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The Dimensionality of DSM5 Alcohol Use Disorder in Puerto Rico

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Abstract

Aims—The test the dimensionality and measurement properties of lifetime DSM-5 AUD criteria in a sample of adults from the metropolitan area of San Juan, Puerto Rico.

Design—Cross-sectional study with survey data collected in 2013-2014.

Setting—General population.

Participants—Random household sample of the adult population 18 to 64 years of age in San Juan, Puerto Rico (N=1510; lifetime drinker N=1107).

Measurement—DSM-5 alcohol use disorder (2 or more criteria present in 12 months).

Results—Lifetime reports of AUD criteria were consistent with a one-dimensional model. Scalar measurement invariance was observed across gender, but measurement parameters for tolerance varied across age, with younger ages showing a lower threshold and steeper loading.

Conclusions—Results provide support for a unidimensional DSM-5 AUD construct in a sample from a Latin American country.

Keywords

DSM-5; dimensionality; Puerto Rico

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Contributors

Raul Caetano and Glorisa Canino designed the study. Glorisa Canino and Katyana Santiago conducted data collection and implementation of the diagnostic procedures in Puerto Rico. Raul Caetano, Patrice Vaeth and Glorisa Canino wrote the manuscript. All authors contributed to the interpretation of results and discussion.

Conflict of Interest

All authors declare that they have no conflicts of interest.

1. Introduction

Recent research on DSM-5 alcohol use disorder (AUD) criteria lacks focus on assessments of the dimensionality of this new formulation in Latin American cultures. Only one study has reported on the dimensionality of DSM-5 AUD in Latin America, confirming a unidimensional structure in a sample of Sao Paulo, Brazil (Castaldelli-Maia et al., 2015). This is important because the frequency with which different alcohol dependence indicators occur and the interpretation of particular dependence indicators varies across cultures (Bennett et al., 1993; Caetano et al., 1999; Room, 1991; Schmidt and Room, 1999). For example, research on the cross-cultural applicability of ICD-10 and DSM-III-R concepts of alcohol dependence showed that tolerance to alcohol was viewed positively in Mexico (Schmidt and Room, 1999). Compulsion to drink and craving were recognized, but were seen as synonyms for dependence or impaired control. Analysis of data from patient samples in the U.S. and Mexico indicated that whereas a unidimensional model of AUD fit data for Mexican Americans in the U.S., it did not for Mexicans in Mexico (Caetano and Schafer, 1996). Cherpitel et al. (2010) reported support for a unidimensional representation of AUDs in emergency room samples from four countries (U.S., Argentina, Mexico and Poland), but significant differential item functioning was also reported for several diagnostic criteria (including craving).

A consistent finding in recent studies of DSM-IV alcohol abuse and dependence measures is that a single dimension of variation can parsimoniously explain observed correlations among criteria (Martin et al., 2006; Saha et al., 2006; Saha et al., 2007; Slade et al., 2009). For instance, using taxometric analysis, Slade et al. (2009) argued for a unidimensional structure for DSM-IV indicators of abuse and dependence in Australia. Saha et al. (2006; 2007) reported support for one-dimensional models on the basis of exploratory and confirmatory factor analysis and item response theory (IRT). Langenbucher et al. (2004) and Ray et al. (2008) reported results consistent with these previous findings, using similar analytic approaches. In contrast, Kerridge et al. (2013) reported a hybrid taxonic-dimensional structure for DSM-IV and DSM-5, depending on whether a 4+ or 3+ threshold, respectively, was used for a positive diagnosis. However, 2 recent papers examining orphans under DSM-5 in the U.S. general population (Agrawal et al., 2011) and in a sample of college students (Hagman et al., 2014) reported that the new diagnostic criteria incorporates as positives many individuals that were previously categorized as orphans.

The objective of this paper is to test the dimensionality and measurement properties of lifetime DSM-5 AUD criteria in a sample of adults from the metropolitan area of San Juan, Puerto Rico. Factors such as attitudes, alcohol expectancies, and reactions from families and friends may influence symptom reporting, working to shield drinkers from negative consequences associated with excessive alcohol intake. Liberal alcohol-related attitudes in Puerto Rico (Bird et al., 2006; Canino et al., 1993; Canino et al., 1992; Warner et al., 2001) could delay the recognition of indicators of abuse and dependence as well as act selectively, increasing the likelihood of identification of some indicators (e.g., withdrawal) over others (e.g., failure to fulfill major roles).

2. Method

2.1 Sample and Procedure

Between May 2013 and October of 2014, trained interviewers administered a Computer Assisted Personal Interview (CAPI) covering alcohol use and associated behaviors to 1510 adult residents of the metropolitan area of San Juan, Puerto Rico. The present analyses are restricted to individuals who reported consuming 12 or more drinks during at least one year of any year of their life ($N=1107$). A standard drink was defined as a 5 ounce glass of table wine, a 12 ounce can of beer, or a 1.5 ounce shot of spirits (a U.S. fluid ounce is equal to 29.6 milliliters). Using a multistage cluster sampling procedure, 220 primary sampling units (PSUs; Census Block Groups) were first divided into segments of 10 households. One segment was randomly selected from each PSU. All household in the selected segment were then screened, and a Kish table (Kish, 1949) was used to randomly select one member of each household to receive the CAPI interview. The survey response rate was 83%. All respondents consisted of Spanish-speaking, self-identified Puerto Ricans aged 18 or older who had no incapacitating cognitive impairment. The pre-programmed CAPI interview instrument was developed in Spanish by the study's principal investigators (Caetano, Canino) and lasted for approximately one hour within the respondent's home. All respondents provided written, informed consent and received \$25 compensation for participating. The study was approved by the Committee for the Protection of Human Subjects at the University of Texas Houston Health Science Center and the University of Puerto Rico.

2.2 Measures

2.2.1 DSM-5 lifetime alcohol use disorder criteria—All 11 of the DSM-5 AUD criteria (American Psychiatric Association, 2013) were assessed using the Spanish version of the World Health Organization's Composite Diagnostic Interview (CIDI). To date the CIDI has not been fully adapted to DSM-5. Rather than considering separately the two DSM-IV disorders of alcohol abuse and dependence, all criteria for these two categories in DSM-IV were considered together, with any two or more of 11 indicators need to be met within a period of 12 months for a positive diagnosis. In addition, DSM-5 eliminated the legal problems criteria, while adding a craving criterion that was already measured in the CIDI. These changes were followed to achieve a positive diagnosis of DSM-5 alcohol use disorder.

The CIDI was originally translated from English and adapted for use in Spanish speaking populations following the cultural adaptation model described by Alegria et al. (2004) that emphasizes cross-cultural equivalence across five dimensions: semantic, content, technical, criterion and conceptual. This version of the instrument exhibits adequate concordance with the Structured Clinical Interview for Axis 1 Disorders (SCID) ($\kappa=.51$; specificity=.82 for lifetime substance use disorders (Alegria et al., 2009). According to DSM-5 criteria, those who experience 2 or more criteria within a one-year timeframe are considered positive for DSM-5 AUD.

2.2.2 Sociodemographic characteristics—Additional variables included in regression models included self-reported age, gender, and marital status. Annual household income was measured as a 4-category variable, derived from a 12-category measure ranging from “under \$4,000” to “over \$100,000”. Employment status was assessed as a categorical variable with groups defined as a) unemployed, b) under-employed (employed part time and wants more work), c) part time (and does not want more work), d) full-time, and e) not in the workforce (e.g., retired, homemakers, students, disabled). A four-level education variable distinguished individuals who a) did not obtain a high school diploma, b) received a high school diploma, c) attended some college or technical/vocational school, or d) received a college degree.

2.2.3 Statistical analyses—All analyses accounted for the complex sampling design of the study. Tabulations and regression models were estimated using Stata 13.1 (StataCorp., 2015). Factor analyses were conducted with Mplus 7.2 (Muthén and Muthén, 2012). The dichotomous criteria were accommodated by using Mplus’ mean and variance-adjusted weighted least squares estimator (WLSMV), which provides factor loadings in a probit metric. In initial exploratory models, one, two, and three-dimensional solutions were examined. Multidimensional solutions were rotated using Mplus’ oblique rotation algorithm GEOMIN. Dimensionality was assessed by considering the ratio of the first to second eigenvalues and the theoretical sensibility of the rotated solutions. Based on the exploratory results and past findings, a confirmatory model was then estimated for the purposes of testing invariance (Vanderberg and Lance, 2000) of the measurement model across age groups (18-29, 30-39, 40-49, and 50+) and gender. Using multiple-group analyses, scalar invariance was tested by computing a scaled χ^2 difference test (Satorra and Bentler, 2001) that contrasted a configural model (loadings and thresholds vary across groups) with a scalar-invariance model (loadings and thresholds constrained to equality across groups). Because the criteria are dichotomous, loadings and thresholds are functions of one another and were therefore freed or constrained in tandem (consequently, no tests of metric invariance are reported). If the difference test was significant, modification index (MIs) for the loading/threshold parameters were consulted for extreme values (>10), and the group equality constraint on the corresponding parameter was relaxed. This process was repeated sequentially until the difference test was no longer significant or no extreme MIs remained.

3. Results

3.1 Dimensionality of the DSM-5 AUD criteria

An exploratory factor analysis showed that the first two eigenvalues of the 11 lifetime criteria were 7.85 and .66, forming a ratio of 11.8. In Table 1, obliquely rotated two and three-factor solutions are shown. The second factor of the two-factor solution was a single factor comprised of one criterion, quit/cut down. The second factor of the three-factor solution had some resemblance to DSM-IV abuse: Of the four criteria that loaded on this factor, three constitute all DSM-IV abuse criteria that were retained in the DSM-5 AUD definition (legal problems was dropped). However, two of those items cross-load on the first dimension, and the larger/longer criterion also loaded on this factor. In addition, factors 1 and 2 from the two factor solution correlated highly ($r=.83$), a common finding in

psychometric studies of diagnostic criteria for AUDs. The third factor in this solution was also a single factor, defined by larger/longer.

Parameter estimates from a confirmatory one-factor specification of the measurement model are shown in Table 2. Tolerance and craving each showed acceptable but comparatively weak loadings/discriminations relative to other criteria. Giving up activities to drink was the most discriminating criterion. The lowest threshold/difficulty was seen for drinking larger/longer than intended; whereas the highest was seen for time spent using/obtaining alcohol. The threshold for craving was among the moderate to high values.

Fit statistics and tests of measurement invariance for multi-group versions of this model are shown in Table 3. Constraining loadings and thresholds to equality across gender did not significantly degrade model fit, but imposing this constraint across age groups did. The largest modification indices in this model were the loading ($MI = 10.7$) and threshold ($MI = 10.6$) for tolerance. Consequently, we re-specified the model with no equality constraints on these two tolerance parameters. In this partially invariant model, the loading for tolerance was stronger (more positive) for young adults (18-29) compared to other age groups, and the threshold was higher for older adults (50+).

Table 4 shows the prevalence of each criterion among individuals who reported one, two or more, and any (1-11) lifetime criteria. Although there was some shuffling of moderately and infrequently endorsed criteria, the rank-ordering of prevalence was largely consistent across all three groups. Larger/longer and hazardous use were consistently the most frequently reported criteria, whereas time spent using/obtaining alcohol was consistently the least prevalent.

4. Discussion

This paper tested the dimensionality and measurement properties of lifetime DSM-5 AUD criteria in a sample of adults from the metropolitan area of San Juan, Puerto Rico, confirming a unidimensional structure of AUD criteria in the sample. This is consistent with many recent factor analytic studies of AUD symptomatology in other populations, (Castaldelli-Maia et al., 2015; Ray et al., 2008; Saha et al., 2006; Saha et al., 2007; Slade et al., 2009),.

The symptom profile for DSM-5 positive individuals in Puerto Rico also has some similarities with previously reported profiles in the literature. For instance, the most commonly reported symptoms in Puerto Rico for those with 2 or more symptoms were hazardous use, drinking larger quantities and for a longer period of time than planned, trying to quit and cut down, and failing to fulfill roles and obligations (Table 4). The first three of these four criteria were also the most frequent among respondents in at least three samples of the U.S. adult population (Agrawal et al., 2011; Caetano et al., 2011; Haeny et al., 2014). Drinking larger quantities and for and longer time than planned plus time spent on drinking related activities were also common in a sample in Germany (Steppan et al., 2014). However, there were also differences in symptom profile across these studies. For example, failing to fulfill role obligations was common in Puerto Rico but not in other countries. The

same is true for tolerance, which was reported by 39% of a German sample (Steppan et al., 2014), 69% of an American sample of young adults in college (Hagman et al., 2014), and by 40.8% of American adults with persistent AUD in a national sample (Agrawal et al., 2011).

It is important to highlight the study by Castaldelli-Maia et al. (2015), because this seems the only other analysis of DSM-5 unidimensionality outside the U.S. This study too was conducted in a large metropolitan area, the city of Sao Paulo, Brazil. Castaldelli-Maia et al. did not report the proportion of respondents reporting specific AUD indicators in their sample, but they reported discriminations and thresholds. Giving up activities was the most discriminating symptom in Puerto Rico, and the second most in Sao Paulo. In this latter sample the item with the highest discriminating value was time spent drinking. However, tolerance and craving had relatively weak discriminating values both in Puerto Rico and Sao Paulo. In light of all these results it would seem that although different samples in different countries can present unidimensional structures for AUD, this does not guarantee that symptom profiles among AUD positive individuals and the discrimination strength of different AUD criteria will not vary from place to place, and within a place from sample to sample. For instance, Steppan et al. (2014) reported that unidimensionality of alcohol use disorder was dependent on sample selection in Germany. In analyses conducted on individuals reporting at least one criterion, unidimensionality was generally supported. However, when analyses included individuals who did not report any criteria a two dimensional model of abuse and dependence was confirmed. It is possible that, as briefly reviewed in the Introduction, these differences are due to cultural influences on symptom recognition and society's reaction to drinking.

The finding of scalar measurement invariance across gender indicates that once the influence of a single common factor is taken into account, males and females do not differ on any criterion (in loadings/discriminations or in thresholds/difficulties). This could be due to the fact that all respondents in the analysis reported drinking at least 12 drinks in some year of their lives, which could increase homogeneity across genders. It could also be inherent to Puerto Rico, which is a relatively small island with a relatively homogeneous culture. Age differences were however observed in parameters for the tolerance criterion. The nature of the threshold difference – higher at older ages – makes sense with respect to previous findings and theory. Young adults are known to report tolerance (and other criteria) for reasons that may not be truly connected with an underlying AUD (Chung et al., 2001).

Strengths of the present study include its sampling methodology, which consisted of a random sample of the adult population of San Juan, Puerto Rico, face to face meetings with respondents, and use of state of the art interviewing procedures. The study also had a high response rate of 83%. As noted in the introduction, this is also one of the first large-scale study of AUD symptomatology in a Hispanic or Latin American country. Limitations of the study include the use of self-reports, which may lead to the under-reporting of alcohol consumption and other information. Also, the use of standardized psychiatric schedules such as the CIDI to diagnose alcohol use disorder has also come under increasing criticism (Caetano and Babor, 2006; Pabst et al., 2012; Slade et al., 2013). In conclusion, a

unidimensional structure fits data on DSM-5 AUD in Puerto Rico, confirming thus the potential cross-cultural validity of this concept. Other tests in other cultures are still needed.

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Highlights

- This was the first test of DSM-5 unidimensionality in a Spanish-speaking country of Latin America.
- DSM-5 alcohol use disorder has a unidimensional structure in Puerto Rico,
- There were no gender differences in any DSM criterion.
- The tolerance criterion had a higher threshold presence at older ages.

Table 1

Oblique solutions from an exploratory factor analysis of 11 DSM-5 AUD criteria.

	1-factor	2-factor		3-factor		
		1	2	1	2	3
Pattern coefficients						
Obligations	.837	.908		.448	.490	
Social	.820	.841		.424	.447	
Hazardous use	.779	.832			.879	
Craving	.753	.689		.705		
Tolerance	.749	.744		.457		
Withdrawal	.838	.803		1.14		
Larger/longer	.852	.776			.702	.717
Quit/cut	.878	.769	.428	.764		
Time spent	.878	.881		.905		
Activities	.905	.912		.924		
Health	.874	.865		.907		
Factor correlations						
1			.19		.83	.28
2						.08
Structural coefficients						
Obligations		.861	-.079	.823	.852	.058
Social		.827	.079	.798	.799	.170
Hazardous use		.801	-.006	.734	.884	.079
Craving		.737	.387	.752	.586	.402
Tolerance		.748	.162	.731	.685	.246
Withdrawal		.830	.294	.866	.611	.300
Larger/longer		.828	.422	.784	.760	.773
Quit/cut		.850	.573	.854	.662	.517
Time spent		.880	.162	.893	.749	.194
Activities		.907	.145	.919	.784	.159
Health		.873	.207	.886	.730	.232

Note. Loadings are shown that exceeded an absolute value of .40. All depicted loadings differed significantly from zero ($p < .05$). An orthogonal 2-factor solution differed in no substantive way from the 2-factor oblique solution. The first two eigenvalues from the initial extraction were 7.85 and 0.66 (ratio: 11.8).

Table 2

One-dimensional confirmatory model.

Criterion	Loadings/ Discriminations	Thresholds	Difficulties
Obligations	1.53	1.70	1.11
Social	1.43	2.36	1.65
Hazardous use	1.24	.97	.78
Craving	1.14	1.77	1.55
Tolerance	1.13	1.65	1.46
Withdrawal	1.54	2.39	1.55
Larger/longer	1.63	.55	.34
Quit/cut	1.83	2.01	1.10
Time spent	1.84	3.24	1.77
Activities	2.13	3.15	1.48
Health	1.79	2.57	1.43

Note. Parameters are shown for factor analytic (loadings, thresholds) and IRT (discriminations, difficulties) parameterizations of the same model. Loadings happen to equal discriminations because the factor was scaled with a unit variance (rather than unit loading) constraint. Model fit indices were: $\chi^2(44)=109.6$, CFI=.99, TLI=.99, RMSEA=.037. All estimates differed significantly from zero ($p<.001$).

Table 3

Measurement invariance tests of DSM-5 AUD criteria.

Grouping variable/Model	Parameters	Model					Difference tests		
		χ^2	df	CFI	TLI	RMSEA	χ^2	df	P
Gender									
Configural	44	148.3	88	.990	.987	.035			
Scalar	35	158.5	97	.990	.988	.034	14.3	9	.1134
Age									
Configural	88	242.2	176	.993	.991	.037			
Scalar	61	279.4	203	.992	.991	.037	44.6	27	.0177
Partially invariant	64	265.1	200	.993	.992	.034			

Note. The partial invariance age model relaxed the loading and threshold for tolerance across age groups.

Table 4

Criterion prevalence among respondents who endorsed 1, 2+, or any number of lifetime criteria.

	1 Criterion			2+ Criteria			Any Criteria		
	(N=167)			(N=397)			(N=564)		
	Estimate	95% CI		Estimate	95% CI		Estimate	95% CI	
Roles/obligations	6.0	3.2	10.9	47.3	42.0	52.6	34.9	30.9	39.1
Social problems	.8	.2	3.3	24.7	20.6	29.3	17.5	14.5	21.0
Hazardous use	23.4	17.2	31.0	66.5	61.5	71.2	53.7	50.0	57.7
Craving	5.2	2.4	10.8	32.2	27.5	37.2	24.1	20.4	28.1
Tolerance	4.2	2.1	8.4	37.0	32.1	42.2	27.2	23.7	31.0
Withdrawal	2.9	1.3	6.7	26.0	20.5	32.3	19.1	14.9	24.1
Larger/longer	51.9	43.4	60.4	87.0	83.2	90.0	76.5	72.6	80.0
Quit/cut down	1.8	.5	5.6	39.0	33.0	45.4	27.8	23.3	32.9
Time spent	.3	.0	2.2	17.0	13.2	21.6	12.0	9.3	15.3
Gave up									
activities	.9	.1	6.1	25.1	19.9	31.0	17.8	14.0	22.4
Health problems	2.6	.9	6.8	28.7	23.5	34.6	20.9	16.8	25.5