

**Modelling the Relationship Between Environmental and Social  
Cognitive Determinants of Risky Drinking Among Emerging  
Adults**

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## **Abstract**

**Objective.** Existing literature based on Social Cognitive Theory has established key environmental and cognitive variables related to problem drinking in emerging adults, but further research is needed to understand the interaction between these variables. The aim of this study was to extend understanding of how environmental and cognitive variables interact to influence problem drinking in a sample of emerging adults. We hypothesized that cognitive factors of alcohol outcome expectancies (AOEs) and drinking refusal self-efficacy (DRSE) would sequentially mediate the relationship between environmental factors (perceived parental/peer drinking) and problem drinking.

**Method.** A sample of 984 Australian emerging adults ( $M$  age = 20.55,  $SD$  = 2.19, range: 18-25 years) completed an online survey including measures of demographics, substance use, environmental variables (perceived drinking by parents and peers) and cognitive variables (AOEs and DRSE). This study employed a cross-sectional design. Path analysis was used to identify indirect pathways for the relationship between environmental factors and drinking behaviour, through cognitive variables.

**Results.** In line with the predicted model, the relationship between parental drinking and problem drinking was sequentially mediated by AOEs, and then DRSE. Participants with heavier drinking parents reported higher AOEs (positive and negative), which related to having lower DRSE, and higher problem drinking. Similarly, the positive relationship between peer drinking and problem drinking was mediated by having higher positive and negative expectancies, but contrary to predictions, DRSE did not mediate these pathways.

**Conclusions.** This study extends on previous research by revealing novel pathways between environmental influences for drinking behaviour, via social cognitive factors that are conducive to change.

**Keywords:** Alcohol, social cognitive theory, drinking refusal self-efficacy, alcohol outcome expectancies, path analysis

## 1. Introduction

Alcohol is the greatest contributor to disability-adjusted life years in youth internationally (Gore, Bloem et al. 2011). In many countries, emerging adults, between the ages of 18 and 25 years-old (Arnett 2000) are a high-risk age group for engaging in hazardous alcohol consumption, particularly risky single occasion drinking (commonly defined as consuming  $\geq 5$  drinks per occasion) (NHMRC 2009) (AIHW 2017, Administration 2020, AIHW 2020, Visontay, Mewton et al. 2020). One such country is Australia, where despite an increase in the proportion of emerging adults abstaining from alcohol, rates of risky single occasion drinking have remained high and stable in recent years (42% in 2016 versus 41% in 2019) (AIHW 2017, AIHW 2020).

A recent systematic review explored the prevalence of hazardous drinking among emerging adult samples globally, between 1989 and 2015 (Visontay, Mewton et al. 2020). This review included only studies that utilised a validated measure of problem drinking called the Alcohol Use Disorders Identification Test (AUDIT; Saunders, Aasland et al. 1993). Although the review demonstrated a potential decline in problem drinking among emerging adults between 1989 and 2015, the study identified continued problems with dependence and short and long-term harm from alcohol use among emerging adults (AIHW 2020, Visontay, Mewton et al. 2020). Of the 32 studies in this review, 13 (41%) of the emerging adult samples scored as problem drinkers, based on average AUDIT score. Of the four Australian studies identified in this review, all samples drank close to or above the AUDIT score of eight that indicates problem drinking (M = 9.43; Ridout, Campbell et al. 2012) (M = 10.13; O'brien, Kolt et al. 2010) (M = 7.5; Lennings 1998) (M = 7.4; Hallett, Howat et al. 2012).

Given the ongoing issue of problem drinking among emerging adults globally, it is useful to understand how important determinants of drinking behaviour may interact to produce

25 problem drinking in this age group. Findings from such research may lead to improvements in  
26 prevention and intervention strategies for alcohol use problems among emerging adults.

### 27 **Social Cognitive Theory**

28 Past research has demonstrated the utility of health behaviour models, like Social  
29 Cognitive Theory (SCT), for understanding drinking behaviour among emerging adults (e.g.  
30 Van Tyne, Zamboanga et al. 2012, Des Rosiers, Schwartz et al. 2013, Hasking, Boyes et al.  
31 2015, Hasking, Dawkins et al. 2020). SCT emphasises the reciprocal relationship between  
32 behavioural factors, environmental factors, and cognitions (Bandura 1986, Bandura 1997).  
33 For example, a SCT-based model by Hasking, Boyes et al. (2015) showed that young adults  
34 ( $M$  age = 26.40 years) who are more reward-sensitive experience greater alcohol-related  
35 problems, because they seek out social environments that stimulate dopaminergic reward  
36 pathways (e.g. drinking events/parties). However, the alcohol-related risk of being in these  
37 social environments is mitigated if the young person holds high confidence and belief in their  
38 ability to limit drinking in social situations (Hasking, Boyes et al. 2015). This example  
39 demonstrates how SCT-based models that include both environmental and cognitive factors  
40 are useful for understanding drinking behaviours among young adults (Oei and Morawska  
41 2004).

### 42 ***Environmental Influences on Problem Drinking***

43 In SCT, environmental factors are important correlates of behaviour, and social  
44 learning is one environmental factor that is particularly emphasised (Bandura 1986, Bandura  
45 1997). In line with this theoretical perspective, research has shown that parents' drinking is  
46 positively associated with alcohol consumption among emerging adults (Pulkkinen and  
47 Pitkänen 1994, Guo, Hawkins et al. 2001, Poelen, Scholte et al. 2007, Mahedy, MacArthur et  
48 al. 2018). Similarly, heavier drinking among peers is associated with problem drinking  
49 (AUDIT scores) among emerging adults (e.g. Atwell, Abraham et al. 2011, de Visser, Hart et

50 al. 2014). However, most studies on youth alcohol use vary in their definitions and  
51 measurements of predictor and outcome variables (e.g. peer/parental influence and drinking  
52 outcomes), which limits the capacity for comparison between studies (Ryan 2010), and  
53 indicates need for more research to support existing findings.

54 While it is possible to alter heavy-drinking practises by making changes to the social  
55 environment, such changes can be difficult to implement and are often met with resistance  
56 (e.g. alcohol policy changes; see Room, MacLean et al. 2022 for review). Furthermore, the  
57 stable rates of risky drinking among emerging adults in recent years (e.g. AIHW 2017,  
58 AIHW 2020) suggest that emerging adults may be resistant to current population-wide efforts  
59 to address harmful drinking (Roche, Kostadinov et al. 2015, Livingston, Callinan et al. 2018).  
60 Alternatively, many studies support the effectiveness of personalised, brief psychotherapy  
61 interventions for young adults aiming to reduce alcohol consumption and related problems  
62 (Organization 2010, Merz, Baptista et al. 2015 for review). In developing such interventions,  
63 comprehensive behavioural models, such as models based on SCT, can be useful for  
64 identifying important cognitive variables to target (Des Rosiers, Schwartz et al. 2013).

### 65 ***Cognitive Factors as Mediators of Environmental Influences for Drinking***

66 Two cognitive processes derived from SCT that are relevant to drinking behaviours  
67 are outcome expectancies and self-efficacy. In SCT, a persons' expectations about the  
68 outcomes of their behaviour (outcome expectancies), and their ability to complete a task  
69 (self-efficacy) are strong predictors of behaviour (Dawkins, Hasking et al. 2021). Research  
70 on drinking among emerging adults supports this theory (Jones, Corbin et al. 2001, Hasking,  
71 Boyes et al. 2015).

72 In SCT, self-efficacy is described as central to human behaviour (Bandura 1989,  
73 Bandura 1991). Drinking refusal self-efficacy (DRSE), derived from 'self-efficacy', refers to  
74 a persons' perceived ability to refuse or resist drinking alcohol (Foster, Neighbors et al.

75 2014), and is a useful predictor of alcohol consumption among emerging adults (e.g.  
76 Baldwin, Oei et al. 1993, Morawska and Oei 2005). Alcohol outcome expectancies (AOEs),  
77 derived from ‘outcome expectancies’, refer to a persons’ expectations (e.g. positive or  
78 negative) about the outcomes of using alcohol. AOEs have also proven to be consistently  
79 related to problem drinking in young adults (e.g. Young and Knight 1989, Lee, Greely et al.  
80 1999, Connor, Williams et al. 2000).

81         Regarding the direction of effects, research with community drinkers generally shows  
82 that greater drinking is related to having low DRSE (Baldwin, Oei et al. 1993, Lee and Oei  
83 1993, Connor, Williams et al. 2000, Hasking and Oei 2002), high positive expectancies  
84 (Leigh and Stacy 1993, Lee, Greely et al. 1999, Connor, Williams et al. 2000, Young, Connor  
85 et al. 2006, Burns, Jancey et al. 2016) and low negative expectancies (Leigh and Stacy 1993,  
86 Lee, Greely et al. 1999). Although, Des Rosiers, Schwartz et al. (2013) noted inconsistencies  
87 regarding the direction of the relationship between negative expectancies and alcohol-related  
88 outcomes, with some studies finding positive associations (e.g. Neighbors, Lee et al. 2007),  
89 others finding negative associations (e.g. Kuntsche, Knibbe et al. 2005), and others finding no  
90 relationship (e.g. Bot, Engels et al. 2005).

91         Social cognitive theorists posit that cognitive variables, such as DRSE and AOEs,  
92 mediate the influence of environmental factors on behaviour (Bandura 1986, Bandura 1997).  
93 Accordingly, research shows that young people who are more exposed to heavier drinking  
94 peers and adults have higher positive alcohol expectancies (Cumsille, Sayer et al. 2000,  
95 Boyd, Sceeles et al. 2018), and having higher positive AOEs relates to heavier personal  
96 drinking outcomes (Mills and Caetano 2010, Samek, Keyes et al. 2013, Boyd, Sceeles et al.  
97 2018). Regarding negative expectancies, research suggests that having peers who drink  
98 heavily relates to having lower negative AOEs and, in turn, heavier personal drinking (e.g.  
99 Waddell, Blake et al. 2020). The literature on negative expectancies and parental drinking is

100 understudied, although some research shows that having heavy-drinking parents is related to  
101 higher negative alcohol expectancies (Wiers, Gunning et al. 1998).

102 SCT also posits that having positive alcohol expectancies alone is not sufficient to  
103 enact a behaviour like drinking, because people use self-regulatory mechanisms to control  
104 their behaviour (Des Rosiers, Schwartz et al. 2013). DRSE is one such mechanism.

105 According to SCT, self-efficacy is the key factor underling human agency (Bandura 1989,  
106 Bandura 1991). Prospective research has shown that DRSE mediates the relationship between  
107 AOE's and drinking behaviours in young adults (Hasking, Boyes et al. 2015).

108 Based on SCT, it is important to investigate comprehensive models that explore how  
109 environmental and cognitive factors related to drinking may interact to influence problem  
110 drinking outcomes in emerging adults (Des Rosiers, Schwartz et al. 2013). Specifically,  
111 models that explore the mediating role of AOE's and DRSE on important environmental  
112 influences might clarify the cognitive pathways through which problem drinking behaviour is  
113 initiated and maintained in emerging adults.

#### 114 **Existing Literature on SCT-Based Models of Drinking**

115 Previous SCT-based models for drinking among emerging adults have investigated  
116 how various cognitions mediate the relationship between environmental factors and drinking  
117 outcomes (e.g. how AOE's mediate the impact of acculturation orientations and family  
118 context on drinking) (Des Rosiers, Schwartz et al. 2013, Hasking, Dawkins et al. 2020).

119 Other SCT-based models of drinking have explored the mediating role of DRSE on AOE's  
120 among emerging adults (e.g. Hasking, Boyes et al. 2015), and the distinct mediating roles of  
121 positive and negative expectancies in predicting drinking outcomes among emerging adults  
122 (Des Rosiers, Schwartz et al. 2013) and adolescents (e.g. Van Tyne, Zamboanga et al. 2012).

123 A limitation of some studies that have explored pathways between social cognitive  
124 variables and drinking outcomes in young people is that they do not account for



125 environmental determinants in the model (e.g. Van Tyne, Zamboanga et al. 2012), which are  
126 an important component of SCT (Bandura 1989, Bandura 1991). Similarly, many studies  
127 exploring SCT-based models of drinking behaviour among young people do not account for  
128 the mediating role of self-efficacy on other correlates of drinking behaviour, despite self-  
129 efficacy being the key factor underling human agency in SCT (Bandura 1989, Bandura 1991)  
130 (e.g. Van Tyne, Zamboanga et al. 2012, Des Rosiers, Schwartz et al. 2013). As such, there is  
131 a need for more research on the utility of comprehensive SCT-based models of drinking that  
132 include both key environmental and cognitive variables.

133         Based on SCT, a comprehensive model of drinking should explore how key cognition  
134 factors related to drinking mediate the influence of environmental stimuli on drinking  
135 behaviour (Bandura 1986, Bandura 1997, Hasking, Boyes et al. 2015). Given the importance  
136 of social learning to SCT, the environmental factors in the model should include key social  
137 influences for drinking. For young adults, research suggests that social influence from peers'  
138 and parents' drinking behaviour are useful constructs to account for (e.g. Atwell, Abraham et  
139 al. 2011, de Visser, Hart et al. 2014). Research also suggests that the model should account  
140 for key cognitive correlates of drinking, including AOE's (e.g. Hasking, Boyes et al. 2015)  
141 and especially DRSE (e.g. Baldwin, Oei et al. 1993, Morawska and Oei 2005), given the  
142 centrality of self-efficacy to human behaviour (Bandura 1989, Bandura 1991).

### 143 **The Current Study**

144         This study aimed to explore the utility of a comprehensive SCT-based model of  
145 drinking that examines how environmental and cognitive factors interact to influence  
146 problem drinking in a large sample of emerging adults. Specifically, our study aimed to  
147 establish whether two important environmental influences on drinking among emerging  
148 adults, perceived drinking by close peers and parents, are mediated by key cognitive factors  
149 related to drinking, including positive and negative AOE's and DRSE. In doing so, this study

150 contributes a novel, comprehensive SCT-based model to the literature, that includes both  
151 environmental and cognitive factors, and is therefore more useful for discriminating drinking  
152 patterns, compared to less comprehensive models (Oei and Morawska 2004).

153 The predicted model (see Figure 1) was designed to test our main hypothesis that  
154 environmental influence from parents' and peers' drinking behaviour impacts emerging  
155 adults' own drinking behaviour indirectly, through AOE's and then, in turn, through DRSE.  
156 This hypothesis aligns with SCT and related research, given that participants AOE's (positive  
157 and negative) develop as a result of prior social experiences of drinking (Jones, Corbin et al.  
158 2001), especially from prominent social referents such as peers and parents (e.g. Cumsille,  
159 Sayer et al. 2000, Poelen, Scholte et al. 2007). Our model also predicted that DRSE would  
160 mediate the relationship between AOE's and problem drinking, in line with previous research  
161 with emerging adults (Hasking, Boyes et al. 2015) and SCT, which posits that self-efficacy is  
162 central to human agency (Bandura 1989, Bandura 1991).

### 163 **Potential Impact**

164 Findings from such research may lead to improvements in personalised interventions for  
165 problem drinking among emerging adults, since this study explores novel mediation  
166 pathways from peer and parental drinking, via cognitive factors that have demonstrated being  
167 amenable to change in past research (AOE's and DRSE) (Kaner and Bewick 2011). This  
168 information is widely applicable to emerging adults who drink, especially those who interact  
169 with heavy drinking peers or parents and experience robust social influence effects from  
170 observing drinking by these prominent social referents (e.g. Cumsille, Sayer et al. 2000,  
171 Poelen, Scholte et al. 2007).

## 172 **2. Method**

### 173 **Recruitment**

174 Participants were required to be 18-25 years old, to have drunk alcohol in the past  
175 month, and live in Australia. University students and community participants were recruited  
176 to complete an online survey via the University of Queensland's (UQ) first-year research  
177 participation scheme for psychology students, snowballing techniques, and posts on various  
178 youth-relevant, online forums (topix.com, www.reddit.org, and the student-community  
179 Facebook pages of several Australian universities). Participants provided online consent  
180 before commencing the survey. Eligibility was assessed at the start of the survey, via self-  
181 report questions (age, past-month alcohol use, country of residence), and the study design  
182 promoted recruitment of an eligible participants. UQ student participants received course  
183 credit for participating. All other participants could enter the draw to win one of two \$100  
184 PayPal gift vouchers. Upon completing the main survey, participants were redirected to a  
185 separate online survey where they entered identifiable information to register for course  
186 credit or the prize draw (a student number field was displayed to UQ course credit  
187 participants and a contact information field was displayed to prize-draw participants). Ethical  
188 approval was granted by the University of Queensland Human Research Ethics Committee  
189 (approval code 17-PSYCH-4-42-JS).

## 190 **Participants**

191 The final sample was 984 emerging adults ( $M$  age = 20.55,  $SD$  = 2.19). Most  
192 participants were female ( $n$  = 681; 69%), students ( $n$  = 869; 88%); Anglo-Saxon/ European ( $n$   
193 = 797, 82%); employed ( $n$  = 673; 68%) and not in a relationship ( $n$  = 517; 53%). To explore  
194 whether there were differences between students and non-students on key variables, we  
195 conducted t-tests and chi-square tests. These tests revealed differences between university  
196 students and non-students on DRSE ( $p$  = .004) (non-students had lower DRSE) and  
197 proportion of friends who drink to get drunk ( $p$  = .015) (non-students had fewer friends who  
198 drink to get drunk). Past research supports the discrepancies between students and non-

199 students on DRSEQ-R total (Oei, Hasking et al. 2005) and peer drinking (e.g. Rickwood,  
200 George et al. 2011), and the limitations of these sample characteristics are addressed in the  
201 Discussion (see ‘Limitations’).

## 202 **Transparency and Openness**

203 We report how we determined our sample size, all data exclusions, all manipulations,  
204 and all measures in the study, and we follow the American Psychological Association Journal  
205 Article Reporting Standards (JARS) (see Appelbaum, Cooper et al. 2018). All data, analysis  
206 code, and research materials are available from the corresponding author on reasonable  
207 request. Data were analysed using IBM SPSS Statistics 28 (IBM 2020) and AMOS 28  
208 statistical software (Arbuckle 2014). This study’s design and its analysis were not pre-  
209 registered.

## 210 **Measures**

212 The 20-30-minute online survey contained the following measures:

### 213 *Demographics*

214 Age, sex, ethnicity, student status, relationship and employment status were assessed.

### 215 *Problem Drinking*

216 The total score of the 10-item Alcohol Use Disorders Identification Test (AUDIT) was  
217 used as a measure of problem drinking (Saunders, Aasland et al. 1993). The AUDIT is a  
218 validated measure of problem drinking with good psychometric properties among adults  
219 (Saunders, Aasland et al. 1993, Reinert and Allen 2007). An AUDIT total score  $\geq 8$  indicates  
220 problem drinking (Saunders, Aasland et al. 1993). In this sample, internal consistency for the  
221 AUDIT was good ( $\alpha = .81$ ). The AUDIT-C (items 1-3) is also reported (see Table 1), which  
222 provides an indication of problem drinking among emerging adults (Campbell and Maisto  
223 2018). An AUDIT-C score of  $\geq 4$  identifies 86% of men who report hazardous drinking or  
224 alcohol use disorders, and a score of  $\geq 2$  identifies 84% of women who report hazardous

225 drinking or alcohol use disorders. Participants were provided with an image of the Australian  
226 standard drinks guide to standardise responses to drinking items in the survey.

### 227 ***Peer Drinking***

228 Perceived peer drinking was measured using a single item: “What proportion of your  
229 close friends drink to get drunk?” Participants answered on a 5-point scale, ranging from 1  
230 “None” to 5 “Almost all”. The wording “drink to get drunk” was used, based on evidence that  
231 this wording is appropriate for measuring problem single occasion drinking in young people  
232 (Thombs, Beck et al. 1993).

### 233 ***Parental Drinking***

234 Perceived parental drinking was measured using two non-standardised items.  
235 Participants were asked, “How many alcoholic drinks would your parent 1 (e.g.  
236 your father) have on a typical occasion when he/she is drinking?” The second item was  
237 worded for “parent 2 (e.g. your mother)”. These questions were adapted from the AUDIT,  
238 item two (WHO 1992). Participants answered on a 6-point scale, ranging from 1 “0 drinks” to  
239 6 “10 or more drinks”. From these items, a parents’ mean total drinks-per-occasion score was  
240 calculated.

### 241 ***Drinking Refusal Self Efficacy***

242 The 19-item Drinking Refusal Self-Efficacy Questionnaire – Revised (DRSEQ-R)  
243 (Oei, Hasking et al. 2005) assessed participants’ perceived ability to decline alcohol across  
244 various scenarios, on a 6-point scale, ranging from 1 “I am very sure I would drink” to 6 “I  
245 am very sure I would not drink”. Higher scores reflect greater ability to refuse alcohol. The  
246 DRSEQ-R Total has demonstrated excellent internal consistency (Oei, Hasking et al. 2005)  
247 and test-retest reliability (Oei and Jardim 2007). In this sample, internal consistency for the  
248 DRSEQ-R Total was excellent ( $\alpha = .92$ ).

### 249 ***Alcohol Outcome Expectancies***

250 The 34-item Alcohol Outcome Expectancies Questionnaire-Revised (AOEQ-R)  
 251 (Leigh and Stacy 1993) provided a measure of participants' expectations about the outcomes  
 252 of drinking alcohol. The AOEQ-R uses a 6-point scale, ranging from 1 "No chance" to 6  
 253 "Certain to happen". This study utilized the AOEQ-R positive (19 items) and negative (15  
 254 items) subscales (Leigh and Stacy 1993). Higher scores reflect higher positive or negative  
 255 expectancies. Past research has demonstrated excellent reliability for the AOEQ-R positive  
 256 and negative subscales (Brown, Christiansen et al. 1987, Leigh and Stacy 1993). In this  
 257 sample, internal consistency was excellent for the AOEQ-R positive ( $\alpha = .93$ ) and good for  
 258 the AOEQ-R Negative ( $\alpha = .86$ ).

## 259 **Data Analysis**

### 260 *Preliminary Analyses*

261 Data was collected using Qualtrics survey software (Qualtrics 2020) and analysed using  
 262 IBM SPSS Statistics 28 (IBM 2020). Initially, the data consisted of 1240 participants however  
 263 4 respondents were excluded as they were non-drinkers (indicated abstinence on the AUDIT),  
 264 and 252 respondents (20%) were incomplete or had upwards of 60% data missing at random  
 265 on key variables. Missing data analysis showed <5% missing data, which were missing at  
 266 random. Item-level missing data for participants who completed >60% of a scale were replaced  
 267 by scale means (as per Allen, Bennett et al. 2018). Reliability of the measures was tested using  
 268 Cronbach's alpha; all measures were above a cut-off of .7 (Christmann and Van Aelst 2006).

269 *Descriptive Statistics.* Table I shows characteristics for the final sample ( $N = 984$ ) on  
 270 the AUDIT-C.

Table I. Sample Characteristics for Problem Alcohol Use on AUDIT-C

<b>Alcohol Use: AUDIT-C</b>	<b><i>M</i></b>	<b><i>SD</i></b>
AUDIT-C Total	4.52	2.42
Female	4.22	2.30
Male	5.21	2.53
AUDIT 1: How often do you have a drink containing alcohol?	<b><i>N</i></b>	<b>%</b>
Monthly or Less	347	35.3

2-4 Times per month	441	44.8
2-3 Times per week	164	16.7
4 or more times per week	32	3.3
AUDIT 2: Typical Number of Drinks per Drinking Occasion		
1 or 2	301	30.6
3 or 4	276	28.0
5 or 6	198	20.1
7 to 9	147	14.9
10 or more	62	6.3
AUDIT 3: How often do you have six+ drinks per occasion?		
Never	210	21.3
Less than monthly	411	41.8
Monthly	261	26.5
Weekly	97	9.9
Daily or Almost Daily	5	0.5

Note. AUDIT-C: Alcohol Use Disorders Identification Test – Section C.

271

272 Table II shows descriptive statistics and correlations for the variables included in the

273 path analysis.

Table II. Means, SD and Correlations for Variables Included the Path Analysis ( $N = 984$ ).

Variables	<i>M</i>	<i>SD</i>	1	2	3	4	5	6
1.AUDIT Total	7.54	5.48						
2.Peer Drinking	2.28	1.20	.45***					
3.Parent Drinking	3.23	1.91	.20***	.14***				
4.DRSE	86.12	13.58	-.47***	-.13***	-.14***			
5.Positive AOE	76.18	13.58	.44***	.31***	.10**	-.41***		
6.Negative AOE	43.19	10.57	.34***	.24***	.11***	-.28***	.39***	

\* $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ ;  $N = 984$

Note: All significance tests were two-tailed. AUDIT: Alcohol Use Disorders Identification Test; DRSE: Drinking Refusal Self Efficacy; AOE: Alcohol Outcome Expectancies.

274

### 275 Path Analysis

276 Path modelling with AMOS 28 statistical software (Arbuckle 2014) was used to test a

277 theoretical model specifying the hypothesised relationship between the study variables (Figure

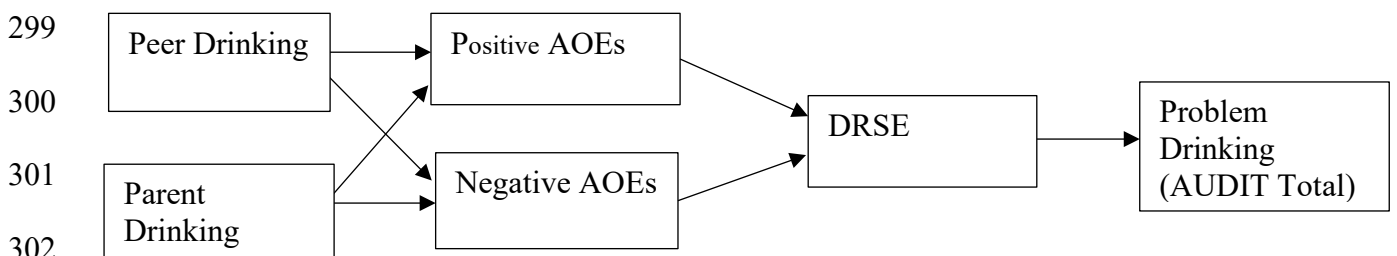
278 1). Path analysis tested the conceptual model presented in Figure 1 with maximum likelihood

279 estimation (Arbuckle 2011). We conducted a post hoc statistical power analysis using R

280 package ‘semPower’ (Moshagen and Erdfelder 2016) to determine the achieved power to

281 assess the fit of the model. Results showed a sample size of  $N = 984$  yields a power of  
 282 approximately 80% to reject a wrong model (with  $df = 2$ ) with an amount of misspecification  
 283 corresponding to the observed RMSEA = .071 and alpha = .05.

284 The initial exploratory model tested for all hypothesised direct and indirect pathways  
 285 to problem drinking (AUDIT total score), based on SCT. Model specification allowed  
 286 correlated error between the environmental factors of perceived peers' and parents' drinking  
 287 and the mediating factors of positive and negative AOE's and DRSE. Model fit was evaluated  
 288 with chi-square ( $\chi^2$ ) goodness of fit index statistic, comparative fit index (CFI), root mean  
 289 squared error of approximation (RMSEA), and standardised root mean square residual  
 290 (SRMR). The cut-off values for these fit indices were based on recommendations (CFI  $\sim$ .95;  
 291 RMSEA  $\sim$ .06; SRMR  $\sim$ .08) (Hu and Bentler 1999). Akaike information criteria (AIC) and  
 292 Bayesian Information Criterion (BIC) values are also reported, with lower values indicating  
 293 better balance between model fit and complexity (Lin, Huang et al. 2017). Additional paths  
 294 were incorporated if modification indices indicated significant improvements, provided that  
 295 these paths were justified based on SCT and/or existing empirical research. A nested models  
 296 approach was used whereby additional paths were added sequentially until the model  
 297 achieved adequate fit (see Table 3 for model fit indices for the hypothesised model and final  
 298 model).



303 Figure 1. The hypothesised model.

### 304 3. Results

#### 307 Path Model

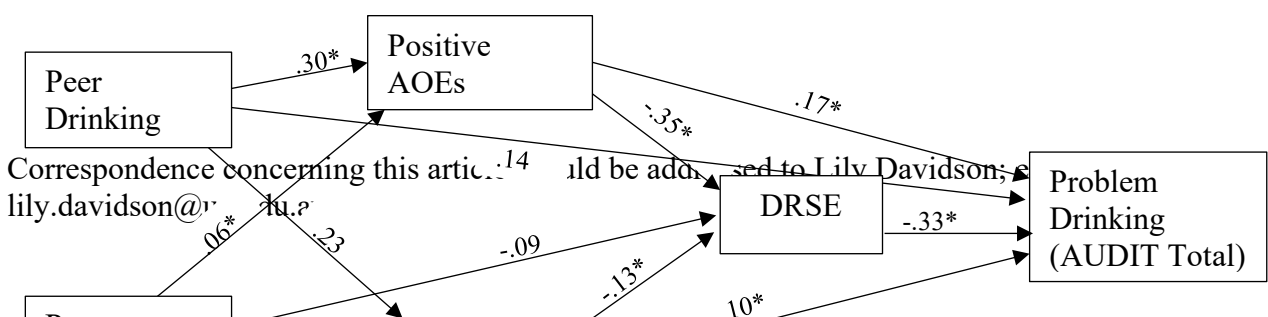


Table III. Model Fit Indices for Hypothesised Model and Final Model.

Model	$\chi^2$	df	p	$\chi^2$ normed	CFI	RMSEA	SRMR	BIC	AIC
Hypothesised	436.45**	8	.000	54.56	.584	.233	.150	526.04	462.45
Final	11.86*	2	.003	5.93	.990	.071	.018	142.80	49.86

\*  $p < .01$ , \*\*  $p < .001$ ;  $N = 984$ .

Table III shows the model fit indices for the hypothesised and final models. The hypothesised model displayed a poor fit,  $\chi^2(8) = 436.45$ ,  $p < .001$ , normed  $\chi^2 = 54.56$ , CFI = .584, RMSEA = .233, SRMR = .150, BIC = 526.04, AIC = 462.45. Modification indices were used to respecify the model. In line with modification indices, additional paths were added between: 1) peer drinking and problem drinking, 2) positive/negative AOE and problem drinking, 3) parent drinking and DRSE. These additional paths were consistent with SCT-related research with emerging adults. Specifically, past research has shown direct associations between problem drinking and modelled peer drinking (Durkin, Wolfe et al. 2005), and AOE (e.g. Young and Knight 1989, Lee, Greely et al. 1999, Connor, Williams et al. 2000). While there has been minimal research on the direct relationship between parental drinking and child DRSE, this relationship was theoretically proposed by Campbell and Oei (2010) on the basis that observing drinking behaviour by ones' parents contributes to a young persons' cognitions about using alcohol (e.g. DRSE), which in turn impacts their alcohol use behaviour. The final model (see Figure 2) showed a good fit to the data,  $\chi^2(2) = 11.86$ ,  $p = .003$ , normed  $\chi^2 = 5.93$ , CFI = .990, RMSEA = .071, SRMR = .018, BIC = 142.80, AIC = 49.86.



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Figure 2. The final model (Model 2) of problem drinking with AOE<sub>s</sub> and DRSE as mediators, with standardised coefficients. This model shows all significant direct and indirect pathways ( $p < .05$ ). \* Denotes a significant indirect pathway.

***Direct Effects***

The final model indicated that perceiving higher drinking among ones' peers and parents was significantly and directly associated with having higher AOE<sub>s</sub> (positive and negative). In turn, having higher AOE<sub>s</sub> (positive and negative) was directly related to having lower DRSE, and having lower DRSE was directly related to higher problem drinking scores (AUDIT). There was also a significant direct positive relationship between peer drinking and problem drinking, and a direct negative relationship between perceived parent drinking and DRSE.

***Indirect Effects***

Significant indirect pathways in the final model indicated the following effects. Having heavier drinking parents (perceived) related to having lower DRSE, as a function of having both higher positive expectancies (standardised indirect effect = -.03, 95% CI = -.06, -.01) and higher negative expectancies (standardised indirect effect = .06, 95% CI = .03, .09). Having heavier drinking peers (perceived) related to having lower DRSE, as a function of having higher positive expectancies (standardised indirect effect = -.13, 95% CI = -.16, -.11), which in turn related to having higher problem drinking scores (AUDIT) (standardised indirect effect = .12, 95% CI = .09, .13). Having higher positive expectancies related to having greater drinking problems (AUDIT), as a function of having lower DRSE (standardised indirect effect = .11, 95% CI = .09, .14). Similarly, having higher negative expectancies related to having

357 greater drinking problems (AUDIT), as a function of having lower DRSE (standardised indirect  
358 effect = .04, 95% CI = .02, .07).

359

#### 4. Discussion

360 This study examined how environmental influences on alcohol consumption, particularly  
361 modelling of drinking by peers and parents, may interact with cognitive variables including  
362 DRSE, positive AOE<sub>s</sub> and negative AOE<sub>s</sub> to influence problem drinking among emerging  
363 adults (Bandura 1999, Hasking, Boyes et al. 2015). Our model proposed that the relationship  
364 between environmental factors and problem drinking would operate indirectly through alcohol  
365 expectancies (positive and negative) and then, in turn, through DRSE.

366 On average, this cohort reported moderate-risk drinking, with a mean total AUDIT  
367 score of 7.54 (*SD*: 5.48), which is similar to AUDIT scores reported for other samples of  
368 young Australian adults (*M* = 7.77; Hasking, Boyes et al. 2015) (*M* = 7.76; Halim, Hasking et  
369 al. 2012). However, scores on the AUDIT-C indicated hazardous drinking among both male  
370 (*M* = 4.52; *SD* = 2.42) and female (*M* = 4.22; *SD* = 2.30) emerging adults in this sample  
371 (Campbell and Maisto 2018). Generally, the predicted indirect effects between the  
372 environmental influences of perceived parent and peer drinking and problem drinking, via  
373 AOE<sub>s</sub> and then DRSE, were observed. However, DRSE did not mediate the pathway between  
374 peer drinking and problem drinking.

375 As expected, the relationship between perceived parental drinking and problem  
376 drinking was entirely mediated by the cognitive factors in the model, including positive and  
377 negative AOE<sub>s</sub>, which both operated indirectly through DRSE. This finding supports two  
378 proposed theoretical effects in SCT. The first is that environmental influences are mediated  
379 by cognitions (since cognitions develop in response to social learning) (Hasking, Dawkins et  
380 al. 2020). The second is that self-efficacy is a key factor underlying the human agency  
381 (Bandura 1989, Bandura 1991, Hasking, Boyes et al. 2015), and this relationship was

382 demonstrated in our study by finding that self-efficacy (in this case DRSE) played an  
383 important role in mediating the effects of cognitions (alcohol expectancies) on drinking  
384 behaviour, as observed in previous research (Bandura 1989, Bandura 1991, Hasking, Boyes  
385 et al. 2015).

386 In line with past research, there was a positive relationship between parental drinking  
387 and positive expectancies (Brown, Creamer et al. 1987, Colder, Chassin et al. 1997) which, in  
388 turn, related to lower DRSE (Cooney, Gillespie et al. 1987, Vik, Carrello et al. 1999,  
389 Hasking, Boyes et al. 2015), and lower DRSE related to heavier drinking (Baldwin, Oei et al.  
390 1993, Lee and Oei 1993, Connor, Williams et al. 2000, Hasking and Oei 2002). There was  
391 also a positive relationship between parental drinking and negative AOE, which indirectly  
392 related to heavier drinking through low DRSE (Baldwin, Oei et al. 1993, Lee and Oei 1993,  
393 Connor, Williams et al. 2000, Hasking and Oei 2002). The mediational pathways identified in  
394 our study contribute further evidence regarding the direction of the relationship between  
395 negative AOE and drinking among emerging adults (Des Rosiers, Schwartz et al. 2013), for  
396 which findings have been inconsistent in previous research. Together, these findings indicate  
397 that emerging adults who perceive their parents as heavier drinkers have higher positive *and*  
398 negative alcohol expectancies (possibly because they have more salient alcohol-related  
399 cognitions overall, compared to children of lighter drinkers), which relates to them having  
400 lower DRSE and, in turn, riskier drinking behaviour.

401 In line with our proposed model, the relationship between peer drinking and problem  
402 drinking was mediated by positive and negative AOE. Contrary to hypotheses, DRSE did  
403 not mediate the relationship between expectancies and problem drinking in this pathway  
404 (Baldwin, Oei et al. 1993, Connor, George et al. 2011). While SCT posits that self-efficacy  
405 (DRSE) should mediate cognitions like AOE (Bandura 1989, Bandura 1991), some  
406 researchers assert that AOE are critical early in a drinking trajectory, since the ability to

407 refuse alcohol (DRSE) is conditioned (i.e. develops with experience refusing alcohol)  
408 (Hasking, Boyes et al. 2015). Considering the strength of peer influence as a correlate of  
409 problem drinking in emerging adults (e.g. Atwell, Abraham et al. 2011, de Visser, Hart et al.  
410 2014), it is possible that DRSE does not mediate expectancies, because DRSE is still  
411 developing in emerging adults (Hasking, Boyes et al. 2015). However, since most studies of  
412 peer influence do not explore the mediating roles of DRSE and AOE, further research is  
413 needed to confirm this finding.

414 In line with past research, positive AOE had a stronger relationship with problem  
415 drinking than negative AOE (Des Rosiers, Schwartz et al. 2013), although both variables  
416 were positively related to problem drinking. These data indicate that emerging adults who  
417 perceive heavier drinking among their peers hold more salient AOE overall (positive and  
418 negative) compared to those with lighter-drinking peers, which relates to heavier personal  
419 drinking. Indirect effects for the peer drinking to problem drinking pathway suggest that  
420 AOE, especially positive AOE, may be a useful target for alcohol intervention among  
421 emerging adults.

422 Contrary to the predicted model, there was a direct pathway between peer drinking  
423 and problem drinking. Based on SCT, we expected that social cognitive factors would fully  
424 mediate the influence of environmental stimuli (peer drinking) on problem drinking (Bandura  
425 1986, Bandura 1997). However, finding a direct positive (although small;  $\beta = .14$ )  
426 relationship between peer drinking and problem drinking is consistent with the robust  
427 evidence for the 'peer influence' effect on drinking among emerging adults (e.g. Atwell,  
428 Abraham et al. 2011, de Visser, Hart et al. 2014). This finding highlights the need to explore  
429 the potential influence of variables other than DRSE and AOE on the relationship between  
430 peer drinking and problem drinking (e.g. 'reward sensitivity', 'impulsivity' and 'drinking  
431 motives' (Van Tyne, Zamboanga et al. 2012, Hasking, Boyes et al. 2015). Future research

432 could aim to improve understanding of factors that mediate the robust peer-drinking to  
433 problem drinking pathway among emerging adults, as this is important for advancement of  
434 effective alcohol interventions for young people.

### 435 **Theoretical Contributions**

436 To our knowledge, this is the first study to explore how key social cognitive factors  
437 related to drinking (positive and negative AOE, and DRSE) (Hasking, Boyes et al. 2015)  
438 mediate the influence of peers' and parents' drinking behaviour, which are two important  
439 environmental influences of drinking for emerging adults (e.g. Atwell, Abraham et al. 2011,  
440 de Visser, Hart et al. 2014). Our model also accounts for the theoretical concept in SCT that  
441 self-efficacy (DRSE) should mediate the relationship between alcohol expectancies and  
442 drinking behaviour (Bandura 1989, Bandura 1991). By doing so, this study extends upon  
443 previous social cognitive studies of drinking behaviour that did not include environmental  
444 determinants (e.g. Van Tyne, Zamboanga et al. 2012) or self-efficacy (Van Tyne, Zamboanga  
445 et al. 2012, Des Rosiers, Schwartz et al. 2013) in their models, which are key determinants of  
446 health behaviour in SCT (Bandura 1986, Bandura 1997).

### 447 **Clinical Implications**

448 This study showed that DRSE mediates the effect of AOE on problem drinking for  
449 emerging adults with heavier-drinking parents. Therefore, emerging adults known to have  
450 heavier-drinking parents could be taught strategies to increase DRSE, potentially mitigating  
451 the impacts of parental modelling and associated AOE on personal drinking (e.g. if this risk-  
452 factor is identified through to youth counselling services). Finding that alcohol expectancies,  
453 but not DRSE, mediated the pathway between peer drinking and problem drinking highlights  
454 the importance of targeting AOE in alcohol interventions for emerging adults, because peer  
455 influence is a robust correlate of drinking in young people (e.g. Cumsille, Sayer et al. 2000,  
456 Poelen, Scholte et al. 2007, Atwell, Abraham et al. 2011).

457 In line with prior research, our results suggest interventions that challenge positive  
458 AOE's may hold promise for reducing problem drinking in emerging adults, since positive  
459 expectancies were more strongly related to problem drinking than negative expectancies. For  
460 example, 'expectancy challenge' interventions (Darkes, Greenbaum et al. 2004), which utilise  
461 various methods aimed at contesting participants' alcohol-related beliefs, have proven  
462 effective for reducing positive expectancies and alcohol consumption among young people  
463 (Corbin, McNair et al. 2001, Scott-Sheldon, Terry et al. 2012). Lastly, the direct relationship  
464 between peer influence and problem drinking highlights the potential utility of interventions  
465 that aim to utilise peer-influence effects advantageously, such as peer-lead interventions,  
466 social network interventions, or social norms interventions (for reviews, see Harden, Oakley  
467 et al. 2001, Lewis and Neighbors 2006, Hunter, de la Haye et al. 2019).

#### 468 **Limitations**

469 Some measures used in this study have limitations. Findings were based on  
470 participants' self-reported behaviour for personal and peer/parent drinking, which may be  
471 susceptible to biases (e.g. recall bias) (Des Rosiers, Schwartz et al. 2013, Hasking, Dawkins  
472 et al. 2020). However, when obtained via confidential surveys, the validity of self-reported  
473 alcohol use in emerging adults is well-established (Simons, Wills et al. 2015). Measurement  
474 of the drinking variables in this study would be improved by using behavioural measures that  
475 are more objective (e.g. collateral reports) (Des Rosiers, Schwartz et al. 2013, Hasking,  
476 Boyes et al. 2015) and less affected by recall bias (e.g. ecological momentary assessment)  
477 (Wray, Merrill et al. 2014).

478 Measurement of drinking by parents and peers would also be improved by use of a  
479 multi-item measure for these constructs. For example, adapting the AUDIT-C (3 items) to  
480 reflect peers' and parents' drinking behaviour may have been a stronger measure of  
481 peer/parent drinking, since the AUDIT-C is a validated, multi-item measure that uses a

482 specified timeframe. Our study could also be improved by using measure(s) that aim to  
483 capture participants' *observation* of peer/parent drinking (e.g. "How often are you with  
484 [parents/close friends] who are drinking alcohol?") (Cumsille, Sayer et al. 2000), rather than  
485 *percieved* peer/parent behaviour (which relates more closely to social norms than social  
486 learning) (Cialdini, Kallgren et al. 1991). However, research has shown that young people  
487 and their friends provide concordant reports of one another's drinking, and their accuracy is  
488 most likely due to close friends having firsthand experience of each other's alcohol use  
489 (Belendiuk, Molina et al. 2010, Beckmeyer and Weybright 2016). Furthermore, the  
490 significant positive relationships between perceived peer/parent drinking and personal  
491 drinking in our study ( $p < .001$ ) increases confidence in the validity the single item measures  
492 used. Future researchers could aim to replicate our findings with stronger measures of  
493 behavioural 'modelling', since social learning via *modelled* behaviour is a key concept in  
494 SCT (Bandura 1977, Bandura 1986).

495 Another limitation was the heavy concentration of female participants (69%),  
496 university students (88%) and participants of Anglo-Saxon/European ethnicity (83%), since  
497 these demographics are not necessarily characteristic of 18-25-year-olds in the general  
498 population. However, the fact that the sample was also recruited partly from the general  
499 community may increase generalisability of results compared to similar studies where  
500 samples were entirely university or school students (e.g. Van Tyne, Zamboanga et al. 2012,  
501 Des Rosiers, Schwartz et al. 2013, Hasking, Dawkins et al. 2020). Furthermore, drinking  
502 behaviour reported on the AUDIT total score for this sample ( $M = 7.54$ ) was very similar to  
503 other studies of emerging adults in Australia, which increases confidence in the  
504 generalisability of our results ( $M = 7.5$ ; Lennings 1998) ( $M = 7.4$ ; Hallett, Howat et al. 2012).  
505 Nonetheless, these findings should be replicated with a more nationally representative  
506 sample.



507 Finally, this investigation employed a cross-sectional design, which limits inferences  
508 regarding temporal effects. Future studies should also use prospective and applied  
509 intervention designs to investigate the pathways to problem drinking identified in this study.  
510 Despite these limitations, our study employed a larger sample size ( $N = 984$ ) than many  
511 similar studies ( $N = 254-733$ ) (Van Tyne, Zamboanga et al. 2012, Hasking, Boyes et al. 2015,  
512 Hasking, Dawkins et al. 2020), which allowed for statistical power to explore multiple social  
513 cognitive correlates of problem drinking. Future studies could also extend on this research by  
514 including other relevant variables in this model, for example ‘reward sensitivity’ and  
515 ‘drinking motives’ (Van Tyne, Zamboanga et al. 2012, Hasking, Boyes et al. 2015).

## 516 **5. Conclusions**

517 The outcomes of this study highlight the utility of comprehensive SCT-based models  
518 for understanding problem drinking among emerging adults. This study identified different  
519 cognitive pathways through which environmental influence from peers and parents affect  
520 problem drinking. Results suggest that targeting alcohol expectancies (especially positive)  
521 may attenuate the impact of peer influence on problem drinking among emerging adults, and  
522 increased DRSE may attenuate the effect of parental drinking. These findings may inform  
523 prevention, early intervention and treatment strategies for emerging adults, who are a high  
524 risk age group for problem single occasion drinking and related consequences in Australia  
525 and abroad (AIHW 2020, Visontay, Mewton et al. 2020).

## 526 **Glossary**

527 Alcohol Outcome Expectancies: AOE

528 Drinking Refusal Self-Efficacy: DRSE

529 SCT: Social Cognitive Theory

530

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