A Principal Components Analysis of the Abbreviated Desires for Alcohol Questionnaire (DAQ)*

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ABSTRACT. Objective: The aim of this study was to examine the abbreviated Desires for Alcohol Questionnaire (DAQ) with respect to component structure and concurrent validity. **Method:** The DAQ was administered to 2,960 adults participating in the Collaborative Studies on the Genetics of Alcohol. Rotated principal components analysis was conducted on 1,500 subjects with an alcohol-use disorder (AUD) and on 1,460 non-AUD subjects. Total DAQ scores were compared for these two subsamples. In addition, correlations were computed between DAQ scores and the following: (1) a sum of alcohol symptoms, and (2) endorsement of a single interview craving question. **Results:** Similar solutions emerged in the AUD and non-AUD subsamples, with dimensions characterized by (1) strong desires/intentions to drink, (2) negative reinforcement, and (3) positive reinforcement + ability to control drinking. Each component was significantly correlated with the alcohol symptom scale in both subsamples (r_s = .25-.64 and .31-.40, respectively, $p < .0001$) and with the interview craving item in the AUD subsample (r_s = .22-.55, $p < .0001$). Total DAQ score was significantly higher for AUD subjects (40.5) than for non-AUD subjects (23.1, $p < .0001$) and exhibited significant correlations with the alcohol symptom scale in the AUD and non-AUD subsamples (r_s = .61 and .39, respectively, $p < .0001$) and with the interview craving item in the AUD subsample (r_s = .51, $p < .0001$). **Conclusions:** The DAQ is an appropriate measure of alcohol craving, as demonstrated by similar component structures across two samples as well as its concurrent validity. (*J. Stud. Alcohol Drugs, 71,* 150-155, 2010)

CRAVING HAS LONG BEEN CONSIDERED central to alcohol dependence (Drummond, 2001). It is the first criterion listed for International Classification of Diseases-10 alcohol dependence syndrome (World Health Organization, 1992), and some researchers have argued for its consideration in the upcoming Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-V) (Martin et al., 2008). In support of this, Foroud et al. (2007) found that 42% of subjects who met criteria for DSM-IV (American Psychiatric Association, 2000) alcohol dependence also experienced craving, with similar rates for men and women (43% and 38%, respectively). In contrast, only 2% of non-alcohol-dependent individuals reported this symptom.

Craving is particularly associated with the severity of alcohol problems. Bohn et al. (1995) examined drinkers in treatment and obtained significant correlations between one measure of craving, the Alcohol Urge Questionnaire, and the number of drinks in the past 30 days (.33), number of previous detoxifications (.31), and total score on the Alcohol Dependence Scale (.21). Similarly, Bucholz et al. (1996) conducted a latent class analysis of individuals in a national high-risk study and obtained four classes of alcohol problems distinguished by increasing overall severity; the symptom of craving was present only in the most extreme alcoholism category.

Craving also predicts the probability of relapse and the extent of consumption following abstinence (Flannery et al., 2001; Monti et al., 1990). Further, it has implications for treatment, as the reduction of craving may underlie the beneficial effects of drugs such as Naltrexone (Monti et al., 2004; Tidey et al., 2008).

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Although craving clearly is an important alcohol symptom, there is a lack of consensus about its definition (Drummond, 2001). While most investigators consider a strong desire or urge for alcohol to be the core feature, additional characteristics have been posited, such as anticipated reinforcement (Bohn et al., 1995; Love et al., 1998), stimulating or subjective effects (Miranda et al., 2008), and obsessive thoughts or images (Anton et al., 1995). Some of these additional components (e.g., the subjective effects of alcohol) may share genetic underpinnings with the core symptom of desire per se (Hutchison et al., 2008), but the extent to which they are conceptually and empirically related has not been completely resolved (Monti et al., 2004).

To help address this issue, researchers have examined the structure of alcohol craving questionnaires to better delineate relationships among its key domains. One such instrument, the Desires for Alcohol Questionnaire (DAQ; Love et al., 1998), is the focus of the current article. The original 36-item instrument was reduced to a 14-item version by Clark and colleagues in an unpublished manuscript. These authors derived four factors from the longer version and selected 14 items that loaded highly on each dimension (cited in Love et al., 1998; P. Willner, personal communication). Love subsequently administered this abbreviated DAQ to 131 alcoholics and obtained a four-component oblimin rotated principal components solution, accounting for 82% of the total variance. The four dimensions were labeled Desires and Intentions to Drink, Negative Reinforcement, Control Over Drinking, and Mild Desires to Drink.

Preliminary evidence for the validity of the 14-question DAQ has been provided by laboratory studies of alcohol cue reactivity. In several investigations, social drinkers exposed to the sight, smell, and taste of alcohol generated higher DAQ scores than did subjects similarly exposed to soft drinks (Schulze and Jones, 1999, 2000). In addition, within-subject increases in the DAQ have been found among social drinkers after ingestion of alcohol in the laboratory (Rose and Duka, 2006; Schoenmakers et al., 2008).

Because the abbreviated DAQ is efficient to administer, addresses several domains of craving, and has laboratory data providing preliminary support for its validity, this instrument was incorporated into the Collaborative Studies on the Genetics of Alcoholism (COGA; Begleiter et al., 1995), a national, family-based project designed to identify genes that affect susceptibility for alcoholism. The present investigation of the DAQ was undertaken to examine its psychometric properties before employing it as a source of craving phenotypes in COGA. As one part of this analysis, we examined the DAQ's concurrent validity in the COGA sample, building on the earlier alcohol cue studies. Follow-up data for the current phase of COGA are too incomplete at this point to permit tests of predictive validity. However, concurrent measures allowed us to examine the relationship between the DAQ and (1) the presence of an alcohol-use disorder (AUD), (2) an alcohol symptom scale based on the sum of several alcohol-dependence items from a semi-structured interview, and (3) a single craving question from the same interview. Positive and significant relationships in each instance would be considered evidence for concurrent validity.

An additional goal for characterizing the DAQ was to further investigate the possible component parts of "craving" as measured by the DAQ. Although Love's research group (Love et al., 1998) obtained a four-component solution from alcoholics with the abbreviated DAQ, they obtained a different, three-component solution from social drinkers with the 36-item version. Because the authors did not use the same instrument with the two samples, it is unclear what role sample characteristics actually may have played in these findings. Accordingly, we conducted rotated principal components analyses among COGA participants with and without an AUD separately, using the same 14-item version of the DAQ.

Method

Subjects

The present investigation was based on data collected from COGA, a high-risk family study designed to identify susceptibility genes for alcoholism. Participants were recruited from six research institutions (University of California at San Diego, University of Connecticut, University of Iowa, Indiana University, Washington University in St. Louis, and the State University of New York at Brooklyn). All subjects were required to speak English, be free of extensive or recent intravenous drug use, and have no life-threatening or incapacitating medical illness. Participants signed informed consent in accordance with institutional review board requirements at their respective sites. Further details about ascertainment and study design can be found in other publications (Begleiter et al., 1995; Edenberg, 2002; Edenberg and Foroud, 2006; Nurnberger et al., 2004).

COGA subjects were drawn from two ascertainment samples. The first (high-risk) consisted of alcohol-dependent probands and their family members. Probands were ascertained through alcohol treatment centers and met criteria for both DSM-III-R alcohol dependence (American Psychiatric Association, 1987) and definite Feighner alcoholism (Feighner et al., 1972). High-risk families that contained at least two additional affected first-degree relatives were extended to more distant biological family members and evaluated with interviews, electrophysiological measures, a neuropsychological test battery, and DNA assessment. The second sample was composed of nuclear families that contained two parents and at least three adolescent offspring available for assessment. These comparison families were recruited through a variety of means (e.g., dental clinics, churches) and were ascertained without regard to the presence of nonpsychotic

psychiatric disorders. Comparison family participants were administered the same assessment battery as high-risk family members.

To complete the DAQ, individuals were required to have had at least one full drink in their lifetime. For the current analysis, subjects consisted of 2,960 COGA adults (age ≥ 18 years; M_{age} = 38.7, *SD* = 13.2) with available DAQ data; 56.5% of this group was female. These subjects were divided into two subsamples: (a) 1,500 alcoholic individuals who met criteria for an AUD, defined as DSM-IV alcohol dependence or alcohol abuse (43.7% female; M_{age} = 39.2, *SD* = 11.4) and (b) 1,460 individuals who did not meet criteria for an AUD (69.7% female; M_{age} = 38.2, *SD* = 14.8).

Instruments

Alcohol dependence and abuse diagnoses were made on the basis of a psychiatric interview created for COGA: the Semi-Structured Assessment for the Genetics of Alcoholism (SSAGA; Bucholz et al., 1994). This polydiagnostic instrument addresses DSM-IV criteria and has good test-retest reliability and validity (Bucholz et al., 2006; Hesselbrock et al., 1999). The SSAGA also was used to create a 10-item alcohol-symptom count scale, selected to represent core problems associated with alcohol dependence and abuse. This scale—which included items such as "gave up or greatly reduced important activities" and "alcohol often interfered with work, school, or family responsibilities"—was originally employed as the outcome measure in a previous COGA longitudinal study of young adult alcohol involvement (Kramer et al., 2008).

The abbreviated DAQ was based on Clark's (Love et al., 1998) 14-item instrument, with the original 7-point Likert scale changed to a 5-point scale—ranging from 1 = "not at all" to 5 = "strongly agree"—because this provided a more normal distribution of subject responses (V. M. Hesselbrock, personal communication). The DAQ contains items that tap several aspects of craving experienced during subjects' heaviest drinking period: mild and strong urges for alcohol, anticipated positive and negative reinforcement from drinking, and expectations of control over drinking. Subjects completed the DAQ by themselves but were encouraged to ask study interviewers for help with unclear items. Following completion of the questionnaire, interviewers inspected protocols for missing or confusing answers and resolved any problems with subjects.

Analyses

Principal components analysis was conducted using the SAS FACTOR procedure (SAS Institute, 2004) separately on the AUD and non-AUD subsamples. In each analysis, obtained components were subsequently subjected to oblique (oblimin) rotation to approximate simple structure because previous studies suggested intercorrelations among components of craving. Inspection of scree plots and eigenvalues, as well as interpretability of each component, were used to identify optimal solutions in each subsample. Items were required to exhibit a standardized regression coefficient for a component at an absolute value of .4 or greater to be considered part of that component. If a DAQ item exhibited coefficients at this level for more than one component, the item was considered part of the component for which it had the highest coefficient.

A one-tailed *t* test was employed to compare mean DAQ total scores between individuals with and without an AUD, because previous research suggests that craving scores should be higher among individuals affected with an AUD. In addition, Spearman correlations were computed to test the association between DAQ scores in each subsample and (1) the 10-item SSAGA alcohol symptom scale and (2) a single craving question from the same interview ("In situations where you couldn't drink, did you ever have such a strong desire for it that you couldn't think of anything else?").

Results

Rotated principal components analysis: AUD subsample

The DAQ exhibited a raw Cronbach's α of .93 in this subsample. Following principal components analysis, inspection of the scree plot and associated eigenvalues suggested an optimal solution of three dimensions, accounting for 74.2% of the total variance (Table 1). Following oblimin rotation, these three components were labeled: (a) Strong Desires/Intentions to Drink, (b) Negative Reinforcement, and (c) Positive Reinforcement + Ability to Control Drinking. Cronbach's α's were .936, .893, and .800, respectively. Intercorrelations among the three rotated components ranged from .290 (Components 1 and 3) to .693 (Components 1 and 2).

Rotated principal components analysis: Non-AUD subsample

The DAQ exhibited a raw Cronbach's α of .88 in this subsample. Inspection of the scree plot and associated eigenvalues suggested an optimal solution of three components, accounting for 72.2% of the total variance (Table 1). These three components had highly similar item content to that found in the AUD subsample and thus were also labeled (a) Strong Desires/Intentions to Drink, (b) Negative Reinforcement, and (c) Positive Reinforcement + Ability to Control Drinking. The one difference was Item 6 ("I would accept any drink that was offered to me"), which was part of the Negative Reinforcement component in the non-AUD subsample but part of the Strong Desires/Intentions to Drink component in the AUD subsample. Cronbach's α's were

TABLE 1. Desires for Alcohol Questionnaire three-component solutions in the alcohol-use disorder (AUD) and non-AUD samples: Standardized regression coefficients of rotated components

	AUD sample			Non-AUD sample		
# Question	Comp. 1	Comp. 2	Comp. 3	Comp. 1	Comp. 2	Comp. 3
1. I wanted a drink so much I could almost taste it.	.93	-.07	.01	.78	-.02	.10
2. My desire to drink seemed overwhelming.	.94	-.03	-.003	.89	.02	.01
3. I thought I would do almost anything to have a drink.	.90	.01	-.07	.90	-.05	-.05
4. I thought about drinking as soon as I possibly could.	.93	-.02	.02	.90	-.01	.02
5. I thought about having a drink most of the time.	.88	.04	-.02	.83	.07	-.04
6. I would accept any drink that was offered to me.	.52	.24	.05	.26	.40	.11
7. I thought that all the bad things in my life would disappear if I drank.	.03	.84	-.08	.13	.78	-.19
8. Even major problems in my life would not bother me if I drank.	.01	.92	-.08	.07	.86	-.11
9. I felt less worried about my daily problems when I drank.	-.005	.90	.01	-.004	.85	.09
10. I thought drinking made me feel less tense.	.11	.64	.21	-.09	.72	.35
11. When I started drinking, I thought I would be able to stop.	.01	-.06	.89	.02	-.08	.91
12. I thought I could easily limit how much I would drink.	-.05	-.06	.92	-.004	-.11	.91
13. I thought drinking was very satisfying.	.20	.38	.44	.12	.34	.60
14. I thought drinking was pleasant.	.07	.40	.48	.10	.26	.67

Note: Comp. = component.

.909, .846, and .844 for the three components, respectively. Intercorrelations among them following oblimin rotation to simple structure ranged from .236 (Components 1 and 3) to .617 (Components 1 and 2).

To compare the two subsample solutions, all subjects were combined and a dichotomous variable was added to the analysis that indicated subsample membership (Garson, 2009). Principal components analysis of the DAQ and dummy variable (group membership) with oblimin rotation was then conducted on this combined sample. In the resulting three-component model, the membership variable exhibited a significant regression coefficient on the first component, but not the other two, indicating that the component structure between AUD and non-AUD subsamples was not invariant.

Concurrent validity

The average DAQ total score (1-5 points per item; possible range = 14-70) was 40.5 for the AUD subsample and 23.1 for the non-AUD subsample, a significant difference ($p < .0001$). In the combined sample, the total DAQ score exhibited Spearman correlations of .72 with the 10-item alcohol symptom scale ($p < .0001$) and .49 with the single interview craving item ($p < .0001$).

In the AUD subsample, the 10-item alcohol symptom scale exhibited Spearman correlations of .61 with total DAQ score, .64 with Component 1, .54 with Component 2, and .25 with Component 3 (all $p < .0001$). Correlations between the single interview craving question and DAQ scores were .51 with total score, .55 with Component 1, .42 with Component 2, and .22 with Component 3 (all $p < .0001$).

In the non-AUD subsample, Spearman correlations between the 10-item alcohol symptom scale and the DAQ, although still significant, were generally smaller. The 10-item alcohol symptom scale correlated .39 with the total DAQ score, .33 with Component 1, .40 with Component 2, and .31 with Component 3 (all $p < .0001$). Neither the total DAQ score nor any of the three components was significantly correlated with the single interview craving question.

Because different data reduction methods can often produce different results, we also applied principal axis factor analyses (using squared multiple correlations as common variance estimates) and maximum likelihood factor analyses to this same data set to determine the stability of the dimensions identified using rotated principal components analysis. Although some slight variations were found in the subsample analysis, three-component/factor solutions in the two subsamples similar to those reported above were confirmed (results available from the corresponding author).

Discussion

Our goal was to examine the psychometric properties of the DAQ in preparation for further studies of craving, including genetic investigations. The significant difference in DAQ total score between individuals with and without an AUD supported prior evidence for a link between craving and the presence of alcohol dependence (Foroud et al., 2007). Further, the positive correlations obtained between DAQ total scores in both subsamples and number of alcohol symptoms was consistent with earlier findings of an association between craving and severity of alcohol involvement (Bohn et al., 1995; Bucholz et al., 1996). Finally, the significant relationship between the DAQ and the interview craving item in the AUD subsample suggests that the DAQ and interview are tapping similar concepts.

In the non-AUD subsample, relationships between the DAQ and other alcohol measures were generally less strong (for the alcohol symptom scale) or nonsignificant (for the interview craving item). This is not unexpected, because the

reduced range of alcohol symptoms and craving symptoms in this more moderate drinking sample may have attenuated the size of correlations.

In both subsamples, similar three-component solutions emerged, each accounting for more than 70% of the total variance. Our findings echoed, but were not identical to, Love et al.'s (1998) three-component solution with recreational drinkers on the 36-item DAQ. Both studies obtained a dimension representing strong intentions and desire to use alcohol, the central characteristic of craving. However, items representing positive and negative reinforcement formed a single dimension in Love et al.'s investigation but were associated with separate components in our study. In a subsequent sample of alcoholics with the abbreviated DAQ, Love's group obtained four rather than three dimensions. Thus we found, as they did, that AUD and non-AUD samples do not generate identical component solutions, although our specific component models differed. These discrepancies may be partly attributable to differences in the ascertainment of subjects and instruments employed in the two investigations. Importantly, the current study's large sample size and the similarity of results in individuals with and without an AUD suggest that three-component models are optimal for describing COGA participants and other samples in which a broad range of age, ethnicity, and drinking styles is represented. However, our results also emphasize that different component scores should be employed when administering the DAQ to individuals with or without an AUD.

The DAQ will be used to further investigate "craving" in the COGA project. Studies will include identification of high-risk alleles associated with DAQ scores, following up an earlier investigation (Foroud et al., 2007), which found a significant relationship between the α-Synuclein (*SNCA*) gene and the interview craving question. Additional analyses of the DAQ will address its role in predicting the course of alcohol dependence and response to treatment among COGA subjects. Although Components 1 and 2 had the highest correlations with alcohol symptoms and with the interview craving item in the current study, all three components will be tested in future investigations to empirically determine the most salient relationships. It is anticipated that the DAQ and its components will provide more stable (Tiffany et al., 1993) and comprehensive craving phenotypes for research than the single craving interview question.

Although the DAQ has primarily been used in research studies, this instrument also could be employed in clinical settings, pending the development of norms. Among other uses, component scores might help assess the efficacy of specific drugs (Addolorato et al., 2005) or identify individuals who are especially vulnerable to drinking cues in social situations (Rose and Duka, 2006). Finally, the DAQ could help clinicians target specific components of craving—such as anticipated negative consequences—for purposes of treatment planning.

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