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Empirically Defined Subtypes of Alcohol Dependence in an Irish Family Sample

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Abstract

Alcohol dependence (AD) is clinically and etiologically heterogeneous. The goal of this study was to explore AD subtypes among a sample of 1,221 participants in the Irish Affected Sib Pair Study of Alcohol Dependence, all of whom met DSM-IV criteria for AD. Variables used to identify the subtypes included major depressive disorder, antisocial personality disorder, illicit drug dependence (cannabis, sedatives, stimulants, cocaine, opioids, and hallucinogens), nicotine dependence, the personality traits of neuroticism and novelty seeking, and early alcohol use. Using latent class analysis, a 3-class solution was identified as the most parsimonious description of the data. Individuals in a Mild class were least likely to have comorbid psychopathology, whereas a Severe class had highest probabilities of all comorbid psychopathology. The third class was characterized by high probabilities of major depression and higher neuroticism scores, but lower likelihood of other comorbid disorders than seen in the Severe class. Overall, sibling pair resemblance for class was stronger within than between classes, and was greatest for siblings within the Severe class, suggesting a stronger familial etiology for this class. These findings are consistent with the affective regulation and behavioral disinhibition subtypes of alcoholism, and are in line with prior work suggesting familial influences on subtype etiology.

Keywords

alcoholism typology; alcohol dependence; alcoholism subtypes; latent class analysis

1. Introduction

1.1 Alcoholism Typologies

Alcohol use disorders (AUDs) are clinically (e.g., Babor et al., 1992; Bucholz et al., 1996) and etiologically (e.g., Cloninger et al., 1981) heterogeneous, the recognition of which has produced a long tradition of describing subtypes of alcoholism (e.g., Jellinek, 1960). One of

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the most influential typologies was developed by Cloninger and colleagues (1981; Bohman et al., 1987) who identified Type I alcoholism, characterized by onset of problem drinking after age 25, less antisocial behavior, and personality styles of lower novelty seeking and higher harm avoidance compared to Type II alcoholism, which is characterized by earlier onset of problem drinking, high rates of antisocial behavior, and personality styles of high novelty seeking and low harm avoidance. Similar to Cloninger's Type I/Type II classification system is Babor et al.'s type A/type B typology (Babor et al., 1992). In contrast to type B, the type A group was characterized by later alcoholism onset, fewer childhood risk factors, less severe dependence, fewer alcohol-related problems, and less comorbid psychopathology, roughly resembling Cloninger's Type I.

Attempts to validate these typologies suggest that more than two classes may be needed to fully characterize the clinical and etiological variation that exists among individuals with AUDs (Epstein et al., 2002). For example, using data from the original Babor et al. study, Del Boca and Hesselbrock (1996) replicated the A/type B solution, but within each class found remaining gender-related differences with respect to affective disorder symptoms, polysubstance use, drinking history, and family history of alcoholism, and argued that four classes provided a better summary of the data. Their final solution included: a mild class characterized by low levels of polysubstance use and psychiatric symptoms and less severe childhood risk factors and alcoholism course; an internalizing class with the highest levels of depression and anxiety and high levels of alcohol consumption and related consequences; an externalizing class also with high levels of drinking and alcohol-related consequences and high levels of antisocial personality disorder (ASPD) as well; and a severe class with the highest rates of childhood behavior problems and early drinking onset, highest levels of polydrug use, and high levels of depression, anxiety, and ASPD. This typology expands upon the original Babor et al. A and B Types and highlights the variation in alcoholism etiology, comorbidity, and clinical severity.

Lesch and colleagues (1988; 1990) described a four class typology, which has been replicated in several samples and has been studied for its usefulness for predicting treatment response (see Hillemacher and Bleich, 2008). However, it differs from others in its focus on childhood precursors and emphasis on reasons for drinking.

Cardoso and colleagues (2006) identified five factors as part of their "NETER" typology, which included two subtypes marked by high loadings of affective disorder symptoms, two externalizing subtypes characterized by adult and childhood conduct problems, and a fifth class characterized by positive family history and severe AD. This pattern of findings is consistent with more diverse heterogeneity in AD and resembles the solution identified by Del Boca and Hesselbrock (1996).

1.2 Polyclass Typologies Based on Latent Class Analysis

Several recent typologies have been based on latent class analysis (LCA; McCutcheon, 1987), in which empirical classes of individuals are identified based on different patterns of dichotomous symptom endorsements. Bucholz et al. (1996) applied LCA to relatives of alcohol-dependent probands from the Collaborative Study on the Genetics of Alcoholism, yielding a four-class solution in which the prevalence of AUD symptoms increased across the classes. Likewise, the prevalences of comorbid psychopathology and alcohol-related risk factors also increased across classes. Applying LCA to data from male twins who had been registered by the Swedish Temperance Board for alcohol-related offenses, Kendler et al. (1998) identified a five-class typology. The generalizability to other typologies and clinical utility of this study are somewhat limited by the use of offenses as the basis for the typology.

Moss et al. (2007) described a 5-class solution applying LCA to data from respondents to the National Epidemiological Survey on Alcohol and Related Conditions who met at least three

DSM-IV AD criteria in the prior year. Two of the classes were characterized by relatively low family history risk and low rates of comorbid disorders, two were similar to previously described externalizing subtypes, with high familial risk, high rates of antisocial behavior and drug use disorders, and early age at first drink and a fifth class was similar to affective regulation types, with relatively high probabilities of depression and anxiety.

Analyses of concordance across the Cloninger, Babor, NETER, Lesch, and two additional typologies suggest significant overlap due to shared features across classes from the typologies (Pombo & Lesch, 2009), but the remaining differences raise some questions about the clinical utility of typologies. Many AD typologies are based on a large number of variables, some of which can be time consuming to assess, thereby reducing their usefulness in treatment settings. A more practical way to subtype AD may be to focus on the comorbid diagnoses and other risk factors that are commonly assessed as part of intake interviews. Additionally, it is well-recognized that AD frequently co-occurs (Kessler et al., 1997) and shares etiology (Button et al., 2007; Kendler et al., 2003; Krueger et al., 2002) with other psychiatric conditions and substance use disorders, suggesting the value of a typology based on comorbid disorders in contributing to existing knowledge about AD clinical presentation.

1.3 Study Aims

The current study used LCA to identify empirical subtypes among a sample of individuals with AD. The typology was based on comorbid psychopathology, personality traits, and age at drinking onset. We hypothesized that at least three classes would be needed to adequately describe the heterogeneity in AD in our sample. We also investigated evidence for the external validity of the identified classes by examining their relation to clinical features of AD and estimating sibling resemblance for class membership.

2. Methods

2.1 Participants

The data for the current study were collected as part of the Irish Affected Sib Pair Study of Alcohol Dependence (IASPSAD), the primary goal of which is to identify genetic susceptibility loci for AD (Prescott et al., 2005). Data were collected in Ireland and Northern Ireland from 1998 to 2002. Probands were recruited through community and treatment settings and were eligible for study inclusion if they met DSM-IV (American Psychiatric Association, 1994) criteria for AD (assessed using a modified version of the Semi-Structured Assessment for the Genetics of Alcoholism; SSAGA version 11; Bucholz et al., 1994), reported having at least one sibling with alcoholism, and all four of their grandparents had been born in Ireland, Northern Ireland, Scotland, Wales, or England. Potentially eligible siblings were contacted for interviews and were included based on the same criteria as for probands. Parents were also interviewed when available and willing. All interviewed participants provided written informed consent and study procedures were approved by the relevant human subjects committees in the U.S., Irish Republic, and Northern Ireland.

The original sample comprised 1,248 individuals. The sample used for the present investigation included 1,221 individuals from 602 families, including 80 families with proband only (because the nominated siblings did not agree to participate or did not meet AD criteria), 446 with proband and one sibling, and 76 with proband plus two or more affected siblings. To have a more clearly defined sample, 27 non-sibling relatives (mostly fathers and uncles) were excluded.

This is a moderately to severely affected sample. Most participants met criteria for 6 or 7 of the 7 DSM-IV AD symptoms ($M=6.3$, $SD=1.2$). Demographic information included age at

interview, education level, marital status, current social class, and paternal social class, and is available in Table 1. Binary variables included gender (0=female, 1=male), marital status (0=not married, 1=married), and education (0=did not complete secondary school, 1=completed secondary school). Social class was rated using a manual specific to Ireland with a response range of 1–6; lower scores indicated higher social class. Participant and paternal social class had modes, medians, and rounded means of 4, which is roughly equivalent to a skilled manual laborer or small farm owner.

2.2 Procedure

Study interviewers were trained psychiatrists, psychiatric nurses, psychologists, and social workers experienced in mental health or substance abuse treatment settings and/or survey or interviewing work. Participants were usually interviewed in their homes or at a treatment facility. The same interviewer typically interviewed multiple individuals from the same family. Individuals living outside of Ireland were interviewed by telephone.

2.3 LCA Measures

A total of 12 indicator variables were used in the LCA, including: lifetime history of major depression, antisocial personality disorder (ASPD), nicotine dependence, and illicit substance dependence (coded separately for cannabis, sedatives, stimulants, cocaine, opioids, and hallucinogens); early drinking onset; and the personality traits of novelty seeking and neuroticism. All LCA variables were coded to be binary, as described below.

Lifetime history of comorbid disorders was assessed using an adapted version of the Structured Clinical Interview for the DSM-III-R (SCID; Spitzer and Williams, 1985) used in prior studies (Kendler and Prescott, 2006). Nicotine dependence was assessed using a cutoff of seven or greater on the Fagerstrom Test for Nicotine Dependence (FTND; Heatherton et al., 1991).

Neuroticism was assessed using the 12-item version of the EPQ scale (range = 0–12; Eysenck et al., 1985) and Novelty Seeking using the 18-item version of the TPQ (Cloninger et al., 1994). Personality scores were dichotomized using median splits (≥ 10 for Neuroticism, ≥ 11 for Novelty Seeking). Early alcohol use was coded as positive for participants reporting consuming a full drink prior to age 15 (the median age at first drink in this sample). Prevalences of the variables used in the LCA are shown in Table 1.

The above disorders and risk factors were selected for inclusion in the LCA because they have been found to share etiology with AD and they are widely available for use in clinical settings. Prior work on drug use patterns (Agrawal et al., 2006; Hammersley et al., 1999; von Sydow et al., 2002) highlights a constellation of drug use that clusters around particular substance classes, namely stimulants, cocaine, and hallucinogens. Because the current study offered an opportunity to investigate the replicability of drug use patterns, rather than combining drug dependence diagnoses into a few categories like much of the prior typology work, we included separate drug dependence diagnoses. Prior typologies commonly include anxiety as an indicator. Because the clinical interview did not assess anxiety disorder symptoms, neuroticism was included in the LCA to serve as a proxy.

2.4 Measures to assess external validity of LCA solution

A set of eight SSAGA variables related to AD clinical severity were selected for examining the external correlates of the classes identified in the LCA analyses, including: lifetime arrest for drunken behavior, serious physiological consequences of AD (coded positive if the participant reported that her/his alcohol use resulted in heart damage, liver damage, pancreatitis, or stomach disease), inpatient treatment for AD, number of DSM-IV AD symptoms, maximum quantity and frequency of drinking, and maternal and paternal AD.

Maximum quantity of drinking was assessed using lifetime maximum number of drinks during a 1-day period. To adjust for skew, the quantity variable was log-transformed. Drinking frequency was assessed with number of drinking days per month during heaviest drinking period. Paternal and maternal AD were based on responses by probands and siblings to the Family History-Research Diagnostic Criteria (Andreasen et al., 1977), which includes items on alcohol treatment and drinking-related problems. Parents were coded as positive for AD if the participant or an interviewed sibling reported three or more symptoms in the respective parent. In this sample, participant reports have previously been shown to have good inter-rater reliability and agreement with clinical assessment of parental AD (Prescott et al., 2005).

Demographic characteristics were also compared across class types. Because current social class could be an outcome rather than a predictor of psychopathology, we also used paternal social class to approximate socioeconomic status when the participant was an adolescent and at risk for developing psychopathology.

2.5 Statistical Analyses

LCA groups patterns of item endorsements into clusters, or classes. Individuals are assigned a probability of membership in each class based on similar endorsement patterns. Individuals can also be assigned to their “most likely” class, based on the maximum value among the conditional probabilities of membership in each class. In the present study, the number of classes needed was evaluated by comparing the fit improvement associated with including each additional class. As described by Acock (2006), there is no standard method to select an optimal latent class solution, but rather this decision can be informed by a variety of criteria. Therefore, in addition to conceptual meaningfulness of classes, we considered several fit indices in selecting the most parsimonious model (see Table 2).

After the most parsimonious solution was selected, validity of the class structure was assessed by examining the solution’s replicability and external validity, and, using sibling resemblance for class, the variation in familial etiology among the classes. LCAs and analyses of sibling resemblance were conducted using Mplus version 4.1 (Muthen & Muthen, 2006).

3. Results

3.1 Results of Fitting Latent Class Models

The results of fitting models of 2 to 7 classes are summarized in Table 2. Significant improvements in AIC were obtained for each higher class solution. The sample-size adjusted BIC, as well as the Lo, Mendell and Rubin statistical tests indicated that three classes best described the data. Therefore, a 3-class solution was selected as providing the most parsimonious description of the data. The 3-class solution had a fair entropy value of .65. Though this was the lowest value of all the solutions fitted, more than half of participants were assigned to their class with a probability of .88 or greater, and the lowest 10% of probabilities ranged from .50 to .64.

For each latent class, Mplus provides estimates of symptom endorsement probabilities (SEPs), representing the probability that a symptom is reported by an individual given membership in that class. Figure 1 shows the SEP plot for the 3-class solution. Based on the profiles we have labeled the classes as Severe (S), Depressed (D), and Mild (M).

3.2 Final 3-class Solution

The Severe class (S) included 10% of the sample, and was characterized by the highest probabilities on all psychopathology indicators, high novelty seeking, and early alcohol use. The Depressed class (D) comprised 50% of the sample and, following the S class, had the

second highest probabilities of all psychopathology indicators and early alcohol use, a very high probability of depression nearly identical to that of the S class (.87 vs .88, respectively), and the highest probability of high neuroticism scores, resembling many of the affective regulation classes of earlier typologies. The Mild class (M) comprised 40% of the sample, and had the lowest SEPs for all indicators.

3.3 Validation of 3-Class Solution

To examine the replicability of the solution, two siblings from each family were assigned to one of two different subgroups, and 2- through 6-class LCAs were conducted separately on these subsamples. The 80 probands from families without siblings were randomly assigned to one of the two subgroups. The class assignments yielded in the complete sample corresponded closely to those found separately in subgroups 1 (n=564) and 2 (n=559), with tetrachoric correlations between the entire sample and each subsample of .95 (SE = 0.012) and .95 (SE = 0.013), respectively.

To examine the external validity of the solution, the classes were compared on a set of variables to assess AD clinical severity as well as demographic characteristics using the SAS version 9.1 software program (SAS Institute Inc., 2002). Results of initial regression analyses indicated that except for parental AD, inpatient treatment, and arrests, the AD severity and demographic variables were associated with years of heavy drinking (calculated as age at which regular drinking began subtracted from age at the most recent AD episode). Therefore, we adjusted for heavy drinking years in MANOVA analyses.

Briefly, AD clinical features differed significantly across classes. Arrests, physiological consequences, paternal AD, number of DSM-IV AD symptoms, and lifetime maximum quantity and frequency of drinking decreased in prevalence from the S class to the M class. The results are summarized in Table 3.

3.4 Familial Resemblance for Class

Sibling resemblance for class was examined using data from 589 families that included probands and 1 or 2 siblings. Approximately 2% (19 individuals from 13 families) of the sample was excluded from these analyses. Table 4 shows the cross-sibling intra-class and inter-class correlations for class membership based on the 3-class solution. We examined both class assignment and probability of class membership. Sibling resemblance for latent class membership was strongest for the S class, moderate for the M class, and was lowest for the D class. Chi-square tests indicated significantly greater similarity for class assignment than expected by chance ($\chi^2_1=48.7$, $p<.0001$).

4. Discussion

The goal of this study was to explore subtypes of AD using a family sample. Based on latent class analyses, a 3-class solution provided the best explanation for the comorbidity and personality features examined in this study. The reliability of the solution was supported by finding the same solution within two independent subgroups of the full sample. The external validity of the solution was supported by differences between classes on indices of clinical severity.

As part of the 3-class solution, a mild class (i.e., class M) was identified, marked by the lowest probabilities of all psychopathology indicators and the lowest neuroticism and novelty seeking scores. Compared to the other classes, this class also had the least severe clinical characteristics, with the lowest rates of arrest and physiological consequences, fewest DSM-IV symptoms, and least drinking quantity and frequency. This class shared similarities with the mild course

classes identified by Bucholz et al. (1996) and Del Boca and Hesselbrock (1996), and is also consistent with prior findings that individuals with comparatively milder AD tend to be older and female (Babor et al., 1992; Bucholz et al., 1996; Cloninger et al., 1981; Del Boca and Hesselbrock, 1996).

A second latent class, D, had the greatest probability of high neuroticism, second highest probability of depression and nicotine dependence, and relatively low probabilities for other disorders. This class shared similarities with the internalizing class described by Del Boca and Hesselbrock (1996) and roughly resembles the two affective regulation subtypes (i.e., Anxiopathic and Thymopathic) identified as part of the NETER typology (Cardoso et al., 2006). In the present study, however, only one such class was identified, possibly due to differences in measurement or statistical procedures.

A severe class had the highest probabilities of all psychopathology indicators, early alcohol use, and high novelty seeking. The highest rates of dependence on all classes of drugs were observed in this class, though the pattern of stimulant, cocaine, and hallucinogen use observed in prior studies (Agrawal et al., 2006; Hammersley et al., 1999; von Sydow et al., 2002) was not replicated, perhaps due to cultural differences in drug use and availability. This class was also characterized by the greatest clinical severity, with the highest levels of arrests and physiological consequences, the greatest number of DSM-IV symptoms, and greater drinking quantity and frequency compared to the other classes. This class was similar to Cloninger's (1981) Type II and Babor's (1992) type B in terms of high levels of ASPD, polydrug involvement, early alcohol use, a low proportion of females, and younger age compared to other classes. The NETER and Del Boca and Hesselbrock typologies each identified more than one subtype similar to the S class in terms of behavioral disinhibition traits, clinical severity, and childhood risk. This may be attributable to different statistical techniques and measures, or may indicate reduced heterogeneity in externalizing traits among the sample used for the current study.

4.1 Etiological Implications

Although all participants had a positive family history of AD in their siblings, there was some evidence that strength of familial liability varied across latent classes. For instance, paternal alcoholism was most common among the S class (68%), followed by 64% in the D class, and 48% among the M class. Sibling resemblance for class membership was stronger within than between classes, suggesting somewhat independent transmission of these subtypes.

Sibling resemblance for class was strongest for the S class, and weakest among the D class. In general, these findings supporting familiarity of subtypes are in line with results from several other studies. Greater family history of AD characterized Cloninger's (1981) Type II and Babor's (1992) type B alcoholics, both of which roughly resemble the S class. Additionally, Kendler et al. (1998) reported significant twin-pair concordance for two classes. This relationship was stronger among monozygotic than dizygotic pairs, and stronger within versus between the two classes, consistent with familial resemblance having a genetic basis and the subtypes having both distinct and shared genetic factors. Genetic differences among subtypes were also identified by Bönsch et al. (2006), who observed significant differences in frequency of methylenetetrahydrofolate reductase (MTHFR) polymorphisms in 134 alcoholics grouped into the four Lesch subtypes.

Clinical typologies may aid in elucidating the etiological pathways that lead to the development of distinct AD subtypes. The typology described in the current study is consistent with two alternative pathways of AD development: negative affect regulation, whereby drinking is used to relieve negative mood states, and behavioral disinhibition, whereby excessive drinking

represents one manifestation of an overall tendency to behave impulsively and to seek excitement (Zucker, 2006).

According to the affective regulation model, negative mood states like depression and anxiety lead to the use of alcohol to alleviate negative mood. The reduction of negative affect is a commonly cited motive for drinking (Peirce et al., 1994). Supporting this model, most AD typologies, including the one described in the present study, have identified a class marked by high levels of depression and anxiety symptoms. Other lines of research provide support for this model, including epidemiologic evidence of the high comorbidity of AD with anxiety and mood disorders (e.g., Compton et al. 2007).

The behavioral disinhibition model is consistent with the inclusion in most typologies of a severe subtype with high rates of comorbid externalizing disorders. Much of the evidence indicates that a common etiology underlies AD and other externalizing characteristics, including antisocial behavior, drug dependence, and disinhibited personality (Button et al., 2007; Kendler et al., 2003; Krueger et al., 2002). Consistent with these findings, high levels of novelty seeking and early age at first drink (Babor et al., 1992; Cloninger et al., 1981) are associated with AD subtypes that follow a more severe course and are associated with elevated family history risk of AD. Overall, this literature implicates a shared familial liability for externalizing behavior as one pathway to the development of severe AD subtypes. This represents an etiologically and developmentally distinct mechanism compared to the affective regulation pathway.

4.2 Limitations and Strengths

The present study should be considered in light of several limitations. First, due to the cross-sectional nature of this study, the developmental course of subtypes was not addressed. Second, results from this sample may not generalize to other cultural groups or to community settings. The sample comprised Caucasian individuals residing in Ireland, all of whom had AD and about 80% of whom reported inpatient treatment. The high rate of treatment is likely due to factors associated with greater access to treatment for alcoholism in Ireland and Northern Ireland and the ascertainment of many study participants through treatment facilities. Finally, the results of typologies derived using LCA are dependent on variable selection, and this limits direct comparisons between our findings and those of other AD typologies based on different sets of variables.

Although exploratory and descriptive in nature, this study has a number of strengths. First, we included several validation procedures, which is important for external validity. We examined sibling resemblance for class type in addition to information about parental AD, thereby enriching the work on differing familial etiologies of subtypes. Finally, our use of comorbid diagnoses as indicators may be of clinical utility in AD treatment settings, as is the use of relatively few indicators.

There is considerable debate about how to best characterize AUDs. Some research upholds the validity of categorical diagnoses, whereas other studies support a dimensional approach, with symptoms and related problems lying along a severity gradient (for review see Hasin, 2003). The present investigation does not address the same questions as do studies that include subthreshold AD cases and individuals who are unaffected or have alcohol abuse. This sample allowed for characterization of the heterogeneity exclusively within individuals with moderate to severe AD, complementing prior work that has included a spectrum of affected and unaffected individuals.

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Figure 1. Symptom endorsement probabilities (SEPs) by class for 3-class solution (n=1221). Note: Dep = dependence. ASPD = antisocial personality disorder.

Table 1

Participant characteristics on demographic and indicator variables

<i>Demographic Characteristics</i>	
	M=41.9
Age at interview	(SD=9.8)
Gender (% male)	64.7
Married at time of interview (%)	41.0
Education (% completed secondary school)	56.0
Social class (mode)	4
Paternal social class (mode)	4
<i>Lifetime Prevalence of Comorbid Disorders</i>	
	%
Cannabis dependence	13.3
Sedative dependence	15.0
Opioid dependence	5.5
Stimulant dependence	8.6
Cocaine dependence	3.1
Hallucinogen dependence	3.0
Nicotine dependence	62.2
Major depressive disorder	71.2
Antisocial personality disorder	29.7
<i>Other Risk Factors</i>	
	%
Early alcohol use (before age 15)	39.1
High neuroticism score	41.5
High novelty seeking score	45.5

Note: Variables were coded as follows: Age; continuous. Gender; 0=female, 1=male. Marital status; 0=not married at time of interview, 1=married at time of interview. Education; 0=did not complete secondary school, 1=completed secondary school. Social class variables: range=1 – 6, lower score indicates higher social class. Comorbid disorders; 0=disorder absent, 1=disorder present. High neuroticism: score of 10 or greater. High novelty seeking: score of 11 or greater.

Table 2

Model fitting results for Latent Class Analyses (n=1221)

	2 Classes	3 Classes	4 Classes	5 Classes	6 Classes	7 Classes
Number of free parameters	25	38	51	64	77	90
Log likelihood	-6201	-6100	-6075	-6053	-6034	-6014
Akaike's information criterion	12451	12277	12253	12234	12223	12209
Sample-size adjusted Bayesian information criterion	12499	12350	12351	12358	12371	12382
Entropy	.76	.65	.70	.69	.70	.77
Lo, Mendell, Rubin test	2 v 1 891 p < .0001	3 v 2 198 p < .0001	4 v 3 49 p = .17	5 v 4 44 p = .11	6 v 5 37 p = .37	7 v 6 34 p = .15
Class prevalence	n (%)					
Class 1	256 (21)	616 (50)	49 (4)	260 (21)	16 (5)	40 (3)
Class 2	965 (79)	121 (10)	94 (58)	96 (8)	195 (16)	18 (2)
Class 3		484 (40)	576 (47)	587 (48)	44 (4)	381 (31)
Class 4			502 (41)	230 (18)	37 (3)	241 (20)
Class 5				48 (4)	430 (35)	444 (36)
Class 6					454 (37)	46 (4)
Class 7						51 (4)

Table 3

Relation of latent classes to demographic characteristics and alcohol dependence (AD) clinical severity

		Class		
		Severe	Depressed	Mild
	F value p value ^a	Percentage		
Gender (% female)	16.1 p<.0001	19.0	37.7	63.6
Education ^b	28.8 p<.0001	47.9	51.8	63.4
Married at time of interview	22.4 p<.0001	10.7	39.5	50.4
Ever arrested for drunk behavior	37.6 p<.0001	81.8	48.7	25.0
Serious physiological consequences	13.9 p<.0001	69.4	54.2	39.5
Inpatient treatment for AD	3.16 p<.03	81.4	83.3	76.7
Maternal AD ^c	2.3 p<.08	27.3	24.0	16.1
Paternal AD	10.9 p<.0001	67.9	63.8	47.6
	F value (p value) ^d	Mean (SD)		
Age at interview	341.4 p<.0001	32.5 (8.1)	41.1 (8.6)	45.2 (9.9)
Participant social class ^d	15.7 p<.0001	4.2 (1.3)	3.8 (1.5)	3.3 (1.5)
Paternal social class ^d	5.1 p<.002	4.2 (1.3)	4.0 (1.5)	3.7 (1.5)
Number of DSM-IV AD symptoms	19.5 p<.0001	6.7 (0.7)	6.6 (0.9)	5.9 (1.5)
Lifetime maximum drinks in 24 hr	23.6 p<.0001	46.1 (1.5)	35.9 (1.6)	29.4 (1.6)
Lifetime maximum drinking days during a 1-month period	2.6 p<.05	20.0 (7.2)	18.8 (7.6)	17.9 (7.9)

^a Overall model F statistic yielded in MANOVA analyses.^b Proportion who completed secondary school (O-levels).^c Not significant at $\alpha=.05$.^d Range = 1 – 6, lower score indicates higher social class.

Table 4

Cross-sibling correlations (n=1202)

		Sibling 1 Class		
		Mild	Depressed	Severe
Sibling 2 Class	Mild	.33 [*]		
		.30 [*]		
	Depressed	-.19 [*]	.17 [*]	
		-.16 [*]	.16 [*]	
	Severe	-.35 [*]	.04	.44 [*]
		-.20 [*]	.01	.25 [*]

* =significant at $\alpha=.05$.

Note. The top number in each cell is based on assigned class membership (i.e., yes/no), and the bottom number is based on probability of class membership. The main diagonal displays the across-sibling within-class correlations. The lower triangle shows the across-sibling across-class correlations.