Published in final edited form as:

Psychosomatics. 2008 ; 49(4): 332–340. doi:10.1176/appi.psy.49.4.332.

Clusters of Alcohol Use Disorders Diagnostic Criteria and Predictors of Alcohol Use Following Liver Transplantation for Alcoholic Liver Disease

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Introduction

Alcoholic liver disease (ALD) is a common indication for liver transplantation (LTX) yet there is little written in the transplant literature about co-morbid alcohol use disorders in ALD LTX recipients. While these patients are often assumed to have an “alcohol abuse problem”, few investigations have dealt with the issue of diagnosing their specific alcohol use disorder [DiMartini 2001]. Interestingly, not all ALD LTX recipients are alcohol dependent. Approximately 70–75% will meet DSMIV criteria for alcohol dependence [Beresford 1997, DiMartini 2004], 20–25% will meet DSMIV criteria for alcohol abuse and 4–5% will not meet criteria for either disorder [DiMartini 2004].

Establishing the correct alcohol use disorder diagnosis is clinically relevant as several reports of post-LTX alcohol use suggest a pre-LTX diagnosis of alcohol dependence (rather than abuse) predicts relapse to alcohol use [Perney 2005, Beresford 1997]. In one study those with a diagnosis of alcohol dependence were 2.6 times more likely to drink post-LTX compared to those with alcohol abuse, and only those with alcohol dependence binge drank (defined as 6 or more drinks in a single episode) [DiMartini 2006].

While establishing the correct alcohol use diagnosis has clinical utility, in practice there is significant heterogeneity possible in the types of symptoms that any given patient might have who meets criteria for the diagnosis. DSM-IV diagnoses of alcohol use disorders are polythetic, based on whether a sheer count of specific criteria exceeds a numeric threshold (the presence of at least 1 of 4 potential criteria for alcohol abuse, or at least 3 of 7 potential

criteria for alcohol dependence). Therefore numerous combinations of specific symptoms are possible to achieve diagnostic significance. In fact, there are 23 theoretical subtypes of alcohol abuse and 99 theoretical subtypes of alcohol dependence [Grant 2000]. Considering the potential variations within alcohol use disorder diagnoses, we hypothesized that there would be distinct clusters of liver transplant recipients who showed specific combinations of alcohol-related symptoms. We also hypothesized that individuals with certain combinations of these symptoms would have a more severe form of the addiction which would, in turn, predict poorer post-LTX alcohol use outcomes.

Methods

Subjects

One hundred twenty ALD LTX recipients who are participating in a longitudinal study of post-LTX alcohol use have received the Structured Clinical Interview for DSMIV (SCID) module for alcohol abuse/dependence. Twenty three met criteria for abuse, 90 met criteria for dependence, and 7 had neither abuse nor dependence. The present analysis focuses on those 113 ALD LTX recipients who, by SCID interview, met criteria for a pre-LTX alcohol use disorder.

These participants were drawn from a larger group of all LTX recipients at the Starzl Transplant Institute (STI) who were transplanted for either a primary or secondary diagnosis of ALD from May 1998 to September 2002. All participants were 3 or more months post-transplant and no longer in the hospital at enrollment. Participants were voluntarily enrolled after agreeing to participate and signing informed consent. During the period of study recruitment, 194 transplant recipients were eligible. Of these, 151 participated (32 (16%) died before enrollment and 11 (5%) refused to participate). Participants were followed 3.2 ± 1.5 years (range 0.5 to 6.4 years).

Alcohol and Medical Diagnoses

The pre-LTX diagnosis of ALD was determined by consensus from interviews and examinations by our transplant surgeons, hepatologists, and psychiatry team (psychiatric nurse clinical specialist-MGF and psychiatrist-AD) during the evaluation for transplant. Patients with ALD had a history of excessive alcohol use, defined as 20 grams of ethanol per day for women or 60 grams ethanol per day for men [Deihl 1997]. The majority (88%) had consumed this amount for 10 years or longer.

In the transplant literature, alcohol diagnoses are most often made by clinical interview usually by a psychiatrist or other mental health professional without the aid of a standardized interview. However, we performed structured clinical interviews to identify not only the exact alcohol use disorder for each patient, but also whether each specific criterion of the alcohol use disorders are endorsed. Of the 151 participants 120 have undergone the structured psychiatric interview conducted by one research staff member trained to reliability in performing the alcohol use modules of the Structured Clinical Interview for DSMIV (SCID)[First 1994]. The accuracy and validity of this research member's interviews were reviewed by experts in SCID training.

Procedures for Identifying and Defining Alcohol Use Outcomes

Interviews and questionnaires

Following LTX, alcohol use was identified using 3 prospective measures. First, every 3 months for the first post-transplant year and every 6 months thereafter patients completed the Alcohol-Timeline Follow-back questionnaire (ATLFB) [Sobell 1992]. The ATLFB is a calendar instrument which captures a daily profile of alcohol use (onset, quantity, frequency, and duration of alcohol use) for the intervals between follow-up interviews. The ATLFB has good psychometric characteristics and allows the dimensions of drinking to be examined separately. It has high test-retest reliability and validity and has been tested on clinical and general population samples [Sobell 1996]. Participants completed the ATLFB questionnaires during a return clinic visit, by telephone interview with the research staff, or by mail. The patients were informed that the ATLFB information would be strictly confidential, would not become part of their medical record, and would not be revealed to any member of the transplant team (including the transplant psychiatrist AD or psychiatric nurse clinical specialist MGF). The research staff were not blinded to the patient's diagnosis or history. Completion rates for ATLFB were high at all time points (75–98%). Additionally, participants who missed one time point provided data on the missed time period at the next study interval.

Second, over the same time intervals, a caregiver who knew the patient best and typically lived with the patient (usually a spouse or family member) filled out a quantity – frequency questionnaire, which specifically asked about the patient's alcohol use since transplant. The caregiver questionnaire was patterned after the National Institute on Alcohol Abuse and Alcoholism (NIAAA) Quantity-Frequency measure [Armor 1978] and asks about the number of drinking days and the amount consumed.

Third, during routine post-transplant clinic appointments, clinical interviews were performed by the transplant psychiatrist (AD) who was blinded to the data obtained by the research staff (i.e. ATLFB and caregiver reports). Responses to questions about alcohol use from the psychiatrist's interview were corroborated with information given by the patient to the transplant coordinators and surgeons. As this clinic interview was conducted in the transplant clinic in conjunction with the transplant team, information provided by the patient to the transplant psychiatrist about alcohol use was revealed to the transplant team and documented in the medical record. For data collection purposes this information was recorded as quantity- frequency of alcohol use with specific dates and amounts of use on a monthly calendar form. Patients are seen in the transplant clinic as medically indicated. However, when possible, most patients are seen twice weekly for the first month after discharge from their hospital admission, then monthly until 3 months post-transplant, then every 3 to 6 months thereafter.

Blood Alcohol Levels

As part of our routine clinical care, random blood alcohol levels were obtained on the patients. At our hospital lab, blood alcohol levels (BAL) are performed by gas chromatography with positive levels identified at values ≥ 0.01 gm/dL. Using the blood

alcohol level and the patient's weight, information on the quantity of alcohol consumed to reach that specific BAL can be estimated. From the equation $Q = V_d \times C_{ss}$ where Q = loading dose (in grams of ethanol), V_d = volume of distribution (in liters) = $0.54 \text{ l/kg} \times$ patient weight in kg, and C_{ss} = concentration at steady state (in grams/liters), we can predict the loading dose of ethanol required to achieve a specific BAL. From the loading doses in grams of alcohol a BAL value can be converted into standard drinks (assuming 10 grams of ethanol/standard drink). BAL data were used to identify specific alcohol use outcomes (i.e. the time to first drink, the time to 6 drinks on a single occasion).

Definition of post-transplant alcohol use outcomes

Drinking occurs in a wide variety of patterns, defined by quantity, frequency, and duration. We chose 2 alcohol use outcomes to define the drinking events for this study: time to first drink (onset of use) and time to 6 drinks in a day for men and 4 drinks in a day for women (binge use). Based on standard research practice we chose different drink amounts for men and women to define binge use [Goldman 2002]. However, all participants who binged drank 6 or more drinks for the episode that defined their binge. The alcohol outcomes were calculated using information from each of the four ascertainment measures (clinical interview, ATLFB, caregiver report, BAL) from date of discharge from the transplant hospitalization until the outcome was achieved. The time to first alcohol use was defined as the time to first positive report on any of the interview/questionnaires or the first positive BAL. Time to binge use was defined as the time to first interview/questionnaire report of this quantity in a day or a BAL level that was calculated to be compatible with this quantity. For participants who did not reach the specific alcohol outcomes, we chose date of last follow-up on either the interview or questionnaires, whichever came first.

Statistical Analysis

In order to address the first research hypothesis, hierarchical agglomerative cluster analysis [Romesburg, 1984; Everitt et al., 2001] was used to identify distinct patterns of symptom endorsement among the 113 patients who met criteria for either abuse or dependence. Cluster analysis is an exploratory, descriptive technique that uses algorithms to sort individuals into groups such that group members are very similar to each other but different from members of other groups. In the present analysis, the analysis began by considering each person as the only member of their own group. The analysis then uses an algorithm—here, the unweighted pair-group method, with arithmetic averages and squared Euclidean distance coefficients—to begin to link individuals together into clusters. This process of linking individuals is known as agglomeration. At each stage of the analysis, an agglomeration coefficient is generated. The optimal stopping point is the analysis comes at the point just before the agglomeration coefficient shows a much greater increase in size than the sizes of the increase on previous steps of the analysis (Romesburg, 1984) Cross-validation was used to determine whether the cluster solution was likely to be stable and hence generalizable. In cross-validation, the original sample is divided and the cluster solution obtained in one subsample is compared to the cluster solution obtained in the other subsample. The goal is to obtain the same number of types of clusters in each subsample.

The second study aim was to identify key correlates of cluster group membership, i.e., pre-transplant demographic and health-related correlates of distinctive patterns of symptom endorsement in the sample. Univariate analyses, followed by discriminant function analysis was used to accomplish this goal. The discriminant function analysis determined which correlates best distinguished between the groups. The analysis generates loadings on each discriminant function extracted (a discriminant function is an underlying dimension on which the groups differ). The larger a correlate's loading on a discriminant function, the more important it is in relation to group membership. The analysis also classifies individuals based on the set of correlates. The greater the proportion of individuals correctly classified, the more important the correlates are for understanding group differences. Finally, analogous to cluster analysis, cross-validation is used to determine the stability and generalizability of the results. Before the discriminant function analysis, the potential correlates were examined and found to meet all analytic assumptions adequately [Tabachnick & Fidell, 2001]. With the present sample size, we had power of .88 to detect a moderate sized association between any given correlate and group membership. The third study aim was to determine whether membership in the distinct cluster groups predicted risk for return to alcohol consumption after liver transplant. Kaplan Meier analysis was used to address this question. Under this analysis, the log-rank test is used to evaluate the statistical significance of any identified differences between groups.

Statistical Package for the Social Sciences (SPSS) for Windows version 12 was used for the analyses.

Results

Identification of groups with distinct patterns of alcohol symptom endorsement

Based on the degree of change in the amalgamation coefficient as cluster agglomeration proceeded, a 9-cluster solution was optimal. However, most individuals ($n=104$ of 113) fell into one of 4 clusters. These 4 cluster groups are shown in Figure 1, which plots the proportions of each who endorsed the DSM-IV symptom items pertaining to alcohol use. Thus, the first cluster included 30 individuals (26.5% of the sample) who, compared to all other cluster groups, were most likely to have the full range of symptoms (i.e., the proportion endorsing each symptom were larger than the proportions in other groups), and the figure shows that they were the most likely to endorse having had legal problems related to alcohol, continued use despite persistent or recurrent psychological or physical problems, inability to reduce the amount of alcohol consumed, and withdrawal symptoms. All individuals in this cluster met criteria for a diagnosis of alcohol dependence.

The second cluster included 21 individuals (18.6% of the sample) who also all met criteria for alcohol dependence, but they showed a different pattern of symptoms. Compared to all other clusters, they were most likely to have symptoms of tolerance. The third cluster included 20 individuals (17.7% of the sample), and they stood out from other clusters by the fact that none reported symptoms of withdrawal, despite evidence of tolerance. They were highly likely to report that alcohol had led them to be unable to perform social roles. Finally, the fourth cluster of 33 individuals included a large proportion of individuals who met

criteria for abuse but not dependence. In general, individuals in which cluster were the least likely to endorse any of the symptoms shown in the figure.

It should be noted that the figure excludes two symptoms that were endorsed by the majority of individuals in all 4 clusters: use of alcohol in situations that could involve physical hazards (endorsed by 100%, 100%, 95%, and 94% of clusters 1 through 4, respectively, $\chi^2 = 3.02$, exact $p = .41$), and a great deal of time spent in getting alcohol (endorsed by 100%, 100%, 100%, and 94% of the four clusters, respectively, $\chi^2 = 4.39$, exact $p = .33$). By contrast, the four clusters differed significantly on their distributions of all of the symptoms illustrated in Figure 1 (see note to figure for χ^2 values). Remaining respondents ($n=9$, 8% of the sample) were dispersed across 5 small clusters which contained 1 to 2 persons each and were thus too small to evaluate further.

The stability and replicability of the cluster solution (i.e., the emergence of 4 dominant clusters, with a small minority of individuals who could not be classified into any of these 4 clusters) was evaluated using a cross-validation procedure, in which a random sample of 50% of respondents was withheld from the cluster solution. For the remaining 50%, a new cluster analysis replicated the pattern in the entire sample (i.e., the degree of change in the amalgamation coefficient as cluster agglomeration proceeded was virtually identical to that for the full sample, and 89% of respondents in the subsample were classified into the same clusters as in the full sample). For the other 50% in the cross-validation subsample, the solution again replicated: 91% were classified into the cluster in which they fell in the full-sample analysis. These classification rates suggest excellent stability, and hence generalizability, of the cluster solution [Tabachnick & Fidell, 2001].

Pre-transplant correlates of alcohol symptom pattern group membership

The first four columns of Table 1 display the distribution of each potential correlate among respondents in the alcohol symptom pattern groups, followed by the univariate test for each correlate. As shown in the fifth column of the table, there were significant group differences in the demographic variables of age and occupation, and in the health history variables of grams of ethanol consumed per day, participation in rehabilitation before transplant, whether respondents met criteria for another nonalcohol substance use diagnosis before transplant, and whether respondents had hepatitis C. These univariate tests, however, do not evaluate whether the groups of respondents could be reliably distinguished from one another across the complete array of interrelated correlates. Discriminant function analysis was used to accomplish this goal.

The small sample sizes in the groups necessitated a conservative approach to the multivariate analysis. We included in the discriminant analysis only those potential correlates that had at least modest effect sizes in the univariate analyses (f for continuous variables and ϕ for dichotomous variables $> .20$; Cohen, 1988). Therefore, the discriminant analysis compared the 4 alcohol symptom pattern groups on a subset of 9 potential correlates. These variables are listed in Table 2.

The discriminant analysis extracted two dimensions along which the alcohol symptom pattern groups varied. The first separated respondents in Group 1 (the most highly

symptomatic group of all)(centroid = 1.15) from Group 4 (the least symptomatic group; centroid = -.85) with Groups 2 and 3 lying in between (centroids of -.28 and .03, respectively). In contrast, the second dimension distinguished Groups 2 and 3 (the two groups with primarily social/role problems and tolerance and/or withdrawal symptoms, centroids of .63 and .72, respectively) from both Groups 1 and 4 (centroids of -.38 and -.59, respectively). Each of these two dimensions differentiating the groups are characterized by distinct sets of correlates, as described below. Each dimension accounted for a significant portion of the correlates' discriminating power (before removal of either function: χ^2 (27, N = 95) = 75.01, $p < .001$; after removal of first function: χ^2 (16, N = 95) = 32.63, $p = .008$; after removal of second function: χ^2 (7, N = 95) = 6.13, $p = .524$).

The correlates' loadings on the two discriminant functions are shown in Table 2. The most important correlates (with loadings of absolute value $> .30$) of whether respondents were in the most symptomatic (Group 1) vs. least symptomatic group (Group 4) were having less education, consuming more grams of ethanol on average, attending alcohol rehabilitation, and having a history of nonalcohol substance abuse/dependence. Along the second dimension, respondents in Groups 2 and 3 (dependence but mostly social and tolerance/withdrawal symptoms) were most likely to have worked in blue collar occupations and were younger.

The set of predictors in the analysis classified 61% of respondents correctly. Group-specific classification accuracy was 77%, 50%, 50%, and 62% for Groups 1, 2, 3, and 4 respectively. This was substantially better than chance (accuracy at chance would have been 27%, 21%, and 21%, and 31%, respectively). Although the discriminant functions did not classify all respondents accurately, the canonical correlations of .62 for the first function (i.e., the correlation of the function with group membership) and .51 for the second function indicate that the set of correlates were indeed important for the ultimate assignment to the pattern-of-distress groups.

Classification stability was examined using cross-validation [Tabachnick & Fidell, 2001]. In an additional analysis, a random sample of 25% of respondents was withheld from the calculation of the classification functions. For the 75% of respondents from which the functions were derived, 60% were correctly classified. For the remaining 25% of respondents, 54% were correctly classified. These results indicate that the classification had very good consistency and hence generalizability.

Alcohol symptom pattern as a predictor of return to drinking post-transplant

We examined the relationship of alcohol symptom pattern group membership to time to first drink post-transplant and time to first episode of heavy drinking (6 drinks on a single occasion). For both outcomes, Group 4 (composed predominantly of individuals with milder alcohol abuse symptoms) had a significantly longer time to drinking and fewer individuals who drank compared to the remaining three groups, while the remaining three groups did not differ significantly from each other. These findings are illustrated in Figure 2, which plots the curves for time to first episode of heavy drinking (log rank test comparing Group 4 to other groups: log rank values of 3.72, $p = .054$, 3.26, $p = .032$, 6.20, $p = .012$ for comparison to Groups 1, 2, and 3, respectively). Although the curve for Group 3 appears to

be substantially different than the other groups with all in that cluster having drunk heavily by 1500 days, this did not reach significance possibly due to the small numbers reaching that time point.

Conclusions

The heterogeneity of psychiatric disorders has been a nosologic issue since the initial development of the DSM classification. While alcohol use disorders are robust and valid diagnostic categories, the polythetic design of the DSM means that there are many distinct combinations of symptoms that will result in a diagnosis. Considering all of the possible combinations, in a non-transplant sample, Grant found that, of the 99 possible subtypes of alcohol dependence that could emerge within the DSM approach, 70% of those with alcohol dependence could be characterized by only 6 subtypes of dependence. Of the 23 theoretical subtypes of alcohol abuse, 90% of those with alcohol abuse could be represented by 3 subtypes [Grant 2000]. This and other investigations on the taxonomy of alcohol use disorders have prompted experts in the field to consider moving from a categorical classification system to a dimensional one using symptom clusters [Hasin 2003], and there is growing sentiment for DSM-V to incorporate a dimensional approach to alcohol and other substance use psychopathology [Krueger 2005].

We were similarly interested in looking beyond a categorical classification of alcohol use disorders in our sample. We had hypothesized that distinct clusters would exist that would identify those with a more severe form of these disorders and predict those more likely to drink. In our sample we identified 3 specific clusters of alcohol dependence and one of alcohol abuse. Only 9 participants could not be assigned to a specific cluster.

These clusters were further distinguished by pre-LTX demographic and addiction history variables. Those in cluster 1 were distinguished from the other clusters not only by showing higher rates of almost all types of alcohol use symptoms, but also in that they were more likely to be less educated, have a larger daily alcohol consumption pre-LTX, were more likely to have attended addiction rehabilitation and to have an additional diagnosis of a non-alcohol substance use disorder. This cluster may represent the type II alcoholic defined by Cloninger (male, early age of onset, more severe course, anti-social behavior) [Cloninger 1987]. Although we did not identify Cloninger's specific alcohol classifications, one prior report found that the type II alcoholics in their LTX cohort were more likely to have used other illicit substances in addition to alcohol prior to LTX [Coffman 1997]. Patients with these characteristics may be increasingly represented in LTX populations as more patients with hepatitis C infections resulting from injected drug use go on to develop end-stage liver disease and proceed to transplantation. While we investigated the use of alcohol in our cohort, patients with other substance use comorbidities should also be clinically monitored for use of these substances after LTX.

Despite the significant variation in the variety and number of alcohol symptoms endorsed by our subtypes of alcohol dependence, within the clusters of those with alcohol dependence, cluster assignment did not predict those more likely to drink. However, those assigned to the alcohol abuse cluster were significantly less likely to drink (both any at all and binge drink)

compared to those with alcohol dependence. This replicates our earlier work and highlights the importance of establishing the correct pre-LTX alcohol use disorder diagnosis as not all LTX candidates will meet diagnostic criteria for alcohol dependence.

Although a limitation of our study may have been the alcohol outcomes we chose to investigate (any alcohol and binge use), we specifically looked at thresholds of alcohol consumption commonly used in alcohol research [Goldman 2002]. While our sample may be considered different from cohorts at other liver transplant programs, the demographics of our group and the percentage of ALD recipients with alcohol dependence is similar to statistics reported from other large national programs [Belle 1997, Beresford 1992, Gish 1993, Lucey 1992].

Our results suggest that the prognosis regarding continued abstinence post-transplant is much more positive for individuals with a diagnosis of abuse than for those who meet criteria for alcohol dependence. Nevertheless all ALD LTX recipients should be closely monitored for alcohol consumption maintaining an open, non-judgmental approach and offering assistance when any alcohol use is identified.

Acknowledgments

This research is funded by grant nos. K23 AA0257 from the National Institute of Alcohol Abuse and Alcoholism and R01 DK066266 from the National Institute of Digestive Disorders and Kidney Diseases Rockville, MD, USA.

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Figure 1.

Four cluster groups' proportion who endorsed of each DSM-IV alcohol criterion symptoms, and their rates of DSM-IV alcohol abuse and alcohol dependence diagnoses.

Note: χ^2 values for the nine symptom item are significantly different ($p < .05$) between the 4 groups. Values of χ^2 are 33.01, 14.61, 15.89, 10.11, 19.45, 48.77, 43.87, 25.31, and 83.11 for the items, respectively (for all, $df = 1$, p 's $< .001$). See text for discussion of two additional DSM-IV symptom items (use in hazardous situations, time spent obtaining alcohol) not displayed in the figure.

Figure 2.

Cluster group differences in time to heavy drinking (n=104)

Log rank test comparing Group 4 to other groups: log rank values of 3.72, $p = .054$, 3.26, $p = .032$, 6.20, $p = .012$ for comparison to Groups 1, 2, and 3, respectively. Groups 1–3 did not differ significantly from one another.

Demographic and health history characteristics in four groups defined by pattern of symptoms of alcohol use disorder in individuals transplanted for alcoholic liver disease (n = 104)

Table 1

Pre-transplant Correlate	Group 1: Symptomatic in all areas (n=30)	Group 2: Social problems, tolerance/withdrawal (n=21)	Group 3 : Role problems, tolerance of abuse (n=20)	Group 4: Symptoms of abuse (n=33)	Test Statistic ^a	p
<u>Demographic characteristics</u>						
Gender, % male	76.7	90.5	95.0	90.9	4.77	.190
Age, M (SD)	50.0 (7.3)	49.7 (7.2)	47.5 (6.7)	54.0 (7.4)	3.90	.011
Education, % high school	70.0	42.9	55.0	48.5	4.54	.209
Occupation, % blue collar	66.7	90.5	90.0	57.6	10.80	.013
Marital status, % married	43.3	66.7	55.0	69.7	5.23	.156
<u>Health history</u>						
Years heavy drinking, M (SD)	19.2 (8.6)	19.6 (8.1)	20.9 (9.3)	22.0 (9.9)	0.59	.621
Average ETOH consumption/day, M (SD) ^e	212 (179)	149 (124)	126 (70)	98 (120)	4.82	.004
Months of sobriety, M (SD) ^e	51.4 (61.0)	39.0 (38.1)	31.3 (42.3)	35.6 (37.0)	0.12	.948
Alcohol rehabilitation, % yes	76.7	47.6	60.0	18.2	22.71	<.001
Family history of alcoholism, % yes	65.5 ^b	61.9	50.0	69.7	2.18	.537
Other DSM substance abuse/dependence diagnosis, % yes	42.9 ^c	25.0 ^b	20.0	6.7 ^d	10.73	.013
DSM Axis I diagnosis (nonsubstance use), % yes	51.7 ^b	42.9	45.0	41.9 ^c	0.67	.880
Childs-Pugh score, M (SD)	10.4 (1.7)	10.1 (2.4)	10.5 (2.4)	10.7 (2.0)	0.39	.763
Presence of Hepatitis C, % yes	70.0	61.9	45.0	39.4	7.10	.069

^a $\chi^2(3)$ for cross-tabulations of dichotomous variables, F (3,100) for analysis of variance for continuous variables, with p values for the test statistic in 6th column

^b 1 case had missing data on this variable.

^c 2 cases had missing data.

^d 3 cases had missing data.

^e log transformed to reduce skewness prior to statistical test. Untransformed means and SDs are presented to facilitate interpretation.

Table 2
Relationship of correlates to alcohol symptom patterns in individuals transplanted for alcoholic liver disease^a

Discriminant function loading		
Pre-transplant Correlate	Dimension 1: Symptoms of alcohol use in many vs. fewer areas	Dimension 2: Predominantly social/role problems, with tolerance vs. other symptom patterns
<u>Demographic characteristics</u>		
Gender, male	-.28	.29
Greater age	-.24	-.46*
Less education	.33*	-.04
Blue collar occupation	-.05	.61*
Married	.26	-.08
<u>Health History</u>		
Greater ETOH consumption/day	.43*	.21
Participated in rehabilitation	.64*	-.26
Other DSM substance use disorder	.37*	.08
Positive for hepatitis C	.25	.07
Canonical correlation (p level)		.51 (.008)

^a Nine persons with incomplete data on one or more predictors were excluded from the discriminant analysis. (n=95 of the 104 assigned to one of the 4 clusters). They did not differ from remaining subjects on other study characteristics.

* loadings meeting criterion for interpretation, loading > .30.