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DSM-5 Alcohol Use Disorder Severity in Puerto Rico: Prevalence, Criteria Profile, and Correlates

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Abstract

Background—To examine lifetime criteria profiles and correlates of severity (mild, moderate, severe) of DSM-5 alcohol use disorders (AUD) in Puerto Rico.

Methods—Data are from a household random sample of individuals 18–64 years of age in San Juan, Puerto Rico. The survey response rate was 83%. DSM-5 AUD was identified with the Spanish version of the World Health Organization's Composite International Diagnostic Interview (CIDI). The analyses also identify correlates of each severity level using an ordered logistic regression model.

Results—The prevalence of lifetime DSM-5 AUD among men and women was 38% and 16%, respectively. Mild lifetime DSM-5 AUD was the most prevalent severity level among both men (18%) and women (9%). The most common criteria, independent of gender and severity level were drinking larger quantities and for longer than planned (men range: 80% to 97%; women range: 78% to 91%) and hazardous use (men range: 56% to 91%; women range: 42% to 74%). Results from ordered logistic regression showed that the adjusted odds ratio (AOR) for weekly drinking frequency, greater volume of alcohol consumed per drinking occasion, positive attitudes about drinking, drinking norms, and male gender invariantly increased risks across all DSM-5 AUD severity levels (mild, moderate, severe). Greater negative attitudes about drinking, low family cohesion and Protestant religion were related to greater risks at higher AUD severity levels.

Conclusions—AUD prevalence is high in San Juan, Puerto Rico. Prevalence rates for some criteria are equally high across severity levels and poorly differentiate between mild, moderate or severe DSM-5 AUD. The sociodemographic and alcohol-related risks vary across DSM-5 severity levels.

Keywords

DSM-5 AUD; severity; prevalence; correlates; Puerto Rico

Introduction

This paper examines the lifetime prevalence of DSM-5 alcohol use disorder (AUD), as well as the lifetime prevalence of the 11 DSM-5 AUD criteria by gender and severity level in San Juan, Puerto Rico. The sociodemographic and drinking correlates of the three DSM-5 AUD severity levels (Mild: 2–3 criteria present; Moderate: 4–5 criteria; Severe: 6+ criteria) are also examined. A previous paper analyzing the same data set tested the unidimensionality of the DSM-5 construct in data from Puerto Rico. The results confirmed a gender-invariant unidimensional model for the DSM-5 AUD criteria (Caetano et al., 2016d). Two other papers examined sociodemographic correlates of DSM-5 AUD but not for lifetime data and not for AUD severity levels (Caetano et al., 2016a; Caetano et al., 2016c).

There are two reasons to focus on Puerto Ricans. This Hispanic national group is the second largest in the U.S., constituting 9.5% of all U.S. Hispanics (Lopez and Patten, 2015). Second, examining the epidemiology of drinking and the characteristics of AUD in Puerto Rico may help address drinking problems on the island and may also help better understand drinking by Puerto Ricans on the U.S. mainland. Puerto Ricans living in the U.S. continent have some of the highest rates of drinking, binge drinking and AUD compared to other U.S. Hispanic national groups (Caetano et al., 2008; Ramisetty-Mikler et al., 2010; Rios-Bedoya and Freile-Salinas, 2014).

Given that this paper focuses on DSM-5 AUD severity levels, it is important to recognize that these severity levels are not uncontroversial. Using criteria counts to determine severity levels has supporters (e.g., Dawson and Grant, (2010) and critics. Among the latter, some have argued that simply counting criteria to determine severity ignores criteria heterogeneity (e.g. some are physiological in nature, some are behavioral), criterion-specific severity (e.g., withdrawal symptoms no matter how mild indicate serious AUD), and variations in criteria combination that have implications for measured severity (Lane and Sher, 2015). Others have argued that requiring just two criteria out of 11 to be positive for a positive diagnosis of AUD is too lenient as a cut-off point (Martin et al., 2011). Finally, the strict categorical approach to AUD severity classification in the DSM-5 has also been criticized (Helzer et al., 2006; Muthen, 2006), with suggestions that a hybrid dimensional-categorical model fit AUD severity better and provides a better indication of clinical course (Kerridge et al., 2013; Fazzino et al., 2014).

Nevertheless, DSM-5 officially proposes three severity levels for AUD, and thus they are examined in this paper with the aim of expanding understanding of these severity categories by examining their prevalence and correlates in a setting outside the U.S. mainland. Differences in criteria prevalence across severity levels in different cultural settings will help identify potential culture-bound aspects of DSM-5 AUD, which will aid its understanding. Such differences will also help in identifying criteria that may be seen as markers of less or more severe AUD. Finding such differences across men and women may advance

understanding of the extent to which AUD is influenced by sex-related biological and psychological characteristics. This will help in refining AUD research foci, and may lead to a better understanding of AUD treatment plans and long term clinical course.

Results from previous analyses of AUD data from Puerto Rico (Caetano et al., 2016c) and the U.S. mainland population (Grant et al., 2015; Alegria et al., 2008; Alegria et al., 2007), have identified sociodemographic (gender, age, marital status, education, religion) alcohol-related (volume of drinking, binge drinking, attitudes and norms) and family related characteristics (cohesion/support) that are associated with overall AUD. Grant et al. (2015) described correlates for DSM-5 AUD severity levels using independent logistic models to analyze data for each level. This approach to analysis does not take advantage of the ordered characteristic of data on AUD severity levels (mild, moderate, severe), as the ordinal logistic regression applied to data analysis herein. It does not therefore differentiate statistically between factors whose association varies in strength or remains constant across severity levels. Grant et al.'s results showed that the adjusted odds ratios for various predictors varied across AUD severity levels.

Based on these previous findings, it seems natural to expect that some of the variables identified in the paragraph above as significantly associated with DSM-5 AUD in the U.S. mainland may also be associated with AUD in Puerto Rico. A second observation that might follow from the previous paragraph is that different covariates might be differently related to severity levels, with some related to "mild" AUD (e.g., frequent but not heavier use) and others related to "severe" AUD (e.g., frequent and heavier use). But the field knows little about this possibility, which can be well explored in the analysis of data on DSM-5 AUD severity levels with the application of an ordered logistic regression procedure. This is examined in this paper with testing of the following hypotheses: a) lifetime DSM-5 AUD prevalence rates will be higher among men and in younger age groups; b) lifetime prevalence for all DSM-5 AUD criteria will be higher among men; c) more severe lifetime DSM-5 AUD will be positively associated with male gender, younger age, lower education, lower levels of family cohesion/support, liberal norms and positive attitudes towards alcohol use, and higher levels of alcohol consumption.

Methods

Sample and data collection

Interviews were conducted with 1,510 residents of the metropolitan area of San Juan, Puerto Rico, between May 2013 and October 2014. Respondent selection followed a multistage cluster sampling procedure, with 220 Primary Sampling Units represented by Census Block Groups. Each selected Block was divided into segments of 10 households, with a segment then randomly selected in each Block. Interviews were then carried out with a household member randomly selected using a Kish table (Kish, 1949). Eligibility was based on age (18–64 years), ability to speak Spanish, no incapacitating cognitive impairment, and self-identification as Puerto Rican. The response rate for the survey was 83%. Trained interviewers conducted Computer Assisted Personal Interviews at the respondents' home that lasted about one hour. The pre-programmed questionnaire was originally developed in Spanish by the fieldwork research team led by the Puerto Rican and U.S. Principal

Investigators (GC, RC), both Spanish-speakers. Respondents received a \$25 incentive for participation and provided written informed consent. The survey was approved by the Committee for the Protection of Human Subjects of the University of Texas Houston Health Science Center and the University of Puerto Rico.

Measurements

Weekly frequency of drinking—Respondents were asked for the overall frequency with which they drank “any kind of beverage containing alcohol.” Eleven categories were offered, ranging from “3 or more times a day” to “never.” Each category was coded to a 7-day frame. So, 3 or more times a day represents 21 occasions (7×3), 1 to 2 times a day represents 10.5 occasions (1.5×7), and so on.

Average number of drinks per week—This was based on the self-reported frequency and quantity of drinking (in standard drinks, i.e., a 5-ounce glass of table wine, a 12-ounce can of beer, a 1.5 ounce shots of spirits) any type of alcohol in the past 12 months, and was estimated using the “graduated frequencies” method (Greenfield and Kerr, 2008; Clark and Hilton, 1991). Values for this variable ranged from 0 (among abstainers) to 91 drinks per week.

Alcohol use disorder—Based on DSM-5 criteria for AUD (American Psychiatric Association, 2013) implemented with the Spanish version of the World Health Organization’s Composite Diagnostic Interview (CIDI). The instrument was translated from English and adapted for use in Spanish speaking populations following a cultural adaptation model described by Alegria et al. (2004). The Spanish version of the instrument has adequate concordance in clinical reappraisal studies with the Structured Clinical Interview for Axis I Disorders (SCID) ($\kappa = .51$; specificity = .82 for lifetime substance use disorders and .67 for major depressive episode) (Alegria et al., 2009). According to DSM-5 criteria, respondents reporting the presence of two or more indicators in a 12-month period during their lifetime are identified as positive for lifetime or past 12-month DSM-5 AUD, respectively. Severity levels in DSM-5 are defined by the number of indicators present in a 12-month span, as follows: mild (2–3 indicators), moderate (4–5 indicators), severe (6 or more indicators).

Positive and negative attitudes toward drinking and drunkenness—Alcohol attitudes were measured with eight positive items (e.g., “having a drink is one of the pleasures of life”; $\alpha = 0.60$) and 4 negative items (e.g., “alcohol brings out the worst in people”; $\alpha = 0.69$), scored on binary agree–disagree scales. Higher scores indicate more positive and more negative attitudes, respectively. A higher score on the items on positive attitudes has been positively associated with the average number of drinks consumed per week and binge drinking in Puerto Rico (Caetano et al., 2016b)

Drinking norms—Drinking norms were assessed with nine items regarding whether drinking is considered acceptable in various circumstances (e.g., with friends at home, with coworkers out for lunch). Higher scores indicate more liberal norms. Cronbach’s alpha in the data set under analysis is .87. A higher score on these items has been previously found to be

associated with a higher volume of drinking and heavier drinking in Puerto Rico (Caetano et al., 2016a)

Family cohesion/pride—This concept was measured with a 10-item scale. Seven items are from Olson's (1986) Family Environment Scale and two others are from Olson's (1986) Family Cohesion Scale (see also, (Rivera et al., 2008; Canino et al., 2008). Cronbach's alpha for the scale is .93. For ease of interpretation, this variable was divided into three categories: high, medium and low cohesion. A total of 41% of the sample had a score of 40, the highest possible score for the scale, and categorized as high cohesion/pride (reference). Scale scores for the rest of the sample were then evenly split, with the lower half labeled low cohesion and the upper half labeled medium cohesion.

Sociodemographic variables—*Gender*. A dichotomous variable coded as male and female (reference) *Age*. The age of respondents was used as a categorical variable: 18–29, 30–39, 40–49, and 50 years and older (reference). *Level of education*. Respondents were categorized into four education categories: a) less than high school; b) completed high school or GED; c) some college or technical or vocational school; d) completed 4-year college or higher (reference group). *Religion*. This variable had 4 categories: Protestant, No religious preference, Catholic (reference), Other. *Marital status*: This is a 3-category variable: a) married; b) separated or divorced, c) single. Widowers (n=33) were dropped from the analyses because 23 had no AUD, which created estimation problems in the multivariate analysis.

Statistical analyses

Cross-tabulations in Tables 1 and 2 were conducted using Stata 14.2 “svy” prefix (Stata, 2015). Analyses were conducted on data weighted to correct for unequal probabilities of selection into the sample. In addition, a post-stratification weight was applied, which corrected for nonresponse and adjusted the sample to known population distributions on certain demographic variables (age and gender). Associations in bivariate analyses (Tables 1 and 2) were tested with chi-square tests with level of statistical significance adjusted using a Bonferroni correction. This indicated that significance levels for Table 1 should be $.05/8 = p < .006$, and for Table 2 $.05/22 = p < .002$. Significance levels for tests contrasting level of criteria endorsement for men versus women in Table 2 should be $.05/11 = .004$. Statistical significance in all tables is identified by lower case superscript “a”, “b”, “c”, and “d” as follows: a: p: ns; b: $p < .05$, c: $p < .01$, d: $p < .001$.

Effects of drinking on DSM-5 severity in multivariate analysis were assessed using a dose-response model developed by Gruenewald et al. (2010) and applied by Mair et al. (2013) and Gruenewald et al. (2014). The model assesses the effect of overall frequency of drinking as well as the effect of continued drinking volumes (the number of drinks consumed after the first drink), providing thus a measure of the risk associated with each additional drink consumed. The multivariate analysis of DSM-5 severity in Table 3 was first conducted with an ordered logistic regression under a proportional odds assumption, as implemented in Stata's “ologit” procedure. However, test results indicated that the proportional odds

assumption was violated. The likelihood-ratio test of proportionality of odds across response categories of the dependent variable was $\chi^2=88.58$ with $df=24$ and $p=.000$.

The same set of variables was then analyzed with Stata's "gologit2" procedure (Williams, 2006; Williams, 2016) using a "gsvy" prefix. This procedure uses a specialized generalized logistic model, a partial proportional odds model that frees identified variables from the constraints of the proportional odds assumption and still fits a parsimonious ordered logistic model. Variables left unconstrained were selected through an iterative process that identifies the best model that fits the data, with $p<.01$ as the level of significance for these tests, as recommended by Williams (2005) for large data sets and models with a large number of variables. Three variables were so identified, and had at least one category left unconstrained: negative attitudes about drinking, religion, and family cohesion/support. AORs in the first column of Table 3 compare no AUD versus any AUD, and represent the odds of any AUD associated with the correlate in the left most column. AORs in the second column compare no AUD plus mild AUD versus moderate and severe AUD combined, and represent the odds of this last combined category. AORs in the third column represent the odds of severe AUD only, when contrasted to all other categories combined.

Results

Sample characteristics

The sample was almost equally divided between men (46%) and women (54%). The mean age was 41.7 years (SE: .36); 51% of the respondents were Catholic and 26% were Protestants. About 54% of the sample had an annual family income below \$18,000, and only 18% reported an annual family income above \$36,000. A total of 38% of respondents had never married, 2% were widowed, and 37% were married or living with someone. About 12% were unemployed, and 58% were employed either part-time or full-time. A completed high school education was reported by 18% of the sample and 43% had a college degree. Finally, only 3% of the sample had ever lived on the U.S. mainland.

Lifetime prevalence of DSM-5 AUD by gender and age

The overall lifetime prevalence of DSM-5 AUD in the sample was 26%. About two fifths of the men had a lifetime diagnosis of DSM-5 AUD (rightmost column, Table 1). The rate of lifetime AUD was highest among men in the 30–39 year old age group, and lowest among those 40–49 years of age. However, these differences in the distribution of overall lifetime AUD rates across age groups among men were not statistically significant. Differences in rates of mild, moderate and severe AUD across age groups were not statistically significant.

In general, rates of lifetime AUD were lower among women than among men ($\chi^2=96.01$; $df=1$; $p<.001$). Almost a fifth of the women had a positive lifetime diagnosis of AUD. Women 18–29 years of age had the highest rate for overall lifetime AUD, followed by women in the 40–49 age group. These differences were statistically significant ($p<.001$). These higher rates for women in younger age groups indicate a convergence of rates for men and women in the age groups 18–39. Differences in the distribution of rates for levels of severity across age groups were not statistically significant.

Prevalence of lifetime criteria by gender and severity level

Table 2 shows the most prevalent criteria among men first, based on prevalence data in the “All” column. Data for women follows the same order from top to bottom as that for men. Among men, the two most prevalent DSM-5 criteria overall were drinking larger quantities and for a longer time than planned (larger/longer), and using alcohol in hazardous situations. The prevalence for all criteria increased as the severity of DSM-5 AUD increased. The differences in prevalence criteria across severity levels were all statistically significant ($p < .001$) after Bonferroni correction. Except for larger/longer, prevalence at the severe DSM-5 AUD level was two to twenty times higher than prevalence at the mild severity level.

Among women, data are shown with moderate and severe DSM-5 AUD combined because of small numbers in these two categories. As among men, the two most prevalent criteria among women were also larger/longer and hazardous use. With exception of craving and larger/longer, criteria prevalence also increased as DSM-5 severity increased, with all differences being statistically significant ($p < .002$ or $p < .001$) after Bonferroni correction. There were statistically significant differences in criteria endorsement between men and women for hazardous use, health problems, neglect activities and interpersonal problems. In all cases, a higher proportion of men than women endorsed these criteria.

Correlates of DSM-5 AUD severity

Table 3 shows results for three groups of variables with three different types of associations with DSM-5 AUD severity. In the first group, are variables that do not fit the proportional odds assumption in the model. The AORs for these variables are unconstrained, showing that the strength of the association with DSM-5 AUD vary across severity levels. Negative attitudes do not affect the odds of any AUD but becomes a risk factor as the severity of AUD increases from no AUD plus mild AUD contrasted to moderate/severe (AOR 2.70), and then no AUD plus mild plus moderate contrasted to severe (AOR 3.07). Low and medium family cohesion/support compared to high also increases the odds of lifetime DSM-5 AUD with varying magnitude across severity levels. Protestant religion compared to Catholic almost doubled the odds of any AUD and more than doubled the odds of moderate/severe AUD compared to no/mild AUD. Protestants are also four times more likely than Catholics to have a severe AUD compared to no/mild/moderate AUD.

For the second group of variables, the strength of the associations does not vary from one severity level to the next; but the associations are statistically significant. AORs for these variables fit the proportional odds assumption in the model and were constrained. These AORs and their 95% CI are shown for the first contrast only (No AUD versus Any AUD), but the variables are included in all models. The odds associated with the weekly drinking frequency and additional drinking volume per drinking occasion are constant across AUD severity levels. An additional drinking occasion per week increased the odds of a more severe level of AUD by about 6%. Each additional drink per drinking occasion increases the odds of a more severe level of AUD by about 5%.

The odds associated with positive attitudes about drinking and more liberal drinking norms are also invariant across AUD severity levels. Positive attitudes about drinking have the

strongest association with AUD severity among all variables in the model, increasing the likelihood of a progressively more severe level of AUD by four from no AUD to AUD, then from no/mild to moderate/severe and finally from no/mild/moderate to severe. Drinking norms have a similar association with AUD severity, doubling the odds associated with a progressively more severe AUD. Finally, male gender is also a factor of risk, and it progressively doubles the odds of a more severe AUD. The third group of variables is formed by those with associations that are not statistically significant.

Discussion

As expected, the lifetime prevalence of DSM-5 AUD was about two times higher among men than among women, a standard finding in the alcohol literature. The observed rate of lifetime AUD among men in Puerto Rico (38%) is not very different from those reported for the NESARC III by Grant et al. (2015) for men on the U.S. mainland general population (36%). The rate for women in the general population appears to be higher on the U.S. mainland than in Puerto Rico (23% vs.16%).

Comparison with DSM-5 prevalence rates from other countries is limited because of differences in sampling and diagnostic time frames. For example, 12-month time frames have been used in data from Australia, (Mewton et al., 2011b), Sweden (Lundin et al., 2015), Switzerland (Mohler-Kuo et al., 2014), and one cross-national study (Borges et al., 2011). Slade et al.'s (2016) cross-national analysis is an exception. These authors analyzed data from 9 countries participating in the World Health Organization's World Mental Health Survey Initiative. Results from all countries showed a lifetime prevalence for DSM-5 of 10.8% (mild: 5.6%; moderate: 2.3%; severe: 2.8%). Lifetime prevalence across countries varied from .9% in Iraq to 19.9% in Australia. By contrast, rates observed among Puerto Ricans in this study were much higher for both men and women.

Other results herein also exhibit effects seen in previous international studies. For example, results in Table 1 also show a convergence in lifetime DSM-5 rates between men and women in the 18–39 age group. This result replicates findings for frequency of drinking and binge drinking in Brazil (Wolle et al., 2011), for abstention rates of recent drinking and problematic drinking in Norway between 1984 and 2008 (Bratberg et al., 2016), and for overall drinking in the U.S.(Dawson et al., 2015; Keyes et al., 2011).

Comparison of island Puerto Ricans with those who moved to the U.S. mainland is difficult because published rates for this group are for lifetime or 12-month DSM-IV alcohol abuse and dependence, not DSM-5. For instance, Alegria et al. (2008) reported a rate of DSM-IV AUD of 12.6% (abuse plus dependence) for both genders combined, which is considerably lower than those reported herein. Twelve-month AUD data are not reported here, but to illustrate differences between island and mainland Puerto Ricans, a previous paper by Caetano et al. (2008) reported a 12-month DSM-IV AUD rate of 20.5% for men and 7.1% for women for mainland Puerto Ricans. On the island, men have a rate of 14%, lower than that for men on the mainland, while women have a rate similar to that of the mainland, 7.1%. Regarding endorsement of DSM-5 criteria, the proportion of men endorsing hazardous use, health problems, neglect activities and interpersonal problems was higher than the

proportion of women, and the differences were statistically significant. This may be because of heavier drinking patterns among men than among women reporting DSM-5 criteria, or because of differences in lifestyle patterns across genders. For instance, hazardous use has been frequently associated with drinking and driving, which is a behavior more common among men than among women both in the U.S. mainland and in Puerto Rico (Caetano et al., 2017; Compton and Berning, 2009). Nevertheless, these gender-related differences do not affect the unidimensionality of the DSM-5 AUD concept, which was gender invariant in data from Puerto Rico (Caetano et al., 2016d).

The two most prevalent DSM-5 criteria among both men and women were larger/longer, and hazardous use. This replicates findings from survey analyses on the U.S. mainland. Saha et al. (2006; 2007) Lane and Sher (2015), Hasin and Beseler (2009), and Caetano et al. (2011) all reported higher prevalence for larger/longer, hazardous use, cut down, and tolerance in the U.S. general population. Results in Table 2 show that the criterion larger/longer was present in 80% to 97% of the men and 78% to 91% of the women, which suggests that in Puerto Rico this criterion would not be useful in providing discrimination across severity levels. The same was true in two (1997 and 2007) Australian national samples (Mcbride et al., 2011; Mewton et al., 2011a), while in Brazil this criterion discriminated well two latent classes within the DSM-5 AUD dimension, “use in larger amounts” and “high-moderate symptomatic class,” versus a “non-symptomatic class” of past year alcohol users (Castaldelli-Maia et al., 2015).

In contrast to hazardous use and large/longer criteria, time spent was the criterion with the lowest prevalence both among men and women. This replicates findings from an analysis of samples from 5 countries (Finland, Canada, Brazil, Japan and Australia) by Preuss et al. (2014) as well as findings from Australian data by Mewton et al. (2011a). Preuss et al.’s (2014) analysis also showed that time spent had the largest severity score, which was a result also present in the analysis of Castaldelli-Maia (2015) in a sample from Brazil. This association of spent time with higher severity is reflected in the results herein by the jump in the prevalence of this criterion from the moderate group to the severe group among men, and from the mild group to the combined moderate/sever group among women. Contradictory results can be found in an analyses of emergency department samples from four countries (U.S., Mexico, Argentina, Poland) by Borges et al. (2010). Variation in the prevalence of time spent across samples was relatively large (2.9% in Poland to 17.2% in the U.S.), but none had prevalence as high as that reported herein for the severe category of DSM-5. Further, differential item functioning analyses showed that time spent had considerable heterogeneity as a severity and discrimination indicator across samples from the four countries in the study.

Correlates of AUD severity

The hypothesis that more severe DSM-5 AUD would be positively associated with male gender, younger age, lower education, lower levels of family cohesion/support, liberal norms and positive attitudes towards alcohol use, and higher levels of alcohol consumption was not confirmed. Only negative attitudes about drinking, low family cohesion/support and Protestant religion showed stronger association with severe AUD. All the other variables had

invariant association with AUD across severity levels. The magnitude of the AOR for negative attitudes about drinking increased as the level of AUD became more severe. This suggests that these attitudes may be a reaction to the negative effects of elevated levels of drinking. If negative attitudes preceded drinking, they should have a protective effect against it and thus AUD. Positive attitudes about drinking behave in the opposite way. As expected, this variable increases the risk for AUD, and the risk is invariant across severity levels. This suggests that contrary to negative attitudes, positive ones would precede drinking and are not a reaction to it. The AOR for low family cohesion/support increases as the level of AUD becomes more severe. In contrast, the AOR for medium family cohesion/support is smaller and varied only slightly across AUD severity levels. This protective effect of high levels of family cohesion/support is not unexpected given the importance of family life in Latin cultures (Sabogal et al., 1987); it has been previously reported by several authors (Ayón et al., 2010; Coohy, 2001), including previous analyses of this data set (Caetano et al., 2016a). In discussing these results, it is also important to consider the cross-sectional nature of the data, and the fact that some of the associations in Table 3 may be reciprocal. For instance, low family cohesion could both precede AUD or be one of its consequences.

The positive association between Protestant religion and severe AUD was not expected. A previous analysis of these Puerto Rican data showed that being a Protestant was protective against drinking and binge drinking, and was not associated with presence of AUD in the past 12 months (Caetano et al., 2016b; Caetano et al., 2016c). However, associations between Protestant religion and drinking are not always uniform. Some denominations emphasize abstention from alcohol, but the extent to which different denominations are proscriptive of alcohol varies. For example, Michalak et al. (2007) reported significant associations between abstention and some denominations, including, the Church of God, Assembly of God, Pentecostal and Baptist. Among drinkers, being a Baptist and Christian (no denomination) was associated with heavy drinking compared to moderate drinking. Previously, Hilton (1991) had associated conservative Protestant denominations (e.g., Baptist, Pentecostal, Assembly of God) with low prevalence of both drinking and heavy drinking.

Analyses of NESARC III data for the general population on the U.S. mainland also show variation in risk across severity levels for some variables not present herein. Examples of these are protective effects for education (less than high school and high school compared college), and increased risk for age (18–29, 45–64 compared to 65 and older), income (all income groups up to \$69,999 versus \$70,000 and more) and marital status (widowed/separated/divorced versus never married) (Grant et al., 2015).

Other variables associated with DSM-5 AUD but whose odds remained constant across severity levels were male gender, liberal drinking norms, a higher frequency of weekly drinking and increased drinking per drinking occasion. They are therefore not differentially related to severity levels and represent factors that affect overall risk for AUD. All these characteristics increased the odds of AUD at a statistically significant level, as reported previously in the literature for Puerto Rico (Caetano et al., 2016c; Caetano et al., 2016a) and the U.S. mainland (Keyes et al., 2009; Li et al., 2007; Caetano et al., 2011).

Strengths and Limitations

The study has many strengths. It analyzes a random sample of the adult population of San Juan, Puerto Rico, which was interviewed face-to-face in a survey with a particularly high response rate of 83%. Data collection covered several drinking outcomes in detail and used state of the art interviewing techniques and questions. Data analyses considered the ordered structure of DSM-5 three levels of severity.

The study also has limitations. Respondents in the sample were selected from the metropolitan area of San Juan, with no representation from rural areas and other cities in Puerto Rico. Information on AUD, drinking and other factors was self-reported, which may lead to under-reporting of alcohol consumption and other information. The study design was cross-sectional, which does not allow for assessments of temporal associations. The survey did not collect data on a measure of religiosity. This could have help explain the unexpected association between Protestant religion and severe DSM-5 AUD.

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Table 1

Prevalence of Lifetime DSM-5 AUD by Gender and Age

	Men				
	18–29 (203)	30–39 (133)	40–49 (114)	50+ (244)	All (694)
Lifetime					
All ^a	37%	48%	32%	36%	38%
Mild ^a	20%	26%	14%	15%	18%
Moderate	9%	9%	7%	8%	8%
Severe	8%	13%	12%	13%	12%
	Women				
Lifetime	(224)	(127)	(140)	(323)	(814)
All ^d	29%	13%	18%	8%	16%
Mild ^a	17%	8%	9%	5%	9%
Moderate	8%	3%	6%	2%	5%
Severe	3%	2%	4%	1%	2%

Men: All ages: $\chi^2 = 7.60$, $df = 3$, $p = ns$; ^aSeverity levels by age, $\chi^2 = 6.47$, $df = 6$, $p = ns$.Women: ^d All ages: $\chi^2 = 43.82$, $df = 3$; $p < .001$; ^a Severity levels by age $\chi^2 = 2.39$, $df = 6$, $p = ns$.Men vs. women: $\chi^2 = 96.01$, $df = 1$, $p < .001$.

Table 2

Prevalence of Lifetime Criteria by DSM-5 AUD by Gender and Severity Level.

	Men			
	Mild	Moderate	Severe	All
	(128)	(58)	(80)	(266)
Larger/Longer <i>d</i>	80%	91%	97%	87% <i>a</i>
Hazardous Use <i>d</i>	56%	90%	91%	74% <i>d</i>
Neglect Obligations <i>d</i>	22%	53%	85%	48% <i>a</i>
Quit/Cutdown <i>d</i>	17%	34%	82%	41% <i>a</i>
Tolerance <i>d</i>	20%	43%	70%	40% <i>a</i>
Craving <i>d</i>	19%	31%	65%	35% <i>a</i>
Health Problems <i>d</i>	8%	24%	76%	32% ^b
Neglect Activities <i>d</i>	8%	15%	70%	28% <i>d</i>
Interpersonal Problems <i>d</i>	6%	26%	65%	28% ^b
Withdrawal <i>d</i>	9%	19%	63%	27% <i>a</i>
Time Spent <i>d</i>	2%	14%	52%	19% <i>a</i>
	Women			
	Mild	Moderate & Severe		All
	(76)	(55)		(131)
Larger/Longer <i>a</i>	78%	91%		83%
Hazardous Use <i>c</i>	42%	74%		56%
Neglect Obligations <i>c</i>	34%	62%		46%
Quit/Cutdown <i>d</i>	20%	51%		33%
Tolerance <i>c</i>	18%	53%		33%
Craving <i>a</i>	21%	34%		27%
Health Problems <i>d</i>	4%	47%		22%
Neglect Activities <i>d</i>	0%	36%		15%
Interpersonal Problems <i>c</i>	8%	34%		19%
Withdrawal <i>c</i>	7%	42%		21%
Time Spent <i>d</i>	1%	33%		14%

^a p=ns;^c p<.01;^d p<.001.

Statistical significance superscripts in the "All" column for men indicate level of significance for differences between men and women. Superscript by each criteria label indicates chi² testing differences across severity levels

Table 3
Multivariate Ordinal Logistic Regression of Lifetime DSM-5 AUD Severity on Sociodemographic and Drinking-Related Variables

	No DSM-5 AUD versus Any AUD			No AUD plus Mild versus Moderate plus Severe			No AUD plus Mild plus Moderate versus Severe		
	AOR	95% CI		AOR	95% CI		AOR	95% CI	
Covariates:									
AOR Varies by Severity Level									
Negative Attitudes	.90	.54–1.50		2.70 ^d	1.53–4.76		3.07 ^c	1.54–6.12	
Family Cohesion (Ref: High)									
Low	2.24 ^d	1.46–3.44		3.23 ^d	1.94–5.37		3.79 ^d	2.16–6.64	
Medium	2.10 ^d	1.52–2.91		1.96 ^d	1.43–2.68		1.96 ^d	1.43–2.68	
Religion (Ref: Catholic)									
Protestant	1.87 ^d	1.30–2.69		2.33 ^d	1.46–3.72		4.01 ^d	2.31–6.96	
Other Religion	1.53	.66–3.54							
No Religion	1.36	.92–2.02							
AOR Constant by Severity Level									
Weekly drinking frequency	1.06 ^c	1.01–1.10							
Weekly continued drinking volume	1.05 ^d	1.03–1.06							
Positive Attitudes	4.68 ^d	2.01–10.91							
Drinking Norms	2.22 ^c	1.41–3.51							
Gender (Ref: Female)									
Male	2.19 ^d	1.57–3.05							
AOR Unrelated to AUD									
Marital Status (Ref: Married)									
Separated/divorced	.85	.60–1.21							
Never Married	.73	.53–1.00							
Age (Ref: 50+)									
18–29	1.26	.84–1.90							
30–39	1.16	.75–1.80							
40–49	1.18	.80–1.74							
Education (Ref: No High School)									
High School Completed	.73	.34–1.57							

Covariates:	No DSM-5 AUD versus Any AUD		No AUD plus Mild versus Moderate plus Severe		No AUD plus Mild plus Moderate versus Severe	
	AOR	95% CI	AOR	95% CI	AOR	95% CI
Some College/Technical	.97	.44–2.13				
College Degree	.90	.44–1.83				

^b p<.05;
^c p<.01;
^d p<.001.

The AORs for variables that fit the proportional odds assumption in the model are constrained and are shown only for the first contrast in the table, but these variables are included in all three contrasts.