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Alexithymia in Relation to Parental Alcoholism, Everyday Frontal Lobe Functioning and Alcohol Consumption in a Non-Clinical Sample

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Abstract

Background: Recent studies have indicated that 45-67% of those in treatment for alcohol use disorders suffer from alexithymia, a multifaceted personality trait characterized by difficulties identifying and describing emotions and an externally oriented cognitive style. The high reported prevalence rates of alexithymia among those with alcohol dependence led to speculation that alexithymia is a personality dimension that may predispose to risky or problematic alcohol use. **Methods:** This notion was examined in 314 adult volunteers (54% female) aged 18-45 years (M = 27.6 years), all of whom reported at least occasional alcohol consumption, who completed online surveys assessing alexithymia (Toronto Alexithymia Scale, or TAS-20), parental alcoholism (Children of Alcoholics Screening Test, or CAST), everyday signs of frontal lobe dysfunction (Frontal Systems Behavior Scale, or FrSBe) and risky alcohol use (Alcohol Use Disorders Identification Test, or AUDIT). **Results:** TAS-20 scores were positively correlated with the index of parental alcoholism CAST, index of frontal lobe dysfunction FrSBe and measure of alcohol-related problems AUDIT. Chi-square test showed an association between TAS-20-defined alexithymia and being the offspring of an alcoholic parent as defined by CAST. Regression analysis showed that frontal lobe dysfunction (FrSBe) mediated the relationship between alexithymia (TAS-20 total score) and risky alcohol use (AUDIT). **Conclusions:** The findings suggest that alexithymia is related to deficiencies in frontal lobe functioning that may reflect a heritable predisposition to alcohol problems.

Alcohol use disorders are the most common substance use disorders in the world (Lowinson, Ruiz, Millman, & Langrod, 2005). One in every eight adults (some 2 million people) or about 13 percent of the population drinks alcohol at risky levels in Australia (ABS, 2006) and approximately 3000 Australians lose their life each year as a result of alcohol misuse (Chrikritzhs et al, 1999). The social costs of alcohol misuse in Australia have been estimated at about $15.3 billion dollars each year (Collins & Lapsley, 2008). An essential task for research is thus to identify potential risk factors for developing an alcohol use disorder.

Alexithymia may be one such risk factor. Alexithymia refers to difficulties in identifying, describing and differentiating feelings and somatic sensations, having a constricted imaginal style and an externally oriented thinking style (Nemiah, Freyberger & Sifneos, 1976). Prevalence rates of alexithymia have been estimated to be 5-13% in the general population (Franz et al., 2008; Mattila, et al., 2006). There is some evidence for genetic factors in the aetiology of alexithymia (Jorgensen, Zachariae, Skytthe, & Kyvik, 2007; Walter, Montag, Market, & Reuter, 2011) as well as poor childhood attachment and adverse childhood experiences including poor maternal care, abuse and family pathology (see Thorberg, Young, Sullivan & Lyvers, 2011). Alexithymia has also been reported following traumatic brain injury (Becerra, Amos, & Jongenelis, 2002; Williams & Wood, 2010) and has been positively associated with anxiety, mood and psychosomatic disorders (Grabe et al., 2006; Gawin, Glaros, & Lumley, 2005; Honkalampi, Hintikka, Koivumaa-Honkanen, Antikainen, Haatainen, & Viinamaki, 2007) as well as somatoform complaints (Lumley, Beyer, & Radcliffe, 2008; Wearden, Lamberton, Crook, & Walsh, 2005). Alexithymia appears to be strongly associated with problematic alcohol use as well as alcohol dependence (Kauhanen et al., 1992; Thorberg, Young, Sullivan & Lyvers, 2009; Thorberg et al., 2011a),

with 45-67% of alcoholics in treatment reportedly being characterised as alexithymic (Thorberg et al., 2009).

Recent research among alcohol dependent individuals (Thorberg, Young, Sullivan & Lyvers, 2011; Thorberg et al., 2009, 2010, 2011ab) has shown that alexithymia is significantly associated with alcohol cravings, alcohol expectancies, and anxious attachment as well as alcohol problem severity. Furthermore, those with combined alcohol dependence and alexithymia started using alcohol at a younger age, abused it for longer periods of time, and reported higher levels of insecure attachment and obsessive and compulsive behaviors related to alcohol compared to those with alcohol dependence alone. Such findings suggest that those with combined alcohol dependence and alexithymia are a more severely afflicted group than those with alcohol dependence alone. Until recently scarce research on underlying mechanisms of the relationship between alexithymia and alcohol dependence existed (see Thorberg et al., 2009). However, a recent key study (Thorberg et al., 2011a) found that the alcohol expectancy domains of affective change and assertion partially mediated the relationship between alexithymia and alcohol dependence. These findings indicate that those with combined alexithymia and alcohol dependence gain access to strong emotions and experience significant social enhancement from drinking alcohol, which may in part account for the higher relapse rates among alcohol dependent individuals with alexithymia (Loas, Fremaux, Otmani, Lecercle, & Delahousse, 1997, Ziolkowski, Gruss, & Rybakowski, 1995).

Another construct relevant to alcohol use is family history of alcoholism (FHA). Interestingly, Finn, Martin and Phil (1987) reported that people with FHA showed higher levels of alexithymia compared to controls. However, as their study utilised the psychometrically limited alexithymia measure, the Schalling Sifneos Personality Scale (see Thorberg et al., 2009), FHA was assessed in the present study to investigate the possible relationship with alexithymia using a sound measure of alexithymia, the Toronto Alexithymia

Scale (TAS-20). Children of alcoholic biological parents are well known to have an elevated risk of alcoholism and also tend to perform relatively more poorly on neuropsychological tests of executive cognitive functioning (Reich et al., 1988). The prefrontal cortex is implicated in a wide array of executive functions including motivation, planning and volition (Passingham, 1993; Stuss & Benson, 1984; Wilkinson, 1991) as well as the regulation of limbic and parietal regions of the brain. Damage to the prefrontal cortex can result in loss of independence or autonomy to varying degrees, depending on the nature and extent of the lesion (Masterman & Cummings, 1997; Petry, Bickel, & Arnett, 1998). As frontal lobe dysfunction has also been associated with addictive behaviors (Lyvers, 2000; Spinella, 2003) as well as alexithymia (as described below), for the purposes of the present study everyday frontal lobe functioning was considered a key framework for examining potential underlying mechanisms of the relationship between alexithymia and risky alcohol use. Other recent work has focused on elucidating neurobiological mechanisms of emotional response in alexithymia (Berthoz et al., 2002; Karlsson, Naatanen, & Stenman, 2008; Moriguchi et al., 2009). This research has indicated that emotional processing in alexithymia is associated with lower activation of frontal regions than in non-alexithymics.

In addition, Traumatic Brain Injury (TBI) is linked to poor affect control, emotional awareness, and impulse control as well as higher levels of alexithymia (Henry et al., 2006; Koponen et al., 2005; Williams et al., 2001). Persons with TBI are six times more likely to be alexithymic than non-TBI controls (Williams & Wood, 2010). Furthermore, longitudinal investigations have indicated that people tend to increase their substance use following a TBI. Spinella (2003) estimated that up to 20% of light drinkers with TBI progressed on to heavy drinking, highlighting the potential importance of the frontal lobes in relation to alcohol use. Together both cross-sectional and prospective longitudinal studies suggest potential

interactions between alexithymia, parental alcohol use, frontal lobe dysfunction and risky or problematic alcohol use that warrant greater attention and clarification.

Given the substantial association of alexithymia with alcohol dependence, alexithymia is proposed to constitute a potential vulnerability marker for problematic alcohol use. Improved understanding of the correlates and trait markers associated with risky drinking, as well as underlying mechanisms, is essential as this may assist the identification of potential targets for prevention among young adults at risk for alcohol problems. No study to date has investigated potential mediators of the relationship between alexithymia and risky drinking in a non-clinical sample. Thus the objectives of the present study of social drinkers aged 18-45 years were to investigate relationships between alexithymia, parental alcoholism, indices of everyday frontal lobe functioning and current alcohol use. Based on evidence and theory cited above, alexithymia was expected to be associated with parental alcoholism, signs of frontal lobe dysfunction and heavier alcohol use in the present investigation. Everyday frontal lobe functioning as assessed by the Frontal Systems Behavior Scale (FrSBe; Grace & Malloy, 2001) was examined as a mediator of the relationship between alexithymia and risky alcohol use.

Method

Participants

The study recruited 428 individuals aged 18 to 45 who agreed to participate; however, of these only 355 individuals actually completed the measures. Further, over 10% of those recruited were non-drinkers and thus were excluded from the study, leaving 314 participants (54% female) aged 18-45 years (M = 27.6 years, SD = 8.4), all of whom reported at least occasional alcohol consumption. The sample was nearly equally divided between current university students (53%) and non-students, with 90% of the sample having at least a year 12 education or higher; 78% were currently employed. Only 6% of the sample reported using an

illicit drug more than once per month on average, and 72% reported they had never smoked cigarettes.

Materials

Toronto Alexithymia Scale (TAS-20; Bagby, Parker, & Taylor, 1994). The TAS-20 is a 20-item self-report questionnaire that uses a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Total scores range from 20 to 100 with higher scores indicating higher levels of alexithymia. The measure has three subscales: Difficulty Identifying Feelings (DIF; e.g., "when I am upset, I don't know if I am sad, frightened, or angry"); Difficulty Describing Feelings (DDF; e.g., "I find it hard to describe how I feel about people"); and Externally Oriented Thinking (EOT; e.g., "I prefer talking to people about their daily activities rather than their feelings"). Cut-off scores have been developed to categorize individuals as alexithymic if their total score was >61 and non-alexithymic if <51 (Bagby, Taylor, & Parker, 1994). The TAS-20 has shown sound internal consistency and test-retest reliability in clinical and analogue samples (Thorberg et al., 2010; Parker, Taylor, & Bagby 2003; Taylor, Bagby, & Parker, 2003). The validity of the three-factor structure has been replicated across various samples (Bagby, Parker & Taylor, 1994; Parker, Taylor & Bagby, 2003).

Alcohol Use Disorders Identification Test (AUDIT; Babor et al., 1992). The AUDIT is a 10 item self-report measure used to identify people with hazardous or harmful patterns of alcohol use. The AUDIT uses a 4-point Likert scale and has 3 consumption questions (e.g., " How often do you have a drink containing alcohol?"), 3 dependence-related items (e.g., " How often during the last year have you failed to do what was normally expected of you because of drinking?"), and 4 alcohol-related consequences or harm items (e.g., " Have you or someone else been injured because of your drinking?"). The AUDIT has a minimum score of 0 (non-drinkers) and maximum score of 40 with a suggested cut-off score of 8 to

differentiate Risky drinkers from Low Risk drinkers. The AUDIT has good construct validity (Shields, Guttmannova, & Caruso, 2004); convergent validity ranges up to .97 against the MAST (Pal et al., 2004); internal consistency (Cronbach's alpha) has reportedly ranged from .80 (Kane, Loxton, Staiger, & Dawe, 2004) to .94 (Pal, Jena, & Yadav, 2004); and test-retest reliability of r = .95 was reported over a 28 day period (Bergman & Kallmen, 2002). The Cronbach's alpha in the present study was .75.

Children of Alcoholics Screening Test (CAST; Jones, 1983). The CAST is a widely used 30-item inventory assessing an individual's feelings, perceptions, attitudes and experiences in relation to their parents' drinking behavior (Jones, 1983; Larson & Thayne, 1998). Dichotomous responses of either "yes"(1) or "no"(0) generate a score reflecting a summation of all affirmative responses. Scores can range from 0 to 30; scores of 6 or more indicate that the individual is likely the offspring of an alcoholic parent. The CAST has been found to be a reliable and valid measure of parental alcoholism (Pilat & Jones, 1985). In the present study the Cronbach's alpha was .96.

Frontal Systems Behavior Scale (FrSBe; Grace & Malloy, 2001). The FrSBE, formerly called the Frontal Lobe Personality Scale (FLOPS), is a 46-item measure for assessing everyday behavioral manifestations of deficits in three major prefrontal-subcortical brain circuits. The FrSBe yields a total score as well as composite scores from three subscales: Apathy (poor initiation, reduced drive and interest), presumed to reflect anterior cingulate dysfunction; Disinhibition (distractibility, problems with inhibition, socially inappropriate behavior), presumed to reflect orbitofrontal dysfunction; and Executive Dysfunction (planning, sequencing, working memory, and mental flexibility difficulties), presumed to reflect dorsolateral prefrontal dysfunction. Questions are rated on a 5 point Likert scale (1= *almost never*, 2 = *seldom*, 3= *sometimes,* 4= *frequently*, 5 = *almost always*). The initial 32 items indicate deficits whereas the last 14 are reverse scored; the magnitude of score on each

subscale suggests the degree of impairment. The construct validity of the FrSBe has been demonstrated with a three factor solution that is easily replicable (Stout, Ready, Grace, Malloy, & Paulsen, 2003). The FrSBe has impressive reliability credentials with internal consistency ranging from .88 to .91 and three month test-retest reliability of .78 (Grace & Malloy, 2001). Diagnostic validity has been demonstrated in the assessment of the frontal lobe functioning of various clinical samples including substance abusers (Spinella, 2003) and healthy populations (Spinella, 2007).The standard version of the FrSBe asks for pre-and post-lesion ratings, but for the purpose of the present investigation and consistent with previous research (Lyvers et al., 2010; Verdejo-Garcia, Rivas-Pereza, Lopez-Torrecillasa & Perez-Garcia, 2006) only present time ratings were obtained. In the present study the Cronbach's alpha was .90.

Demographics Questionnaire. Demographic information was collected with a brief questionnaire containing 12 items. These items included questions on age, gender, student status, education level, whether the participant uses alcohol, the age at which they started drinking, and whether they smoked cigarettes or use illicit drugs more than once a month on average. These items were used for screening purposes as well as to examine other measures in relation to demographic factors.

Procedure

The study's protocol was approved by Bond University Human Research Ethics Committee (BUHREC) prior to data collection. Participants were approached on the Bond university campus and asked if they were interested in being a research subject in a project that would require only 20 minutes at a time and place of their convenience. They were told this would entail completing an online survey on their own. Interested individuals were directed to Survey Monkey, a commercial internet-based survey host. A link to this website was provided and each volunteer was encouraged to distribute the link via email to their

friends and colleagues (snowball method). Before responding to the online questionnaires respondents were required to review and accept an Informed Consent Form (posted on Survey Monkey), which described the purpose of the study, the voluntary nature of participation and the anonymity of responses. Respondents were de-identified by the survey program. Answers provided by respondents were coded and collated by the website into an anonymous data pool. No incentive was offered for participation.

Results

The assumptions of linearity and homoscedasticity were examined and found to be met (Tabachnik & Fidell, 2007). AUDIT and CAST scores were skewed, but this was as expected for these measures and transformation of scores did not alter the substantive interpretation of the data. Intercorrelations among continuous measures were calculated. As can be seen in Table 1, TAS-20 total scores were significantly positively correlated with AUDIT, CAST, and total FrSBe frontal lobe dysfunction scores and negatively correlated with age. The age at which participants first started drinking weekly was negatively correlated with AUDIT and FrSBe, as found in previous work (Lyvers et al., 2010).

CAST Group Comparisons

Chi-square test showed an association between TAS-20-total score and being the offspring of an alcoholic parent as defined by CAST, $\chi^2(1) = 10.44$, $p < .001$. Among the 68 CAST-defined children of alcoholic parents (COAs), 22% were classed as alexithymic by TAS-20 compared to only 8% of the 246 non-COAs. CAST groups did not differ by gender according to chi-square test. To further explore group differences associated with CAST status, a CAST group (COA, non-COA) X gender multivariate analysis of covariance (MANCOVA) was conducted on age when first started drinking weekly, AUDIT and the subscale scores for the FrSBe and TAS-20. Age was the covariate given its significant associations with other study variables (see Table 1). Pillai's Trace indicated a significant

multivariate effect of CAST group, $F(8, 293) = 2.44$, $p = .01$. Significant between groups differences were found for the TAS-20 DIF subscale, $F(1, 300) = 12.12$, $p = .001$, and the FrSBe Disinhibition subscale, $F(1, 300) = 5.43$, $p = .02$, and Executive Dysfunction subscale, $F(1, 300) = 6.43$, $p = .01$. These significant group differences are shown in Table 2.

There was also a significant multivariate effect of gender according to Pillai's Trace, $F(8, 293) = 8.69$, $p < .0001$. All dependent variables except age when first started drinking weekly were significantly different between men and women in this sample, as shown in Table 3. These differences were all in expected directions based on previous work cited earlier above. There was no interaction between CAST group and gender.

AUDIT Group Comparisons

Low Risk and Risky drinking groups were identified based on the recommended AUDIT cut-off score of 8. An AUDIT group X gender MANCOVA was then conducted on age when first started drinking weekly and the subscale scores for the FrSBe and TAS-20, with age again the covariate. AUDIT risk group showed a significant multivariate effect according to Pillai's Trace, $F(7, 294) = 2.96$, $p = .005$. Univariate effects were significant for age when first started drinking weekly, $F(1, 300) = 5.22$, $p = .02$; DDF, $F(1, 300) = 4.81$, $p = .03$; and FrSBe Disinhibition, $F(1, 300) = 6.55$, $p = .01$. These significant group differences are shown in Table 4. No other AUDIT group differences approached significance. Gender was again significant as above, but there was no interaction.

Path Analysis

Based on theoretical considerations the index of everyday frontal lobe dysfunction FrSBe total score was hypothesized to mediate the relationship of TAS-20 total score to AUDIT score. In order to test for mediation, a series of criteria must be met. The predictor variable needs to be significantly correlated with the dependent variable and the predictor variable also has to be significantly correlated with the mediator. The mediator needs to be

significantly related to the dependent variable even after controlling for the independent variable. If the predictor variable is no longer significantly associated with the dependent variable after controlling for the mediator, a full mediation is established (Baron & Kenny, 1986).

To investigate the hypothesised path model a set of regression analyses were undertaken to examine the mediational effect of everyday frontal lobe dysfunction (FrSBe) in the relationship between alexithymia and risky drinking. First, a standard regression analysis found a significant relationship between the predictor variable total TAS-20 and the dependent variable AUDIT, $F(1, 312) = 6.797$, $p < .01$, accounting for 2.1% of the variance ($R^2 = .021$, $p < .01$). Second, a significant relationship was found between the predictor variable TAS-20 and the mediator FrSBe, $F(1, 312) = 124.27$, $p < .0001$, accounting for 28.5% of the variance ($R^2 = .285$, $p < .0001$). Third a multiple regression analysis was performed with TAS-20 and FrSBe to investigate the mediational effect of FrSBe, $F(2, 311) = 9.04$, $p < .0001$, indicating that only FrSBe ($\beta = .22$, $t(2) = 3.33$, $p < .001$) showed univariate significance (see Table 5). As all four conditions were met these findings indicate that FrSBe fully mediated the relationship between the TAS-20 total score and the AUDIT. Participants who indicated high levels of alexithymia were likely to have higher scores on frontal lobe dysfunction, and through high levels of frontal lobe dysfunction, more likely to indicate higher levels of alcohol-related risk (see Figure 1).

Discussion

The results indicated that total TAS-20 alexithymia scores were significantly positively correlated with the index of everyday frontal lobe dysfunction FrSBe, the index of parental alcoholism CAST and the measure of alcohol-related risk AUDIT, as predicted based on previous research in alcoholic samples as well as theoretical considerations (see Lyvers, 2000; Thorberg et al., 2009, 2010). These data highlight the importance of frontal

lobe functioning in relation to alexithymia as well as the likely role of parental alcoholism. A key finding was that frontal lobe functioning as assessed by FrSBe fully mediated the relationship between alexithymia and risky alcohol use. This is a potentially important finding that extends current knowledge about mediators of alexithymia and alcohol dependence among alcoholics (see Thorberg et al., 2011a) to a non-clinical sample, and is entirely consistent with the well-known role of the frontal lobes in emotional awareness and self-regulation (Lyvers et al., 2010). Further, replicating previous work (Lyvers et al., 2009, 2010), Risky drinkers as defined by AUDIT scored higher on the Disinhibition subscale of the FrSBe and reported an earlier age of initiation of regular drinking compared to Low Risk drinkers in the present study.

One way of interpreting these current results is that alexithymia is related to deficiencies in frontal lobe functioning and emotional processing that may reflect an underlying heritable predisposition to alcohol problems. The fetal effects of maternal alcohol use are well known (e.g., Hill & Hruzka, 1992; Reich, Earls, & Powell, 1988; Steinhausen & Spohr, 1986). CAST scores do not tell us which parent was an alcoholic; however in general, alcohol dependence is about six times more common among men than women (Cloninger, 1987), hence a fetal alcohol effect seems unlikely to account for the present findings. There is also some evidence for a possible role of genetic factors in the aetiology of alexithymia (Jorgensen et al., 2007; Walter et al., 2011), an issue which merits further research attention.

Another way of interpreting the current data is that child rearing or attachment factors may be implicated in the development of alexithymia. The current study found that respondents with alcoholic parents as defined by CAST (i.e., COAs) had significantly higher TAS-20 Difficulty Identifying Feelings scores than non-COAs. Alcohol dependence or high levels of alcohol use by primary caregivers can result in child rearing patterns that are inattentive and unresponsive to the child's emotional states, perhaps leading to deficits in

emotional self-regulation. Indeed, a recent meta-analysis on parental attachment and alexithymia (Thorberg, Young, Sullivan, & Lyvers, 2011) found that a lack of maternal care was associated with TAS-20 alexithymia as well as Difficulty Identifying Feelings and Difficulty Describing Feelings. Further, maternal and paternal overprotection was also related to TAS-20 alexithymia and Difficulty Describing Feelings, emphasising the importance of dysfunctional parental attachment for the development of alexithymia. However, COAs also had higher FrSBe Disinhibition and Executive Dysfunction scores than did non-COAs in the present study. These links with indices of frontal lobe dysfunction might be considered as more congruent with genetic involvement, possibly reflecting an inherited vulnerability to both alexithymia and problematic drinking. However, COAs and non-COAs did not differ in AUDIT scores, the index of problematic drinking, in the present mostly young adult sample.

There was an 11.1% prevalence rate of TAS-20-defined alexithymia in the present sample. No current data are available on the prevalence rate of alexithymia in the wider Australian population, however Mattila and collaborators (2006) identified a prevalence rate of 9.9% for alexithymia in Finland, which is similar to the present sample. The present study found a negative relationship between TAS-20 total scores and age (i.e., the levels of alexithymia decreased with increasing age), which is supported by previous evidence of a negative relationship between TAS-20 scores and age (Gunzelmann, Kupfer, & Brahler, 2002) and also consistent with evidence suggesting that emotional awareness and expression tend to improve with age (Bar-On & Parker, 2000). Also consistent with previous findings (Lane et al., 1998; Mattila et al., 2006; Parker et al., 1993), in the present study men had significantly higher alexithymia scores than women. Differential parental child rearing attitudes towards males and females and culture-bound gender socialization roles have been suggested as possible reasons for gender differences in alexithymia (Polce-Lynch et al., 1998; Wester, Vogel, Pressly, & Heesacker, 2002). One view is that through socialization males learn to

restrict emotional expression from an early age, whereas females may increase emotional expression during the same period (Liu & Iwamoto, 2007; Polce-Lynch et al., 1998). According to Lumley and Sielky (2000) alexithymia may reflect a manifestation of biological factors in men, and a history of psychological traumata in women.

A limitation of the present investigation concerns the use of self-report indices of alexithymia. This is not just because self-report responses are innately subjective and may be inaccurate, but also because alexithymia by its very nature is characterized by difficulty identifying, distinguishing, describing and differentiating emotional feelings – which may have implications for the accuracy of self-report. The ability of self-report measures such as the TAS-20 to accurately capture complex constructs such alexithymia, a defect in important aspects of self-awareness, is a subject of ongoing debate. However, TAS-20 scores fared somewhat better than observer ratings of alexithymia using the Observer Alexithymia Scale in a recent psychometric comparison in alcohol dependent patients (Thorberg et al., 2010). Another limitation is the lack of control for negative affect as previous research has reported a positive relationship between alexithymia and negative mood states (Gawin et al., 2005; Grabe et al., 2006; Honkalampi et al., 2007), thus future research should control for such potential confounds. Lastly, the present investigation was conducted at a single Australian university, which limits the external validity of the findings.

Taken together, the current findings have extended previous research and suggest that alexithymia is associated with parental alcoholism and risky drinking. This study has also provided empirical support for the importance of possible mild frontal lobe deficiencies as an underlying mechanism that may account for the relationship of alexithymia and problematic alcohol use, a pattern of relationships suggestive of genetic vulnerabilities and one which warrants further investigation.

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Table 1.

Intercorrelations among primary variables (see text for definitions).

Variables	1	2	3	4	5	6
1. Age	--					
2. Age first drinking	.25**	--				
3. AUDIT	-.36**	-.25**	--			
4. CAST	.13*	-.08	-.08	--		
5. FrSBe Frontal Dysfunction	-.24**	-.19**	.23**	.15**	--	
6. TAS-20 Alexithymia	-.14*	.04	.15**	.16**	.53**	--

* $p < .05$ ** $p < .01$

Table 2.

Means and (in parentheses) standard deviations for the Toronto Alexithymia Scale (TAS-20) Difficulty Identifying Feelings subscale (DIF), and the Frontal Systems Behavior Scale (FrSBe) Disinhibition and Executive Dysfunction subscales as a function of Children of Alcoholics Screening Test (CAST) defined status as a child of an alcoholic (COA) or not (non-COA).

Variables	COA (*n* = 66)	non-COA (*n* = 239)
DIF	12.56 (4.43)	12.1 (3.98)
Disinhibition	34.67 (6.86)	33.25 (6.47)
Executive Dysfunction	37.08 (7.84)	35.72 (7.55)

Table 3.

Means and (in parentheses) standard deviations for measures showing significant gender differences (see text for variable details).

Variables	men (n = 136)	women (n = 169)	p value
DIF	14.64 (5.79)	13.32 (5.32)	.02
DDF	13.63 (4.12)	11.05 (3.68)	< .0001
EOT	20.46 (4.73)	18.46 (4.20)	.006
Apathy	28.53 (6.02)	23.55 (5.16)	< .0001
Disinhibition	35.37 (6.59)	32.10 (6.21)	.006
Executive Dysfunction	38.63 (7.46)	33.90 (7.10)	< .0001

Table 4.

Means and (in parentheses) standard deviations for Low Risk and Risky drinkers (as defined by AUDIT) for measures showing significant group differences (see text for descriptions of variables).

Variables	Low Risk (n = 184)	Risky (n = 121)
Age first drinking	16.79 (2.27)	15.85 (2.70)
DDF	11.51 (3.70)	13.25 (4.41)
Disinhibition	32.19 (6.57)	35.65 (6.02)

Table 5.

FrSBe as a Mediator of TAS-20 Total Scale and AUDIT.

Variables	$R^{\nabla 2}$	*B*	*SE B*	βz
AUDIT (DV)				
Step 1	.021*			
TAS-Total Scale		.06	.02	.15
FrSBe-Total Scale (DV)				
Step 1	.285**			
TAS-Total Scale		.85	.08	.53
AUDIT (DV)				
Step 1	.055**			
TAS-Total Scale		.01	.03	.03
FrSBe-Total Scale		.06	.02	.22

*$P < .01$, **$P < .0001$. DV=Dependent variable, FrSBe= Frontal Systems Behavior Scale, TAS=Toronto Alexithymia Scale.

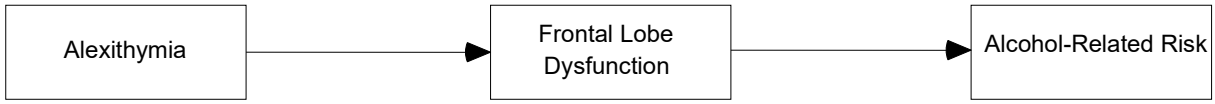

Figure 1. Total FrSBe frontal lobe dysfunction score as a mediator of the relationship between TAS-20 total score and AUDIT score.