between the four factors to be equal across US and Portuguese samples. As shown in Table 2, the CFI difference tests suggest that the groups are invariant with respect to the six factor covariances (ΔCFI = -0.004), and nearly invariant with respect to the factor variances (ΔCFI = -0.012). Factor variances and correlations of the two samples are presented in Fig. 1.

3.1.5. Uniqueness variance invariance

It is not uncommon in practical applications of invariance analysis to find the configural, metric, and covariance tests that support conclusions of invariance. Finding invariance across the errors of the indicator variables (uniqueness) is a more demanding proposition (Vandenberg & Lance, 2000) and is often seen as not critical in establishing invariance (Newsom, 2015). Model fit statistics, summarized in Table 2 show that the residual variances of the 20 DMQ-R items exceed Cheung and Rensvold's (2002) criterion for invariance (ΔCFI = −0.039). Thus, the measurement errors of the DMQ-R are judged to be non-invariant across US and Portuguese groups.

3.2. Validity tests of the DMQ-R latent variables—tests of structural invariance

We tested hypotheses of structural (as opposed to measurement) invariance (Steenkamp & Baumgartner, 1998; Vandenberg & Lance, 2000), by (1) testing the latent variable mean differences between groups, and (2) fitting a multivariate structural regression model in which a latent variable of alcohol consumption (consisting of the measured indicators of drinks per week, peak drinking, and binge drinking) was regressed on the four latent variables of the DMQ-R and adjusted for sex and age of the respondent.

As summarized in Table 3, the latent variable means for Portuguese and US student samples differed significantly ($\Delta\chi^2_{(4)} = 252.39$, $p < 0.001$). Coterminous Wald tests on each mean difference also confirmed that the two samples differed. Since the Portuguese sample comprised the reference group in the structured mean difference test (Kline, 2011), the US sample showed consistently higher levels on all four motives.

A second structural invariance analysis was conducted as a multiple group structural equation model, the results of which are displayed in Fig. 2. The standardized factor loadings for peak drinks (γ_{US} = 0.83, γ_{PT} = 0.90), drinks per week (γ_{US} = 0.88, γ_{PT} = 0.86), and binge drinking (γ_{US} = 0.79, γ_{PT} = 0.79) were all remarkably similar across

Table 1
Factor loadings of the DMQ-R from US sample, PT sample, and Cooper (1994).

Item #	Item	Unstandardized				Standardized		
		PT λ	US λ	$\lambda_{PT} - \lambda_{US}$ *p*-value	Cooper λ	PT Std. λ	US Std. λ	CooperStd. λ
3	Because it helps you enjoy a party	1.00	1.00	–	0.95	0.77	0.80	0.78
5	To be sociable	0.68	0.76	0.33	0.63	0.59	0.63	0.53
11	Because it makes social gatherings more fun	1.14	1.09	0.65	1.09	0.86	0.87	0.86
14	Because it improves parties and celebrations	1.20	1.16	0.69	1.08	0.90	0.89	0.87
16	To celebrate a special occasion with friends*	0.77	0.60	0.02	0.76	0.60	0.55	0.62
1	To forget your worries	1.00	1.00	–	0.67	0.80	0.75	0.78
4	Because it helps you when you feel depressed or nervous	1.13	1.17	0.57	0.80	0.72	0.81	0.81
6	To cheer up when you are in a bad mood	1.02	1.22	0.13	0.77	0.54	0.76	0.71
15	Because you feel more self-confident and sure of yourself	0.78	0.86	0.58	0.41	0.41	0.45	0.42
17	To forget about your problems	1.23	1.28	0.60	0.82	0.87	0.85	0.86
7	Because you like the feeling	1.00	1.00	–	1.12	0.78	0.88	0.84
9	Because it's exciting	0.75	0.81	0.29	0.68	0.69	0.65	0.63
10	To get high	0.73	0.66	0.31	0.88	0.67	0.52	0.72
13	Because it gives you a pleasant feeling**	0.90	1.05	0.01	1.05	0.81	0.90	0.86
18	Because it's fun*	1.03	0.87	0.04	1.05	0.84	0.80	0.82
2	Because your friends pressure you to drink	1.00	1.00	–	0.48	0.51	0.59	0.61
8	So that others won't kid you about *not* drinking	0.71	0.81	0.27	0.55	0.62	0.64	0.74
12	To fit in with a group that you like	1.28	1.46	0.25	0.64	0.72	0.75	0.73
19	To be liked**	0.88	1.29	0.03	0.51	0.75	0.76	0.79
20	So you won't feel left out**	0.96	1.72	<0.01	0.62	0.72	0.89	0.78

Note. Items marked with a * or ** reflect significant differences between US and Portuguese samples on that item. * $p < 0.05$, ** $p < 0.01$. Five of 20 items differed across samples.

variables and across groups. All coefficients were statistically different from zero at $p < 0.0001$.

Enhancement motives were the only significant predictor of the latent alcohol consumption variable for both the US and Portuguese student samples (See Table 4). Multicollinearity may have masked the relationship between the remaining drinking motives and alcohol consumption since all four motives were evaluated in a single model.

Separate models in which each motive was evaluated separately, adjusted only for age and sex, showed each motive to be significantly related to alcohol consumption ($p < 0.001$ for both US and Portuguese social, coping, and enhancement motives. For conformity motives $p = 0.013$ for the Portuguese and $p = 0.042$ for the US). Participants' sex significantly predicted alcohol consumption at approximately the same level in both samples. In both the US and Portugal, males demonstrated greater alcohol consumption than females.

4. Discussion

In this study we assessed the invariance of the factor structure of the DMQ-R, as well as the ranking of drinking motives and their associations with alcohol consumption among groups of college/university students from the US and Portugal. As expected, the 4-factor structure demonstrated an adequate fit to the data for participants from both countries and all factor loadings were significantly associated with their designated latent factor. We found strong forms of invariance, demonstrating configural, metric, and factor variance and covariance invariance for the DMQ-R across US and PT samples. We were not able to demonstrate the most stringent form of invariance, indicator residual variance (error) invariance, yet this is not uncommon (Vandenberg & Lance, 2000). Further, invariance of the rank order of the four drinking motives was found, along with equivalence of the associations between drinking motives and the latent alcohol consumption variable and its three indices of consumption (i.e., peak drinks, drinks per week, and binge drinking).

The statistical evidence supporting measurement invariance in the current study is remarkably similar to that reported by Kuntsche et al. (2008) in a cross-national comparison of adolescents from three countries. Strong evidence of invariance across the US and Portuguese samples assessed here allows us to conclude that the DMQ-R measures the same latent drinking motives constructs for each of these two cultures. Further, we can conclude that the mean differences in drinking motives we observed between samples, as well as any differences in associations between motives and alcohol outcomes we may observe in the future, are true differences in the constructs and associations between constructs, not underlying differences in the measurement of drinking motives across groups. Findings of invariance across US and Portuguese college students also extends previous evaluations of the psychometric properties, including invariance, of the DMQ-R among Hungarian and Spanish college students (Németh et al., 2011), Brazilian college students (Hauck-Filho, Teixeira, & Cooper, 2012), and among various racial/ethnic groups within countries (Cooper, 1994; Theakston, Stewart, Dawson, Knowlden-Loewen, & Lehman, 2004).

The differences in mean levels of each drinking motive latent variable differed significantly across our two national samples, which is a similar outcome to other cross-national tests of invariance (see for example, Kuntsche et al., 2008, and Kuntsche et al., 2014). The US participants had significantly higher mean levels of the four drinking motives than the Portuguese participants. In addition to these differences, the rank order of latent variables was the same across US and Portuguese students. Both samples endorsed drinking for social motives most

Table 2
Multiple group CFA Model Tests of measurement invariance for US and Portuguese samples.

Model and constraints	χ^2	*df*	*p*	*RMSEA*	RMSEA CI_{90}	CFI	ΔCFI
All parameters freely estimated (configural baseline)	1517.86	328	<0.001	0.086	0.082–0.090	0.888	–
Factor *loadings* constrained (weak invariance)	1591.90	344	<0.001	0.096	0.082–0.090	0.882	−0.006
Factor loadings and *intercepts* constrained (strong invariance)	2180.97	364	<0.001	0.101	0.097–0.105	0.829	−0.053
Factor loadings, intercepts & *factor variances* constrained	2298.47	368	<0.001	0.104	0.099–0.107	0.817	−0.012
Factor loadings, intercepts, factor variances and *factor covariances* constrained	2358.91	374	<0.001	0.104	0.100–0.108	0.813	−0.004
Factor loadings, intercepts, error variances, factor covariances & *factor variances* constrained	2793.85	394	<0.001	0.111	0.107–0.115	0.774	−0.039

Note. ΔCFI is the change in CFI between the constrained model and the freely estimated model. A change of less than −0.01 is considered evidence of invariance (Cheung & Rensvold, 2002).

Table 3
Latent variable mean differences between US and Portuguese samples.

Latent variable	$\mu_{US} - \mu_{PT}$	SE	Wald test	*p*-Value
Social	1.014	0.067	15.19	<0.001
Coping	0.350	0.050	7.07	<0.001
Enhancement	1.220	0.072	17.01	<0.001
Conformity	0.220	0.031	51.41	<0.001

Note. All tests are normal Z tests. Positive mean differences imply that the US latent variable mean is higher than the Portuguese latent variable mean.

frequently, followed by enhancement, coping, and conformity motives in that order. These findings are consistent with findings among diverse adolescents and college students across the US, Canada and twelve European countries (Kuntsche et al., 2008; Kuntsche et al., 2014; Neighbors, Larimer, Geisner, & Knee, 2004).

Finally, results of tests of associations between motives and drinking behaviors across cultures supported the convergent validity and invariance of the DMQ-R across our samples of US and Portuguese students. The standardized factor loadings of peak drinking, drinks per week, and binge drinking on the latent variable of alcohol consumption were similar across variables and across national groups. Further, separate analyses of each motive independent of the others yielded significant relationships between each of the four motives and alcohol consumption for both national groups.

4.1. Limitations

The most obvious limitation of the present study is the cross-sectional nature of the data that precludes causal conclusions. Data were collected from two samples of convenience, hence, there is a potential for self-selection bias. The self-report nature of the data subjects it to recall bias. However, self-report measures of alcohol consumption are considered generally reliable (Babor, Steinberg, Anton, & del Boca, 2000; Miller et al., 2002). Similar, yet slightly different, self-report methods were used to collect data in the US versus Portugal. Although rigorous translation, back- translation processes were used to translate English language measures for the Portuguese participants, it is possible that results may have been influenced by methodological differences between the two samples.

Table 4
Multivariate SEM regression model predicting a latent variable of alcohol consumption from drinking motives.

Alcohol consumption latent variable regressed on drinking motives	Standardized coefficient (γ)	Standard Error	*Z*	*p*
US sample				
Social → alcohol	.089	.075	1.19	.235
Coping → alcohol	.068	.052	1.29	.196
Enhancement → alcohol	.380	.072	5.26	<.001
Conformity → alcohol	.005	.051	0.10	.924
Age → alcohol	−0.027	.041	−0.66	.509
Sex → alcohol	−0.272	.041	−6.66	<.001
Portuguese sample				
Social → alcohol	.070	.130	0.54	.588
Coping → alcohol	.062	.053	1.18	.238
Enhancement → alcohol	.370	.127	2.90	.004
Conformity → alcohol	−.008	.053	−0.15	.884
Age → alcohol	−.017	.042	−0.41	.688
Sex → alcohol	−.260	.043	−6.01	<.001

4.2. Clinical implications and future research directions

The similarities between the factor structure, rank ordering of drinking motives, and associations between motives and various forms of alcohol use across our distinct samples is striking considering the vast differences in geographic location, drinking and university cultures, legal drinking age and methodology between the two samples. Similarities in drinking motives and drinking behaviors despite the aforementioned differences found in our study and other cross-national studies of college students seems to speak to a global influence of alcohol on motivations and behaviors regardless of age, gender, race/ethnicity or national origin.

Our findings of invariance of the DMQ-R lends support for use of the instrument with college students from the US and Portugal for both clinical and research purposes. Clinically, the measure could be used as part of motivational interviewing-based brief, personalized, normative feedback prevention and intervention programs commonly and effectively to reduce alcohol use among college students (Cronce & Larimer, 2011; Larimer & Cronce, 2007). The DMQ-R could be used to assess and provide feedback on US and Portuguese participants' motives

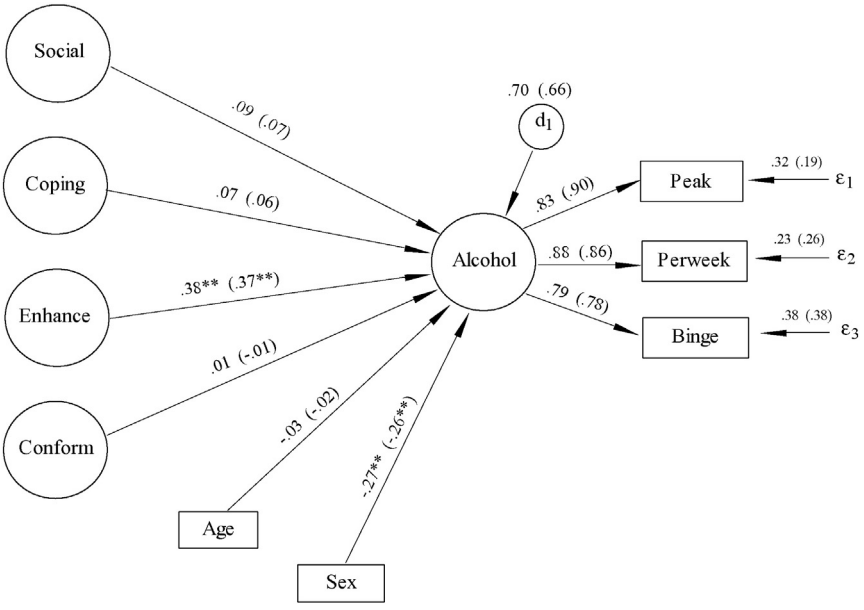

Fig. 2. Multivariate regression of drinking behaviors latent variable on drinking motives, age and sex. Portuguese estimates are in parentheses. Significance levels denoted as ** $p < .01$. All estimates are standardized. The measured indicators of the drinking motives latent variables are not displayed here to reduce congestion of the diagram. The standardized factor loadings for drinking motives items are shown in Table 1.

for alcohol use, similar to the program for Canadian adolescents developed by Conrod et al. (2013). Evidence of convergent validity found in the present study suggest that prevention/intervention programs that could reduce any of the four motives may lead to reductions in drinks per week, peak drinks, and binge drinking episodes. This study and several others (Kuntsche et al., 2008, 2014; Theakston et al., 2004; Hauck-Filho et al., 2012) provide evidence of invariance of the DMQ-R among Western nations. An important area of future research is to test the invariance of this measure in developing countries.

In conclusion, results of the present study support the factorial invariance and convergent validity of the DMQ-R across US and Portuguese college students, making it a trustworthy means of assessing college students' drinking motives. Given these results, college student alcohol interventions incorporating assessment and feedback on drinking motives may be a promising area for development and evaluation among diverse groups of students from different geographic regions. Additionally, the DMQ-R appears to be useful measure for future research assessing between- group differences in drinking motives among Portuguese and US college students.

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Contributors

Martin, Ferreira, Martins & Coelho were responsible for the study design, and data collection. Haase was responsible for data analysis. Martin, Ferreira, and Haase were responsible for writing the first draft of the manuscript. All authors contributed feedback on all drafts and approved the final draft.

Conflict of interest

All authors declare that they have no conflicts of interest.

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