Personality and alcohol-related risk: Neuroticism, extraversion, and alexithymia

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Abstract

Previous research has established associations of personality traits neuroticism and extraversion with risky or problematic alcohol use in both clinical and non-clinical samples. More recently, alexithymia – a personality trait defined by difficulties in identifying and describing feelings as well as concrete thinking – has been implicated as a risk factor for problematic drinking; however, whether this trait is an independent risk factor or overlaps with others has not been determined. The present study examined neuroticism, extraversion, and alexithymia in relation to risky drinking in a nonclinical sample of 285 male and female alcohol consumers aged 18-60 years. Neuroticism and extraversion were measured using the International Personality Item Pool Big Five Factor Markers (IPIP), whereas alexithymia was measured using the Toronto Alexithymia Scale 20 (TAS-20). The Alcohol Use Disorders Identification Test (AUDIT) provided an index of alcohol-related risk. Hierarchical regression indicated that neuroticism, extraversion and alexithymia were all significant positive predictors of risky drinking after controlling for demographic and mood variables. Alexithymia was positively related to neuroticism, and both were negatively related to extraversion. The relationship between alexithymia and risky drinking was partially mediated by neuroticism, and the association of alexithymia with neuroticism was partially mediated by negative mood. Neuroticism, extraversion and alexithymia appear to be independently related to alcohol-related risk, though the influence of alexithymia may partially overlap with that of neuroticism. Both alexithymia and neuroticism are associated with proneness to negative moods; a reliance on drinking to cope with such states may account for the links of both traits to risky or problematic drinking in line with Cloninger's Type I alcoholism. However, additional aspects of alexithymia may also contribute to its role in alcohol-related risk. The relationship of extraversion to risky drinking appears congruent with Cloninger's Type II alcoholism, where high reward sensitivity motivates drinking for enhancement of positive states.

Alcohol consumption is a common and widely accepted part of various social, cultural and sports-related activities in many countries worldwide, but there are downsides to such widespread use of alcohol. For example, the Centers for Disease Control and Prevention ([CDC]) estimates that 88,000 people in the United States die from alcohol-related causes annually, making alcohol one of the leading causes of preventable death. In Australia, a country with a much smaller population, the Australian Bureau of Statistics (ABS, 2018) reported that there were over 4000 deaths attributed to alcohol in 2017. Excessive drinking is a major contributor to the overall disease burden in Australia, responsible for 66,000 hospitalizations between 2013 and 2014 (Australian Institute of Health and Welfare [AIHW], 2017). Short term adverse consequences of risky drinking often reflect impaired judgement and coordination, including involvement in criminal activities, violence, antisocial behaviors and accidents. The long-term consequences of chronic heavy drinking can include alcohol dependence, alcoholic dementia, depression, liver cirrhosis, cancers and cardiovascular disease (AIHW, 2014; World Health Organization, 2015). Given the substantial societal, economic and health burdens associated with risky or problematic drinking, much research has been devoted to identifying factors that may predispose individuals to drink alcohol at potentially harmful levels, including personality traits (Fairbairn et al., 2015; Malouff, Thorsteinsson, Rook & Schutte, 2007). Understanding the influences of such traits on drinking behaviors may help to explain why different individuals in similar sociocultural contexts exhibit differences in alcohol use, and why some individuals develop an Alcohol Use Disorder (AUD) whereas others do not.

Although impulsivity is often cited as the trait most strongly linked to AUD risk (Littlefield & Sher, 2010; Slutske et al., 2002), two distinct forms of impulsivity have been identified as separate risk factors: rash impulsiveness, or acting spontaneously without regard for consequences, and sensitivity to reward, or the tendency to pursue sources of positive reinforcement and to experience positive emotions when such rewards are obtained (Dawe, Gullo & Loxton, 2004). These

in turn show distinct relationships with other personality traits that have been linked to risky drinking and/or AUD across multiple studies and samples. Such traits include two of the Big Five personality factors, extraversion and neuroticism (Lange, Wagner, Muller & Eggert, 2017), such that those who score high on neuroticism tend to exhibit high levels of rash impulsiveness, whereas those who score high on extraversion tend to exhibit high levels of reward sensitivity. In addition, a variety of evidence indicates that another trait dimension, alexithymia, is also positively associated with risky or problematic drinking as well as rash impulsiveness (e.g., Lyvers, Hinton et al., 2014), but how alexithymia may contribute to alcohol-related risk in the context of the Big Five neuroticism and extraversion factors is unclear. As discussed below, the issue is complicated by the likelihood that highly alexithymic individuals exhibit features of both high neuroticism and low extraversion, which might be expected to have opposite influences on alcohol-related risk. The present study assessed neuroticism, extraversion and alexithymia concurrently in relation to risky or problematic drinking, with the goal of delineating the degree of independence or overlap of the associations of each trait factor with risky drinking in a nonclinical, predominantly young adult sample.

Extraversion and Alcohol

Extraversion is a personality trait characterized by gregariousness, activity, assertiveness, excitement-seeking, and positive emotion (Costa & McCrae, 1992). High extraversion is associated with subjective well-being and greater self-reported health, quality of life and longevity (Haddock & Rutkowski, 2014). However, high extraversion has also been linked to negative health behaviors including cigarette smoking (Spielberger & Jacobs, 1982), risky driving (Dahlen & White, 2006; Schwebel, Severson, Ball & Rizzo, 2006) and risky sexual behaviors (Ingledew & Ferguson, 2007). Another negative health behavior associated with extraversion is risky drinking, with research indicating links between high levels of extraversion and excessive alcohol consumption, alcohol-related problems and binge-drinking (Allsopp, 1986; Benjamin & Wulfert,

2005; Martsh & Miller, 1997; Sher, Trull, Bartholow, & Vieth, 1999). Those high in extraversion tend to show an earlier onset of drinking (Hill, Shen, Lowers, & Locke, 2000) and demonstrate higher rates of heavy drinking in comparison to those low in extraversion (Grau & Ortet, 1999), as well as a greater likelihood of transitioning from moderate to heavy drinking over time (Hakulinen et al., 2015). Highly extraverted individuals also expect and report more positive rewarding effects from alcohol than do those who score low on measures of this trait, consistent with the notion that high extraversion is associated with high sensitivity to reward (Fairbairn et al., 2015).

Neuroticism and Alcohol

The personality trait of neuroticism refers to individual differences in negative emotional responses to perceived threat, frustration or loss (Goldberg, 1993; Lahey, 2009). High neuroticism is associated with anxiety, hostility, depression, self-consciousness, and rash impulsiveness (Costa & McCrae, 1992). Such individuals tend to be highly self-critical and sensitive to the criticism of others (Watson, Clark & Harkness, 1994). Those low in neuroticism, by contrast, are likely to be more emotionally stable, less impulsive and less reactive to stress. High neuroticism has been linked to a range of negative physical and psychological problems including early mortality, major depression, generalized anxiety disorder, panic disorder, phobias and substance dependence (Khan, Jacobson, Gardner, Prescott & Kendler, 2005). High neuroticism has also been identified as a risk factor for heavy alcohol consumption, alcohol-related problems and binge drinking (Benjamin & Wulfert, 2005; Ham & Hope, 2003; Martin & Sher, 1994; Ruiz, Pincus & Dickson, 2003). A longitudinal study (Turiano, Whiteman, Hampson, Roberts & Mroczek, 2012) that examined personality factors and substance use behaviors in a large national sample of adults in the United States found that neuroticism predicted future alcohol-related problems over a ten-year period.

Alexithymia and Alcohol

The term ‘alexithymia’ was first introduced by Sifneos (1973) to explain an observed

pattern in patients with psychosomatic disorders. Sifneos noted that some of these patients had a relative constriction in emotional functioning, poverty of fantasy life and an inability to find appropriate words for feelings. Sifneos termed this phenomenon 'alexithymia' which translates to 'no words for feelings' from Greek (Nemiah, Freyberger, & Sifneos, 1976). Today alexithymia is generally regarded as a relatively stable personality trait (see Thorberg et al., 2016a) that encompasses cognitive and affective styles, with characteristics including difficulty identifying and describing feelings, difficulty in distinguishing between feelings and bodily sensations of emotional arousal, restricted fantasy life and an externally oriented cognitive style (Taylor, Bagby & Parker, 1991). Alexithymia has been linked to a variety of interpersonal deficits including social isolation, insecure attachment and maladaptive behaviors due to difficulties identifying, understanding and expressing emotions, which in turn may make it difficult for highly alexithymic individuals to rely on others for support (Taylor, Bagby & Parker, 1997; Vanheule, Desmet, Meganck & Bogaerts, 2007).

Alexithymia has also been consistently linked to risky or problematic drinking, with research indicating that between 30% and 70% of alcohol dependent individuals are highly alexithymic (Cruise & Becerra, 2018; Thorberg, Young, Sullivan & Lyvers, 2009) in comparison to reported rates of around 10-15% in the general population (Franz et al., 2008; Mattila, Salminen, Nummi, & Joukamaa, 2006). Individuals with both AUD and alexithymia experience more negative consequences than individuals with AUD alone, including stronger alcohol craving, earlier onset age of drinking, more suicidal ideation, insecure attachment styles and lower mental and physical quality of life (Evren, Dulbudak, Durkaya, Cetin & Evren, 2010; Sakuraba, Kubo, Komoda & Yamana, 2005; Thorberg et al., 2011a, 2011b; Uzun, 2003). Alexithymia has also been reported to interfere with treatment outcomes for individuals with alcohol dependence (Thorberg et al., 2009). Although the relationship between alexithymia and problematic drinking is well

established, the nature of this relationship is unclear and requires further attention, particularly given the other personality traits that have previously been identified as risk factors including neuroticism and extraversion.

Personality Traits and Drinking Motives

Based on the work of Cox and Klinger (1988), Cooper and colleagues (Cooper, 1994; Cooper, Frone, Russell & Mudar, 1995) distinguished between four types of drinking motives: enhancement, coping, social, and conformity. Of these, the so-called internal drinking motives of enhancement and coping are associated with elevated risk of alcohol problems (Stewart & Chambers, 2000), and thus are of particular interest when investigating drinking motives in relation to personality. Kuntsche, von Fischer and Gmel (2008) examined such relationships in a sample of over 2000 university students and found that extraversion was associated with enhancement motives for drinking (i.e., drinking for positive reward, to "get high"), whereas neuroticism was associated with coping motives (i.e., drinking for negative reinforcement via suppression of negative affect), similar to the earlier findings of Stewart and Devine (2000). Like those with high neuroticism, highly alexithymic individuals also tend to score higher on coping motives than those with low or no alexithymia, suggesting that those with high alexithymia may learn to rely on alcohol to regulate persistent negative affect (Finn, Martin & Pihl, 1987; Lyvers, Simons, Hayes & Thorberg, 2014). For example, Lyvers, Hasking, Albrecht and Thorberg (2012) examined alexithymia and drinking motives in a nonclinical sample of 262 Australian adults, and found a significant positive relationship of alexithymia with coping motives but not enhancement motives. A more recent follow-up study (Lyvers, Coundouris, Edwards & Thorberg, 2018) found that the positive relationship between alexithymia and risky drinking was mediated by coping motives, and the relationship of alexithymia to the latter was mediated by negative moods. The same study also found that the positive relationship between reward sensitivity (which, as noted earlier, is elevated in extraversion) and risky drinking was mediated by enhancement motives for drinking.

The notion of two distinct pathways from personality traits to problematic drinking via distinct drinking motives is not new. Cloninger's (1987) well-known typology invoked factors of personality, genetics, drinking motives and onset age to identify two distinct forms of alcoholism. Type I is most common and encompasses the excessive use of alcohol by those who drink as a coping strategy to deal with persistent negative affect. Cloninger cited neuroticism as a key predisposing trait in Type I, but the primary drinking motive of drinking to cope with negative moods would seem to apply to alexithymia as well. Type II alcoholism, by contrast, reflects high sensitivity to the positive rewarding or euphoriant effects of alcohol (Cloninger, Sigvardsson & Bohman, 1996), consistent with the enhancement motives for drinking and expectation of pleasurable alcohol effects that are associated with high extraversion (Fairbairn et al., 2015). Differential drinking motives thus provide plausible links between specific personality traits and alcohol-related risk (Littlefield & Sher, 2010).

Alexithymia in Relation to Neuroticism and Extraversion

Luminet, Bagby, Wagner, Taylor and Parker (1999) examined the relationships between alexithymia, as measured by the Toronto Alexithymia Scale-20 (TAS-20), and the Big Five personality factors, as measured by the NEO Personality Inventory (NEO-PI; Costa & McCrae, 1992), in a sample of university students. Alexithymia scores were positively correlated with total scores for neuroticism and the facets of anxiety, depression, self-consciousness and vulnerability. Subsequent work (Zimmerman, Rossier, Meyer de Stadelhofen & Gaillard, 2005) revealed positive relationships between alexithymia and neuroticism, and negative associations between alexithymia and extraversion. These findings are consistent with clinical and other observations that highly alexithymic individuals frequently experience emotional instability and psychological distress - consistent with the personality trait of neuroticism – as well as a limited capacity to experience the positive emotions and social rewards associated with the personality trait of extraversion (Costa &

McCrae, 1980; Krystal, 1988; McDougall, 1982). Highly alexithymic individuals are described as cold or detached in social interaction (Vanheule et al., 2007) and often suffer from loneliness and social isolation (Qualter, Quinton, Wagner & Browndue, 2009) - characteristics that are clearly inconsistent with extraverts as individuals who are highly sociable, warm and assertive (Costa & McCrae, 1992; Haddock & Rutkowski, 2014; Kail & Cavanaugh, 2015).

The positive association between neuroticism and alexithymia likely reflects features common to both. Alexithymia is consistently associated with negative emotionality, including tendencies to experience anxiety, anger, depression and feelings of shame and embarrassment (Bagby et al., 1994ab; Luminet et al., 1999; Zimmermann, Rossier, Meyer de Stadelhofen & Gaillard, 2005), as well as low levels of happiness and life satisfaction (Hendryx, Haviland & Shaw, 1991; Holder, Love & Timoney, 2015; Honkalampi, Hintikka, Tanskanen, Lehtonen & Viinamäki, 2000; Timoney & Holder, 2013). Neuroticism and alexithymia also exhibit similar relationships with risky drinking. Both traits have been linked to drinking to cope with negative affective states such as depression, anxiety and stress, as described earlier. The positive association between neuroticism and alexithymia suggests that these traits may overlap to the extent that both are characterized by the tendency to experience frequent negative affect, which in turn may lead to the use of alcohol as a coping mechanism. However, other evidence indicates that highly alexithymic clients with alcohol dependence drink in anticipation of disinhibiting alcohol effects – e.g., reporting expectancies of intensified affect (including negative affect) and assertiveness from alcohol (Thorberg et al., 2016b) - suggesting that the desire to release and express normally suppressed or otherwise inaccessible emotional feelings may be another element in the alexithymia-alcohol relationship, distinct from a desire to alleviate negative moods. Alexithymia has also been interpreted as reflecting a generalized deficit of interoceptive awareness (Brewer, Cook, & Bird, 2016), which would reduce the ability to detect internal cues of overconsumption - perhaps further promoting risky or problematic levels of

drinking.

The present study assessed alexithymia, extraversion and neuroticism in relation to alcohol-related risk as well as negative mood in a nonclinical sample. Based on the evidence cited earlier, all three personality traits were expected to show positive associations with risky drinking. Further, based on the similar associations of neuroticism and alexithymia to negative moods and coping motives for drinking, the present study assessed whether the relationship between alexithymia and risky drinking would be mediated by neuroticism, and whether the relationship between alexithymia and neuroticism would be mediated by the negative affective tendencies common to both traits. If such predicted mediations were indicated, then the evidence for alexithymia as a risk factor for problematic drinking could be attributed to its overlap with neuroticism in promoting drinking to cope with negative affective states, consistent with Type I alcoholism. On the other hand, if alexithymia and neuroticism were found to be independently correlated with alcohol-related risk, additional factors such as the expectation of disinhibiting alcohol effects (Thorberg et al., 2016b) and/or deficient awareness of overconsumption (Brewer et al., 2016) might plausibly account for the unique contribution of alexithymia to alcohol-related risk.

Method

Participants

Recruitment was via email and internet notice board from two universities in southeast Queensland, Australia, as well as from the general Australian public via Facebook. The notices asked for at least occasional alcohol consumers aged 18 or older who would like to participate in a research project examining personality, mood and alcohol use. University students were offered the incentive of either 1 credit point toward their undergraduate psychology class (57 students) or entry into a raffle for a $50 gift voucher (25 students); the other participants were offered raffle entry only. The initial sample of 299 volunteers was reduced to 285 after removing multivariate outliers identified via Mahalanobis

Distance ($p < .001$). There were 109 men (38%) and 176 women (62%) in the final sample. Ages ranged from 18 to 60 years ($M = 25.54$, $SD = 8.15$). Of these participants, 125 (44%) had completed undergraduate study, 112 (39%) had completed high school, 39 (14%) had completed postgraduate study (i.e., 4th year university or higher) and 9 (3%) did not complete high school. Most participants (191; 67%) were born in Australia, 24 (8%) were born in the USA, 16 (6%) in the UK, 10 (4%) in New Zealand, 7 (3%) in South Africa, and only 1-2 participants originated from each of 22 other countries.

Materials

The following questionnaires were administered online to all participants.

Demographics. Demographic items were included in the survey to assess participants' age, gender, country of origin, and highest level of education completed to date.

International Personality Item Pool Big-Five Factor Markers (IPIP; Goldberg, 1992). A 40-item self-report IPIP extraversion and neuroticism questionnaire was derived from Goldberg's (1992) markers for the Big-Five factor structure. There were 20 items on both the extraversion and neuroticism scales. Participants were required to read each statement and indicate how accurately it described them using a 5-point Likert scale which ranged from 1 *strongly disagree* to 5 *strongly agree.* Extraversion items include items such as "I am the life of the party" and "I start conversations." Neuroticism items include "I worry about things" and "I am easily disturbed." Total scores for each scale are produced by summing the corresponding items, and may range from 20 to 100 with higher scores indicating higher levels of the corresponding trait. The IPIP has demonstrated concurrent validity in a community sample, showing a significant correlation between IPIP extraversion and the extraversion scale of the Eysenck Personality Questionnaire (EPQ; Eysenck & Eysenck, 1985) ($r = 0.85$) as well as a significant correlation between the neuroticism subscale of the IPIP and the neuroticism subscale of the EPQ ($r = 0.84$) (Gow, Whiteman, Pattie & Deary, 2005). The IPIP extraversion scale and IPIP neuroticism scale both exhibited excellent internal consistency

in the current study (extraversion $\alpha = 0.95$, neuroticism $\alpha = 0.94$).

Toronto Alexithymia Scale-20 (TAS-20; Bagby, Parker, & Taylor, 1994ab). The TAS-20 is a 20-item self-report scale designed to measure alexithymia. The measure includes three subscales, difficulty identifying feelings, difficulty describing feelings and externally oriented thinking. Participants are required to indicate how much they agree or disagree to a range of statements on a 5-point Likert scale which ranges from 1 "*strongly disagree"* to 5 "*strongly agree"*. Examples of items include "I am often confused about what emotion I am feeling" and "I have physical sensations that even doctors don't understand." Responses are summed to produce total scores which may range from 20 to 100, with higher scores indicating higher alexithymia. The TAS-20 has exhibited significant negative correlations with the openness to experience dimension of the NEO-PI ($r = -0.41$) as well as significant positive correlations with neuroticism ($r = 0.38$) and the facets reflecting the tendency to experience depression ($r = 0.44$), self- consciousness ($r = 0.31$) and vulnerability ($r = 0.39$; Luminet et al., 1999). The TAS-20 also showed discriminant validity, with expected nonsignificant correlations between the TAS-20 and traits of agreeableness and conscientiousness (Luminet et al., 1999). The TAS- 20 exhibited good internal consistency in the current study ($\alpha = 0.88$).

Alcohol Use Disorders Identification Test (AUDIT; Babor, de la Fuente, Saunders, & Grant, 1992). The AUDIT is a 10-item screening instrument for hazardous and harmful alcohol consumption that was developed from a six-country World Health Organization collaborative project. The scale takes approximately 2 to 4 minutes to complete. Items are answered using Likert scales ranging from 0 to 4. The scale includes three questions assessing alcohol consumption, three assessing alcohol dependence and four assessing problems resulting from drinking. Responses are summed to yield a total score that can range from 0 to 40, with higher scores indicating higher levels of risky or problematic drinking. The AUDIT exhibited good internal consistency in the current

study ($\alpha = 0.80$).

Depression Anxiety Stress Scales-21 (DASS 21; Lovibond & Lovibond, 1995). The DASS-21 is a 21-item self-report questionnaire designed to measure the negative mood states of depression, anxiety and stress. The measure consists of seven items for each corresponding mood scale and takes approximately 5 to 10 minutes to administer. Participants are required to read each item and indicate the extent to which each symptom had bothered them over the past week using a 4-point Likert scale, ranging from 0 *did not apply to me at all* to 3 *applied to me most of the time.* Responses are summed such that higher scores indicate higher levels of negative mood. The DASS-21 exhibited excellent internal consistency in the current study with an internal consistency reliability coefficient of $\alpha = 0.94$ for the total scale, which was used as an index of overall negative mood.

Procedure

Approval was provided by the ethics committees of both universities prior to data collection. The questionnaire battery was administered online using Qualtrics, a survey hosting website. Upon accessing the link, participants were presented with an explanatory statement outlining the general goals of the study and informing them that the survey would take approximately 25-30 minutes to complete. Participants were also informed that their participation was voluntary, that they may withdraw at any time and that any information they provided was strictly anonymous. Contact details were also provided for mental health services if participants experienced any distress during the completion of the survey. Participant consent was indicated by answering *yes* to the question *do you consent to your data to be used in the following research study?* Participants were then directed to the demographics questionnaire for completion, followed by the other questionnaires in randomized orders. Upon completion of the questionnaire battery participants were presented with a screen that thanked them for their participation. They were required to save a screenshot of the final

screen and email it to one of the researchers in order to receive their incentive.

Results

Preliminary analyses examined personality traits as categorical variables, such that high alexithymia was defined by TAS-20 scores of 61 or higher (Bagby et al., 1994ab), whereas high/low neuroticism and high/low extraversion were defined by median splits. There was no association between alexithymia and gender in the present sample, $\chi^2(1) = .04$, $p = .83$. There were 48 participants in the current sample who met the TAS-20 criterion for high alexithymia, comprising 17% of the overall sample. Of the 48 defined by TAS-20 as highly alexithymic, 44 (92%) had neuroticism scores above the median, a highly significant association, $\chi^2(1) = 43.22$, $p < .0001$. Further, of the 48 defined as highly alexithymic, 37 (77%) scored below the median on extraversion, $\chi^2(1) = 16.29$, $p < .0001$. Examination of cells indicated that only one participant classed as highly alexithymic scored both below the median on neuroticism and above the median on extraversion. Thus all but one of the 48 classed as highly alexithymic in the present sample were characterized by high neuroticism and low extraversion, $\chi^2(3) = 48.83$, $p < .0001$.

An alexithymia X gender multivariate analysis of variance (MANOVA) was conducted on the indices of risky drinking, extraversion, and neuroticism, and the index of negative mood provided by summing the three DASS-21 scales (depression + anxiety + stress). According to Pillai's Trace there were significant multivariate main effects of alexithymia, $F(4, 278) = 20.69$, $p < .0001$, $\tilde{\eta}^2 = .23$, and gender, $F(4, 278) = 6.61$, $p < .0001$, $\tilde{\eta}^2 = .09$, but no alexithymia X gender interaction, $F < 1$. Univariate effects of gender were significant only for neuroticism, such that women ($M = 67.18$) scored significantly higher than men ($M = 58.61$), $F(1, 281) = 15.53$, $p < .0001$, $\tilde{\eta}^2 = .05$. Univariate effects of alexithymia were significant for all dependent measures: AUDIT risky drinking, $F(1, 281) = 7.40$, $p = .007$, $\tilde{\eta}^2 = .03$; IPIP extraversion, $F(1, 281) = 31.39$, $p < .0001$, $\tilde{\eta}^2 = .10$; IPIP neuroticism, $F(1, 281) = 61.57$, $p < .0001$, $\tilde{\eta}^2 = .18$; and the total DASS-21, $F(1, 281) = 52.66$, $p < .0001$, $\tilde{\eta}^2 = .16$. As shown in

Table 1, those classed by their TAS-20 scores as highly alexithymic scored significantly higher on risky drinking, neuroticism, and negative mood, and significantly lower on extraversion, than those defined as having low or no alexithymia by TAS-20 cut-off.

Bivariate correlations of continuous measures are shown in Table 2. The table reveals that TAS-20 alexithymia scores were significantly positively correlated with AUDIT risky drinking, IPIP neuroticism, and DASS-21 depression, anxiety and stress scores, and significantly negatively correlated with IPIP extraversion scores, all as per expectations. AUDIT risky drinking scores were significantly positively correlated with alexithymia and neuroticism as well as all three negative mood indices of the DASS-21, but not with extraversion. Neuroticism was significantly positively correlated with the three negative mood indices of the DASS-21, and negatively correlated with extraversion.

To assess the relative contributions of personality and mood variables to alcohol-related risk after controlling for demographic factors, a hierarchical linear regression was conducted on AUDIT risky drinking scores. Gender, age and education level were entered at step 1 but the model was not significant, $F(3, 281) = 2.20$, $p = .09$, accounting for 2.3% of the variance. Neuroticism scores were entered at step 2, explaining a significant 7% of additional variance in AUDIT, $\Delta F(1, 280) = 20.83$, $p < .0001$, resulting in a significant model, $F(4, 280) = 6.97$, $p < .0001$. Gender became significant at this step (see Table 3). Extraversion was added at step 3 and was significant, $\Delta F(1, 279) = 5.22$, $p = .02$, accounting for 2% of additional variance. The model remained significant, $F(5, 279) = 6.70$, $p < .0001$. Alexithymia was added at step 4, accounting for an additional 3% of variance, which was significant, $\Delta F(1, 278) = 9.36$, $p = .002$. The model was again significant, $F(6, 278) = 7.31$, $p < .0001$. The negative mood index of total DASS-21 scores was entered at the final step, but was not significant, $\Delta F(1, 277) = 2.30$, $p = .131$, accounting for less than 1% of additional variance. The final model was significant, $F(7, 277) = 6.63$, $p < .0001$. Gender, extraversion, neuroticism and alexithymia were all significant predictors of AUDIT in the final model (see Table 3).

To test the hypothesis that the positive relationship of alexithymia to risky drinking would be mediated by neuroticism, the conservative approach developed by Baron and Kenny (1986) was used given the sample size and the normally distributed variables. In this approach the predictor must predict the criterion and the mediator, and the impact of the predictor must decrease significantly according to Sobel test when the mediator is added to the regression model. After controlling for gender at the first step, alexithymia significantly predicted risky drinking, $\Delta F(1, 282) = 20.93$, $p < .0001$, and also predicted the presumed mediator neuroticism, $\Delta F(1, 282) = 106.14$, $p < .0001$. A hierarchical regression was then conducted on risky drinking, with gender entered at as a covariate at step 1, alexithymia at step 2, and neuroticism at step 3. The model was not significant at step 1, $F(1, 283) = 1.89$, $p = .17$, with gender explaining less than 1% of variance. The addition of alexithymia at step 2 explained an additional 7% of variance in risky drinking, $\Delta F(1, 282) = 20.93$, $p < .0001$. In the final step the addition of neuroticism explained an additional 3% of variance in risky drinking, $\Delta F(1, 281) = 8.45$, $p = .004$. The coefficient for alexithymia was significantly reduced according to Sobel test, $z = 2.80$, $p = .005$, indicating partial mediation as the contribution of alexithymia remained significant (see Table 4).

Finally, to test the hypothesis that negative mood would mediate the association of alexithymia with neuroticism after controlling for gender, alexithymia was shown to predict neuroticism, $\Delta F(1, 282) = 106.14$, $p < .0001$, accounting for 33% of variance. A second regression showed that alexithymia predicted negative mood after controlling for gender, $\Delta F(1, 282) = 101.68$, $p < .0001$, accounting for 27% of variance. A final hierarchical regression was conducted on neuroticism, with gender entered at step 1, alexithymia at step 2, and negative mood at step 3. Gender was significant at step 1, accounting for 7.5% of variance in neuroticism, $F(1, 283) = 22.79$, $p < .0001$. The addition of alexithymia at step 2 explained an additional 25% of variance, $\Delta F(1, 282) = 106.14$, $p < .0001$. At step 3, the addition of negative mood explained an additional 19% of variance, $\Delta F(1, 281) = 114.31$, $p <$

.0001. Alexithymia remained significant, but the coefficient for alexithymia was significantly reduced according to Sobel test, $z = 7.33$, $p < .0001$, indicating partial mediation (see Table 5). Figure 1 illustrates the relationships among variables.

Discussion

Predicted relationships of personality traits to alcohol-related risk and negative mood were supported in the present nonclinical sample of 285 mostly young adult social drinkers. Extraversion, neuroticism and alexithymia were significant positive predictors of risky drinking in the regression model. Both neuroticism and alexithymia were significantly negatively correlated with extraversion, but positively correlated with each other, consistent with the notion that neuroticism and alexithymia share proneness to negative affective states in contrast to the positive affect associated with extraversion. This idea was additionally supported by the present finding that negative mood partially mediated the association between alexithymia and neuroticism. Further, the relationship between alexithymia and risky drinking was partially mediated by neuroticism. Thus, although all three traits were independent predictors of risky drinking in the final regression model, there was partial overlap between alexithymia and neuroticism in terms of their associations with both negative mood and risky drinking, consistent with theory. Given that the overlap was only partial, however, the role of alexithymia as a risk factor for alcohol problems may not be entirely attributable to aspects shared with neuroticism such as proneness to negative moods. Another plausible interpretation of alexithymia's role as a unique risk factor is that highly alexithymic individuals may learn to rely on the disinhibiting effects of alcohol to release suppressed or otherwise inaccessible feelings, thereby getting more in touch with their own emotions – including negative ones - as well as becoming temporarily more socially assertive (Thorberg et al., 2016b). A further interpretation is that high alexithymia is characterized by a general deficit of interoceptive awareness (Brewer et al., 2016), including poor ability to detect internal cues of overconsumption. Of course, it is possible that all these factors

contribute to the substantial proportion of AUD clients reported to highly alexithymic (Cruise & Becerra, 2018; Thorberg et al., 2009) as well as the consistent association of alexithymia with risky or problematic drinking reported in nonclinical samples (e.g., Lyvers et al., 2018). In any case, the present findings would seem to rule out an interpretation of the alexithymia-alcohol relationship as simply reflecting the high levels of another risk factor, neuroticism, among those with alexithymia.

As noted by Littlefield and Sher (2010), although most research on links between personality and problematic drinking has relied on self-report questionnaires to assess the levels of personality traits, this approach suffers from the limitation that people may not always know themselves well enough to provide information that consistently matches observer ratings or behavioral outcomes. The issue may seem especially pertinent in regard to alexithymia, a trait dimension that reflects a deficiency in some aspects of self-knowledge. On the other hand, Thorberg et al. (2010) reported that in a sample of alcohol-dependent clients, TAS-20 alexithymia scores and clinician ratings of alexithymia were in close agreement, so such concerns may not always be warranted. The present study employed well-established, widely used, validated self-report indices of neuroticism, extraversion and alexithymia as well as negative moods and alcohol-related risk. The results were consistent with an interpretation of the three personality traits as independently associated with risky drinking. Neuroticism did account for some of the variance in risky drinking associated with alexithymia, and the overlap between these two traits apparently reflected a similar proneness to negative affective states. Nevertheless, even after accounting for mood, each of the three personality traits - neuroticism, alexithymia and extraversion - contributed unique variance to risky drinking in the present study.

Cloninger's (1987; Cloninger et al., 1996) alcoholism typology implied distinct pathways from personality to problematic drinking through differential motivations for using alcohol. Type I alcoholism was said to be characterized by high neuroticism, rash impulsiveness, and drinking to cope with negative affect, whereas Type II was said to be characterized by high reward sensitivity and

drinking for euphoria, or to "get high;" alexithymia as a risk factor would thus appear to fit with the Type I concept, and extraversion with Type II, given the differential drinking motives reportedly associated with these traits. But as noted earlier, the present findings also suggest that alexithymia as a risk factor cannot be explained solely by the high levels of neuroticism associated with alexithymia. Aspects of alexithymia other than a tendency to rely on alcohol to cope with negative affect may explain why the present study found only partial mediation of the alexithymia-alcohol relationship by neuroticism.

In the regression model, the three personality traits were significantly but not highly predictive of the AUDIT index of risky or problematic drinking in the present nonclinical sample. Future research might expand on these findings in larger samples by incorporating measures of impulsivity along with the personality traits assessed in the present study. As noted earlier, impulsivity is widely regarded as the trait dimension most strongly predictive of alcohol-related risk (Littlefield & Sher, 2010; Slutske et al., 2002), thus measures of impulsivity would likely account for some of the variance in the relationship of traits such as alexithymia, neuroticism and extraversion with risky drinking. Such measures should include indices of the two impulsivity subtypes - rash impulsiveness and reward sensitivity – that have both shown substantial associations with risky drinking and other forms of substance abuse in previous work (Dawe et al., 2004) as well as showing differential relationships to neuroticism, extraversion and alexithymia as described earlier (Lange et al., 2017; Lyvers, Hinton et al., 2014). Other traits are likely to be relevant in this context as well; for example, the longitudinal study by Turiano et al. (2012) found that for both neuroticism and extraversion, the positive association with alcohol-related risk was moderated by the level of another Big Five factor, conscientiousness. Future work on these issues should aim to further elucidate the complex interrelationships among personality, motivation and mood variables in terms of their direct and indirect associations with alcohol-related risk.

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Table 1

Means (M) and Standard Deviations (SD) of Dependent Variables for Alexithymia Groups

Variable	High Alexithymia (n = 48)		Low Alexithymia (n = 237)
	M (*SD*)		*M* (*SD*)
Risky Drinking	10.94 (6.56)	**	8.56 (5.25)
Extraversion	51.29 (12.41)	***	63.25 (14.17)
Neuroticism	72.29 (11.34)	***	55.43 (14.53)
Negative Mood	26.16 (12.40)	***	12.90 (11.15)

Note. $N = 285$. $^{**}p < .01$. $^{***}p < .0001$.

Table 2

Correlations among Study Variables.

Variable	1	2	3	4	5	6
1. AUDIT	-					
2. Alexithymia	.26***	-				
3. Extraversion	.02	-.39***	-			
4. Neuroticism	.24***	.50***	-.36***	-		
5. Depression	.21***	.52***	-.39***	.56***	-	
6. Anxiety	.23***	.45***	-.28***	.52***	65***	
7. Stress	.22***	.39***	-.24***	.69***	68***	.75***

Note. AUDIT = Alcohol Use Disorders Identification Test.
***$p < .0001$.

Table 3

Hierarchical Multiple Regression Analysis Predicting Alcohol-Related Risk from Personality Traits.

Predictor	ΔR^2	β	*B*	*SE B*	95% CI for *B*
Step 1	.02				
Age		.03	.02	.04	[-.06, .10]
Gender		-.09	-1.00	.67	[-2.33, .32]
Education		-.14*	-1.00	.47	[-1.92, -.08]
Step 2	.07***				
Gender		-.16**	-1.84	.68	[-3.17, -.51]
Neuroticism		.28***	1.00	.02	[.06, .14]
Step 3	.02*				
Extraversion		.14*	.05	.02	[.01, .10]
Step 4	.03**				
Alexithymia		.21**	.09	.03	[.03, .15]
Step 5	.01				
Age		.06	.04	.04	[-.04, .12]
Gender		-.15*	-1.66	.67	[-2.98, -.33]
Education		-.08	-.60	.45	[-1.48, .29]
Neuroticism		.18*	.06	.03	[.01, .12]
Extraversion		.20**	.07	.02	[.03, .12]
Alexithymia		.18**	.08	.03	[.02, .14]
Negative Mood		.12	.05	.04	[-.02, .12]

Note. SE B = standard error of unstandardized coefficient; CI = confidence interval. Due to space considerations only the added or newly significant variables are shown for steps 2-4.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 4

Hierarchical Multiple Regression Analysis Predicting Alcohol-Related Risk from Alexithymia and Neuroticism after controlling for Gender.

Predictor	ΔR^2	β	*B*	*SE B*	95% CI for *B*
Step 1	.01				
Gender		-.08	-.93	.68	[-2.26, .40]
Step 2	.07***				
Gender		-.08	-.91	.65	[-2.19, .38]
Alexithymia		.26***	.12	.03	[.07, .17]
Step 3	.03**				
Gender		-.14*	-1.54	.68	[-2.88, -.20]
Alexithymia		.16*	.07	.03	[.01, .13]
Neuroticism		.20**	.07	.03	[.02, .12]

Note. SE B = standard error of unstandardized coefficient; CI = confidence interval.
* $p < .05$. ** $p < .01$. *** $p < .0001$.

Table 5

Hierarchical Multiple Regression Analysis Predicting Neuroticism from Alexithymia and Negative Mood after controlling for Gender.

Predictor	ΔR^2	β	*B*	*SE B*	95% CI for *B*
Step 1	.08***				
Gender		.27***	8.63	1.81	[5.07, 12.18]
Step 2	.25***				
Gender		.28***	8.74	1.54	[5.70, 11.78]
Alexithymia		.50***	.62	.06	[.50, .74]
Step 3	.19***				
Gender		.22***	6.98	1.31	[4.40, 9.57]
Alexithymia		.24***	.29	.06	[.18, .41]
Negative Mood		.52***	.64	.06	[.52, .76]

Note. SE B = standard error of unstandardized coefficient; CI = confidence interval.
* $p < .05$. ** $p < .01$. *** $p < .0001$.

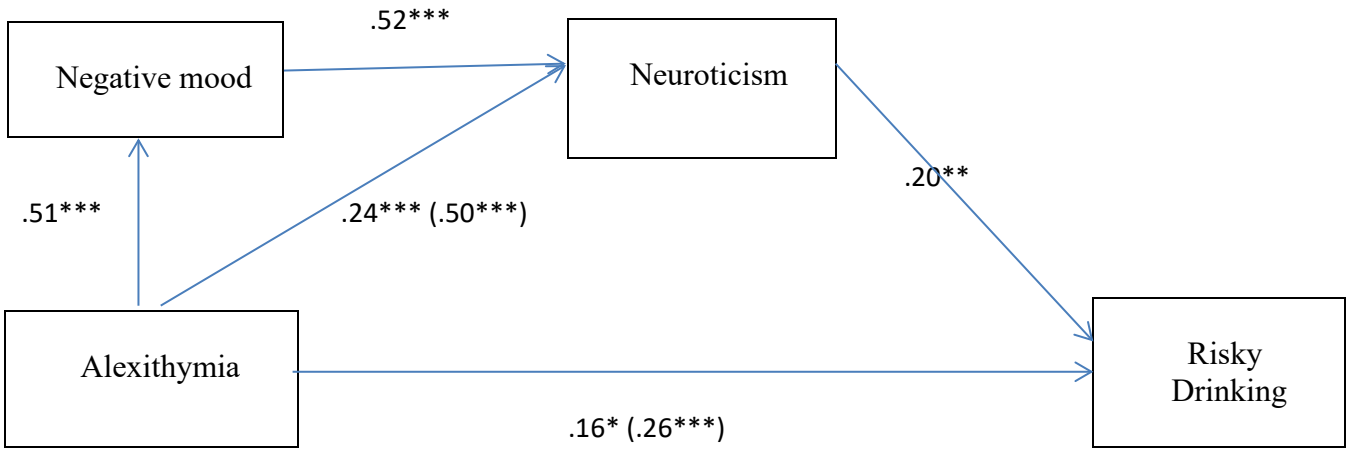

Figure 1. Relationships among alexithymia, neuroticism, negative mood, and risky alcohol use after controlling for gender. *$p < .05$. **$p < .01$. ***$p < .0001$.