

Personality and Early Adolescent Alcohol Use: Assessing the Four Factor Model of Vulnerability

Keywords: Alcohol; Impulsivity; Sensation Seeking; Hopelessness; Anxiety sensitivity; Adolescence

Abstract

Aim: To examine the longitudinal associations between impulsivity, sensation seeking, hopelessness, anxiety sensitivity and alcohol use across early adolescence.

Design and participants: A total of 604 students (mean age = 13.0, SD = 0.40; 65% female) from eight schools across Australia took part in this longitudinal study. Participants completed a self-report questionnaire at four time points across a 36 month period (ages 13 to 16 years) which assessed their levels of impulsivity, sensation seeking, hopelessness, anxiety sensitivity and alcohol use (any alcohol use including a sip and binge drinking - consuming 5 or more standard drinks on one occasion). To examine the longitudinal relationship between personality and alcohol use, generalised estimating equations (GEEs) were conducted.

Results: Over time, alcohol use significantly increased as did episodes of binge drinking. As hypothesised, impulsivity (Odds Ratio (OR) = 1.20), sensation seeking (OR = 1.47) and hopelessness (OR = 1.22) were significantly and independently associated with increased alcohol use. Similarly, impulsivity (OR = 1.45), sensation seeking (OR = 1.78) and hopelessness (OR = 1.55) were significantly and independently associated with increased binge drinking. Anxiety sensitivity, however, was not significantly associated with alcohol use or binge drinking over time.

Conclusion: This study is the first to examine the four factor model of vulnerability and early adolescent alcohol use over a 36 month period. Findings have important implications for the timing and implementation of selective prevention programs.

Introduction

Alcohol is the most commonly used licit drug amongst adolescents in Australia and, after tobacco, is linked to more hospitalisations and deaths than any other drug in adults [1,2]. One in five people consume alcohol at a level which increases risk of chronic disease and two in five are at risk of a serious alcohol-related injury every year [1]. Chronic alcohol consumption has been linked with liver disease, cardiovascular problems, cancers and neurological damage resulting in dementia which all place heavy financial burden on the healthcare system [3,4].

Whilst previous literature has established a number of risk factors for alcohol misuse including genetics, family environment and peer group, understanding the relationship between personality and early alcohol use is particularly important as these factors are amenable targets for prevention programs [5-7]. Whilst personality traits have

been shown to be stable throughout adolescence recent personality-targeted prevention programs which teach alternative coping skills have been effective in reducing alcohol use in this age group [8,9]. The four factor model of vulnerability suggests the personality traits most commonly associated with substance misuse are impulsivity, sensation seeking, hopelessness and anxiety sensitivity [10]. To date however, there have been few studies assessing and comparing all four risk profiles, particularly in the critical period of early adolescence where alcohol initiation is likely to occur [2].

Impulsivity is characterised by a tendency to make rapid responses to stimuli without considering the consequences to the self, others or the environment [11]. There is an extensive body of research linking impulsivity with increased quantity and frequency of alcohol use in young adulthood [12,13]. Specifically, Krueger and colleagues found impulsivity, measured as low constraint at 18 years of age, predicted alcohol abuse in both males and females by 21 years of age [14]. Another study found adolescent impulsivity, as rated by parents, predicted increased alcohol consumption at both 20 and 25 years [15]. Though there are a limited number of studies focusing on personality and alcohol use in very early adolescence, there is preliminary evidence that impulsivity is also concurrently and longitudinally predictive of alcohol use within this critical period [16,17].

Sensation seeking, which is the tendency to crave highly



Journal of Addiction & Prevention

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Submission: 20 May, 2016

Accepted: 28 June, 2016

Published: 02 July, 2016

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Reviewed & Approved by: Dr. Steven L. Youngentob, Department of Psychiatry and Behavioral Sciences, State University of New York, Upstate Medical University, USA

stimulating experiences and a willingness to take risks to engage in them, has been strongly and consistently linked with alcohol misuse both in adolescence and adulthood [9,18,19]. This personality factor has also been linked with binge drinking, particularly in adolescent samples [17,20]. Trials involving high school students in the United Kingdom (UK) and Canada have found sensation seeking to be associated with binge drinking both concurrently and longitudinally [9,19]. Research has shown that sensation seeking is associated with an earlier pathway of alcohol use characterised by early initiation, early onset dependence in young adulthood and early onset of severe dependence in later life [6,21,22]. Despite the extensive research in this area, very few studies have focused on alcohol use in early adolescence.

Another facet of the four factor model is hopelessness which is characterised by a tendency to think negatively about the future [23]. Although most previous literature has focused on adult samples, some studies have found a link between hopelessness and alcohol use among high school students in Canada, the UK and Turkey while other studies have shown this factor predicts an accelerated trajectory of alcohol use in young people [16,17,19,24,25]. Hopelessness, as measured by negative affect, has also been linked with an increased risk of developing an alcohol use disorder in adulthood [23]. Most of this literature, however, has focused on adult samples.

Another trait in the four factor model thought to predict alcohol use in later life is anxiety sensitivity which is characterised by a specific fear of anxiety-related bodily sensations due to beliefs that they will lead to catastrophic outcomes [8]. Whilst there is extensive literature prospectively linking impulsivity, sensation seeking and hopelessness with alcohol misuse, there are very few studies examining the longitudinal relationship between anxiety sensitivity and substance misuse particularly in adolescence, and those that do exist show mixed results [10]. While there is some evidence that anxiety assessed in children and adolescents is associated with later alcohol misuse, other studies suggest there is no concurrent or longitudinal relationship between anxiety sensitivity and substance use [16,26,27]. It has been suggested that this relationship is age-specific as some studies involving adults show an association between anxiety and alcohol use whereas most focusing on adolescent samples do not [10]. Recent studies suggest anxiety sensitivity may be a protective factor in very early adolescence [17]. It is clear that more research is needed to examine under which conditions anxiety sensitivity predicts alcohol use.

To address the gaps in the literature, the aim of the current study is to examine the longitudinal associations between personality risk factors and alcohol use during early adolescence (13 to 16 years), when alcohol initiation is most common. It is hypothesised that high levels of impulsivity, sensation seeking, hopelessness and anxiety sensitivity will be associated with increased alcohol use and binge drinking over time. Previous research has suggested the need to examine personality - related pathways to substance use across different developmental periods including early adolescence [10]. This is the first study to compare the personality traits of the four factor model of vulnerability and early adolescent alcohol use across a 36 month period.

Method

Participants and procedure

The sample was derived from the Climate and Preventure (CAP) study, a cluster randomised controlled trial designed to prevent substance use and related harms. The study was conducted in 26 schools in Australia between 2012 and 2015¹. A detailed description of the study participants and procedure is published elsewhere [28]. This study presents secondary analysis of baseline, 12 month, 24 month and 36 month follow-up data from the eight control schools, to avoid any contaminating effect of the interventions. From these eight schools, 604 students (who received parental consent and gave consent themselves) completed the baseline assessment (65% female, mean age: 13.0 years, SD = 0.40). Students were surveyed, at baseline and each follow-up occasion in a classroom setting using self-report questionnaires. The research protocol was approved by the University of New South Wales Human Research Ethics Committee (HREC11274) and the trial is registered with the Australian New Zealand Clinical Trials Registry (ACTRN12612000026820).

Measures

Demographics: Demographic information including gender and age was obtained.

Alcohol consumption: Participants were asked to indicate whether or not they had consumed any alcohol in the past six months (including a sip or a full-serve), and whether or not they had consumed alcohol at a level that put them at risk of short-term harm (binged) in the past six months (i.e. consumed five or more standard drinks on one occasion) as defined by the Australian National Health and Medical Research Council (NHMRC) at the time of the study (National Health and Medical Research Council, 2009). Although these are risk levels specified for adults, in the absence of specific drinking guidelines for people under 18 years of age in Australia, these guidelines are commonly used in school - and population - based surveys to enable comparisons between young people [29].

Personality risk factors: The Substance Use Risk Profile Scale (SURPS) is a 23-item questionnaire which assesses personality risk for substance abuse and dependence along four dimensions: Impulsivity (IMP), Sensation Seeking (SS), Hopelessness (H) and Anxiety Sensitivity (AS) [27]. Participants are asked to indicate the extent to which they agree with each item (e.g. "I usually act without stopping to think") on a scale from 1 (strongly disagree) to 4 (strongly agree). The SURPS subscales demonstrated acceptable to good internal consistency reliability in our sample (IMP: $\alpha = 0.78$; SS: $\alpha = 0.67$; H: $\alpha = 0.86$; AS: $\alpha = 0.62$) which is consistent with previous research [27].

Factors associated with sample retention

Almost all students (93.2%) provided follow-up data on at least one occasion. Of the total sample, 527 participants completed the 12 month assessment, 512 participants completed the 24 month assessment and 425 participants completed the 36 month assessment.

¹ Initially, 27 schools agreed to participate however, due to time constraints, one school withdrew from the intervention condition prior to completing baseline questionnaires. This school completed questionnaires at baseline and all follow-up occasions and as such has been included in the analysis for this study.

To determine whether those who completed follow-up assessments differed from the original baseline sample, a series of logistic regressions and analyses of variance (ANOVA) were conducted. Compared to those who completed only the baseline assessment, those who were followed up were more likely to report lower H scores ($F(1,603) = 4.57, p = 0.03$), lower IMP scores ($F(1,603) = 6.87, p = 0.009$) and were less likely to have binged (OR = 0.26, 95% CI = 0.09 - 0.72) at baseline.

Statistical analysis

The estimated rates of alcohol use and binge drinking were calculated as the number of participants responding positively to the relevant item as a proportion of respondents with complete data on that item. Measures of alcohol use and personality risk factors were obtained at baseline and at each follow up occasion. To examine the longitudinal relationship between substance use and personality risk factors, generalised estimating equations (GEEs) were conducted for each of the substance use outcomes (drank alcohol or binged in the past 6 months). GEE analyses are commonly used for studies in which a repeated measure binary dependent variable is analysed longitudinally as they take into account the correlation among repeated observations and utilise all available data [30,31]. Based on the fact that alcohol use significantly increased over time and on examination of the quasi-information criterion (QIC) for the different correlation structures, the present study employed the autoregressive correlation structure (AR1). The AR1 structure assumes that the correlation between observations is a function of the separation between the observations (i.e. the covariance reduces exponentially as a function of time) [31]. An additional advantage of using the GEE approach is its ability to utilise all available data, and as such, analyses are not limited to cases with complete data [31].

For the GEE analyses, gender was included in the model as males and females tend to exhibit differing levels of substance use during the adolescent years [32]. Age was included as alcohol use has been found to significantly increase over the adolescent years [2]. Time was included in the model as a categorical variable with each wave coded as 1 (baseline), 2 (12 month follow-up), 3 (24 month follow-up) or 4 (36 month follow-up).

To determine independent predictors of substance use and binge drinking over time and to adjust for potential confounding, multivariate logistic GEEs were carried out which included all four personality factor variables as well as gender and age. All GEE analyses were conducted using PASW Statistics 22 and significant levels were set at $p < 0.05$. Standardised z-scores for IMP, SS, H and AS were used in the GEE models. The reported odds ratios represent the likelihood of consuming alcohol or bingeing for every one unit increase in standard deviation (SD) above the sample mean. Significant results are reported as the exponential of the regression coefficient for the dichotomous outcome variables (i.e. odds ratio with 95% confidence intervals; OR, 95% CI) as suggested by Diggle, Heagerty, Liang and Zeger [33].

Intra-cluster correlations (ICCs) were calculated for each of the substance use outcomes to examine variance explained by school level. As all ICCs were well below 10% no adjustments for clustering were made which is consistent with previous recommendations [34].

A check for multicollinearity amongst the independent variables in the GEE models was also conducted. Variance inflation factors ranged from 1.03 to 1.43, indicating acceptable levels of collinearity, even according to the most conservative guidelines [35]. The two outcome variables, alcohol use and binge drinking, were only moderately correlated ($r = 0.38$).

Results

Sample characteristics

Demographics: Sixty-five percent of the sample were female and participant ages at baseline ranged from 12-15 years, with a mean age of 13.0 years (SD = 0.40).

Substance use: At baseline, 64.6% of participants had tried alcohol and 15.7% had consumed a full serve during their lifetime. In the 6 months preceding baseline assessment, 35.9% reported having any alcohol. During this time 4.1% of the sample had binged, that is they had consumed alcohol above the NHMRC guidelines at the time of the study for risk of harm in the short term [1]. These rates of alcohol use are similar to larger school and population-based surveys [2,36].

Table 1 depicts the prevalence of alcohol use and binge drinking at baseline and each follow-up occasion. GEE analysis revealed the proportion of those who used alcohol increased significantly between each time point ($p < 0.001$) and the proportion of those binge drinking increased significantly between each time point ($p < 0.001$).

Personality risk factors: Participants' IMP and H baseline scores were skewed (skewness = 3.61 and 8.61 respectively) therefore both the mean and median for these variables are reported. IMP scores ranged from 5 to 20, with a mean of 11.28 (SD = 2.70) and a median score of 11.00. SS scores ranged from 7 to 24, with a mean of 15.89 (SD = 3.17). H scores ranged from 7 to 28, with a mean of 11.96 (SD = 3.32) and a median score of 12.00. AS scores ranged from 5 to 20, with a mean of 11.87 (SD = 2.43).

Personality risk factors associated with alcohol use over time

Table 2 depicts the mean scores for IMP, SS, Hand AS for those who drank and those who did not drink at baseline and each follow up stage. When examining each personality factor individually, there were significant main effects for IMP (OR 1.37, 95% CI: 1.23 - 1.51), SS (OR 1.50, 95% CI: 1.36 - 1.66) and H (OR 1.24, 95% CI: 1.12 - 1.37) indicating that those who reported higher scores for IMP, SS and H were more likely to use alcohol over the study period. After controlling for age and gender the main effects for IMP (OR 1.38, 95% CI: 1.25 - 1.53), SS (OR 1.53, 95% CI: 1.38 - 1.70) and H (OR 1.23, 95% CI: 1.11 - 1.36) remained significant. There was a non-significant main effect for AS (OR 0.96, 95% CI: 0.87 - 1.05). After controlling for

Table 1: Proportion of participants using alcohol and binge drinking at each follow-up.

	Baseline (n = 604)	12 month follow-up (n = 527)	24 month follow-up (n = 512)	36 month follow-up (n = 425)
Used alcohol	35.9%	46.3%	59.6%	69.5%
Binged	4.1%	8.2%	21.3%	34.4%

Table 2: Impulsivity, sensation seeking, hopelessness and anxiety sensitivity scores for those who drank and those who did not drink alcohol at each follow-up (*M, SD*).

	Baseline		12 month follow-up		24 month follow-up		36 month follow-up	
	Used (n = 217)	Did not use (n = 387)	Used (n = 283)	Did not use (n = 244)	Used (n = 304)	Did not use (n = 207)	Used (n = 295)	Did not use (n = 130)
IMP	12.00 (2.70)	10.86 (2.59)	11.73 (2.71)	10.76 (2.83)	11.68 (2.91)	10.47 (2.51)	11.11 (2.85)	10.24 (3.05)
SS	16.90 (3.18)	15.31 (3.01)	16.46 (3.36)	15.23 (3.41)	16.74 (3.60)	14.80 (3.21)	16.69 (3.71)	14.80 (3.31)
H	12.64 (3.72)	11.58 (3.02)	13.12 (3.95)	12.10 (3.46)	13.23 (4.24)	12.16 (3.28)	12.89 (3.89)	12.58 (3.51)
AS	11.86 (2.47)	11.90 (2.39)	11.80 (2.68)	11.87 (2.70)	11.94 (2.97)	11.88 (2.51)	11.84 (2.95)	12.20 (3.05)

Note: IMP: Impulsivity; SS: Sensation Seeking; H: Hopelessness; AS: Anxiety Sensitivity

Table 3: Impulsivity, sensation seeking, hopelessness and anxiety sensitivity scores for those who binge and those who did not binge at each follow-up (*M, SD*).

	Baseline		12 month follow-up		24 month follow-up		36 month follow-up	
	Binged (n = 25)	Did not binge (n = 579)	Binged (n = 43)	Did not binge (n = 484)	Binged (n = 108)	Did not binge (n = 403)	Binged (n = 145)	Did not binge (n = 279)
IMP	13.92 (2.91)	11.16 (2.62)	13.65 (3.30)	10.99 (2.66)	12.85 (2.79)	10.75 (2.72)	11.68 (3.16)	10.40 (2.72)
SS	17.92 (2.48)	15.79 (3.16)	17.84 (4.16)	15.62 (3.32)	18.23 (3.33)	15.34 (3.38)	17.62 (3.76)	15.32 (3.41)
H	14.60 (4.49)	11.84 (3.22)	15.02 (4.42)	12.35 (3.58)	14.88 (4.57)	12.24 (3.52)	13.16 (4.01)	12.60 (3.65)
AS	11.92 (1.98)	11.88 (2.44)	12.26 (2.90)	11.80 (2.67)	11.90 (3.01)	11.92 (2.73)	11.73 (3.43)	12.05 (2.72)

Note: IMP: Impulsivity; SS: Sensation Seeking; H: Hopelessness; AS: Anxiety Sensitivity.

age and gender, the main effect for AS remained non-significant (OR 0.95, 95% CI: 0.87 - 1.05).

Multivariate analysis revealed IMP, SS and H were independently associated with alcohol use over time (while also controlling for age and gender). Scoring 1 SD above the IMP mean was associated 20% increase in the odds of consuming alcohol (OR 1.20, 95% CI: 1.07 - 1.35). Scoring 1 SD above the SS mean was associated with a 47% increase in the odds of consuming alcohol (OR 1.47, 95% CI: 1.31 - 1.65). Scoring 1 SD above the H mean was associated with a 22% increase in the odds of consuming alcohol (OR 1.22, 95% CI: 1.09 - 1.36). AS was not independently associated with alcohol use over time (OR 0.91, 95% CI: 0.82 - 1.01).

Personality risk factors associated with binge drinking over time

Table 3 depicts the mean scores for IMP, SS, H and AS for those who binged and those who did not binge at baseline and each follow up stage. When examining each personality factor individually, there were significant main effects for IMP (OR 1.85, 95% CI: 1.59 - 2.15), SS (OR 1.94, 95% CI: 1.64 - 2.30) and H (OR 1.53, 95% CI: 1.33 - 1.76) indicating that those who reported higher scores for IMP, SS and H were more likely to binge over the study period. After controlling for age and gender the main effects for IMP (OR 1.85, 95% CI: 1.59 - 2.14), SS (OR 1.94, 95% CI: 1.64 - 2.30) and H (OR 1.54, 95% CI: 1.33 - 1.77) remained significant. There was a non-significant main effect for AS (OR 0.99, 95% CI: 0.86 - 1.13). After controlling for age and gender, the main effect for AS remained non-significant (OR 0.97, 95% CI: 0.85 - 1.11).

Multivariate analysis revealed IMP, SS and H were independently associated with binge drinking over time (while also controlling for age and gender). Scoring 1 SD above the IMP mean was associated 45% increase in the odds of bingeing (OR 1.45, 95% CI: 1.23 - 1.71). Scoring 1 SD above the SS mean was associated with a 78% increase

in the odds of bingeing (OR 1.78, 95% CI: 1.50 - 2.11). Scoring 1 SD above the H mean was associated with a 55% increase in the odds of bingeing (OR 1.55, 95% CI: 1.34 - 1.80). AS was not independently associated with bingeing over time (OR 0.90, 95% CI: 0.77 - 1.04).

Discussion

This study was the first to examine the longitudinal relationships between the four factor model of vulnerability (impulsivity, sensation seeking, hopelessness and anxiety sensitivity) and early adolescent alcohol use over a 36 month period. As hypothesised, impulsivity, sensation seeking and hopelessness were independently and consistently associated with adolescent alcohol use and binge drinking over time. Anxiety sensitivity, however, was not associated with alcohol use or binge drinking between the ages of 13 and 16 years.

Findings regarding impulsivity, sensation seeking and hopelessness are consistent with previous literature which has shown a strong link between these personality factors and alcohol use, including an early trajectory of drinking [9,13,16,17,21]. Adolescents displaying these traits may benefit from selective school-based prevention programs, such as Preventure, which focus on teaching alternative coping strategies and problem solving skills specific to personality risk factors [9]. These prevention programs are justified in selecting teenagers who are at least one standard deviation above the mean on these traits.

Whilst anxiety sensitivity does not appear to be a risk factor for very early alcohol use, findings suggest this risk profile may be age-specific. Previous studies on adolescents have shown no cross-sectional or prospective relationship with anxiety sensitivity and alcohol use while some have shown a significant negative relationship [16,17,19]. In contrast, the relationship between anxiety sensitivity and substance misuse in adults has been well documented [37]. It has been suggested that anxiety sensitivity represents a specific risk

profile which predicts who will use alcohol to cope with significant life stressors such as trauma or grief [38]. Perhaps when focusing on an early adolescent sample this relationship cannot be detected as most have not yet experienced significant stressors. This idea is also supported by studies showing anxiety sensitivity to be more closely associated with coping or conformity drinking motives than with quantity or frequency of alcohol consumption itself [8]. This notion that anxiety sensitivity may become a risk factor beyond the early adolescent period has important implications for prevention programs which aim to reduce alcohol-related harms. It may prove more beneficial to implement these interventions in later adolescence or early adulthood, and it may be more appropriate to assess for both anxiety sensitivity and drinking motives when selectively targeting participants.

The present findings also extend on the four factor model of vulnerability by comparing the personality risk profiles. Sensation seeking, which was associated with a 78% increase in risk of binge drinking, appears to be the strongest predictor of harmful alcohol use while impulsivity and hopelessness are more moderately associated with alcohol use and binge drinking in this age group. Whilst many previous studies have looked at these four factors in isolation, this study shows sensation seeking, impulsivity and hopelessness are independent predictors of early alcohol use [22,27]. It is important to examine the four factor model in later developmental periods to more accurately map the trajectory of use among these personality profiles.

The current study also provides a valuable description of drinking patterns in young people across the ages of 13-16 years. Although the majority of the sample reported having tried alcohol at baseline (64%), less than one in five of these adolescents had actually consumed a full standard serve. The proportion of adolescents drinking increased significantly over time, which is consistent with epidemiological studies showing that drinking increases with age [1,2,29]. When looking at more harmful drinking behaviours, binge drinking increased by 8-fold over the 36 month period, where one in three participants were found to be binge drinking at 16 years of age. This finding is also consistent with patterns reported in large epidemiological studies [1,29]. Although bingeing was not as common as alcohol use, the rapid increases in binge drinking shown in this study are worrying as excessive consumption has often been linked with harms such as injury and violence [2]. The identification of personality risk factors can help to inform targeted interventions which aim to reduce harmful alcohol use in such a critical period of development.

A potential limitation of this study is that data was not collected into late adolescence. With literature in this field suggesting anxiety sensitivity could be linked with alcohol use in later developmental periods, it is pertinent for future studies to examine the relationship between personality and alcohol use beyond 16 years of age. Another limitation of the study is the differential attrition observed across follow-up surveys. However, it should be noted that almost all participants (93.2%) completed at least one follow-up assessment. Thirdly, all measures of alcohol use were obtained via self-report. Although some might question the reliability of self-report of substance use, this method of data collection among adolescents has consistently shown to be valid and is widely accepted [16,39]. Lastly,

GEE analyses should be interpreted with caution as the relationship between personality and drinking can be attributable to both changes in drinking and changes in personality factors. However, previous studies have shown the four personality traits examined in this study remain relatively stable over adolescence [8].

In conclusion, three personality traits within the four factor model (impulsivity, sensation seeking, and hopelessness) appear to be significant risk factors for harmful alcohol use across early adolescence. A fourth trait, anxiety sensitivity, was not a risk factor in this age group, though it may be a significant predictor of substance use in later life. Though the risk factors for substance use are numerous and complex, some factors such as personality tendencies are particularly amenable to prevention as we know it is possible to teach vulnerable young people personality-specific coping strategies [16]. Utilising these factors to identify young people who may benefit from additional support has the potential to reduce the detrimental alcohol-related harms experienced amongst this age group.

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Acknowledgements

The authors would like to acknowledge the schools, students, teachers and health professionals who participated in this research. The research team also acknowledges the assistance of the NSW Department of Education and Communities for access to its schools (SERAP 2011201). This research was funded by the National Health and Medical Research Council (APP1004744).