Reducing Alcohol Consumption during Pre-Drinking Sessions: Testing an Integrated
Behaviour-Change Model

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Design: University students (N = 289) completed an online questionnaire comprising measures of motivational and social-cognitive constructs related to reducing pre-drinking alcohol consumption and past behaviour, and an implicit association test for drinking identity. Participants reported their pre-drinking alcohol consumption at follow-up, four weeks from baseline.

results: A variance-based structural equation model revealed that few model hypotheses were supported. Although the effects of past behaviour, perceived behavioural control, and implicit drinking identity, on follow-up pre-drinking alcohol consumption were statistically significant, the effect of intention was not.

Keywords: pre-drinking; alcohol; self-determination theory; theory of planned behaviour; dual-systems model

23 Introduction

24 Pre-drinking is defined as the consumption of alcohol prior to attending a subsequent
25 event, where alcohol consumption often continues (Pedersen & LaBrie, 2007), and has been
26 linked to greater risk of alcohol-related harm. Pre-drinkers have higher blood alcohol
27 concentrations than those who do not pre-drink (Barry, Stellefson, Piazza-Gardner, Chaney,
28 & Dodd, 2013). Further, approximately 25% of pre-drinkers report becoming unconscious
29 during a pre-drinking session within the previous month (LaBrie, Hummer, Kenney, Lac, &
30 Pedersen, 2011) and are also more likely to report experiencing violent incidents within the
31 previous twelve months (Miller et al., 2015). Pre-drinking is prevalent in university student
32 populations, which also have higher overall rates of excessive alcohol consumption compared
33 to non-student populations (Burns et al., 2015; Hallett, McManus, Maycock, Smith, &
34 Howat, 2014; Kypri, Cronin, & Wright, 2005). Research related to pre-drinking has generally
35 focused on its prevalence, and relationship to alcohol-related harm (Miller et al., 2015; Wells,
36 Graham, & Purcell, 2009), as well as understanding pre-drinkers' motives that reflect
37 perceived practical and social benefits of engaging in pre-drinking (LaBrie, Hummer,
38 Pedersen, Lac, & Chithambo, 2012). However, there appears to be a relative dearth of pre-
39 drinking research that incorporates psychological theories of motivation and social cognition
40 (Foster & Ferguson, 2013). For example, the theory of planned behaviour (Ajzen, 1991,
41 2015) has been widely applied to investigate excessive patterns of alcohol consumption in a
42 wide range of settings (Cooke, Dahdah, Norman, & French, 2014). Research applying social
43 psychological theories to predict health behaviour provide an evidence base of the factors and
44 mechanisms that may inform the development of effective behaviour change interventions
45 (Hamilton & Hagger, 2014).

46 Recently, Hagger and Chatzisarantis (2014) have proposed an integrated behaviour
47 change model which represents recent developments in synthesising research findings from

two psychological theories: self-determination theory (Deci & Ryan, 1985), and the theory of planned behaviour (Ajzen, 1991). Self-determination theory concerns the quality of motivation in influencing behavioural engagement, whereby motivation exists on a continuum from more *controlled* (less self-determined) to *autonomous* (more self-determined) forms. Where controlled motivation refers to external regulations for engaging in behaviour (e.g., because of some extrinsic reward, or to avoid feelings of guilt or shame), autonomous motivation refers to more internal regulations (e.g., because of some intrinsically meaningful reward, or for enjoyment). The theory of planned behaviour states that *intention*, which reflects motivation to participate in future behavioural, is a direct predictor of behaviour, and is a function of three sets of belief-based evaluations – *attitude* towards engaging in the behaviour; the *subjective norm*, or perceived social influence related to behavioural engagement, and *perceived behavioural control*. Integration of these theories is based on their complementary explanations of behaviour and maximisation of parsimony (Hagger, 2014; Hagger & Chatzisarantis, 2009). Self-determination theory presents the motivational basis for behavioural engagement but does not clarify how motivation leads to action, whereas the theory of planned behaviour presents belief-based evaluations that influence intention (i.e., attitude, subjective norm, perceived behavioural control) but is not concerned with how these beliefs are formed. The result of integration is a framework where autonomous motivation influences attitude, subjective norm, and perceived behavioural control, which in turn influences intention. For example, an individual may consider reducing pre-drinking alcohol consumption for its valued benefits (e.g., health outcomes), then forming positive attitudes towards reducing future reductions in pre-drinking alcohol consumption (e.g., that doing so would be beneficial, or good), influencing their intentions accordingly. However, it is important to note that controlled motivation may be especially relevant to the formation of belief-based evaluations that underlie intentions to consume

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3 73 alcohol (Chawla, Neighbors, Logan, Lewis, & Fossos, 2009; Knee & Neighbors, 2002).
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5 74 Similarly, an individual may have an external rationale for reducing pre-drinking alcohol
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7 75 consumption (e.g., a friend or family member wanting them to), which is associated with
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9 76 feelings of guilt or shame at the thought of failure to do so. The individual is, therefore, more
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11 77 likely to form beliefs consistent with this external rationale, which is consistent with the
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13 78 conceptualization of subjective norm as comprising external influences to act (e.g., people
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15 79 who are important to me would want me to reduce my pre-drinking alcohol consumption) and
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17 80 intention.
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21 81 An important advancement of Hagger and Chatzisarantis' (2014) integrated behaviour
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23 82 change model is the incorporation of reflective and impulsive components from dual-systems
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25 83 theories (Hofmann, Friese, & Wiers, 2008; Strack & Deutsch, 2004). While a reflective,
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27 84 deliberative route incorporates an individual's motivation and social cognitions (e.g.,
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29 85 autonomous motivation, attitude, intentions, subjective norms), an impulsive, non-conscious
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31 86 route to behaviour incorporates learned cue-response associations, typically measured using
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33 87 reaction-time-based tasks that infer associations beyond conscious awareness (Strack &
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35 88 Deutsch, 2004). Increasing evidence has shown that the impulsive system plays an important
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37 89 role in determining health behaviour, as more reflective psychological constructs, (e.g., from
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39 90 motivational and social cognition theories) are not ubiquitously influential (Hagger, 2016). A
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41 91 noted limitation of reflective constructs is demonstrated by research concerning intention-
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43 92 behaviour "gap", and issues with *inclined abstainers* (Orbell & Sheeran, 1998) – individuals
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45 93 who intend to act, yet do not do so. When intention is low, or shows modest prediction of
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47 94 behaviour, impulsive processes may override these intentions, or showing stronger prediction
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49 95 of behaviour (Hofmann, Friese, & Strack, 2009; Hofmann et al., 2008).
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54 96 Caudwell and Hagger (2015) have previously applied a model based on the
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56 97 motivational sequence from the integration of self-determination theory and the theory of
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98 planned behaviour premise, to predict students’ intentions to engage in pre-drinking sessions.

99 The authors found students’ autonomous motivation towards engaging in pre-drinking were

100 associated with their attitudes, and intentions, towards doing so in the next month. The

101 integrated behaviour change model is broader in scope, in that it incorporates the influence of

102 impulsive processes that are thought to operate outside the more reflective measures of

103 motivational and social cognitive constructs. The aim of the present study was, therefore, to

104 extend previous applications of the integrated behaviour change model to pre-drinking by

105 incorporating implicit measures that capture impulsive processes to action in order to better

106 understand reflective and impulsive constructs underlying individuals’ pre-drinking alcohol

107 consumption.

108 The present study will make a unique contribution to knowledge, as it is the first to

109 apply a newly-proposed integrated model based on multiple theoretical perspectives on health

110 behaviour to health behaviour, and is also the first to apply the model to pre-drinking

111 behaviour, a pattern of alcohol consumption that has rarely been studied, particularly in

112 studies adopting a theoretical approach. Given previous research which has revealed effects

113 of explicit social cognitive, motivational and volitional constructs as well as implicit factors

114 on alcohol consumption behaviour, application of an integrated behaviour change model may

115 provide a more detailed account of the influence of these factors as they relate to pre-

116 drinking. Specifically, the items for self-determination theory and the theory of planned

117 behaviour constructs referred to reducing alcohol consumption behaviour over the following

118 four-week period. This was to elucidate potential areas that might be targetable in health

119 behavioural interventions in this population. A series of hypotheses were formulated based on

120 the proposed relationships of the integrated behaviour change model and research from its

121 component theories, presented in Figure 1.

122 We hypothesised that the paths between autonomous motivation and attitude,
123 subjective norm, perceived behavioural control, and intention, would be statistically
124 significant (H1). An individual that is autonomously motivated to reduce their pre-drinking
125 alcohol consumption, will do so because the behaviour is consistent with their genuine sense
126 of self, and something they would do out of their own choice or volition. They would likely
127 to align their personal beliefs regarding future pre-drinking with these autonomous reasons.
128 These beliefs are represented by the belief-based social cognitive constructs from the theory
129 of planned behavior in the integrated behaviour change model. For example, the individual
130 will likely hold positive attitudes consistent with their autonomous motives to reduce their
131 pre-drinking alcohol consumption in the future (e.g., that it would be beneficial, useful, and
132 positive). This relationship has been noted in previous research on binge drinking among
133 university students (Hagger et al., 2012). Similarly, a relationship between autonomous
134 motivation and subjective norm may reflect internalized support for reducing pre-drinking
135 alcohol consumption stemming from important social referents (e.g., friends; Chawla et al.,
136 2009). In addition, an individual that is autonomously motivated to reduce their pre-drinking
137 alcohol consumption will tend to perceive a strong sense of agency to do so (Deci & Ryan,
138 1985), which may positively contribute to perceptions of behavioural control.

139 In relation to the effects of controlled motivation in the model, we proposed that paths
140 from controlled motivation to attitude, subjective norm, perceived behavioural control, and
141 intention, would be statistically significant (H2). Although controlled motives do not tend to
142 be related to persistence with behavior over a long period of time, controlled motives can be
143 effective in predicting behavior when external contingencies are present or salient. Previous
144 research on controlled motivation and alcohol consumption has found individuals who
145 exhibit controlled motives likely consume alcohol for reasons related to peer influence or
146 self-esteem (Chawla, Neighbors, Logan, Lewis, & Fossos, 2009; Knee & Neighbors, 2002),

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3 147 which may influence their intentions to do so in the future. We therefore predicted that
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5 148 controlled motivation would be related to subjective norms for reducing pre-drinking alcohol
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7 149 consumption (e.g., Knee & Neighbors, 2002). For example, an individual citing controlled
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9 150 motives for reducing pre-drinking would be motivated to avoid feelings of guilt or shame at
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11 151 the thought of failing to meet those expectations. The individual may therefore hold beliefs
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13 152 consistent with their controlled reasons for reducing their pre-drinking, such as beliefs that
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15 153 significant others expected them to reduce their pre-drinking, represented by the subjective
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17 154 norm construct (Ajzen, 1991). Similarly, these external rationales may lead the individual to
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19 155 perceive low levels of agency or control over their pre-drinking manifested in a negative
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21 156 relationship between controlled motivation and perceived behavioural control (i.e., high
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23 157 levels of controlled motivation would be associated with lower perceived control over the
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25 158 decision to pre-drink). this is consistent with research demonstrating that controlled forms of
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27 159 motivation may reflect a lack of satisfaction of the need for competence and, therefore, tend
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29 160 to be associated with lower perceived competence with respect to participating in the
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31 161 behaviour in future (Knee & Neighbors, 2002).
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36 162 Consistent with the tenets of the theory of planned behaviour, we hypothesised
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38 163 significant paths between attitude, subjective norm, and perceived behavioural control, and
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40 164 intention (H₃), and between intention and perceived behavioural control, and pre-drinking
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42 165 alcohol consumption (H₄), where perceived behavioural control approximated actual control
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44 166 (Ajzen, 1991).
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47 167 Finally, consistent with previous research demonstrating the influence of impulsive
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49 168 processes on health behaviour (Hofmann et al., 2008; Strack & Deutsch, 2004), we
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51 169 hypothesised that the path between implicit drinking identity and follow-up pre-drinking
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53 170 alcohol consumption would be statistically significant (H₅). The drinking identity implicit
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55 171 association test (IAT) (Lindgren et al., 2012) was selected as a measure of impulsive
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172 processes. Scores on the test have been found to predict a range of alcohol-related outcomes
173 (e.g., consumption, expenditure, and harm), an indication of the contribution of impulsive
174 processes to alcohol consumption.

175 We also predicted a series of process-related mediation effects among constructs in
176 our proposed model. We hypothesised that the effects of autonomous (H_6) and controlled
177 (H_7) motivation on intention would be mediated by attitude, subjective norm, and perceived
178 behavioural control. This would provide support for an integrated behaviour change model, in
179 which individuals' beliefs with respect to future behavioral participation are aligned with
180 their generalized motivational orientations from self-determination theory (Hagger &
181 Chatzisarantis, 2014). Consistent with previous research, we expected the indirect effects of
182 controlled motivation on intention and behavior to be smaller relative to those of autonomous
183 motivation (Hagger et al., 2011; Hagger. & Chatzisarantis, 2014).

184 **Method**

185 **Participants**

186 Participants were students recruited from two Australian universities. Students opting
187 to participate in return for course credit and the study advertised on flyers displayed around
188 campuses. Eligibility criteria were that participants had to be current drinkers, who had
189 engaged in pre-drinking within the previous twelve months. The study was approved by
190 respective university human research ethics committees. Participants were directed to a
191 webpage providing information about the study, before proceeding to an electronic consent
192 form that informed participants that clicking 'next' indicated they were providing consent to
193 participate. The study was correlational in design, with participants completing theory-based
194 and pre-drinking alcohol consumption measures at baseline, and invited via automated email

195 to complete the same pre-drinking alcohol consumption behavioural measures at follow-up,
196 four weeks later.

197 Participants (total $N = 289$, 76.50% female, $M_{age} = 20.11$ years, $SD = 2.37$ years) were
198 undergraduate students from Australian universities, in Western Australia ($n = 132$; 75.80%
199 female; $M_{age} = 19.92$, $SD_{age} = 2.74$ years) and Queensland ($n = 157$; 77.10% female; $M_{age} =$
200 20.28 years, $SD_{age} = 2.00$ years). Most of the participants identified as Caucasian Australian
201 (Western Australian sample = 73.50%; Queensland sample = 79.00%) and the majority
202 reporting consuming alcohol at least once a month (Western Australian sample = 87.10%;
203 Queensland sample = 72.00%). Participants from Western Australia reported studying in the
204 Faculty of Health Sciences ($n = 117$; 88.60%) with a small minority of participants studying
205 on programmes from multiple faculties ($n = 12$; 9.10%), and other Faculties ($n = 3$; 3.10%).
206 The majority of participants from Queensland reported studying in the Health Sciences
207 faculty ($n = 65$; 41.40%), followed by students studying on programs in combined faculties
208 ($n = 36$; 22.90%), the Arts, Education and Law faculty (26; 16.50%), and Sciences faculty (n
209 = 16; 10.20%). There were no differences between the typical pre-drinking alcohol
210 consumption of Western Australian ($M = 6.03$, $SD = 2.93$) and Queensland ($M = 5.80$, $SD =$
211 4.35) university students: $t(287) = .52$, $p = .605$, nor were there any differences between
212 faculties in terms of the distributions of typical pre-drinking frequency (Western Australia:
213 $\chi^2(3) = 4.01$, $p = .261$; Queensland: $\chi^2(6) = 3.97$, $p = .680$) or typical pre-drinking alcohol
214 consumption (Western Australia: $\chi^2(3) = 2.44$, $p = .486$; Queensland: $\chi^2(7) = 3.01$, $p = .798$).

215 **Measures**

216 A complete list of measures in included in the Appendix (online supplementary
217 materials).

Theory of planned behaviour constructs. Measures followed Ajzen's (2002) guidelines in relation to target, context, action and time (i.e., *reducing alcohol consumption during pre-drinking sessions over the next four weeks*), adapted from previous research (Caudwell & Hagger, 2015). Responses were made on six-point scales; scale anchors are provided in the Appendix. Five items were used to measure participants' attitudes towards reducing their pre-drinking over the next four weeks. Bipolar statements with a common stem (e.g., "*reducing my alcohol consumption during pre-drinking sessions over the next four weeks would be...*") were presented, with participants indicating their response (e.g., *bad – good*). Four items were used to measure subjective norm (e.g., "*People whose opinions I value would want me to reduce my alcohol consumption during pre-drinking sessions over the next four weeks*"). Four items were used to measure perceived behavioural control (e.g., "*Reducing my alcohol consumption during pre-drinking sessions over the next four weeks is up to me*"), and three items were used to measure intentions (e.g., "*I intend to reduce my pre-drinking alcohol consumption over the next four weeks*").

Self-determination theory constructs. Statements based on the perceived locus of causality scale and adapted for pre-drinking were used (see Caudwell & Hagger, 2015). Participants responded to a series of statements reflecting motivational regulations for reducing pre-drinking alcohol consumption. Statements reflecting identified regulation (e.g., "*I reduce my alcohol consumption during pre-drinking sessions because I value the benefits*") and intrinsic motivation (e.g., "*It is enjoyable to reduce my alcohol consumption during pre-drinking sessions*") were used. Statements reflecting extrinsic motivation (e.g., "*I reduce my alcohol consumption during pre-drinking sessions because I will feel guilty or embarrassed if I do not*") and introjected regulation (e.g., "*I reduce my alcohol consumption during pre-drinking sessions because other people say I should*") were used to reflect

242 controlled motivation. Responses were provided on a four-point scales ranging from 1 (*not at*
243 *all true*) to 4 (*very true*).

244 **Implicit drinking identity.** The drinking identity implicit association test (IAT) is a
245 variation on the computerised implicit association test paradigm, which requires participants
246 to sort word stimuli presented in the centre of the screen into corresponding categories, using
247 specified keyboard commands corresponding to left (*e*) or right (*i*) sides of the screen. The
248 task comprises seven blocks, each comprising twenty trials. Specifically, blocks comprise the
249 categories *drinker* (i.e., *drink, drinker, drunk, partier*) and *non-drinker* (i.e., *abstain,*
250 *abstainer, non-drinker, sober*); and/or the categories *me* (i.e., *me, mine, my, myself*) and *not*
251 *me* (e.g., *theirs, them, they, others*). Blocks 1, 2, and 5 require the participant to sort word
252 stimuli (e.g., *my*) into one of two categories (e.g., *me* or *not me*). Blocks 3 and 4, and 6 and 7,
253 require the participant to sort word stimuli (e.g., *my* or *drunk*) into one of two paired
254 categories (e.g., *drinker + me*, or *non-drinker + not me*). Blocks 6 and 7 differ from blocks 3
255 and 4, in that the side of the screen is switched for the *me* and *not me* categories. Response
256 latencies for each trial are compared for blocks 3 and 4, and 6 and 7, revealing bias towards a
257 certain category/attribute pairing (e.g., participants may take less time to sort words, and
258 make fewer errors, in blocks where *drinker + me* and *non-drinker* and *not me* pairings are
259 used). The resulting metric, termed a D-score (Greenwald, Nosek, & Banaji, 2003), is
260 calculated based on a series of steps and established inclusion/exclusion criteria for trials and
261 participants. Trials longer than 10,000ms are excluded from the calculation (i.e., they are too
262 long to be considered accurate or implicit), and participants for whom more than 10% of
263 trials exhibit a response latency *less* than 300ms are excluded (i.e., they are likely non-
264 compliant). Positive D-scores indicate quicker associations with *drinker + me* pairings;
265 negative scores indicate quicker associations to *drinker + not me* pairings. The IAT
266 demonstrates strong internal consistency and test-retest reliability, and has been used in

267 university student samples (Lindgren, Foster, Westgate, & Neighbors, 2013; Lindgren,
268 Neighbors, et al., 2016; Lindgren et al., 2012; Lindgren, Ramirez, Olin, & Neighbors, 2016;
269 Ramirez, Dennhardt, Baldwin, Murphy, & Lindgren, 2016).

270 The IAT procedure was administered online, consistent with previous research
271 (Caudwell & Hagger, 2014). Internal consistency reliability coefficients for the IAT were .42
272 for the Western Australian sample, and .50 for the Queensland sample, with the former
273 coefficient slightly lower than those observed in previous research (Greenwald et al., 2003).¹

274 **Pre-drinking alcohol consumption.** At baseline (past behaviour) and follow-up,
275 participants reported the standard drinks² they had consumed during pre-drinking sessions per
276 week, over the previous four weeks. Consistent with previous approaches, participants were
277 shown a pictorial guide adapted from the National Health and Medical Research Council
278 (NHMRC, 2009) to aid in their standard drink estimates (Black & Mullan, 2015; Caudwell &
279 Hagger, 2015).

280 **Analytic Method**

281 We used partial least squares-based structural equation modelling (PLS-SEM) to test
282 the hypothesised relationships in the integrated behaviour change model (see Figure 1). The
283 PLS-SEM analysis comprises two models: a measurement, or outer model; and, a structural,
284 or inner model (Hair, Hult, Ringle, & Sarstedt, 2013). The measurement model consists of
285 the relationships between latent constructs (also termed latent variables) and their indicators –
286 in this case, from the integrated theoretical model (i.e., questionnaire items), and is evaluated
287 based on criteria associated with the reliability of indicators and their loadings on respective
288 and other constructs. The structural model consists of relationships between variables (e.g.,

¹Data on the number of participants whose IAT data was excluded due to not meeting the screening criteria is not available due to a software error.

²A 'standard drink' differs between countries. In Australia, a standard drink is a beverage that contains 10g of ethanol, compared to 14g in the United States, and 8g in the United Kingdom (Furtwaengler & Visser, 2013).

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289 Figure 1), represented by standardised path coefficients (β), associated statistical significance
290 values (p), and effect sizes (f^2), and is evaluated by observing a range of metrics related to
291 the suitability of the model in predicting variance in endogenous, or dependent variables
292 (Kock, 2015).

293 Variance-based structural equation modelling was selected as it is a distribution-free
294 modelling method (i.e., data need not meet distributional assumptions), making it adequate
295 for use with alcohol consumption data (Hair, Ringle, & Sarstedt, 2011; Neal & Simons,
296 2007). Results of PLS-SEM analyses are similar to covariance-based approaches, and are
297 considered well-suited to theory testing and applications in psychological research (Hair et
298 al., 2013; Willaby, Costa, Burns, MacCann, & Roberts, 2015). Further, mediation analyses
299 can be conducted in PLS-SEM by isolating the path of interest, and comparing the indirect
300 and total effects (Kock, 2015). Using this method, a significant indirect and total effect is
301 indicative of partial mediation, and a significant indirect and total effect in the absence of a
302 significant direct effect is indicative of complete mediation (Kock, 2011).

303 A series of criteria have been recommended to evaluate PLS-SEM analyses, related to
304 the convergent and discriminant validity of the outer model, and the predictive relationships
305 between latent variables in the inner model (Kock, 2015; Vinzi, Chin, Henseler, & Wang,
306 2010). To satisfy convergent validity, both Cronbach's alpha and composite reliability
307 coefficients for each factor must exceed .70, and the average variance extracted (AVE) in
308 each factor must exceed .50. To satisfy discriminant validity, the square root of the average
309 variance extracted ($\sqrt{\text{AVE}}$) for each factor must exceed its correlation with other factors in
310 the model (Fornell & Larcker, 1981). A resampling algorithm is recommended to increase the
311 stability of path coefficients between variables, and reduce standard errors when estimating
312 the model (Kock, 2015). It is also necessary that both the average block variance inflation
313 factor (AVIF) and average full collinearity variance inflation factor (AFVIF) are less than or

equal to 3.30, indicating little influence of variable collinearity and multicollinearity (Kock, 2015). Finally, a suitable inner model comprises a statistically significant average path coefficient (APC) and adjusted average R^2 (AAR^2). A Goodness of Fit statistic (Tenenhaus, Amato, & Vinzi, 2004) has been developed for PLS-SEM, however its use and interpretation is subject to debate (Hair et al., 2013). Individual model hypotheses were tested via the evaluation of standardised path coefficients (β) between proposed constructs in the model and their associated effect size, analogous to Cohen's (1988) f^2 statistic (Kock, 2015), whereby effect sizes of .02, .15, and .35 are interpreted as small, medium, and large, respectively.

In terms of model specification, we assigned items to indicate each respective latent factor underlying the integrated model (e.g., the latent variable 'attitude' was indicated by the five attitude items). Attitude, subjective norm, perceived behavioural control, and intention factors, were indicated by their respective items in this way. The autonomous motivation factor was indicated by items measuring intrinsic motivation and identified regulation to reduce pre-drinking alcohol consumption, whereas the controlled motivation factor was indicated by items measuring extrinsic and introjected regulation to reduce pre-drinking alcohol consumption (Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004). Gender (coded as 1 = male, 2 = female), sample (coded as 1 = Western Australia, 2 = Queensland), age, and IAT D-score were estimated as single-item latent factors. The past behaviour (i.e., baseline pre-drinking alcohol consumption) and follow-up pre-drinking alcohol consumption factors were each indicated by four items representing pre-drinking alcohol consumption for the four weeks prior to baseline and follow-up. We controlled for baseline pre-drinking alcohol consumption, age, gender, and sample, by drawing paths from these factors to all other latent

factors in the model, consistent with previous approaches (Caudwell & Hagger, 2015; Kock, 2011)³.

Results

Preliminary analyses

We conducted a preliminary analysis to detect the extent of bias across University samples in demographic and psychological measures. A one-way MANOVA revealed a statistically significant main effect for state on model variables, $F(10, 265) = 5.325, p < .001; \eta^2_p = .17$. Statistically significant differences were observed between averaged item means for autonomous motivation (Western Australia sample: $M = 1.81, SD = .61$; Queensland sample: $M = 2.00, SD = .76; F(1,274) = 4.72, p = .031, \eta^2_p = .02$), perceived behavioural control (Western Australia sample: $M = 5.19, SD = .73$; Queensland sample: $M = 5.62, SD = .51; F(1,274) = 33.24, p < .001, \eta^2_p = .11$), follow-up pre-drinking alcohol consumption (Western Australia sample: $M = 3.89, SD = 9.29$; Queensland sample: $M = 2.03, SD = 4.23; F(1,274) = 4.82, p = .029, \eta^2_p = .02$), and implicit drinking identity (Western Australia sample: $M = .36, SD = .44$; Queensland sample: $M = .24, SD = .45, F(1,274) = 5.03, p = .026, \eta^2_p = .02$), although the effect sizes for the differences were small. No significant gender differences between samples were observed, $\chi^2(1) = .07; p = .793$, nor were there differences in age between samples: $t(287) = -1.30, p = .194$. Attrition analyses using averaged item scores from model variables indicated no difference between participants who dropped out (WA = 162, Qld = 81) or remained (WA = 132, Qld = 157) in the study: Western Australia sample: $F(9,284) = 1.90, p = .052, \eta^2_p = .06$; Queensland sample: $F(9,228) = .95, p = .487, \eta^2_p = .04$. The samples were combined for analyses with PLS-SEM; descriptive statistics for the pooled sample are included in Table 1.

³Relationships between control and model variables are available in the online supplementary materials

359 **Model evaluation**

360 Internal reliability and discriminant validity indices met the established criteria (see
 361 Table 1). Regarding internal reliability, Cronbach's alpha scores ranged from .74 to .98,
 362 composite reliability scores, based on the factor loadings, ranged from .84 to .99, and the
 363 AVE for each factor exceeded .50 ($M_{AVE} = .68$; $SD_{AVE} = .14$), indicating acceptable
 364 convergent validity. Regarding discriminant validity, $\sqrt{AVE}$ for each factor exceeded that
 365 factor's correlation with other factors. The AVIF and AFVIF values were below the
 366 recommended cut-off value of 3.50 (Kock, 2015), indicating no issues with variable
 367 collinearity and multicollinearity. Both the APC (.11) and AAR^2 (.18) were statistically
 368 significant ($p < .001$), and the Tenenhaus Goodness of Fit (Tenenhaus et al., 2004) was .37
 369 (large), indicating that the model represented good fit with these data. Overall, the model
 370 accounted for 47% of the variance in intention to reduce pre-drinking alcohol consumption,
 371 and 22% of the variance in pre-drinking alcohol consumption at follow-up.

372 **Path coefficients**

373 Figure 2 shows the statistically-significant direct path coefficients in the integrated
 374 behaviour change model, controlling for gender⁴, sample (i.e., 1 = Western Australia; 2 =
 375 Queensland), and past behaviour. The path between autonomous motivation and attitude was
 376 statistically significant, with a medium effect size ($\beta = .42$, $p < .001$, $f^2 = .20$). Consistent with
 377 our hypothesis (H_1), paths between autonomous motivation and subjective norm ($\beta = .18$, $p =$
 378 $.001$, $f^2 = .05$), perceived behavioural control ($\beta = .12$, $p = .019$, $f^2 = .03$), and intention ($\beta =$
 379 $.23$, $p < .001$, $f^2 = .12$) were statistically significant, all with small effect sizes. Paths from
 380 controlled motivation to subjective norm ($\beta = .29$, $p < .001$, $f^2 = .11$), perceived behavioural

⁴We tested whether the model paths and pattern of relationships hypothesised in the integrated behaviour change model differed by gender. Using Satterthwaite Approximation and pooled standard error approaches to compare the path coefficients from each model (Kock, 2014), we found no statistically significant differences.

control ($\beta = -.23, p < .001, f^2 = .07$), and intention ($\beta = .12, p = .022, f^2 = .05$) were statistically significant with small effect sizes. However, the path between controlled motivation and attitude was not statistically significant ($\beta = .10, p = .052, f^2 = .03$)⁵. Therefore, H₂ was supported for the effect of perceived control but not attitude. The path between attitude and intention was statistically significant, ($\beta = .43, p < .001, f^2 = .27$) with a medium effect size. However, the path between subjective norm and intention ($\beta = .07, p = .124, f^2 = .03$), and between perceived behavioural control and intention ($\beta < .01, p = .496, f^2 < .01$) were not statistically significant, so we rejected our hypothesis (H₃). The path between intention and pre-drinking behaviour was also not statistically significant ($\beta = .03, p = .296, f^2 < .01$)⁶. However, the path between perceived behavioural control and pre-drinking alcohol consumption was statistically significant ($\beta = -.18, p < .001, f^2 = .04$), with a small effect size. We only found support for the effect for perceived behavioral control specified in our hypothesis (H₄). The path between implicit drinking identity and pre-drinking alcohol consumption was statistically significant, with a small effect size ($\beta = .11, p = .026, f^2 = .01$), providing support for H₅. It should be noted that the path from past behaviour to pre-drinking alcohol consumption was statistically significant, ($\beta = .35, p < .001, f^2 = .14$), with a small effect size.

Mediation analyses

⁵We tested a model excluding the 61 participants who reported consuming alcohol less than once a month (n = 228). Results revealed similar patterns of effects to the overall sample, with slightly larger Beta values associated with the PBC – PDAC ($\beta = -.26, p < .001, f^2 = .06$) and D – PDAC ($\beta = .16, p = .009, f^2 = .02$) paths. The effect of controlled motivation on attitude was also statistically significant ($\beta = .11, p = .049, f^2 = .04$), when it was not significant in the overall sample. We also tested a model excluding the 52 participants who reported did not report consuming alcohol during pre-drinking sessions at baseline (n = 237). Results revealed similar patterns of effects to the overall sample, with the following differences: the controlled motivation – intention path was statistically non-significant ($\beta = .03, p = .301, f^2 = .01$); the subjective norm to intention path was statistically significant ($\beta = .11, p = .037, f^2 = .05$); autonomous motivation to PBC was statistically non-significant ($\beta = .08, p = .098, f^2 = .01$); and the controlled motivation – attitude was statistically significant ($\beta = .14, p = .017, f^2 = .05$) in this sample.

⁶The zero-order correlation between intention and behaviour was also non-significant ($r < .01, p = .956$)

Support for only one of the proposed mediation effects was found. The effect of autonomous motivation on intention was partially mediated by autonomous motivation (direct effect = .23, Cohen's $f^2 = .12$; $p < .001$; indirect effect = .18, Cohen's $f^2 = .09$, $p < .001$; total effect = .47, Cohen's $f^2 = .24$; $p < .001$), with small-to-medium effect sizes, providing support for out hypothesis H₆. The remainder of the proposed mediation effects were not supported, as evidenced by non-significant direct effects (i.e., there was no effect to mediate), and/or non-significant indirect effects (i.e., the effect was not mediated). These results are presented in the Appendix.

Discussion

The aim of the present study was to test the motivational, explicit social cognitive, and implicit factors that influence intentions to reduce pre-drinking alcohol consumption and subsequent behaviour. We found limited support for the proposed relationships between constructs with the exception of the partial mediation of the effect of autonomous motivation on intention through attitude, and the direct effects from perceived behavioural control and implicit drinking identity to behaviour. The lack of an intention-behaviour relationship provides limited support for the integrated behaviour change model in predicting pre-drinking alcohol consumption (Ogden, 2003; Weinstein, 2007). However, results offer an important contribution to the understanding of the predictors of pre-drinking alcohol consumption, particularly the prominent role for implicit drinking identity. It also justifies our decision to adopt a model incorporating dual processes. Had we selected an approach based solely on social cognitive and motivational factors we would have failed to explain variance in pre-drinking beyond the effects of past behavior.

Results indicated significant positive associations between autonomous motivation and attitudes, subjective norm, and perceived behavioural control; and between controlled

motivation and subjective norm, indicating that individuals form these belief-based evaluations of reducing pre-drinking alcohol consumption consistent with their motivational orientations. The negative path from controlled motivation to perceived behavioural control indicates that individuals who exhibit more external rationales for reducing pre-drinking (e.g., “*because I would feel guilty or embarrassed if I do not*”) likely experience low perceptions of control over engaging in such behaviour in the future. The relationships between autonomous and controlled motivation and perceived behavioural control may be explained by considering perceived behavioural control as comprising *self-efficacy* (e.g., “if I wanted to do X, I could”) and *perceived controllability* (e.g., “How much control do you have over doing X?”; Armitage & Conner, 1999; Fishbein & Ajzen, 2011)⁷. Similarly, Cooke et al. (2014) demonstrated that the self-efficacy and perceived control components of perceived behavioural control, had different effects on alcohol consumption intentions and behaviour (i.e., self-efficacy was strongly correlated with intentions and behaviour related to engaging in alcohol consumption; whereas perceived control had small negative correlations with intentions and behaviour). The effects of autonomous and controlled motivation on perceived behavioural control may therefore relate to different but related aspects of the superordinate construct. For example, an individual with more controlled motives for reducing pre-drinking alcohol consumption may feel they have low perceived controllability over doing so, as they express external rationales for behavioural engagement. Conversely, an individual who is more autonomously motivated to reduce pre-drinking alcohol consumption may form beliefs consistent with self-efficacy (i.e., “If I wanted to reduce my pre-drinking alcohol consumption, I could”). Future research could further test these relations using distinct measures of perceived controllability and self-efficacy (Cooke et al., 2014).

⁷Fishbein and Ajzen (2011) refer to these constructs as *capacity* and *autonomy*, respectively.

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3 446 The finding regarding the effect of autonomous motivation and attitudes on intentions
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5 447 to reduce pre-drinking alcohol consumption is consistent with previous research (Cooke et
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7 448 al., 2014; McEachan, Conner, Taylor, & Lawton, 2011). That the effect of autonomous
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9 449 motivation on intention was mediated by attitudes suggests that individuals believe that
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11 450 reducing pre-drinking alcohol consumption carries meaningful benefits that may form the
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13 451 basis of their intentions. However, that there was no statistically significant effect of intention
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15 452 on pre-drinking behaviour warrants further examination. Given the substantial effect of past
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17 453 behaviour (i.e., baseline pre-drinking alcohol consumption) on follow-up pre-drinking
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19 454 alcohol consumption, the proposed constructs in the integrated behaviour change model had
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21 455 relatively trivial effects on behaviour. This means that even if students held autonomous
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23 456 orientations and positive attitudes toward reducing pre-drinking, such motives were only
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25 457 related to precipitating intentions to reduce their pre-drinking alcohol consumption and not
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27 458 actual behaviour. Intentions were, therefore, do not seem to be implicated in students'
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29 459 participation to in pre-drinking. . The large effect of past behaviour on follow-up pre-drinking
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31 460 alcohol consumption is inconsistent with previous meta-analytic research on alcohol
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33 461 consumption (Hagger, Chan, Protogerou, & Chatzisarantis, 2016), and seems to indicate that
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35 462 this behaviour is more to be under control of habitual (Hamilton, Kirkpatrick, Rebar, &
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37 463 Hagger, 2017) or likely non-conscious determinants (Hagger, 2016; Sheeran, Gollwitzer, &
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39 464 Bargh, 2013).

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44 465 Individuals reporting high control over reducing pre-drinking alcohol consumption
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46 466 reported lower levels of pre-drinking alcohol consumption at follow-up. According to Ajzen
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48 467 (1991), this occurs when individuals have a high level of information regarding the
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50 468 behaviour, or when requirements or resources to perform the behaviour remain constant. In
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52 469 this case, individuals high in perceived behavioural control may be better able to access and
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54 470 use available information to form accurate control beliefs regarding reducing pre-drinking
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alcohol consumption (e.g., the ability to refuse drinks, or plan reductions in advance; Hagger et al., 2012; Murgraff, White, & Phillips, 1996; Young, Connor, Ricciardelli, & Saunders, 2006). The effect of implicit drinking identity on follow-up pre-drinking alcohol consumption is consistent with Strack and Deutsch’s (2004) proposal that impulsive processes activate previously-learned behavioural schemata – for example, seeing an alcoholic beverage activating the schema for pre-drinking. These processes influence behaviour independent of deliberative processes, such as intentions (Hofmann et al., 2008; Rebar et al., 2016). This suggests that pre-drinking alcohol consumption may be more related to impulsive processes (as represented by implicit drinking identity). A growing body of research in this area looks at evaluative conditioning and the impulsive system – utilising implicit constructs such as goals (Fishbach, Friedman, & Kruglanski, 2003), as well as attempts to correct and reduce the influence of these processes through training (Allom, Mullan, & Hagger, 2015; Bartsch, Mullan, & Houben, 2014; Black & Mullan, 2015; Houben, Havermans, & Wiers, 2010; Houben, Nederkoorn, Wiers, & Jansen, 2011). Given the results of this study, further research in this area is needed to develop interventions that target both the reflective and impulsive system. Such research should explore methods or strategies that would increase an individual’s control over consuming alcohol within a pre-drinking environment, and, resist the contextual or environmental cues that trigger implicit associations that influence pre-drinking alcohol consumption (Hollands, Marteau, & Fletcher, 2016; Houben et al., 2011; Houben & Wiers, 2009; Ouellette & Wood, 1998; Papies, 2016).

Strengths, Limitations, and Future Research Directions

The present study has a number of strengths and limitations that warrant discussion. The application of the comprehensive integrated behaviour change model to an area of research that has tended to lack a theoretical approach, or focus on cognitive processes and mechanisms, represents a substantial contribution to the understanding of pre-drinking

behaviour. Although our correlational design does not provide strong evidence of causal links between variables, it highlights important relations between potentially manipulable psychological factors and pre-drinking behaviour that may provide some basic information to inform intervention development. For example, interventions may consider targeting both reflective and impulsive processes - by promoting control over pre-drinking, and reducing the influence of the impulsive system in determining behaviour (Hollands et al., 2016; Papies, 2016).

Results should also be interpreted in light of the accuracy of participant-reported alcohol consumption (White et al., 2005). Retrospective reports of alcohol consumption are often inaccurate, and tend to be underestimated (Monk, Heim, Qureshi, & Price, 2015).

Although we attempted to facilitate participant reporting with a detailed, comprehensive pictorial guide (NHMRC, 2009), we cannot be certain that this increased participants' accuracy. In addition, a lack of correspondence between theory-based measures, and self-reported alcohol consumption may have attenuated the intention-behaviour relationship: the former referred to pre-drinking generally, and the latter to standard drinks consumed when pre-drinking. Future research may attempt to quantify pre-drinking alcohol consumption referred to in measures of psychological constructs to maximise correspondence, as has been done to some extent with binge or heavy episodic drinking studies previously (see Cooke et al., 2014). The context in which the theory of planned behaviour measures are completed should also be considered. Cooke and French (2011) demonstrated that completion location affected the relationship between social cognitive constructs and alcohol consumption. Research is increasingly looking towards measures of blood alcohol concentration and event-level assessment of alcohol consumption using smartphones (e.g., Barry et al., 2013; Kuntsche, Otten, & Labhart, 2015), and these approaches could benefit further research. It should also be noted that the internal consistency of the drinking identity implicit association

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521 test was lower than typically observed (Greenwald et al., 2003), which may be the result of
522 administering the test online. Research has found no differences in relations among drinking
523 identity IAT, explicit measures of alcohol beliefs, and alcohol consumption for laboratory-
524 and online-administered IAT measures (Houben & Wiers, 2008). However, the drinking
525 identity IAT has yet to tested using these procedures.

526 While the association between the drinking identity IAT and pre-drinking behaviour
527 within the integrated behaviour change model tested in the current study may serve to
528 represent one component of the impulsive system – that is associations between alcohol
529 consumption and personal identity likely constructed over repeated experiences with the
530 behaviour over time – it does not capture the impulsive system explicitly. It may, therefore,
531 be pertinent to test the effects of these associations in the context of other constructs that may
532 represent the impulsive system. Such constructs may be behavioural prepotency or cue-
533 behaviour associations. For example, an extension of temporal self-regulation theory (Hall &
534 Fong, 2007) has been used to ascertain the influence of behavioural prepotency (i.e., past
535 behaviour, habit, and cues to action) on excessive alcohol consumption (Black, Mullan, &
536 Sharpe, 2017). In this augmented model, executive function was found to moderate the effect
537 of intentions and behavioural prepotency on alcohol consumption behaviour. Further research
538 that elucidates the conditions under which the impulsive system exerts its influence on
539 behaviour is necessary to inform effective dual-systems interventions for reducing hazardous
540 alcohol consumption behaviours.

541 Some discussion of the sample composition and demographic background in relation
542 to study findings is warranted. The majority of the participants were female, studying mainly
543 in health-related disciplines. Evidence for gender differences in relation to pre-drinking
544 alcohol consumption is inconclusive, however may be influenced by context effects such as
545 the absolute number of other pre-drinkers, the number of pre-drinkers from the opposite sex,

or the type of alcohol consumed (Hummer, Napper, Ehret, & LaBrie, 2013; Labhart, Wells, Graham, & Kuntsche, 2014; Ogeil et al., 2016). Differences in alcohol consumption behaviour between faculties of study have been noted, which may reduce the representativeness of the present sample to the university student population (Hallett, Howat, et al., 2014; Webb, Ashton, Kelly, & Kamali, 1997). Finally, the sample on average did not strongly intend to reduce their pre-drinking alcohol consumption, as indicated by the weak relationship between pre-drinking alcohol consumption and intention. Although we have no reason to believe that the low levels of intention and weak intention-behaviour relationship in the current study are not representative of the student population as a whole, it would be premature to reject the integrated model on the basis of these data alone. Replications of current findings in larger, more representative samples are warranted to corroborate current findings.

Conclusion

The present study tested an integrated behaviour change model in a pre-drinking context. Overall, we found little support for many of the relationships between motivational and social cognitive constructs, as well as their effects on pre-drinking alcohol consumption. Only the direct effects from perceived behavioural control and implicit drinking identity constructs on pre-drinking alcohol consumption at follow-up were significant, after controlling for past behaviour. This raises question over the applicability of the overall model in this behavioral context, although the non-conscious pathway yielded valuable data on the potential correlates of pre-drinking. We suggest that future research test relations between factors that might be related to non-conscious pathways including traits like self-control (Hagger et al., 2013), causality orientations (Deci & Ryan, 1985), habit (Hagger, Rebar, Mullan, Lipp, & Chatzisarantis, 2015), and affective components of attitudes (Lawton, Conner, & McEachan, 2009), and alongside drinking identity (Caudwell & Hagger, 2014).

571 Doing so may provide a better understanding of the psychological constructs that are
572 influential in determining pre-drinking alcohol consumption, which may contribute to the
573 development of behaviour change interventions to reduce pre-drinking behaviour that target
574 both constructs of both the reflective and impulsive systems (e.g., Caudwell, Mullan, &
575 Hagger, 2016).

References

- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179-211. doi:10.1016/0749-5978(91)90020-t
- Ajzen, I. (2002). Constructing a TPB questionnaire: Conceptual and methodological considerations. 1-14.
- Ajzen, I. (2015). The theory of planned behaviour is alive and well, and not ready to retire: a commentary on Sniehotta, Priesseu, and Araújo-Soares. *Health psychology review*, 9(2), 131-137. doi:10.1080/17437199.2014.883474
- Allom, V., Mullan, B., & Hagger, M. S. (2016). Does inhibitory control training improve health behaviour? A meta-analysis. *Health psychology review*, 10(2), 168-86.
- Armitage, C. J., & Conner, M. (1999). The theory of planned behaviour: Assessment of predictive validity and perceived control. *British Journal of Social Psychology*, 38(1), 35-54.
- Barry, A. E., Stelfox, M. L., Piazza-Gardner, A. K., Chaney, B. H., & Dodd, V. (2013). The impact of pregameing on subsequent blood alcohol concentrations: An event-level analysis. *Addictive behaviors*, 38(8), 2374-2377. doi:10.1016/j.addbeh.2013.03.014
- Bartsch, A., Mullan, B., & Houben, K. (2014). The effect of non-specific response inhibition training on alcohol consumption: An intervention. *European Health Psychologist*, 16(S), 399.
- Black, N., & Mullan, B. (2015). An intervention to decrease heavy episodic drinking in college students: The effect of executive function training. *Journal of American College Health*, 63(4), 280-284. doi:10.1080/07448481.2014.990969
- Black, N., Mullan, B., & Sharpe, L. (2017). Predicting heavy episodic drinking using an extended temporal self-regulation theory. *Addictive Behaviors*, 73, 111–118. <https://doi.org/10.1016/J.ADDBEH.2017.04.017>

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56
57
58
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60

601

602 Burns, S., Crawford, G., Hallett, J., Jancey, J., Portsmouth, L., Hunt, K., & Longo, J. (2015).
603 Consequences of low risk and hazardous alcohol consumption among university
604 students in Australia and implications for health promotion interventions. *Open*
605 *Journal of Preventive Medicine, Vol.05No.01*, 13. doi:10.4236/ojpm.2015.51001

606 Caudwell, K. M., & Hagger, M. S. (2014). Pre-drinking and alcohol-related harm in
607 undergraduates: the influence of explicit motives and implicit alcohol identity.
608 *Journal of Behavioral Medicine, 37*(6), 1252-1262. doi:10.1007/s10865-014-9573-6

609 Caudwell, K. M., & Hagger, M. S. (2015). Predicting alcohol pre-drinking in Australian
610 undergraduate students using an integrated theoretical model. *Applied Psychology:*
611 *Health and Well-Being, 7*(2), 188–213. <https://doi.org/10.1111/aphw.12044>

612 Caudwell, K. M., Mullan, B. A., & Hagger, M. S. (2016). Combining motivational and
613 volitional approaches to reducing excessive alcohol consumption in pre-drinkers: a
614 theory-based intervention protocol. *BMC Public Health, 16*(45), 1-12.
615 doi:10.1186/s12889-015-2648-7

616 Chawla, N., Neighbors, C., Logan, D., Lewis, M. A., & Fossos, N. (2009). Perceived
617 approval of friends and parents as mediators of the relationship between self-
618 determination and drinking. *Journal of Studies on Alcohol and Drugs, 70*(1), 92.

619 Cohen, J. E. (1988). *Statistical Power Analysis for the Behavioral Sciences*. Hillsdale, NJ:
620 Lawrence Erlbaum Associates, Inc.

621 Conner, M., Sandberg, T., McMillan, B., & Higgins, A. (2006). Role of anticipated regret,
622 intentions and intention stability in adolescent smoking initiation. *British Journal of*
623 *Health Psychology, 11*(1), 85-101.

- 624 Cooke, R., Dahdah, M., Norman, P., & French, D. P. (2014). How well does the theory of
625 planned behaviour predict alcohol consumption? A systematic review and meta-
626 analysis. *Health psychology review*(ahead-of-print), 1-20.
- 627 Cooke, R., & French, D. P. (2011). The role of context and timeframe in moderating
628 relationships within the theory of planned behaviour. *Psychology & Health*, 26(9),
629 1225-1240. doi:10.1080/08870446.2011.572260
- 630 Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human*
631 *behaviour*. New York: Plenum.
- 632 Deci, E. L., & Ryan, R. M. (1985). The general causality orientations scale: Self-
633 determination in personality. *Journal of Research in Personality*, 19, 109-134. doi:
634 10.1016/0092-6566(85)90023-6
- 635 Fishbach, A., Friedman, R. S., & Kruglanski, A. W. (2003). Leading us not into temptation:
636 Momentary allurements elicit overriding goal activation. *Journal of personality and*
637 *social psychology*, 84(2), 296.
- 638 Fishbein, M., & Ajzen, I. (2011). *Predicting and changing behavior: The reasoned action*
639 *approach*: Taylor & Francis.
- 640 Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with
641 unobservable variables and measurement error. *Journal of Marketing Research*, 18(1),
642 39-50.
- 643 Foster, J. H., & Ferguson, C. (2013). Alcohol 'pre-loading': A review of the literature.
644 *Alcohol and Alcoholism*, agt135.
- 645 Furtwängler, N. A. F. F., & De Visser, R. O. (2013). Lack of international consensus in low-
646 risk drinking guidelines. *Drug and Alcohol Review*, 32(1), 11–18.
647 <https://doi.org/10.1111/j.1465-3362.2012.00475.x>

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55
56
57
58
59
60

648 Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and using the
649 Implicit Association Test: I. An improved scoring algorithm. *Journal of Personality*
650 *& Social Psychology*, 85(2), 197-216. doi:10.1037/0022-3514.85.2.197

651 Hagger, M. S. (2009). Theoretical integration in health psychology: Unifying ideas and
652 complementary explanations. *British Journal of Health Psychology*, 14(2), 189-194.
653 doi:10.1348/135910708x397034

654 Hagger, M. S. (2014). Avoiding the ‘déjà-variable’ phenomenon: Social psychology needs
655 more guides to constructs. *Frontiers in Psychology*, 5, 52.
656 doi:0.3389/fpsyg.2014.00052

657 Hagger, M. S. (2016). Non-conscious processes and dual-process theories in health
658 psychology. *Health Psychology Review*, 10, 375-380.
659 doi:10.1080/17437199.2016.1244647

660 Hagger, M. S., Chan, D. K., Protogerou, C., & Chatzisarantis, N. L. (2016). Using meta-
661 analytic path analysis to test theoretical predictions in health behavior: An illustration
662 based on meta-analyses of the theory of planned behavior. *Preventive medicine*, 89,
663 154-161. doi:10.1016/j.ypmed.2016.05.020

664 Hagger, M. S., & Chatzisarantis, N. L. D. (2009). Integrating the theory of planned behaviour
665 and self-determination theory in health behaviour: A meta-analysis. *British Journal of*
666 *Health Psychology*, 14(2), 275-302. doi:10.1348/135910708x373959

667 Hagger, M. S., & Chatzisarantis, N. L. D. (2014). An integrated behavior change model for
668 physical activity. *Exercise and sport sciences reviews*, 42(2), 62-69.

669 Hagger, M. S., Lonsdale, A. J., Hein, V., Koka, A., Lintunen, T., Pasi, H., . . . Chatzisarantis,
670 N. L. D. (2011). Predicting alcohol consumption and binge drinking in company
671 employees: An application of planned behaviour and self-determination theories.
672 *British Journal of Health Psychology*, 1-29. doi:10.1111/j.2044-8287.2011.02043.x

- 673 Hagger, M. S., Lonsdale, A. J., Koka, A., Hein, V., Pasi, H., Lintunen, T., & Chatzisarantis,
674 N. L. D. (2012). An intervention to reduce alcohol consumption in undergraduate
675 students using implementation intentions and mental simulations: A cross-national
676 study. *International Journal of Behavioral Medicine*, 19, 82-96.
- 677 Hagger, M. S., Panetta, G., Leung, C.-M., Wong, G. G., Wang, J. C. K., Chan, D. K.-C., . . .
678 Chatzisarantis, N. L. D. (2013). Chronic inhibition, self-control and eating behavior:
679 Test of a 'resource depletion' model. *PLoS ONE*, 8, e76888.
680 doi:10.1371/journal.pone.0076888
- 681 Hagger, M. S., Rebar, A. L., Mullan, B. A., Lipp, O. V., & Chatzisarantis, N. L. D. (2015).
682 The subjective experience of habit captured by self-report indexes may lead to
683 inaccuracies in the measurement of habitual action. *Health Psychology Review*, 9,
684 296-302. doi: 10.1080/17437199.2014.959728
- 685 Hair, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2013). *A primer on partial least
686 squares structural equation modeling (PLS-SEM)*. California, USA: SAGE
687 Publications.
- 688 Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a Silver Bullet. *Journal
689 of Marketing Theory and Practice*, 19(2), 139-152. doi:10.2753/MTP1069-
690 6679190202
- 691 Hall, P. A., & Fong, G. T. (2007). Temporal self-regulation theory: A model for individual
692 health behavior. *Health Psychology Review*, 1(1), 6-52.
693 doi:10.1080/17437190701492437
- 694 Hallett, J., Howat, P., McManus, A., Meng, R., Maycock, B., & Kypri, K. (2014). Academic
695 and personal problems among Australian university students who drink at hazardous
696 levels: web-based survey. *Health promotion journal of Australia*, 24(3), 170-177.

697 Hallett, J., McManus, A., Maycock, B. R., Smith, J., & Howat, P. M. (2014). "Excessive
698 Drinking - an inescapable part of university life?" A focus group study of Australian
699 undergraduates. *Open Journal of Preventive Medicine*, 4(7), 14.
700 doi:10.4236/ojpm.2014.47071

701 Hamilton, K., & Hagger, M. S. (2014). The ‘health’ of health psychology in Australia:
702 Behavioural approaches and interventions. *Australian Psychologist*, 49(2), 63-65.

703 Hamilton, K., Kirkpatrick, A., Rebar, A., & Hagger, M. S. (2017). Child sun safety:
704 Application of an integrated behavior change model. *Health Psychology*, 36, 916-926.
705 doi:10.1037/hea0000533

706 Hofmann, W., Friese, M., & Strack, F. (2009). Impulse and self-control from a dual-systems
707 perspective. *Perspectives on Psychological Science*, 4(2), 162-176.
708 doi:10.1111/j.1745-6924.2009.01116.x

709 Hofmann, W., Friese, M., & Wiers, R. W. (2008). Impulsive versus reflective influences on
710 health behavior: a theoretical framework and empirical review. *Health psychology
711 review*, 2(2), 111-137. doi:10.1080/17437190802617668

712 Hollands, G. J., Marteau, T. M., & Fletcher, P. C. (2016). Non-conscious processes in
713 changing health-related behaviour: a conceptual analysis and framework. *Health
714 psychology review*, 1-14. doi:10.1080/17437199.2015.1138093

715 Houben, K., Havermans, R. C., & Wiers, R. W. (2010). Learning to dislike alcohol:
716 conditioning negative implicit attitudes toward alcohol and its effect on drinking
717 behavior. *Psychopharmacology*, 211(1), 79-86. doi:10.1007/s00213-010-1872-1

718 Houben, K., Nederkoorn, C., Wiers, R. W., & Jansen, A. (2011). Resisting temptation:
719 Decreasing alcohol-related affect and drinking behavior by training response
720 inhibition. *Drug and Alcohol Dependence*, 116(1–3), 132-136.
721 doi:10.1016/j.drugalcdep.2010.12.011

- Houben, K., & Wiers, R. W. (2009). Response inhibition moderates the relationship between implicit associations and drinking behavior. *Alcoholism: Clinical and Experimental Research*, 33(4), 626-633. doi:10.1111/j.1530-0277.2008.00877.x
- Hummer, J. F., Napper, L. E., Ehret, P. E., & LaBrie, J. W. (2013). Event-specific risk and ecological factors associated with prepartying among heavier drinking college students. *Addictive behaviors*, 38(3), 1620-1628. doi:10.1016/j.addbeh.2012.09.014
- Keatley, D. A., Clarke, D. D., & Hagger, M. S. (2013). The predictive validity of implicit measures of self-determined motivation across health-related behaviours. *British Journal of Health Psychology*, 18(1), 2-17. doi:10.1111/j.2044-8287.2011.02063.x
- Knee, C. R., & Neighbors, C. (2002). Self-determination, perception of peer pressure, and drinking among college students. *Journal of Applied Social Psychology*, 32(3), 522-543. doi:10.1111/j.1559-1816.2002.tb00228.x
- Kock, N. (2011). Using WarpPLS in e-collaboration studies: Mediating effects, control and second order variables, and algorithm choices. *International Journal of e-Collaboration*, 7(3), 1-13. doi:10.4018/jec.2011070101
- Kock, N. (2014). Advanced mediating effects tests, multi-group analyses, and measurement model assessments in PLS-based SEM. *International Journal of e-Collaboration*, 10(1), 1-13.
- Kock, N. (2015). WarpPLS 5.0 User Manual (pp. 55). Texas, USA: ScriptWarp Systems.
- Kuntsche, E., Otten, R., & Labhart, F. (2015). Identifying risky drinking patterns over the course of Saturday evenings: An event-level study. *Psychology of Addictive Behaviors*, 29, 744-752. doi:10.1037/adb0000057
- Kypri, K., Cronin, M., & Wright, C. S. (2005). Do university students drink more hazardously than their non-student peers? *Addiction*, 100(5), 713-714.

Labhart, F., Wells, S., Graham, K., & Kuntsche, E. (2014). Do individual and situational factors explain the link between predrinking and heavier alcohol consumption? An event-level study of types of beverage consumed and social context. *Alcohol and Alcoholism*, 49(3), 327-335. doi:10.1093/alcalc/agu001

LaBrie, J. W., Hummer, J., Kenney, S., Lac, A., & Pedersen, E. (2011). Identifying factors that increase the likelihood for alcohol-induced blackouts in the prepartying context. *Substance use & misuse*, 46(8), 992-1002. doi:10.3109/10826084.2010.542229

LaBrie, J. W., Hummer, J. F., Pedersen, E. R., Lac, A., & Chithambo, T. (2012). Measuring college students' motives behind prepartying drinking: Development and validation of the prepartying motivations inventory. *Addictive behaviors*, 37(8), 962-969. doi:10.1016/j.addbeh.2012.04.003

Lawton, R., Conner, M. T., & McEachan, R. (2009). Desire or reason: Predicting health behaviors from affective and cognitive attitudes. *Health Psychology*, 28, 56-65. doi:10.1037/a0013424

Lindgren, K. P., Foster, D. W., Westgate, E. C., & Neighbors, C. (2013). Implicit drinking identity: Drinker + me associations predict college student drinking consistently. *Addictive behaviors*, 38(5), 2163-2166. doi:10.1016/j.addbeh.2013.01.026

Lindgren, K. P., Neighbors, C., Teachman, B. A., Baldwin, S. A., Norris, J., Kaysen, D., . . . Wiers, R. W. (2016). Implicit alcohol associations, especially drinking identity, predict drinking over time. *Health Psychology*, 35(8), 908. doi:10.1037/hea0000396

Lindgren, K. P., Neighbors, C., Teachman, B. A., Wiers, R. W., Westgate, E., & Greenwald, A. G. (2012). I drink therefore I am: Validating alcohol-related implicit association tests. *Psychology of Addictive Behaviors*, 27(1). doi:10.1016/j.addbeh.2013.01.026

Lindgren, K. P., Ramirez, J. J., Olin, C. C., & Neighbors, C. (2016). Not the same old thing: Establishing the unique contribution of drinking identity as a predictor of alcohol

- consumption and problems over time. *Psychology of Addictive Behaviors*, 30(6), 659.
doi:10.1037/adb0000195
- McEachan, R. R. C., Conner, M., Taylor, N. J., & Lawton, R. J. (2011). Prospective prediction of health-related behaviours with the theory of planned behaviour: A meta-analysis. *Health psychology review*, 5(2), 97-144.
doi:10.1080/17437199.2010.521684
- McLachlan, S., & Hagger, M. S. (2011). The influence of chronically accessible autonomous and controlling motives on physical activity within an extended theory of planned behavior. *Journal of Applied Social Psychology*, 41(2), 445-470.
- Miller, P. G., Droste, N., Groot, F., Palmer, D., Tindall, J., Busija, L., ... Wiggers, J. (2015). Correlates and motives of pre-drinking with intoxication and harm around licensed venues in two cities. *Drug and Alcohol Review*, 35(2), 177-186.
<https://doi.org/10.1111/dar.12274>
- Monk, R. L., Heim, D., Qureshi, A., & Price, A. (2015). "I have no clue what I drunk last night" Using smartphone technology to compare in-vivo and retrospective self-reports of alcohol consumption. *PloS one*, 10(5), e0126209.
- Murgraff, V., White, D., & Phillips, K. (1996). Moderating binge drinking: It is possible to change behaviour if you plan it in advance. *Alcohol and Alcoholism*, 31(6), 577-582.
- National Health and Medical Research Council. (2009). *Australian guidelines to reduce risks from drinking alcohol*. Canberra, ACT: Commonwealth of Australia.
- Neal, D. J., & Simons, J. S. (2007). Inference in regression models of heavily skewed alcohol use data: A comparison of ordinary least squares, generalized linear models, and bootstrap resampling. *Psychology of Addictive Behaviors*, 21(4), 441.
doi:10.1037/0893-164X.21.4.441

795 Ogden, J. (2003). Some problems with social cognition models: A pragmatic and conceptual
796 analysis. *Health Psychology, 22*(4), 424-428. doi:10.1037/0278-6133.22.4.424

797 Ogeil, R. P., Lloyd, B., Lam, T., Lenton, S., Burns, L., Aiken, A., . . . Lubman, D. I. (2016).
798 Pre-Drinking Behavior of Young Heavy Drinkers. *Substance use & misuse, 51*(10),
799 1297-1306. doi:10.3109/10826084.2016.1168443

800 Orbell, S., & Sheeran, P. (1998). ‘Inclined abstainers’: A problem for predicting healthrelated
801 behaviour. *British Journal of Social Psychology, 37*(2), 151-165. doi:10.1111/j.2044-
802 8309.1998.tb01162.x

803 Ouellette, J. A., & Wood, W. (1998). Habit and intention in everyday life: the multiple
804 processes by which past behavior predicts future behavior. *Psychological bulletin,*
805 *124*(1), 54.

806 Papies, E. K. (2016). Health goal priming as a situated intervention tool: How to benefit from
807 nonconscious motivational routes to health behavior. *Health psychology review,*
808 *10*(4), 408-424. doi:10.1080/17437199.2016.1183506

809 Pedersen, E. R., & LaBrie, J. W. (2007). Partying before the party: Examining prepartying
810 behavior among college students. *Journal of American College Health, 56*(3), 237-
811 245. doi:10.3200/JACH.56.3.237-246

812 Ramirez, J. J., Dennhardt, A. A., Baldwin, S. A., Murphy, J. G., & Lindgren, K. P. (2016).
813 Alcohol-approach inclinations and drinking identity as predictors of behavioral
814 economic demand for alcohol. *Experimental and clinical psychopharmacology,*
815 *ePub*(ePub), ePub-ePub. doi:10.1037/pha0000086

816 Rebar, A. L., Dimmock, J. A., Jackson, B., Rhodes, R. E., Kates, A., Starling, J., &
817 Vandelanotte, C. (2016). A systematic review of the effects of non-conscious
818 regulatory processes in physical activity. *Health psychology review, 10*(4), 395-407.
819 doi:10.1080/17437199.2016.1183505

- 820 Sheeran, P., Gollwitzer, P. M., & Bargh, J. A. (2013). Nonconscious processes and health.
821 Health Psychology, 32, 460-473. doi:10.1037/a0029203
- 822 Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behavior.
823 *Personality and Social Psychology Review*, 8(3), 220-247.
824 doi:10.1207/s15327957pspr0803_1
- 825 Tenenhaus, M., Amato, S., & Vinzi, V. E. (2004). *A global goodness-of-fit index for PLS*
826 *structural equation modelling*. Paper presented at the XLII SIS Scientific Meeting,
827 2004, Padova, Italy. .
- 828 Vansteenkiste, M., Simons, J., Lens, W., Sheldon, K. M., & Deci, E. L. (2004). Motivating
829 learning, performance, and persistence: the synergistic effects of intrinsic goal
830 contents and autonomy-supportive contexts. *Journal of personality and social*
831 *psychology*, 87(2), 246. doi:10.1037/0022-3514.87.2.246
- 832 Verplanken, B., Aarts, H., Knippenberg, A., & Moonen, A. (1998). Habit versus planned
833 behaviour: A field experiment. *British Journal of Social Psychology*, 37(1), 111-128.
834 doi:10.1111/j.2044-8309.1998.tb01160.x
- 835 Vinzi, V. E., Chin, W. W., Henseler, J., & Wang, H. (2010). *Handbook of Partial Least*
836 *Squares : Concepts, Methods and Applications*. New York, USA: Springer.
- 837 Webb, E., Ashton, H., Kelly, P., & Kamali, F. (1997). Patterns of alcohol consumption,
838 smoking and illicit drug use in British university students: interfaculty comparisons.
839 *Drug & Alcohol Dependence*, 47(2), 145-153. doi:10.1016/S0376-8716(97)00083-5
- 840 Weinstein, N. D. (2007). Misleading tests of health behavior theories. *Annals of Behavioral*
841 *Medicine*, 33(1), 1-10.
- 842 Wells, S., Graham, K., & Purcell, J. (2009). Policy implications of the widespread practice of
843 'pre-drinking' or 'pre-gaming' before going to public drinking establishments - Are

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844 current prevention strategies backfiring? *Addiction*, 104(1), 4-9. doi:10.1111/j.1360-

845 0443.2008.02393.x

846 White, A. M., Kraus, C. L., Flom, J. D., Kestenbaum, L. A., Mitchell, J. R., Shah, K., &

847 Swartzwelder, H. S. (2005). College students lack of knowledge of standard drink

848 volumes: Implications for definitions of risky drinking based on survey data.

849 *Alcoholism: Clinical and Experimental Research*, 29(4), 631-638.

850 doi:10.1097/01.alc.0000158836.77407.e6

851 Willaby, H. W., Costa, D. S. J., Burns, B. D., MacCann, C., & Roberts, R. D. (2015). Testing

852 complex models with small sample sizes: A historical overview and empirical

853 demonstration of what Partial Least Squares (PLS) can offer differential psychology.

854 *Personality and Individual Differences*, 84, 73-78. doi:10.1016/j.paid.2014.09.008

855 Young, R. M., Connor, J. P., Ricciardelli, L., & Saunders, J. B. (2006). The role of alcohol

856 expectancy and drinking refusal self-efficacy beliefs in university student drinking.

857 *Alcohol and Alcoholism*, 41(1), 70-75.

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Figure 1. An integrated behaviour change model as applied to pre-drinking alcohol consumption (adapted from Hagger & Chatzisarantis, 2014). Dashed lines represent paths which are posited to be mediated by the hypothesised paths (e.g., autonomous motivation → attitude → intention). Past behaviour (i.e., baseline pre-drinking alcohol consumption) is omitted for clarity. *Note.* PDAC = follow-up pre-drinking alcohol consumption

Table 1. Means, Standard Deviations, Model Evaluation Statistics, and Correlations between Latent Variables from in Integrated Behaviour Change Model

	1. Sample	2. Gender	3. Age	4. PB	5. AM	6. CM	7. Att	8. SN	9. PBC	10. Int	11. D	12. PDAC
<i>M</i>	#	#	20.14	3.46	1.90	1.44	3.68	3.45	5.40	2.78	.29	2.67
<i>SD</i>	#	#	2.33	4.69	.70	.52	1.09	1.09	.64	1.43	.46	6.40
<i>AVE</i>	#	#	#	.60	.64	.50	.60	.75	.58	.96	#	.78
α	#	#	#	.77	.92	.86	.83	.89	.74	.98	#	.91
ρ	#	#	#	.85	.93	.89	.88	.92	.84	.99	#	.94
FCVIF	1.16	1.11	1.05	1.28	1.73	1.55	1.91	1.41	1.22	2.81	1.05	1.23
1.	#											
2.	.02	#										
3.	.08	#02	#									
4.	#08	#10	#12*	.77								
5.	.10	.03	.10	#22**	.80							
6.	#09	#04	#01	#03	.44**	.71						
7.	#05	.14*	.09	#09	.46**	.30**	.78					
8.	#10	#01	#02	.08	.26**	.38**	.44**	.87				
9.	.28**	.06	.09	#13*	.01	#26**	.04	#05	.76			
10.	#04	.14*	.02	#01	.49**	.37**	.62**	.35**	<.01	.98		
11.	#12*	#04	#08	.05	#01	.11	.03	.10	#02	.07	#	
12.	#12*	#16	#10	.34**	#08	.03	#05	.02	#18**	<#01	.07	.89

Note. $\sqrt{AVE}$ values are presented on the principal diagonal for variables with multiple indicators.
PB = past behaviour (i.e., baseline predrinking alcohol consumption); AM = autonomous motivation; CM = controlled motivation; Att = attitude; SN = subjective norm; PBC = perceived behavioural control; Int = intention; D = drinking identity implicit association test D#score; PDAC = follow#up predrinking alcohol consumption; α = Cronbach’s alpha; ρ = composite reliability
* $p < .05$; ** $p < .01$. For dichotomous variables Sample and Gender, 1 = Western Australia/male; 2 = Queensland/female.

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Figure 2. Path diagram showing statistically significant standardised path coefficients (β) between variables in the integrated behaviour change model, with variance explained (R^2) in intention and pre-drinking alcohol consumption.

Table 1. *Questionnaire Items Measuring Self-Determination Theory, the Theory of Planned Behaviour, and Planning Constructs*

Construct	Item	Response scale
CM	I limit my alcohol consumption during pre-drinking sessions because other people say I should.	1 (Not at all true) to 4 (Very true)
	I limit my alcohol consumption during pre-drinking sessions because my friends/peers/partner say I should.	
	I limit my alcohol consumption during pre-drinking sessions because others will be disappointed if I don't.	
	I get restless and uncomfortable if I don't limit my alcohol consumption during pre-drinking sessions.	
	I feel bad about myself if I do not limit my alcohol consumption during pre-drinking sessions.	
	I limit my alcohol consumption during pre-drinking sessions because I will feel guilty if I do not.	
	I feel ashamed when I do not limit my alcohol consumption during pre-drinking sessions.	
	I feel under pressure from my friends/peers/partner to limit my alcohol consumption during pre-drinking sessions.	
AM	I limit my alcohol consumption during pre-drinking sessions because I value the benefits.	1 (Not at all true) to 4 (Very true)
	It is pleasurable to limit my alcohol consumption during pre-drinking sessions.	
	It is important to me to limit my alcohol consumption during pre-drinking sessions.	
	I enjoy limiting my alcohol consumption during pre-drinking sessions.	
	I find limiting my alcohol consumption during pre-drinking sessions a pleasurable activity.	
	I get pleasure and satisfaction from limiting my alcohol consumption during pre-drinking sessions.	

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	I limit my alcohol consumption during pre-drinking sessions because it is an important part of my life.	
Attitude	For me, reducing my alcohol consumption during pre-drinking sessions over the next four weeks would be...	1 (Unimportant / Not Worthwhile / Harmful / Unenjoyable / Bad) to 6 (Important / Worthwhile / Beneficial / Enjoyable / Good)
SN	Most people who are important to me would want me to reduce my alcohol consumption during pre-drinking sessions over the next four weeks.	1 (Disagree very strongly)
	Most people I know would approve of me reducing my alcohol consumption during pre-drinking sessions over the next four weeks.	to 6 (Agree very strongly)
	Most people whose opinions I value would approve of me reducing my alcohol consumption during pre-drinking sessions over the next four weeks.	
	Most people who are relevant to me would approve of me reducing my alcohol consumption during pre-drinking sessions over the next four weeks	
PBC	How much personal control do you have over reducing your alcohol consumption during pre-drinking sessions over the next four weeks?	1 (No control at all) to 6 (Complete control)
	It is mostly up to me whether or not I reduce my alcohol consumption during pre-drinking sessions over the next four weeks	
	If I wanted to, I could reduce my alcohol consumption during pre-drinking sessions over the next four weeks.	1 (Disagree very strongly) to 6 (Agree very strongly)
	Reducing my alcohol consumption during pre-drinking sessions over the next four weeks is up to me.	
Intention	I intend to reduce my alcohol consumption during pre-drinking sessions over the next four weeks.	1 (Disagree very strongly) to 6 (Agree

	I plan to reduce my alcohol consumption during pre-drinking sessions over the next four weeks.	very strongly)
	I will try to reduce my alcohol consumption during pre-drinking sessions over the next four weeks.	
Planning*	I will figure out exactly how I can reduce my alcohol consumption during pre-drinking sessions over the next four weeks.	
	I will make a plan to reduce my alcohol consumption during pre-drinking sessions over the next four weeks.	1 (Disagree very strongly) to 6 (Agree very strongly)
	I will come up with a strategy to reduce my alcohol consumption during pre-drinking sessions over the next four weeks.	

Note. CM = controlled motivation; AM = autonomous motivation; SN = subjective norm; PBC = perceived behavioural control. Planning was measured but not included in the main analyses, due to a high correlation with intention (i.e., $r = .74$) and unsatisfactory crossloadings with intention items.

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Table 2. *Path Coefficients Between Control and Model Variables in the Integrated Behaviour Change Model*

	Sample	Gender	Age	PB	AM	CM	Att	SN	PBC	Int	D	PDAC
Sample	-	.02	.08	-.08	.10	-.09	-.05	-.10	.28*	-.04	-.12*	-.12*
Gender		-	-.02	-.10	.03	-.04	.14*	-.01	.06	.14*	-.04	-.16**
Age			-	-.12*	.10	-.01	.10	-.02	.10	.02	-.08	-.10
PB				-	-.22**	-.03	-.09	.08	-.13	-.01	.05	-.36**

* $p < .05$; ** $p < .01$;
PB = past behaviour; AM = autonomous motivation; CM = controlled motivation; Att = attitude; SN = subjective norm; PBC = perceived behavioural control; Int = intention; D = drinking identity implicit association test D-score; PDAC = pre-drinking alcohol consumption.
For dichotomous variables Sample and Gender, 1 = Western Australia/male; 2 = Queensland/female.

Supplementary Table 3. *Mediation Results for Paths in the Integrated Behaviour Change Model*

Path	Mediator	Direct (f^2)	p	Indirect (f^2)	p	Total (f^2)	p
AM-Int	Att			.18 (.09)	<.001	.41 (.21)	<.001
	SN	.23 (.12)	<.001	.01 (.01)	.388	.24 (.13)	<.001
	PBC			<.01 (<.01)	.499	.23 (.12)	<.001
CM-Int	Att			.04 (.02)	.162	.16 (.06)	.003
	SN	.12 (.05)	.022	.02 (.01)	.320	.14 (.05)	.009
	PBC			<.01 (<.01)	.499	.12 (.05)	.022
AM-PDAC	Att			.01 (<.01)	.403	-.01 (<.01)	.456
	SN			<.01 (<.01)	.495	.02 (<.01)	.396
	PBC	-.02 (<.01)	.369	<.01 (<.01)	.499	-.02 (<.01)	.401
	Int			.01 (<.01)	.414	-.01 (<.01)	.461
CM-PDAC	Att			<.01 (<.01)	.494	-.06 (.01)	.162
	SN			-.01 (<.01)	.409	-.07 (.01)	.104
	PBC	-.06 (.01)	.153	.04 (.01)	.166	-.02 (<.01)	.370
	Int			.01 (<.01)	.440	-.06 (.01)	.163
Att-PDAC	Int	-.01 (<.01)	.440	.01 (<.01)	.383	<.01 (<.01)	.476
SN-PDAC	Int	-.03 (<.01)	.285	<.01 (<.01)	.482	-.03 (<.01)	.297
PBC-PDAC	Int	-.17 (.03)	.002	<.01 (<.01)	.500	-.17 (.03)	.002

Note. AM = autonomous motivation; Int = intention; Att = attitude; SN = subjective norm; PBC = perceived behavioural control; CM = controlled motivation; PDAC = follow-up pre-drinking alcohol consumption