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Measuring Alcohol Craving: Development of the Alcohol Craving Questionnaire

Running head: The Alcohol Craving Experience Questionnaire (ACE)

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Conflict of Interest
None

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Abstract

Aims. To develop a measure of craving based on the Elaborated Intrusion (EI) theory of desire and to examine the construct, concurrent and discriminant validity of the instrument.

Design. Cross-sectional.

Setting and Participants. Two hundred and thirty patients from a hospital alcohol and drug outpatient service, participants in a randomised controlled trial (N=219) and students in a university based study of alcohol craving (N=202) were recruited.

Measurements. The Alcohol Craving Experience questionnaire (ACE) was developed to measure sensory aspects of craving (imagining taste, smell or sensations of drinking and intrusive cognitions associated with craving) when craving was maximal during the previous week (ACE-S: strength), and to assess the frequency of desire-related thoughts in the past week (ACE-F: frequency). The ACE and the Alcohol Use Disorders Identification Test were completed by all participants. The Obsessive Compulsive Drinking Scale and the Depression, Anxiety & Stress Scale was completed by the hospital patients and the randomised control trial participants.

Findings. Exploratory factor analysis demonstrated a clear three-factor structure representing *Imagery, Strength* and *Intrusion* for ACE-S (Strength) and for ACE-F (Frequency). An attempt to confirm this factor structure required a reduction in items (two from ACE-S, five from ACE-F) before a good fit to the three-factor model was obtained. Concurrent validity with the OCDS, with severity of alcohol dependence and with depression, anxiety and stress was demonstrated. The ACE discriminated between clinical and non-clinical populations and between those at higher risk of alcohol dependence and those at lower risk.

Conclusions. The ACE is a robust and psychometrically sound instrument that captures the key constructs of the Elaborated Intrusion (EI) theory of desire.

Introduction

Alcohol craving is a poorly understood phenomenon. It correlates with the severity of alcohol dependence [1,2] and is predictive of relapse following treatment [3,4]. Mechanisms of alcohol craving are complex and involve a combination of fundamental changes in neurobiological structures associated with repeated alcohol use, conditioning and higher order learning [5]. For broader research and clinical application, theoretical and measurement issues require further elaboration.

More recently craving measurement has applied multidimensional instruments, which attempt to capture different components of the craving experience [6]. The most widely used multidimensional measure is the Obsessive Compulsive Drinking Scale (OCDS) [7]. Development of the OCDS involved a sequential modification of two previous measures, the Yale-Brown Obsessive Compulsive Scale [8] and the Yale-Brown Obsessive Compulsive Scale-Heavy Drinking [9]. The OCDS was developed from clinical observations and the perception of congruence between craving and substance misuse and the symptoms of obsessive compulsive disorder. Craving, as measured by the OCDS is conceptualised as a cognitive process, describing the extent to which thoughts about alcohol are intrusive (obsessive), reflected in altered function and control over the urge to drink (compulsive). The OCDS has acceptable test-retest reliability, concurrent validity [7] and internal reliability [7,10,11] and is stable over time [12]. Limitations in construct validity is a weakness of the scale, with two, three and four factors identified across studies (see Connor and colleagues for a summary [13]).

One recently developed cognitive theory of craving, the Elaborated Intrusion (EI) theory of desire, considers sensory imagery as a critical component of craving [14]. This theory sees craving as being on a continuum with less intense desires, and views desires as cognitive-emotional events, with the characteristics of frequency, duration, intensity and

content focus. In other words, craving is a state that can occur sporadically with each episode having a particular duration and intensity. Individuals who are trying to abstain from a substance or activity may find that they experience a greater frequency of cravings for their target, and that each episode may be of greater intensity and duration, than before consumption was being controlled. The content of each episode may also involve more vivid sensory imagery. These changes in craving may be linked to the successfulness of the abstention attempt.

While craving can be voluntarily generated (e.g. by consciously thinking about alcohol), it is more commonly triggered by intrusive thoughts that occur because of associations with environmental cues (e.g. when walking past a bar), with other thoughts (e.g. about a party), by an awareness of a classically conditioned reaction (e.g. salivation), or by awareness of a physiological state that is attributed to a need for alcohol (e.g. a dry mouth). Episodes of craving are elaborated and strengthened by eliciting related information from long-term memory (sensory information-e.g. alcohol's smell or taste, propositional knowledge-e.g. high quality of a specific drink, or episodic memories-e.g. of pleasurable drinking occasions), and retaining and manipulating that information in working memory to create complex, multi-sensory images or episodic scenes. These multisensory images of alcohol or drinking initially elicit relief or pleasure, but then increase a sense of alcohol deprivation (which when strong, is highly aversive). The generation of sensory mental imagery places load on the limited capacity of working memory, potentially interfering with performance on concurrent cognitive tasks. On the other hand, attending to these tasks can break the craving cycle. In the absence of high deprivation or powerful cues, relief from the craving may be obtained.

Empirical evidence supports the EI theory of craving. Imagery has long been used to trigger craving in the laboratory [15]. It naturally occurs during episodes of desire. Kavanagh,

May & Andrade found that 81% of study participants experienced imagery during craving for alcohol, and stronger craving was associated with increased frequency of imagery [16]. Craving can be also suppressed by alternate imagery [17-19]. This competes for capacity within the same type of working memory store as is used to maintain elaboration of craving. Despite the importance of imagery in craving, existing measures have not focused on this, except for isolated items (e.g. taste elicitation, as an index of craving intensity).

The purpose of this study was to develop an alcohol craving measure (Alcohol Craving Experience [ACE] questionnaire), based on EI theory. It was hypothesized the key constructs of sensory imagery, intrusive thoughts and intensity of craving would be replicated across clinical samples. This could offer considerable psychometric and theoretical strengths over existing alcohol craving measures and further develop earlier work [20]. EI theory recognises that craving is not the sole determinant of alcohol-related problems and it was hypothesized that the new measure would be significantly associated with problem drinking indices and would discriminate between subjects with and without alcohol use disorders.

Methods

Participants

Participants were recruited from a public hospital alcohol and drug outpatient service and from a randomised controlled trial (RCT) for alcohol use disorders. The public hospital group included consecutively treated patients receiving a 12-week cognitive behavioural treatment (CBT) program for alcohol dependence (AD) which was delivered by clinical psychologists. All met DSM-IV-TR criteria for current AD, were not dependent on other substances (excluding nicotine) and were not taking anti-craving medication at assessment.

Participants in the RCT met the inclusion criteria of: drinking above NH&MRC (2001) recommended levels (>28 standard drinks per week for men, and >14 standard drinks per week for women), meeting diagnostic criteria for alcohol use disorders, not using any

other substances (excluding nicotine or prescription medications), including intravenous illicit drugs in the month prior to recruitment, absence of a psychotic or bipolar disorder and the absence of concurrent treatment for alcohol misuse. Recruitment occurred through the media, the internet and referral from general medical practitioners. These participants were assessed for lifetime and current alcohol use disorders with DSM- IV-TR criteria. Data were missing for seven individuals and one individual did not meet criteria for any alcohol use disorder. Ninety-eight percent met criteria for AD (current and/or lifetime), and 2% met criteria for alcohol abuse.

A non-clinical sample consisting of 202 undergraduates (55 males, 147 females, mean age = 28.1, SD = 10.2) participating in a university based study of alcohol craving in students was also recruited.

Measures and Instruments

Alcohol Craving Experience Questionnaire (ACE).

Twenty-nine items were developed, which focus on key elements of EI Theory (sensory aspects of craving-e.g., imagining the taste, smell, or sensation of drinking, and the intrusive cognitive aspects of craving) [21]. Nine of the 29 items were based on preliminary developmental work [20]. One part of the questionnaire (ACE-S (Strength), Items 1-13) focuses on the perceived intensity of the craving experience. To minimise errors related to difficulties in averaging variable experiences and to focus on a situation likely to present particular risks of relapse, the ACE-S inquires about the time when craving was **maximal** during the previous week (the '**focal' period).** The ACE-F (Frequency) (Items 14-29) targets a second characteristic of craving, the **frequency** of desire-related thoughts, again using the timeframe of the previous week. ACE-S assessed vividness of sensory imagery (items 6-11), intensity of the urge to drink (1-5) and magnitude of the intrusiveness of thoughts about drinking (items 12 and 13). ACE-F focussed on the frequency of sensory imagery (items 19-

24), urges (items 14-17, 28 & 29) and intrusive thoughts (items 18, 25-27). A visual analogue scale, with anchor points of zero (*not at all*) and 10 (*extremely/constantly*) was used.

Obsessive Compulsive Drinking Scale (OCDS)

The OCDS is a 14-item self-report instrument assessing obsessive and compulsive characteristics of drinking-related thoughts, urges to drink or craving, and the ability to resist those thoughts and urges [7, 22]. Items 7 & 8 (consumption items) were excluded in order to provide a measure of compulsive behaviour that was not influenced by quantity and frequency of drinking [12].

Alcohol Use Disorders Identification Test (AUDIT)

The AUDIT is a 10-item, self-report measure of hazardous and harmful alcohol consumption, drinking behaviour, and adverse reactions to alcohol alcohol-related problems [23]. Consumption was measured using the AUDIT-C which consists of the first three items of the AUDIT [24].

Depression, Anxiety and Stress Scale (DASS21)

The DASS21 is a 21-item, self-report measure of severity of mood disturbance [25].

Procedures

Hospital participants were assessed by a physician and referred to a clinical psychologist for cognitive behavioural treatment. Baseline assessments (ACE, AUDIT, OCDS, and DASS21) were completed during the first clinical session.

Participants in the RCT were screened by telephone and invited for interview prior to treatment. Baseline assessments were completed prior to interview.

The student sample was recruited at the beginning of lectures. Participation was anonymous and voluntary.

Results

Missing Data

All ACE data were missing for 13 RCT participants and they were removed. An additional two participants had more than 50% of ACE data missing and were also removed.

Sample characteristics

The public hospital sample comprised 230 consecutively treated patients (157 male, 73 female), with a mean age of 38.1 years (SD = 10.6), and the RCT had 219 consecutively recruited individuals (131 male, 88 female, mean age = 49.6, SD = 10.7), giving a total of 449 in the clinical sample (64.1% male; mean age = 43.7 years, SD = 12.1, Range = 18-76). Just over half of the clinical participants (52.6%) were married, 21.7% were divorced, separated or widowed and the remainder had never married. Engagement in full, part-time or casual work was reported by 72.3%, and 67.9% had completed high school or obtained a post high school qualification. Within the student sample of 202, 55% were male and mean age was 28.1 years (SD = 10.2; range = 18-57). The protocol for the student study did not allow for collection of other demographic data.

Descriptive Statistics

Table 1 shows the descriptive statistics for all measures completed.

Exploratory Factor Analysis. ACE-S and ACE-F data from the first consecutively recruited 150 individuals in each of the two clinical samples (public hospital group, n=75 and RCT group, n=75) were analysed using principal axis factoring (SPSS, Version 17.0). Data from the subsequently recruited 299 participants from the combined hospital and RCT groups were included in the CFA (Figure 1).

The item-correlation matrix for ACE-S showed all coefficients were significant except for the correlation between item 1 and item 12 (r = .12, p = .061), and ranged from r = 15, p < .05 to r = .85, p <.001. For ACE-F, correlation coefficients ranged from r = .14 to r = .91, and all were significant (p < .05). For ACE-S and ACE-F respectively, a significant Bartlett's test of sphericity (χ^2 = 1,440.53, df = 78, p < .001; χ^2 = 2,094.49, df = 120, p <.001)

demonstrated the correlation matrices were not identity matrices. Using Kaiser's criteria, [26] obtained KMOs of .883 and .904 for ACE-S and -F respectively, showed small partial correlations among items, suggesting that items shared common factors. Individual measures of sampling adequacy (MSAs) showed correlations between items ranged from .763 to .944 (Focal) and from .859 to .975 (Frequency). These two measures indicated adequacy of the correlation matrix for factor analysis [27]. Using oblique rotation (Oblimin), with delta set to zero and eigenvalues equal to or greater than one, three clear factors emerged for ACE-S accounting for 52.99% of the variance (Factor 1), 11.95% (Factor 2) and 9.41% (Factor 3). For ACE-F three clear factors also emerged: 57.42% (Factor 1), 10.00% (Factor 2) and 7.49% (Factor 3). Tables 2 and 3 show the eigenvalues, the variance accounted for by each factor, the item loadings and communalities for ACE-S and ACE-F respectively.

The pattern matrix and variables with loadings of .40 and above were used for factor definition. No cross loading items were identified. Factor 1 comprised ACE items 6-11, which were conceptually related to sensory imagery (taste, smell, feel), and this factor was labelled *Imagery.* Items 1-5, which measured strength of wanting and needing to drink, strength of the urge to drink and difficulty thinking about or doing other things formed Factor 2 (*Strength).* Factor 3 (*Intrusion)* had two items (12 and 13), which measured trying not to think about alcohol and the intrusiveness of the thoughts. Recognising the potential instability in a two-item factor, we retained the three-factor solution because it made strong conceptual sense in the context of the theoretical model.

For ACE-F, *Imagery,* consisted of the equivalent items 19 to 24, *Strength,* had items 14-17, 28, and 29, and *Intrusion,* included items 18, and 25-27. All three factors for ACE-S (*Imagery* and *Strength,* r = .56; *Imagery* and *Intrusion,* r = .47; *Strength* and *Intrusion,* r = .38) and ACE-F (*Imagery* and *Strength,* r = .68; *Imagery* and *Intrusion,* r = .59; *Strength* and *Intrusion,* r = .47) were moderately correlated.

Internal Reliability of the ACE subscales

Cronbach's alpha coefficient showed all subscales had acceptable internal reliability: ACE-S *Imagery* (α = .91), *Strength* (α = .90) and *Intrusion* (α = .74); *ACE-F, Imagery* (α = .93), *Strength* (α = .94) and *Intrusion* (α = .78).

Confirmatory Factor Analysis

The extent that the internal structure of the ACE from the exploratory factor analyses provided a good fit to data from an independent sample was tested by applying confirmatory factory analyses (AMOS, Version 17) with the remainder of the hospital sample (n=155) and participants in the RCT (n=144). A significant chi-square statistic for ACE-S indicated a poor initial fit to the three-factor model, $\chi^2 = 475.77$, $df = 62$, $p < 0.001$. Examination of other fit indices showed that none reached the required level for adequate fit (RMSEA = .15; NFI = .88; RFI = .85; IFI = .89, TLI = .86; CFI = .89). A similar picture emerged for ACE-F: $\chi^2 = 774.60$, $df = 101$, $p < 0.001$; (RMSEA = .15; NFI = .86; RFI = .83; IFI = .87, TLI = .85; CFI = .87).

Model modification indices were examined to determine if model improvement was possible based on shared (error) variance. Decisions guiding model improvement were conceptually driven by EI theory [21] and executed in a sequential fashion [28]. A series of reduced models were examined for fit and the best fitting and most conceptually robust model obtained was one in which two items from ACE-S were removed ([5]"How hard was it to get other things done?" and [6]"How vividly did you imagine a drink?"). Corresponding items were removed from ACE-F (18 and 19), along with three additional items that had no corresponding items in ACE-S (27, 28, 16). Resulting models for ACE-S and ACE-F provided a good fit of the data. Table 4 reports fit indices.

Normative data for ACE subscales are available from the authors.

Internal Reliability of the ACE subscales

Cronbach's alpha coefficient showed all subscales had acceptable internal reliability: ACE-S *Imagery* (α = .94), *Strength* (α = .93) and *Intrusion* (α = .80); *ACE-F, Imagery* (α = .93), *Strength* (α = .92) and *Intrusion* (α = .86).

Concurrent Validity

ACE-S and -F factor scores were obtained by summing the items on each factor. Zero order correlations were conducted between ACE-S and –F factor scores, the AUDIT-C score, the subscales of the OCDS and DASS. Table 5 shows the correlation matrix and indicates significant correlations between all ACE factors and all factors of the OCDS and DASS.

Discriminant Validity

Descriptive discriminant analyses tested whether scores on the three subscales of the ACE discriminated between (1) a university student sample (n = 204) and the clinical sample (n = 299) and (2) between students identified as having higher risk of alcohol dependence (AUDIT score ≥13, n = 58) and students with lower risk of alcohol dependence (AUDIT<13) [21]. Figure 1 shows mean differences for the three groups on the three factors.

The overall relationship between the grouping and response variables was explained by one significant discriminant function. The factors for ACE-S distinguished between non-clinical and clinical participants. This function explained 37% of between group variance, χ^2 = 155.5, df = 3, p <.001. The non-clinical participants were more successfully classified (78.9% of cases) than clinical participants (69.9% of cases). All three ACE factors were significantly discriminated between non-clinical and clinical participants: *Intrusion* (F[1,501] = 137.36, p < .001) was the most powerful discriminator, followed by *Strength* (F[1,501] = 132.4,p < .001) and *Imagery* (F[1,501] = 52.1,p < .001).

For ACE-F, one single discriminant function explaining 50.2% of between group variance, χ^2 = 203.2, df = 3, p < .001 distinguished between the non-clinical and clinical

participants. Of the original grouped cases, the discriminant function classified 88.7% of non-clinical and 70.6% of clinical participants respectively). The ACE significantly discriminated between non-clinical and clinical participants: *Strength* (F[1,501] = 178.8, p <.001) was the strongest discriminator, followed by *Intrusion* (F[1,501] = 155.6, p < .001) and *Imagery* (F[1,501] = 64.4,p < .001).

The structure coefficient matrices for both ACE- S and ACE- F showed the three factors were highly correlated with the discriminant functions (r = .53; r = .50 [*Imagery*]; r = .86; r = .78 [*Intrusion*]; r = .85; r = .84 [*Strength*]).

Discriminating between Higher Risk and Lower Risk Students

The student sample included 146 higher risk students (AUDIT<13) and 58 lower risk students (AUDIT = >13). For both ACE-S and ACE-F, one significant discriminant function explained the overall relationship between the grouping and response variables (χ^2 = 50.4, df = 3, p <.001 and χ^2 = 64.12 df = 3, p <.001) and accounted for 28.6% and 37.7% of the between-group variance respectively. The discriminant function correctly classified 74.7% of lower risk and 72.4% of higher risk cases for ACE-S. The ACE-F significantly discriminated between lower risk and higher risk participants. *Strength* (F[1,202] = 49.9, p < .001) was the strongest discriminator, followed by *Imagery* (F[1,202 = 33.6, p < .001) and *Intrusion* (F[1,202] = 31.1, p <.001).

For ACE-F, the discriminant function correctly classified 86.3% of lower risk and 63.8% of higher risk cases. The ACE-F significantly discriminated between lower and higher risk participants. *Strength* (F[1,202] = 72.2, p < .001) was the strongest discriminator, followed by *Imagery* (F[1,202] = 45.9, p < .001) and *Intrusion* (F[1,202] = 40.1, p < .001). For both ACE-S and ACE-F the structure matrix showed the three factors were highly correlated with the discriminant functions (r = .76; r = .77 [*Imagery*]; r = .73; r = .72 [*Intrusion*]; r = .93; r = .97 [*Strength*]).

To maximise specificity within each group, similar analyses were conducted using cutoffs of <9 (lower risk of alcohol dependence) and >20 (higher risk of alcohol dependence). One discriminant function differentiated between the two groups for ACE-S and ACE-F (χ^2 = 37.71, *df* = 3, *p* <.001 and χ^2 = 85.61 *df* = 3, *p* <.001). The discriminant function correctly classified 85.0% and 68.8% of lower and higher risk cases for ACE-S and 94.7% (lower risk) and 91.5% (higher risk) cases were correctly classified for ACE-F.

Discussion

Based on EI theory, this study developed an alcohol craving measure (ACE) that assesses key constructs of craving. Separate exploratory factor analyses examining maximal craving and frequency identified three distinct underlying factors: *Imagery*, *Strength* and *Intrusion.* Very satisfactory factor solutions with high item loadings were obtained for both ACE-S and ACE-F. An initial confirmatory factor analysis required exclusion of 7 items before confirming the three-factor structure. Future research will attempt to replicate this structure, using confirmatory factor analyses applied to additional independent samples. Despite the brevity of the Intrusion subscale, internal consistencies of all subscales were satisfactory, and concurrent validity with the OCDS, with AD severity and with depression, anxiety and stress was established. For example, both the vividness and frequency of intrusive thoughts were positively correlated with problematic alcohol use. Frequency of intrusive thoughts was also correlated with stress, as was vividness of imagery. However future research will examine whether additional intrusion items further improve the psychometrics of that subscale.

Predictive validity of the ACE in relation to other self-report indices was equivalent to (or in some cases, superior to) the OCDS. Neither scale was strongly associated with past alcohol consumption (indicated by the AUDIT-C), and we await further work on the ability of the ACE to predict subsequent drinking.

The ACE discriminated between clinical and non-clinical populations, and within the non-clinical sample the ACE successfully discriminated between those who screened positive for higher risk of alcohol dependence and those who did not. These observations support the contention that individuals with alcohol dependence report more vivid and frequent sensory imagery. They also report greater intensity and frequency of thoughts about desires to drink, including intrusive thoughts about alcohol.

The ACE it is easy to administer, can be completed and scored quickly (< 5 minutes) by the patient or clinician and is easily interpretable. Additionally, it has hallmark characteristics of other extensively used instruments including, low cost, self-report format and results that can easily be discussed with patients [29].

There are three specific areas of clinical application. The ACE can differentiate between problematic and non-problematic drinkers and therefore it is a potentially useful screening measure in primary care facilities. Its application could inform decisions about treatment strategies, for example, brief intervention versus more specialised intervention. Secondly, the ACE could be applied to treatment to increase patients' awareness of craving and facilitate greater understanding of the components of craving. Its focus on current states is also likely to enable tracking of changes in craving over time. The ACE could be used to identify individual craving profiles to inform individualised treatment plans including the appropriateness of anti-craving medication. Interventions could be tailored to the specific type of sensory craving of a particular patient, potentially facilitating retention in treatment.

Individuals with craving profiles characterised by high intrusive scores may find craving best managed by strategies specifically targeting unwanted thoughts. Najmi and colleagues demonstrated that focussed distraction (that is, strategically focussing attention away from intrusive thoughts) and acceptance (a mindfulness based technique involving increasing the individual's willingness to take an observational stance and experience

problematic thoughts without trying to alter them in any way) are effective techniques for managing intrusive thoughts [30].

The study's limitations include the fact that the clinical sample consisted of treatment-seeking individuals actively engaged in a treatment program. Replication in non-treatment seeking populations would be of value, especially in relation to the ability of the ACE to predict later drinking or interference with cognitive tasks. The cross-sectional nature of the study yields no information on causality. In addition to confirming the factor structure of the ACE, future studies should consider the relationship between the ACE, key dependent severity markers and treatment outcome, and the development of equivalent versions for use with other substance dependent groups. Prospective studies will also allow the degree of test-retest stability to be established.

The Elaboration Intrusion theory offers a novel approach to the complex phenomenon of alcohol craving. The ACE provides a robust measurement tool to capture the key constructs of this theory. The strong psychometric properties allow for further empirical investigation in both research and clinical applications.

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Table 1

Descriptive Data for Clinical and Non-clinical Samples in Phase 1 (EFA) and Phase 2 (CFA and Discriminant Analysis)

	Phase 1 Clinical Sample $N = 150$			Phase 2 Clinical Sample $N = 299$			Phase 2 Student Sample $N = 204$		
Measure	*M*	*SD*	Range	*M*	*SD*	Range	*M*	*SD*	Range
AUDIT	25.5	6.4	0-40	25.9	8.1	0-40	9.36	7.0	0-35
OCDS *Obsessive Thoughts*	5.8	3.63	0-16	6.2	3.9	0-19	--	--	--
Compulsive Drinking	10.7	3.9	0-19	11.3	3.8	0-20	--	--	--
DASS *Depression*	12.8	10.8	0-42	12.7	11.7	0-42	6.9	8.1	0-34
Anxiety	9.7	9.1	0-40	9.5	9.0	0-42	5.6	7.1	0-33
Stress	16.0	9.8	0-40	15.2	10.4	0-42	11.0	9.1	0-36

Table 2

ACE-S Items, Grouped by Factor Loadings [ac]

		F1	F2	F3	h^2
Factor 1: Imagery (Eigenvalue = 6.89, Variance = 52.99%, α = 0.91)					
6	How vividly did you imagine a drink? [b]	**0.446**	-0.373	0.136	0.736
7	How vividly did you picture alcohol or drinking?	**0.754**	0.015	0.180	0.753
8	How vividly did you imagine what it would taste like?	**0.800**	-0.210	-0.118	0.755
9	How vividly did you imagine what it would smell like?	**0.927**	0.113	-0.017	0.710
10	How vividly did you imagine what it would feel like in your mouth or throat?	**0.872**	0.015	-0.062	0.675
11	How vividly did you imagine how your body would feel if you had a drink?	**0.500**	-0.081	0.186	0.457
Factor 2: Strength (Eigenvalue = 1.55, Variance = 11.95%, α = 0.90)					
1	How strongly did you want a drink?	-0.033	**-0.936**	-0.050	0.793
2	How much did you feel you needed a drink?	0.084	**-0.823**	-0.067	0.716
3	How strong was the urge to drink?	0.015	**-0.959**	-0.054	0.838
4	How hard was it to think about anything else?	0.068	**-0.601**	0.281	0.701
5	How hard was it to get other things done? [b]	0.021	**-0.442**	0.333	0.550
Factor 3: Intrusion (Eigenvalue = 1.22, Variance = 9.41%, α = 0.74)					
12	How hard were you trying not to think about alcohol	0.015	0.067	**0.665**	0.380
13	How intrusive were the thoughts?	0.099	-0.138	**0.765**	0.599

[a] numbering shows the order in the original questionnaire
[b] items removed in confirmatory factor analysis
c principal axis factoring, oblimin rotation

Table 3

ACE-F Items Grouped by Factor Loadings [ac]

		F1	F2	F3	h^2
Factor 1: Imagery (Eigenvalue = 9.18 , Variance = 57.42%, α = 0.93)					
19	How often did you imagine a drink? [b]	**0.654**	-0.125	0.106	0.742
20	How often did you picture alcohol or drinking?	**0.726**	0.011	0.240	0.806
21	How often did you imagine what it would taste like?	**0.922**	-0.027	-0.070	0.803
22	How often did you imagine what it would smell like?	**0.820**	0.000	0.033	0.732
23	How often did you imagine what it would feel like in your mouth or throat?	**0.990**	0.044	-0.115	0.784
24	How often did you imagine how your body would feel if you had a drink?	**0.507**	-0.095	0.169	0.492
Factor 2: Strength (Eigenvalue = 1.60, Variance = 10.00%, α = 0.94)					
14	How often did you want a drink?	0.096	**-0.849**	-0.138	0.748
15	How often did you think about needing a drink?	0.127	**-0.768**	-0.014	0.744
16	How often did you have an urge to drink? [b]	-0.089	**-0.973**	-0.006	0.830
17	How often did you find it hard think about anything else?	0.198	**-0.453**	0.287	0.719
28	How often did you strongly want or need a drink? [b]	0.058	**-0.780**	0.093	0.882
29	How often did you have a strong urge to have a drink?	-0.032	**-0.886**	0.069	0.896
Factor 3: Intrusion (Eigenvalue = 1.19, Variance = 7.49%, α = 0.78)					
18	How often did you find it hard to get other things done? [b]	0.053	-0.290	**0.415**	0.508
25	How often were you trying not to think about alcohol?	0.019	0.110	**0.790**	0.532
26	How often were the thoughts intrusive?	0.063	-0.030	**0.827**	0.703
27	How often did thoughts about alcohol seem to pop into your head? [b]	0.073	-0.225	**0.613**	0.666

[a] numbering shows the order in the original questionnaire
[b] items removed in confirmatory factor analysis
c principal axis factoring, oblimin rotation

Table 4

Measure of Fit for ACE Factor Structure

ACE	χ^2	df	RMSEA	NFI	RFI	IFI	TLI	CFI
ACE-S	183.16	41	.108	.94	.92	.95	.94	.95
ACE-F	231.99	41	.125	.92	.90	.94	.91	.94

Table 5

Zero-order Correlations Between ACE, AUDIT, AUDIT-C, DASS and the OCDS (n = 299)

Measure and Subscale	*ACE-S*			*ACE-F*			*AUDIT*	*AUDIT-C*	*DASS*			*OCDS*	
	Imagery	*Strength*	*Intrusion*	*Imagery*	*Strength*	*Intrusion*	*Total*	*Consumption*	*Depression*	*Anxiety*	*Stress*	*Obsessive Thoughts*	*Compulsive Drinking*
ACE-S													
Imagery	-	.652***	.639***	.816***	.633***	.603***	.112	-.111	.391***	.424***	.462***	.542***	.410***
Strength		-	.604***	.587***	.730***	.548***	.092	.040	.281***	.318***	.457***	.457***	.429***
Intrusion			-	.594***	.526***	.764***	.224**	-.013	.391***	.443***	.448***	.511***	.344***
ACE-F													
Imagery				-	.778*	.656*	.147 *	-.036	.414***	.449***	.472**	.581***	.439***
Strength					-	.588*	.153 **	.106	.365***	.376***	.477**	.506***	.489***
Intrusion						-	.185**	-.086	.431***	.478***	.534**	.541***	.349***
AUDIT Total							-	.712**	.199**	.193**	.217***	.289***	.291***
AUDIT-C									-.034	-.028	.025	.028	.145**
DASS Depression									-	.687***	.724***	.508***	.459***
DASS Anxiety										-	.772***	.479***	.440***
DASS Stress											-	.511***	.522***
OCDS Obsessive Thoughts												-	.662***
OCDS Compulsive Drinking													-

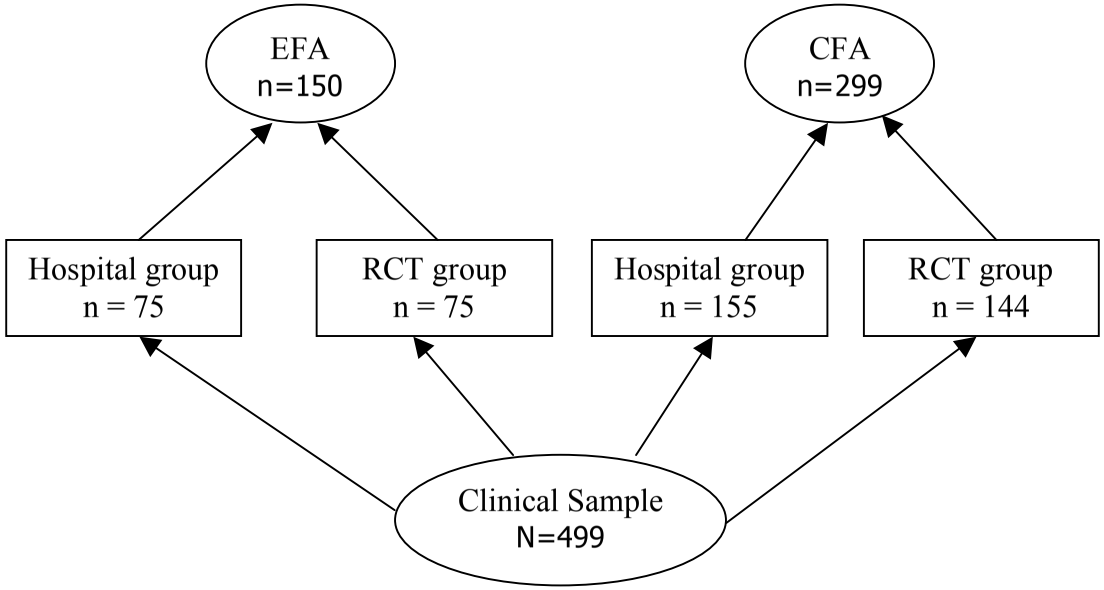


Figure 1. Contribution of the clinical sample to the EFA and CFA.

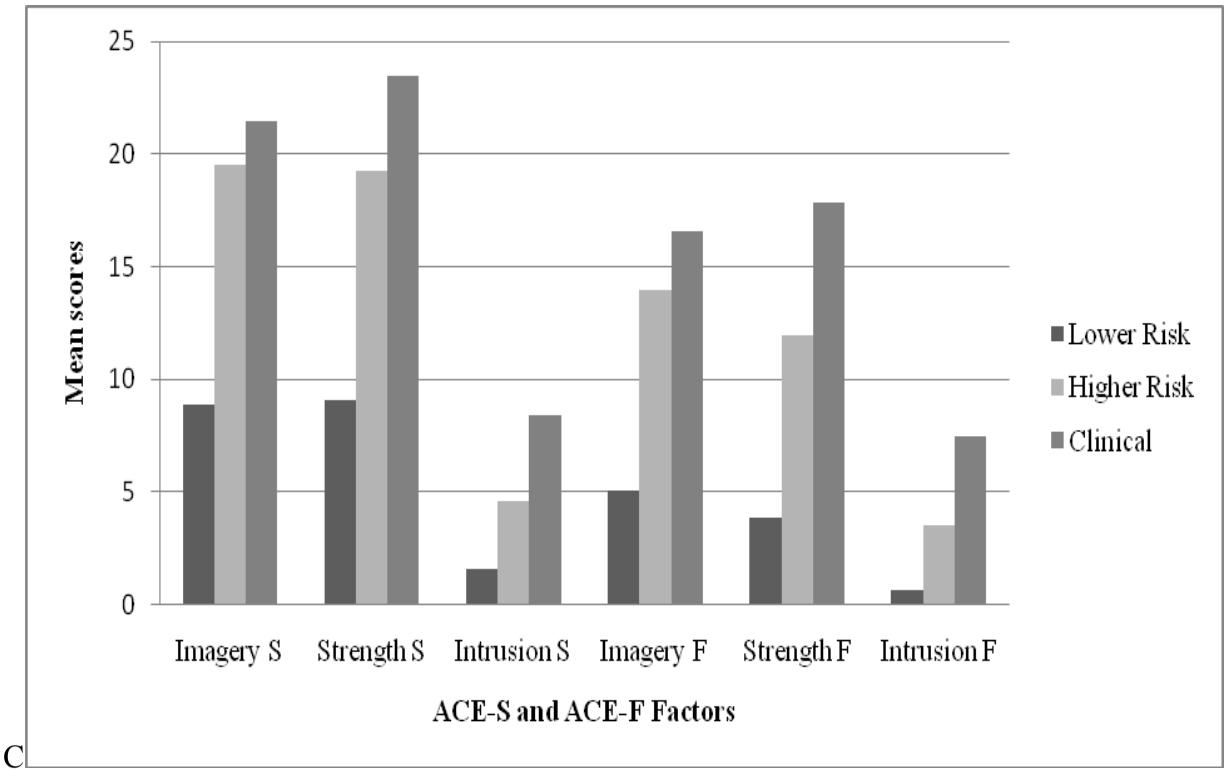
C 

Figure 2. Mean scores for lower risk (students), higher risk (students), and clinical participants on *Imagery*, *Strength* and *Intrusion* for ACE-S and ACE-F.