EPIDEMIOLOGY

Assessing the Dimensionality of Lifetime DSM-IV Alcohol Use Disorders and a Quantity–Frequency Alcohol Use Criterion in the Australian Population: a Factor Mixture Modelling Approach

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Abstract — Aims: With the revision of the DSM-IV underway, two important research issues currently dominate the addiction literature: (a) how can the dimensionality of DSM-IV alcohol use disorders (AUD) diagnostic criteria best be described? and (ii) should a quantity–frequency alcohol use (QF) criterion be added to the existing diagnostic criteria set in the DSM-V? The current study addressed these aims by analysing lifetime data from a recent Australian population survey. Methods: Data from adults screened for lifetime DSM-IV AUD in the 2007 National Survey on Mental Health and Wellbeing (NSMHWB) were analysed (n = 5409). A series of alternative factor analytic, latent class and factor mixture or ‘hybrid’ models were used to assess the dimensionality of lifetime DSM-IV AUD diagnostic criteria and a lifetime QF criterion. Results: Examination of the goodness-of-fit indices revealed that a one-factor or a two-factor model, a three-class latent class model or a two-factor zero-class hybrid model, were all acceptable models for the data. A simple structure one-factor model was considered to be the most parsimonious and theoretically meaningful model, given the high correlation between the abuse and dependence factors (0.874) in the two-factor model. The inclusion of the QF criterion did not enhance the fit of the one-factor model. Conclusions: Incorporating both dimensional and categorical conceptions of lifetime AUD did not provide substantial gains over a simple structure unidimensional model of AUD severity. The utility of a QF use criterion in helping to diagnose AUD is questionable. These findings should be of relevance to the DSM-5 substance use disorder workgroup.

INTRODUCTION

With the next edition of the Diagnostic and Statistical Manual for Mental Disorders (DSM) due for release in 2013, a research agenda to help inform the revision of the DSM-IV (American Psychiatric Association, 1994) alcohol use disorder (AUD) diagnostic criteria was established recently (Kupfer et al., 2002; Saunders and Schuckit, 2006). The aim of this agenda was to review the literature to highlight important areas for research that could be addressed using existing epidemiological data sets (Cottler and Grant, 2006; Schuckit and Saunders, 2006). Two major issues identified in this agenda, which are frequently debated within the field, include: (a) the dimensionality of the diagnostic criteria for AUD and (b) whether a new diagnostic criterion, pertaining to quantity and frequency of alcohol use (QF), could be useful in assessing for the presence of AUD.

The first issue, which contemplates whether AUD should be viewed as a categorical or dimensional entity, has its roots in the psychiatric literature. Clinicians argue that a categorical approach to diagnosis is important for determining a treatment plan and for the reimbursement of costs relating to treatment. Researchers tend to advocate a dimensional approach to diagnosis because they work in situations where a quantitative score is more useful (Muthén, 2006). To date, numerous empirical studies have been conducted, using a variety of statistical techniques, to contribute to this debate. Factor analytical (FA) approaches are useful for studying continuous latent variables or underlying dimensions (Muthén, 2006). Several FA studies have reported evidence of two or more separate, but related factors, which appear to reflect alcohol abuse and dependence (Grant et al., 2007; Muthén et al., 1993a,b; Muthén, 1995). Other studies have argued in support of a one-factor model of AUD (Feingold and Rounsaville, 1995; Hasin et al., 1994; Kahler and Strong, 2006; O’Neil et al., 2003; Proudfoot et al., 2006; Saha et al., 2006).

Latent class analysis (LCA) has also been used to examine the dimensionality of DSM-IV AUD. LCA is a technique whereby categorical latent variables are used to identify homogenous groups of individuals in a population (Hagenaars and McCutcheon, 2002). Lynskey et al. (2005) analysed data from a sample of male Australian twins. Five latent classes emerged in support of the bi-axial conceptualization of AUD in the DSM-IV. Specifically, four classes appeared to reflect different levels of severity of alcohol dependence, whereas the fifth class was qualitatively different from the others, representing symptoms of alcohol abuse and excessive binge drinking. Elsewhere, the majority of latent class studies tend to support a unidimensional model of AUD severity, identifying unobserved groups of individuals who differ in relation to the severity, rather than the type, of the diagnostic criteria they experience (Heath et al., 1994; Moss et al., 2007; Nelson et al., 1998).

Although FA and LCA are useful statistical techniques for analysing diagnostic criteria to represent alternative viewpoints of complex entities such as AUD, they also have several limitations (see Muthén, 2008 for an overview). Briefly, FA provides a continuous latent score but does not provide information on categories for the purpose of diagnosis. LCA is more closely aligned to the diagnostic approach; however, the categorical phenotype results in a less powerful genetic analysis than if the phenotype is continuous (Muthén and Asparouhov, 2006). Recent research has revealed that ‘hybrid’ or factor mixture models (FMMs) can overcome the limitations of conventional models by incorporating aspects of both FA and LCA (Muthén, 2006). An FMM allows the underlying structure of a mental disorder to be categorical.

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and dimensional simultaneously (Clark et al., 2009). Specifically, the categorical strand of the model allows for the classification of individuals into diagnostic groups through the use of latent classes. Once individuals are classified into classes, continuous latent variables are used to allow for variation in the severity of the disorder (Clark et al., 2009). The dual functionality of the FMM makes it an attractive model for researchers and clinicians alike. Often, however, these models are complex and time-consuming to implement. For many professionals, these disadvantages would only be offset if the FMM could provide a superior conceptualization of AUD compared with more traditional models.

Only a few studies have used the FMM to assess the dimensionality of DSM-IV AUD. Muthén (2006) estimated an FMM consisting of one factor and two latent classes, whereby the diagnostic criteria were specified to measure a single factor or construct, which differed across the two classes. In other words, a separate dimensional representation was obtained for each class (Muthén, 2006). The first class contained individuals with a low probability of endorsing the DSM-IV AUD diagnostic criteria (81% of drinkers in a national US sample). The second class comprised individuals with varying degrees of problematic alcohol involvement (the remaining 19% of drinkers). Muthén (2006) argued that the FMM provided a more comprehensive explanation of dimensionality of the diagnostic criteria compared with the FA and LCA models. Elsewhere, Baillie and Teesson (2010) explored the utility of the FMM in explaining the dimensionality of DSM-IV AUD in the Australian general population. A series of FMMs, consisting of one or two factors and a ‘zero-class’, were estimated. Such a model hypotheses that: (a) there are drinkers who do not experience any of the DSM-IV AUD criteria and (b) the patterns of AUD symptoms experienced by the remaining drinkers can be accounted for by one or two dimensions (Baillie and Teesson, 2010). The findings revealed, however, that a simple structure unidimensional confirmatory factor analysis (CFA) model accounted for more variance in the DSM-IV AUD criteria than the FMM model, suggesting that the AUD can be explained most effectively by a dimensional score. Finally, Kuo et al. (2008) analysed lifetime alcohol dependence data obtained via the Virginia Twin Registry Study using a series of latent variable models, including the FMM. The results revealed that the LCA models outperformed the CFA models; however, the FMM with one factor and three latent classes provided the best explanation of the data. The three classes corresponded to a non-problematic drinker group, as well as those experiencing moderate or severe drinking-related problems. Latent variable models based on the DSM-IV conceptualization did not fit the data well. Kuo et al. (2008) concluded that a single continuous latent construct of alcohol dependence could not explain the overall covariation among alcohol symptoms and the heterogeneous nature of alcohol problems in the general population. This generally supports the findings of Muthén (2006). Collectively, these findings suggest that the FMM may be useful, but inconsistencies in the literature suggest that further exploration is necessary.

The second important issue on the DSM-5 research agenda relates to the creation of a new QF diagnostic criterion to help assess for the presence of AUD (Li et al., 2007). Recently, Saha et al. (2007) demonstrated that an indicator of gender-specific ‘at-risk’ drinking (i.e. >4 drinks for a woman or >5 drinks for a man per day on a typical drinking occasion, at least weekly in the last 12 months) was clinically and aetiologically a useful criterion that could potentially represent symptoms at the milder end of the AUD continuum of severity (Saha et al., 2007). Borges et al. (2010) arrived at a similar conclusion by conducting analysis on cross-national data using a QF measure of 5+ drinks weekly for men or 5+ drinks monthly for women. Inconsistent findings in relation to the utility of a QF criterion have also been reported. For example, Hasin and Beseler (2009) analysed data from the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC; Grant et al., 2003) to explore the relationship between the lifetime DSM-IV AUD diagnostic criteria, a gender-specific lifetime ‘binge’ drinking criterion, and two externalizing variables (i.e. family history of alcoholism and early age of drinking onset). The findings revealed that although the DSM-IV criteria for alcohol abuse and dependence were arrayed along an underlying continuum, the addition of the binge-drinking criterion decreased the model fit. This suggests that introducing a new QF diagnostic criterion might not be as appropriate as previously conceived (Hasin and Beseler, 2009; Shmulewitz et al., 2010). This is concerning, given that the addition of a new criterion to an existing set of diagnostic criteria, without consistent evidence supporting its validity, has the potential to reduce the reliability and validity of the entire criteria set (Hasin and Beseler, 2009). It is also likely to introduce undesirable heterogeneity in groups defined by that criteria set.

The current study was devised to explore these two issues in greater detail through the analysis of Australian epidemiological data. Our aim is 2-fold: (a) to explore how the latent structure of lifetime DSM-IV AUD diagnostic criteria can be best explained using a series of alternative latent variable models, and (b) to investigate the utility of a lifetime QF criterion as an indicator of an AUD continuum of severity. Analysing lifetime diagnostic criteria data is important. Researchers often focus on the occurrence of the DSM-IV AUD diagnostic criteria in the past year because recent events tend to be reported with greater accuracy than more temporally distant events (Hasin and Beseler, 2009). However, many genetic and epidemiological research investigations require information on the occurrence of the AUD diagnostic criteria during the lifespan. Clinicians also commonly assess for a lifetime history of problematic alcohol use. Thus, it is crucial that a set of lifetime AUD diagnostic criteria outlined in a major classification system such as the DSM is useful and informative (Hasin and Beseler, 2009; Hasin and Grant, 2004; Shmulewitz et al., 2010).

METHODS

Survey

The 2007 National Survey on Mental Health and Wellbeing (NSMHWB; ABS Australian Bureau of Statistics, 2009) is a nationally representative survey of Australians aged 16–85 years living in private households, funded and conducted by the Australian Government Department of Health and Aging between August and December 2007 (Slade et al., 2009).
A stratified, multistage probability area sample of private dwellings was used to select individuals at random for participation. The area-based selection ensured that all sections of the population living in private dwellings within the geographical scope of the survey were represented. Each State and Territory was stratified geographically and each household within a stratum had an equal and known probability of being selected. Special dwellings (hospitals, nursing homes, gaols, hotels) and dwellings in remote and sparsely settled regions of the country were not sampled (Australian Bureau of Statistics, 2009). Initially, 17,352 private dwellings were considered eligible to be targeted. Accounting for ineligible households (e.g. vacant dwellings), the actual sample size was 14,805. In each household, the person aged 16–85 years with the next birthday was selected for inclusion in the survey. Of these individuals, 8841 agreed to participate in the survey, representing a response rate of 60% (Slade et al., 2009). The age and gender characteristics of the sample were weighted to match the age and gender distributions in the national census (Australian Bureau of Statistics, 2009).

Diagnostic interview
The modified version of the World Mental Health Survey Initiative version of the World Health Organisation Composite International Diagnostic Interview (WMH-CIDI; Kessler and Üstün, 2004) was the computer-assisted personal interview (CAPI) used in the NSMHWB. The CIDI has been used in a wide range of epidemiological studies and has been shown to be a reliable and valid CAPI (Peters and Andrews, 1995; Wittchen, 1994).

Assessment of lifetime DSM-IV alcohol use disorders
The standardized field survey assessment in the 2007 NSMHWB followed the DSM-IV convention and was based on a familiar multi-item approach with items that tap the following problems: TOLERANCE, WITHDRAWAL, using larger amounts for longer than intended (LARGER), unsuccessful attempts at cutting down or controlling drinking (CUT DOWN), giving up important activities (GIVE UP), spending a great deal of time getting alcohol or recovering from the effects of alcohol (TIME SPENT), continuing to drink despite physical or psychological health problems (CONTINUED USE), failing to fulfil major role obligations (MAJOR ROLE), using alcohol in situations that are physically hazardous (HAZARDOUS USE), experiencing alcohol-related legal problems (LEGAL) and continued use despite social problems (SOCIAL).

The sequencing in the alcohol and drug sections of the CIDI was edited to enable the diagnosis of alcohol dependence without alcohol abuse. In assessing the presence of DSM-IV AUD, participants were initially asked whether they had consumed at least 12 alcohol drinks (containing 10 g of ethanol) in any 1 year in their lifetime. Individuals who responded ‘no’ to this question (n = 1732) were not asked any additional questions in the alcohol section. Individuals who responded ‘yes’ (n = 7109; ‘lifetime drinkers’) were also asked whether they had ever in their lifetime drank on ≥3 days a week and/or have usually consumed ≥3 drinks on the days they were drinking. Only those who positively answered this question were administered the symptom questions that operationalize the DSM-IV AUD diagnostic criteria (n = 5522; 77% of ‘lifetime drinkers’). The lifetime prevalence for alcohol abuse and alcohol dependence in the general population was 18.3 and 3.9%, respectively (Teesson et al., 2010). The sample used in this study included only individuals aged 18 years and older, resulting in a sample of 5409. The majority of the sample was male (59%), married (53%), employed (71.7%), post-secondary school qualification (57%). The mean age was 45.8 years (SD 17.4 years; range 18–85 years).

Alcohol quantity–frequency use criteria
Consistent with previous US research (Keyes et al., 2009; Saha et al., 2007), three alternative binary coded variables were created to represent the lifetime consumption of: (a) 4+ drinks on a typical drinking occasion, (b) 4+ drinks at least once a week and (c) 4+ drinks for a woman (5+ for a man) at least once a week.

Analytic plan
Confirmatory factor analysis (CFA)
CFA was used in the first instance to test the factor structure of the DSM-IV AUD diagnostic criteria. A one-factor model to assess for an AUD continuum of severity was estimated (Model 1). This was followed by three separate one-factor models with the inclusion of one QF criterion (Models 2–4). Finally, a two-factor model representing the DSM-IV conceptualization of AUD (Model 5) was tested.

Latent class analysis (LCA)
LCA was used to evaluate whether a group of associated observed variables (i.e. the DSM-IV AUD diagnostic criteria) can be related to an underlying categorical variable, or class, having two or more categories that classify the subjects (Adamson et al., 2007; Hagenaars and McCutcheon, 2002; McGrath et al., 2004). LCA considers not only the number of diagnostic criteria endorsed, but also the overall pattern of criterion endorsement (Shevlin et al., 2007). In the current study, a series of successive models, ranging from a two-class to a five-class model, were estimated (Models 6–9). Decisions regarding the most appropriate latent class model should be guided by both statistical fit indices (as outlined below) and conceptual considerations, that is, the meaningfulness and distinctiveness of the latent class profiles.

Factor mixture models (FMMs)
An FMM combines the latent class model and the common factor model (Lubke and Muthén, 2005). An FMM can be estimated in a number of different ways, depending on the measurement invariance assumptions that can be made about the data (see Clark et al., 2009 for a comprehensive overview). Briefly, more restrictive FMMs, which are estimated with strong measurement invariance properties, are often relatively easy to interpret, but can be difficult to estimate (Clark et al., 2009). Less restrictive models are generally easier to estimate but tend to be more complex to interpret (Clark et al., 2009). In this study, FMMs (Models 10–14) were estimated with class-varying thresholds and factor variances but class-invariant factor loadings, consistent with recent studies (Muthén and Asparouhov, 2006; Wu et al.,
As outlined in Table 1, the 11 DSM-IV AUD criteria were strong, positive and statistically significant indicators of the underlying AUD continuum (Model 1). For Models 2–4, the factor loadings for the diagnostic criteria remained similar; however, the factor loadings for the three QF diagnostic criteria were relatively weak in comparison: Model 2 (0.516); Model 3 (0.513) and Model 4 (0.549). Model 5, the DSM-IV conceptualization of alcohol abuse and dependence, produced a strong factor correlation (0.874), which suggests that the one-factor model was a more parsimonious explanation of the data. Goodness-of-fit indices for all the CFA models, and all of the other models tested, are presented in Table 2.

Lower values on the AIC, BIC and SSABIC indicated that the two-factor model (Model 5) was a superior explanation of the data when compared with the one-factor model (Model 1). Differences in the variables included in the analysis prohibit comparisons of the being made between Models 2–4 and Models 1 and 5 in terms of the goodness-of-fit indices.

**Latent class analysis**

Fit indices for the latent class models did not clearly identify the model that was the best explanation of the data. The AIC, BIC and SSABIC values decreased from Model 6 to Model 9, although the biggest decreases were from Model 6 to Model 7. There is an improvement in the log-likelihood from Model 6 to Model 9, but again the biggest improvement was from Model 6 to Model 7. Examination of the LMR-LRT values suggested that Model 7 (three-class solution) was a good fitting model (Table 2). The entropy suggested that classification in Model 7 was acceptable. The latent class profiles of Model 7 were also examined (Fig. 1) and they were considered to be conceptually meaningful and in line with the previous literature. Specifically, Class 1 represented the largest proportion of alcohol users (68.1%) and can be considered as a ‘zero-class’, that is, individuals in this class had a very low probability of endorsing any of the 11 DSM-IV diagnostic criteria. Approximately one-quarter (27.1%) of respondents were assigned to Class 2, which was categorized by a relatively high probability of endorsing LARGER and, to a lesser extent, HAZARDOUS USE. A small percentage of drinkers (4.8%) were classified into Class 3. These individuals had a high probability of endorsing all of the AUD criteria except GIVE UP and LEGAL. Comparison of the fit indices across the CFA and LCA models, however, revealed that Model 7 was not a superior fit when compared to Model 5.

**Factor mixture modelling**

The log-likelihood value improved in a linear fashion from Model 10 to Model 14. Examination of the BIC index revealed that the best fitting FMM was a two-factor model with a zero-class (Model 11). This model had the highest entropy value of all the FMM models. Model 11 proposes that there are people who drink alcohol but do not report experiencing any of the DSM-IV AUD diagnostic criteria and that the remainder of drinkers is accounted for by two dimensions (abuse and dependence).

**Overall best conceptual and most parsimonious model**

For each set of analysis, the best fitting model, based solely on the fit indices, was identified (bold text in Table 2): CFA (Model 5; a two-factor model), LCA (Model 7; a three-class
model) and FMM (Model 11; a two-factor model with a zero-class). Decisions about the most appropriate model theoretically, however, should not be made entirely on the basis of the goodness-of-fit indices. While there is a body of strong empirical evidence to suggest that AUD as conceptualized by the DSM-IV appear to tap into any underlying continuum of severity, there is much less evidence available to demonstrate the ability of the FMM to consistently identify dimensions and categories of problematic alcohol users. Taking this information into account, we considered Model 1, a simple structure one-factor CFA model, to be the most parsimonious model and conceptually meaningful explanation of the lifetime data.

Model 1 can be explained further by interpreting two important model parameters: (a) criterion severity, and (b) criterion discrimination (cf. Birenbaum, 1968). The severity of a criterion is the point along the latent continuum of AUD at which the criterion has a 50% probability of being endorsed (Kahler and Strong, 2006). The discrimination of a criterion explains how rapidly the probability of observing the criterion changes across increasing levels of the latent continuum of AUD. Figure 2 graphically represents item response curves for each diagnostic criterion. This plot illustrates that LARGER and LEGAL were the least and most severe criteria, respectively. In terms of discrimination, LEGAL was the least discriminating criterion, whereas GIVE UP was the most discriminating criterion of all of the DSM-IV AUD diagnostic criteria.

**DISCUSSION**

This study used a variety of sophisticated analytical techniques to investigate two specific issues high on the research agenda for the revision of the DSM-IV AUD diagnostic criteria.
criteria. First, in relation to the utility of the FMM in explaining the dimensionality of DSM-IV AUD, the current findings revealed that incorporating both dimensional and categorical conceptions of lifetime AUD did not provide substantial gains over a conventional dimensional conception of these disorders. Our findings suggest that a simple structure one-factor model is a relatively good conceptualization of the AUD latent trait, which is consistent with epidemiological research exploring the latent structure of past year alcohol and cannabis use disorders in Australia (Baillie and Teesson, 2010). Some studies have argued for the superiority of FMM over other more conventional latent variable models in
exploring the dimensionality of past year AUD (Muthén, 2006; Muthén et al., 2006). Comparison with other studies advocating the utility of FMM (Kuo et al., 2008) is constrained due to the sole focus on alcohol dependence criteria. Close inspection of the goodness-of-fit indices reported in these studies generally, however, suggest that there is often very little difference between the simple structure one-factor CFA model of AUD and the complex FMM models that allow for more flexible representations of underlying heterogeneity in the study population (Muthén, 2006; Muthén et al., 2006). Clearly, the FMM may be an important analytical tool for conceptualizing the structure of psychological disorders and for genetic analyses of heterogeneous populations. Perhaps the strongest argument for using these complex FMM models is that dimensions of AUD severity, as well as categories for diagnosis, can be provided (Muthén, 2006). Classifying individuals in terms of their AUD symptoms for treatment purposes is an important goal for clinicians. However, researchers and clinicians should be aware that there are several issues and challenges associated with implementing FMM models, including a difficulty with identifying a clear ‘winning’ model when comparing alternative models on the basis of goodness-of-fit indices alone (Clark et al., 2009). Moreover, these models can be specified and estimated in numerous different ways, depending on what assumptions are being made about the underlying structure of the disorder in a specific population, which need to be taken into account when comparing results across studies. Given that only a handful of studies thus far have explored the utility of the FMM in explaining the dimensionality of alcohol and other drug use disorders, further epidemiological research in this area is required. In the interim, our findings contribute to a wider body of evidence which suggests that a simple continuous scale of alcohol problem severity is useful for researchers and clinicians alike, and offers more information than dichotomous diagnostic measures such as alcohol abuse or harmful use and alcohol dependence (Dawson et al., 2010).

Comparing the characteristics of the unidimensional model for lifetime DSM-IV AUD in this study to other studies highlights some interesting findings. In their study, Shmulewitz et al. (2010) reported that the MAJOR ROLE and CUTDOWN were the most and least discriminating lifetime criteria in a sample of Israeli household residents. Herein, GIVE UP and LEGAL were the most and least discriminating criteria. Identical findings emerged for the severity parameters, whereby LEGAL and LARGER were the most and least severe lifetime diagnostic criteria across both studies. Elsewhere, Kahler and Strong (2006) reported that symptoms operationalizing the lifetime DSM-IV AUD diagnostic criteria in the NESARC covered a broad range of severity. Consistent with the current study, symptoms relating to WITHDRAWAL and HAZARDOUS USE were of relatively high and low severity levels, respectively (Kahler and Strong, 2006).

Despite suggestions for the inclusion of a QF diagnostic criterion for the assessment of AUD in the DSM-5 (Saha et al., 2007), our findings suggest that such an indicator may not be a useful diagnostic criterion, which is generally consistent with recent research (Hasin and Beseler, 2009; Keyes et al., 2009; Shmulewitz et al., 2010). Including a QF criterion as part of the definition for AUD in the DSM-5 would have a number of important epidemiological and clinical implications. Keyes et al. (2009) demonstrated that including a QF measure as either a prerequisite for a diagnosis of alcohol dependence or as an additional criterion for alcohol dependence would greatly decrease and increase the prevalence of alcohol dependence in the general population, respectively. Even though having a requirement that an individual exceeds a given QF threshold before a diagnosis of alcohol dependence is warranted might help improve the phenotype definition for genetic research, it may also reduce eligibility for treatment services among particularly vulnerable groups (e.g. ethnic minorities, women etc.) (Keyes et al., 2009). Clearly, additional research investigating the implication of introducing a QF criterion is required before any recommendations can be made in relation to the revision of the DSM-IV AUD criteria (Hasin and Beseler, 2009).

This study’s findings should be considered in the light of several limitations. As noted by Teesson et al. (2010), the 40% non-response rate in this 2007 NSMHWB is a potential source of error in the current study. All of the participants recruited in this survey were resident in private dwellings in Australia; people usually resident in non-private dwellings (e.g. hotels, motels, hospitals, nursing homes, short-stay caravans parks) or those living in very remote areas of Australia were not included in the scope of the survey (Australian Bureau of Statistics, 2009). The assessment of AUD in the 2007 NSMHWB was defined solely in terms of the DSM-IV diagnostic criteria; other facets of alcohol dependence (e.g. denial) were not assessed for and could not be included in the analyses. Another potential limitation is that the WMH-CIDI used in the 2007 NSMHWB only yields data pertaining to the occurrence of lifetime AUD. It was not possible, therefore, to conduct this series of analysis using current timeframe data to compare what impact recall biases may have had on the results. The results of the 2007 NSMHWB place Australia as a country with one of the highest rates of AUD worldwide. Comparisons can be made with other countries participating in the World Mental Health Survey Initiative (Kessler and Üstün, 2004), for example New Zealand, taking into account slight differences in the methodological instruments used. Briefly, as described in detail elsewhere (Teesson et al., 2010), earlier versions of the WMH-CIDI in the New Zealand survey and elsewhere, only assessed for alcohol dependence if the requirements for alcohol abuse were not met. In the 2007 NSMHWB, all participants were asked about symptoms of alcohol dependence. Despite these methodological differences, the lifetime prevalence of alcohol abuse and alcohol dependence in New Zealand was very similar to those for Australia at 13.2 and 3.9%, respectively (Wells et al., 2006). Given the much higher rates of alcohol dependence in the 1997 Australian NSMHWB (Teesson et al., 2000) however, it is possible that the WMH-CIDI is conservative in case ascertainment.

Notwithstanding these limitations, the current study was strengthened by the application of a variety of different statistical models to explore the dimensionality of diagnostic criteria for lifetime DSM-IV AUD in a nationally representative sample of Australian adults. Consistent findings regarding the positioning of the lifetime AUD diagnostic criteria along the underlying latent continuum of severity between this study and other studies analysing past year AUD diagnostic...
criteria in Australia and the USA is reassuring for geneticists and epidemiologists who assess for lifetime AUD in their research. It is important to remember that clinicians need to use the DSM to determine entry into treatment. It may also still be the case, therefore, that a categorial use of the DSM is more clinically meaningful. Given that there is an abundance of research advocating the inclusion of a dimensional measure of AUD severity in the DSM-5 (Dawson et al., 2010) however, research efforts now need to focus on establishing useful cut-offs or thresholds for a dimensional model of AUD (e.g. Grove et al., 2010).

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