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## Abstract

**Background:** The aim of the present study was to examine the social-cognitive and motivational factors associated with pre-drinking based on a model integrating motivational constructs from self-determination theory and belief-based constructs from the theory of planned behaviour.

**Methods:** A prospective correlational design was used. Participants ( $N = 286$ ; 66.4% female) completed self-report measures of past alcohol consumption, autonomous and controlled forms of motivation from self-determination theory, and attitudes, subjective norms, perceived behavioural control, and behavioural intentions from the theory of planned behaviour at baseline. Participants reported pre-drinking frequency four weeks later.

**Results:** Variance-based structural equation modeling showed that the hypothesized model predicted 54% of the variance in pre-drinking intentions at baseline, and 20% of the variance in pre-drinking behaviour at follow-up. Mediation analyses indicated strong, statistically-significant effects of autonomous motivation on intentions to pre-drink, partially mediated by attitudes and subjective norms. Intention and perceived behavioural control significantly predicted pre-drinking frequency.

**Conclusions:** Results provide support for the hypothesized model relationships. Autonomous motivation, attitude, subjective norm, and perceived behavioural control were influential in forming students' intentions to pre-drink. However, consistent with previous findings, the intention-behaviour relationship was relatively weak. Future research should look to non-intentional and volitional processes that may influence pre-drinking in undergraduates.

**Keywords:** pre-drinking; pre-loading; alcohol consumption; theory of planned behaviour; self-determination theory; undergraduate alcohol consumption

1           *Pre-drinking* is a pattern of alcohol consumption that has received increased intention  
2 in research on the harmful effects of alcohol. Pre-drinking (also referred to as, *pre-loading*,  
3 *pre-partying*, *pre-gaming*) is defined as the consumption of alcohol, usually at one's home or  
4 another's residence, prior to attending another social event which usually involves further  
5 alcohol consumption (e.g., attending bars, clubs; Pedersen & LaBrie, 2007). Research by  
6 DeJong et al. (2010) showed students reported consuming, on average, 4.9 drinks during their  
7 most recent pre-drinking occasion. This average exceeds safe drinking guidelines that  
8 recommend consuming fewer than four standard drinks on drinking occasions to avoid the  
9 risks of alcohol-related harm (National Health and Medical Research Council, 2009). Recent  
10 research indicates that university student pre-drinkers report higher total alcohol intake on  
11 drinking occasions that involve pre-drinking, and are more likely to be involved in alcohol-  
12 related accidents and violence, than on occasions that do not involve pre-drinking (Hummer,  
13 Napper, Ehret, & LaBrie, 2013). A recent Australian study has demonstrated that three  
14 quarters of drinkers between the ages of 18 and 25 report pre-drinking within the past year  
15 (MacLean & Callinan, 2013). Given the majority of Australian university students fall within  
16 this age bracket and are known to report higher incidence of risky drinking practices when  
17 compared to their non-student peers (Hallett et al., 2012; Kypri, Cronin, & Wright, 2005),  
18 pre-drinking is likely a prevalent practice among Australian university students.

19           Recent studies have looked to the psychological, social, and economic factors related  
20 to the increasing prevalence of pre-drinking as a pattern of alcohol consumption. A major  
21 reason for pre-drinking appears to be the lower cost of consuming pre-purchased alcohol,  
22 when compared with purchasing and consuming alcohol at licensed venues (Caudwell &  
23 Hagger, 2014; MacLean & Callinan, 2013; Miller & Droste, 2013). Pre-drinking is also  
24 considered to have emerged in response to increased legislative or premise-based policies  
25 intended to reduce excessive drinking at licensed venues effectively displacing excessive

1 drinkers to private residences (Wells, Graham, & Purcell, 2009; Wiggers, Tindall, Gillham, &  
2 Lecathelinais, 2012). The social elements of pre-drinking have also been linked to its  
3 prevalence. University students report pre-drinking as an opportunity to socialize, relax, and  
4 become sufficiently intoxicated prior to attending the main event (Wells et al., 2009).  
5 Interpersonal enhancement (drinking for enjoyment or entertainment) also appears a strong  
6 motive underlying student pre-drinkers (Caudwell & Hagger, 2014; LaBrie, Hummer,  
7 Pedersen, Lac, & Chithambo, 2012).

8         There have been relatively few applications of psychological theory to understand  
9 pre-drinking behaviour (see Foster & Ferguson, 2013). Theory-based research is important  
10 because it provides a hypothesis-testing framework for understanding the mechanisms and  
11 processes underlying health behaviours, and paves the way for guiding the development of  
12 effective interventions that target the theoretical constructs that have been found to predict  
13 health-related behaviour, such as reducing alcohol consumption. The theory of planned  
14 behaviour (Ajzen, 1991) is a theoretical framework that has been widely used in the health  
15 behaviour field (Ajzen, 2014; McEachan, Conner, Taylor, & Lawton, 2011). The theory  
16 posits that behavioural *intention* is the proximal predictor of subsequent behaviour, and that  
17 intention is predicted by three variables; *attitude*, *subjective norm*, and *perceived behavioural*  
18 *control* (Ajzen, 1991). Attitude reflects an individual's beliefs that performing a given  
19 'target' behaviour will lead to salient outcomes; subjective norm reflects the extent to which  
20 an individual believes that important social referents want them to engage in the target  
21 behaviour; and perceived behavioural control reflects the extent of an individual's capacity to  
22 engage in the target behaviour. Intention mediates the effect of these constructs on behaviour,  
23 with perceived behavioural control also exerting a direct effect when it approximates actual  
24 behavioural control (Ajzen, 1991).

1           The theory of planned behaviour has demonstrated predictive efficacy across many  
2 health behaviours and contexts (Armitage & Conner, 2001; Hagger, Chatzisarantis, et al.,  
3 2007; McEachan et al., 2011). A recent meta-analysis of studies adopting the theory in the  
4 context of alcohol consumption found support for the relationships posited by the theory,  
5 between attitudes and intentions, and intention and behaviour (Cooke, Dahdah, Norman, &  
6 French, 2014). However, these relationships differed depending on the type of alcohol  
7 consumption behaviour under investigation, with authors noting a paucity of investigating  
8 certain patterns of alcohol consumption, such as pre-drinking (Cooke et al., 2014). Further,  
9 augmentations of the theory of planned behavior that may increase the variance explained for  
10 certain behaviours should be considered (Conner, 2014; McEachan et al., 2011). Therefore,  
11 alternative theoretical approaches that may increase predictive efficacy of existing health  
12 behavioural models, that offer insight into the elements underlying behavioural intention and  
13 engagement and may hold utility in designing health behavioural interventions, should be  
14 considered (Conner, 2014; Hagger, 2009; Hagger & Chatzisarantis, 2009b).

15           Another theory that has been applied extensively to understand and predict health  
16 behaviour is self-determination theory (Deci & Ryan, 1985). The key premise of self-  
17 determination theory is that the *quality* of an individual's motivation is an important factor  
18 determining behavioural engagement and persistence. Motivation is posited to exist on a  
19 continuum reflecting the perceived origins of behavioural engagement. The continuum ranges  
20 from *controlled motivation* to *autonomous orientation* and is known as the *perceived locus of*  
21 *causality* (Ryan & Connell, 1989). *External regulation* denotes motivation from external  
22 sources, such as to gain reward or to avoid punishment, or from others. *Introjected regulation*  
23 refers to individuals being motivated to pursue certain behaviours to avoid feelings such as  
24 guilt or shame. Both external regulation and introjected regulation are considered types of  
25 controlled motivation. *Identified regulation* relates to goals, or favored outcomes (e.g., pre-

1 drinking to save money, or because it makes for an enjoyable occasion). *Intrinsic motivation*  
2 reflects engaging in behaviour for reasons consistent with an individual's personal goals and  
3 needs, in the absence of any external contingency, and done for the inherent enjoyment and  
4 satisfaction the behaviour offers. Identified regulation and intrinsic motivation are considered  
5 autonomous forms of motivation. An additional element to self-determination theory is that  
6 motives are proposed to arise from the satisfaction of basic psychological needs that are  
7 considered innate and universal. Specifically, individuals are more likely to experience  
8 autonomous forms of motivation toward behaviour when three psychological needs  
9 (*autonomy, competence, and relatedness*) are met (Ryan & Deci, 2000). Conversely, when an  
10 individual feels these needs are not supported, or thwarted, they experience less self-  
11 determined forms of motivation. Research has demonstrated that the fulfilment of these  
12 psychological needs are linked to greater reported autonomous motivation and higher levels  
13 of engagement in various health-promoting behaviours (Ng et al., 2012; Ryan & Deci, 2000).  
14 Meta-analyses of research adopting self-determination theory have found it a sound  
15 conceptual framework for assessing the influence of motivation on a range of health-related  
16 behaviours (N. L. D. Chatzisarantis, Hagger, Biddle, Smith, & Wang, 2003; Ng et al., 2012).

17 A recent approach has been to integrate self-determination theory and the theory of  
18 planned behaviour to improve model predictive efficacy and give further insight into the  
19 motivational elements underlying health behaviour (Hagger & Chatzisarantis, 2009b).  
20 Integrating compatible theories can address individual shortcomings in each theory and give a  
21 more comprehensive account of the factors associated with health behaviours which may  
22 influence further research, policy, and potential for theory-based interventions (Hagger,  
23 2009). Integration of self-determination theory and the theory of planned behaviour is based  
24 on the notion that an individual's autonomous and controlled motivational orientation from  
25 self-determination theory influences the formation of intention, through the mediation of

1 attitudes, subjective norm, and perceived behavioural control, from the theory of planned  
2 behaviour (Hagger & Chatzisarantis, 2009). It is important to note the differing ontological  
3 and epistemological perspectives of these two theories and whether they could potentially  
4 offer complementary explanations of behaviour. Self-determination theory comes from an  
5 organismic perspective, based on the fulfilment of psychological needs; as such, motivational  
6 orientations reflect *generalised* tendencies to act in a behavioural domain in order to fulfil  
7 these needs. In contrast, social cognitive theories such as the theory of planned behaviour are  
8 based on beliefs regarding *future* engagement in an activity. A possible means by which these  
9 theories could complement each other lies in explanations of origins and how distal motives  
10 are translated into actions. Self-determination theory provides some indication of the origins  
11 of the social cognitive beliefs, based on the idea that an individual will seek out further  
12 opportunities to engage in behaviours that are need-satisfying, and form congruent beliefs  
13 regarding these behaviours. The theory of planned behaviour assists in delineating the  
14 process by which the generalised motives from self-determination theory are converted into  
15 actual behaviour. For example, an individual who feels autonomously motivated to pre-drink  
16 may form congruent beliefs regarding the evaluation of future engagement in pre-drinking;  
17 these beliefs may in turn influence their intentions to pre-drink.

18         Research has adopted the integration of the two theories to predict behaviour (Hagger  
19 & Chatzisarantis, 2009b, 2012). In the context of alcohol consumption, the integrated model  
20 has been adopted to heavy episodic drinking in a sample of company employees across three  
21 time points (Hagger, Lonsdale, Hein, et al., 2012). Results indicated that, identified  
22 regulation, an autonomous form of motivation, and attitudes to reduce excessive drinking,  
23 accounted for a substantial proportion of the variance in heavy episodic drinking behaviour,  
24 suggesting that participants may choose to reduce their alcohol consumption because they

1 value the benefits of avoiding adverse alcohol-related health effects and believe it beneficial  
2 to keep their drinking within safe limits.

### 3 **The present study**

4         Given the evidence supporting the integration of self-determination theory and the  
5 theory of planned behaviour into a single model (Hagger & Chatzisarantis, 2009b; Hagger,  
6 Lonsdale, Hein, et al., 2012), it may provide a theoretical framework to guide research into  
7 the motives underpinning pre-drinking behaviour. Research on self-determination theory has  
8 tended to focus on links between autonomous motivation and avoidance of risky, health-  
9 compromising behaviours (e.g., alcohol consumption, eating a high-fat diet), and between  
10 autonomous motivation and uptake of adaptive health behaviours (Ng et al., 2012). Much of  
11 the research investigating the link between self-determination theory and alcohol  
12 consumption have found controlled forms of motivation tend to be associated with increased  
13 alcohol consumption, and conversely, autonomous forms of motivation are associated with  
14 avoidance of, or reduced alcohol consumption (Neighbors, Lewis, Fossos, Grossbard, &  
15 Brown, 2007). Generally, research suggests that controlled motivation leads individuals to  
16 consume alcohol due to social pressures, typical of exhibiting extrinsic rationales for  
17 behavioural engagement (Chawla, Neighbors, Logan, Lewis, & Fossos, 2009; Neighbors,  
18 Larimer, Markman G., & Knee, 2004). However, Amiot, Sansfaçon, and Louis (2013)  
19 comment on the lack of self-determination theory research on the relationship between  
20 autonomous motivation and engaging in harmful behaviours (e.g., drug use, cheating). They  
21 found that when considering harmful behaviours, university students favoring in-group norms  
22 reported higher self-determined motivation to engage in behaviour consistent with the norms.  
23 This indicates that individuals may be similarly autonomously motivated to pursue health-  
24 risk behaviours (e.g., pre-drinking), in part due to normative influences. Therefore, the  
25 influence of subjective norm in the theory of planned behaviour may be congruent with

1 controlled or autonomous reasons for acting. In addition to these studies, the meta-analysis by  
2 McEachan et al. (2011) included studies adopting the theory of planned behaviour on  
3 intention to avoid alcohol consumption as well as to consume alcohol, which show  
4 comparable predictive efficacy in terms of the theoretical components. Considering these  
5 findings, we adopted a novel approach in the present study to apply the integrated model to  
6 predict intentions to pre-drink and pre-drinking frequency in undergraduate students.

7         We proposed a series of hypotheses that reflected the stimulated pattern of effects of  
8 the integrated model, based upon the proposed motivational sequence in which relations  
9 between motivational orientations from self-determination theory and intentions with respect  
10 to pre-drinking are mediated by constructs from the theory of planned behaviour (see Figure  
11 1 for a diagrammatic representation of the proposed relationships between theoretical  
12 constructs). Specifically, we hypothesized that autonomous motivation toward pre-drinking  
13 would positively predict attitude, subjective norm, and perceived behavioural control (H<sub>1</sub>).  
14 This hypothesis was based on previous research finding attitudes and perceived behavioural  
15 control are more likely consistent with autonomous motivation (e.g., Hagger, Chatzisarantis,  
16 & Biddle, 2002; Hagger, Chatzisarantis, & Harris, 2006b; Hagger, Lonsdale, Hein, et al.,  
17 2012) and that individuals may also be autonomously motivated to engage in behaviour  
18 because drinking at the behest of others is consistent with their autonomous motives and their  
19 genuine sense of self (Amiot et al., 2013). However, we also expected that controlled  
20 motivation would predict subjective norm (H<sub>2</sub>) as this variable may reflect perceived social  
21 approval to engage in behaviour, consistent with externally-referenced reasons for acting and  
22 previous research regarding controlled orientations and alcohol consumption (Chawla et al.,  
23 2009; Knee & Neighbors, 2002). Consistent with the latter proposal, we expected no effects  
24 for controlled motivation on attitudes and perceived behavioural control (H<sub>3</sub>) as these are  
25 more likely to be aligned with autonomous motivation and have been consistently related to



1 beliefs that reflect this motive (i.e., attitudes and perceived behavioural control). In keeping  
2 with the main tenets of the theory of planned behaviour (Ajzen, 1991), we expected attitude,  
3 subjective norm, and perceived behavioural control to significantly predict intention (H<sub>4</sub>). We  
4 also hypothesized that intention and perceived behavioural control (H<sub>5</sub>) would predict pre-  
5 drinking frequency directly, where the latter approximated actual control (i.e., where  
6 perceptions of control reflect actual behavioural control unrelated to one's intentions). With  
7 regards to the motivational sequence specified by the integrated model, and results of  
8 previous research (Amiot et al., 2013; Hagger, Lonsdale, Hein, et al., 2012), we expected the  
9 effects of autonomous motivation on intention be mediated by attitude, subjective norm, and  
10 perceived behavioural control (H<sub>6</sub>). Similarly, we expected the effect of controlled motivation  
11 on intention to be mediated by subjective norm only (H<sub>7</sub>) and that there would be no  
12 mediation of this path by attitude or perceived behaviour control (H<sub>8</sub>). Further, we anticipated  
13 the direct effects of autonomous and controlled motivation on intention would be zero, as the  
14 effects would be fully mediated by the proximal antecedent constructs from the theory of  
15 planned behaviour (H<sub>9</sub>). Finally, we hypothesized three-segment paths from autonomous  
16 motivation to pre-drinking behaviour through attitude, subjective norm, perceived  
17 behavioural control, respectively, and intention (H<sub>10</sub>). We also proposed that autonomous  
18 motivation would predict pre-drinking behaviour indirectly through perceived behavioural  
19 control (H<sub>11</sub>). Similarly, we hypothesized a three-segment path from controlled motivation to  
20 pre-drinking behaviour through subjective norm and intention (H<sub>12</sub>), but not through attitude  
21 nor perceived behavioural control and intention, or through perceived behavioural control  
22 (H<sub>13</sub>).

## 23 **Method**

### 24 **Design**

1 A prospective correlational design was adopted. Study measures were included in two  
2 separate internet-based questionnaires administered at two time points, four-weeks apart.  
3 Self-report measures of psychological variables from self-determination theory and the theory  
4 of planned behaviour as well as a self-report measure of past alcohol consumption were  
5 collected at baseline, with behavioural data (i.e., pre-drinking sessions) collected at a follow-  
6 up time point, four weeks later. Data were collected over a period of four months<sup>1</sup>.

## 7 **Participants**

8 Ethical approval was secured by the [University omitted for masked review]  
9 university human research ethics committee prior to data collection. Undergraduate students  
10 were recruited via social media and recruitment posters placed on noticeboards and  
11 prominent locations around university campus locations in Western Australia. Participation  
12 was incentivized through entry into a prize draw or by offering course credit. Participants  
13 were eligible if they were aged 18 years or older and enrolled in a full-time course at a  
14 Western Australian university. A total of 508 participants completed the baseline  
15 questionnaire with 341 (67.1%) completing the follow-up questionnaire.<sup>2</sup>

## 16 **Measures**

17 **Past Alcohol Consumption Behaviour.** Participants' alcohol consumption was  
18 collected using a computer-assisted personal interviewing method (Del Boca & Darkes,  
19 2003). Participants were asked to enter the amount of alcohol they had consumed in each

<sup>1</sup>We conducted a univariate ANOVA to test whether self-reported pre-drinking frequency (recorded at follow-up) differed significantly between months of data collection. The result was statistically non-significant;  $F(3,278) = .529, p = .663$ ; partial  $\eta^2 = .006$ , indicating a lack of sampling bias.

<sup>2</sup>A MANOVA indicated there was no significant difference between completers and non-completers on theoretical and behavioural measures at baseline;  $F(36, 456) = .894, p = .648$ ; Wilk's  $\Lambda = 0.934$ , partial  $\eta^2 = .066$ . Tests of attrition bias revealed no statistically-significant difference in age ( $t(498) = -3.73, p = .709$ ) or gender distribution ( $\chi^2(1) = .046, p = .830$ ) across completers and non-completers who provided useable responses.

1 week in standard drink equivalents over the previous four weeks. In order to mitigate social  
2 desirability effects, we included statements reaffirming confidentiality as a preface to survey  
3 questions, and provided participants with a pictorial reference to assist in estimating their  
4 alcohol consumption, adapted from the National Health and Medical Research Council's  
5 (2009) standard drinks guide.

### 6 **Definition of Pre-Drinking and Participant Identification as a Pre-Drinker.**

7 Participants were presented with the following statement defining pre-drinking behaviour,  
8 based on a conceptual definition provided by Pedersen and LaBrie (2007): "...drinking  
9 alcohol (purchased at a liquor store or supermarket) at your home or someone else's house  
10 before you 'go out' for the night (e.g., visiting a bar, pub, nightclub, music venue, gig, or  
11 other social gathering)" (p. 238). This definition has been frequently used in other pre-  
12 drinking research (e.g., Zamboanga, Schwartz, Ham, Borsari, & Van Tyne, 2010).

13 Participants who indicated having engaged in pre-drinking in the past six months continued  
14 with the questionnaire and were invited to complete the follow-up upon completion, while  
15 those who had not were directed to an exit page.

16 **Autonomous and Controlled Forms of Motivation.** Measures of autonomous and  
17 controlled forms of motivation from self-determination theory were based on Ryan and  
18 Connell's (1989) perceived locus of causality scale and adapted from Hagger et al. (2011) to  
19 refer to pre-drinking behaviour. Participants were asked "*Why are you likely to drink alcohol*  
20 *at your home or someone else's before 'going out'?*" and were directed to respond to a series  
21 of reasons reflecting underlying motivational constructs: *introjected regulation* (e.g., "I feel  
22 ashamed when I do not drink before I go out"); *extrinsic regulation* (e.g., "I drink alcohol  
23 because other people say I should"); *identified regulation* (e.g., "It is important for me to  
24 drink alcohol before I go out"), and; *intrinsic motivation* (e.g., "I enjoy drinking before I go  
25 out"). Four items were used for each construct; with Likert-type response scales ranging from

1 1 (*not true at all*) to 4 (*very true*). We used responses to introjected regulation and extrinsic  
2 regulation items to create a scale for *controlled motivation*, and responses on identified  
3 regulation and intrinsic motivation to create a scale for *autonomous motivation*.

4       **Theory of Planned Behaviour.** Items measuring the attitude, subjective norm,  
5 perceived behavioural control, and intention constructs from the theory of planned behaviour  
6 were developed in line with Ajzen's (2002) recommendations. Items made reference to the  
7 target behaviour (i.e., pre-drinking), the time frame of interest (i.e., over the past/next four  
8 weeks), and the behavioural context (i.e., on each individual occasion or session). Attitude  
9 was measured on five items preceded by a common stem: "For me, [pre-drinking] over the  
10 next four weeks is..." followed by five-point bipolar adjective scales: *unimportant/important*,  
11 *not worthwhile-worthwhile*, *harmful-beneficial*, *unenjoyable-enjoyable*, and *bad-good*.  
12 Subjective norm was measured using three items (e.g., "People who are important to me  
13 would approve of my decision to [pre-drink] over the next four weeks") with responses made  
14 on 6-point scales ranging from *strongly disagree* (1) and *strongly agree* (6). Perceived  
15 behavioural control was measured using three items (e.g., "How much personal control do  
16 you have over [pre-drinking] over the next four weeks?") with responses made on six-point  
17 scales ranging from *no control at all* (1), to *complete control* (6). Intention was measured  
18 using three items (e.g., "I intend to pre-drink over the next four weeks") with responses made  
19 on 6-point scales anchored by *extremely unlikely* (1) and *extremely likely* (6).

20       **Follow-up Pre-drinking Behaviour.** In a follow-up questionnaire, participants  
21 entered the number of times they had engaged in pre-drinking each week, for the previous  
22 four weeks, into four text boxes, using the same CAPI method as in baseline and similar to  
23 previous research (e.g., Hagger, Lonsdale, Hein, et al., 2012; LaBrie et al., 2012).

24 **Procedure**

1 Participants were directed to a web page providing information on the study and a link  
2 to the online baseline questionnaire. Participants were informed that consent to participate  
3 was considered declared once they indicated that they had agreed with the ethics statements  
4 and consented to complete the questionnaire. Participants were required to enter their email  
5 address at baseline, which was retained on the server for automated distribution of the  
6 invitation to complete the second questionnaire, four weeks later. Participants were either  
7 offered prize draw entry or points toward course credit for their participation. Data were  
8 matched across time points using an anonymized code unique to each participant.

## 9 **Data Analyses**

10 Variance-based structural equation modeling (VB-SEM) was used to test the  
11 adequacy of the hypothesized model in accounting for variance in the endogenous variables  
12 while controlling for measurement error and to test for significance of the hypothesized  
13 pattern of effects. The analysis was conducted using a non-parametric bootstrap resampling  
14 technique with 100 samples to maximize stability of path coefficients (Kock, 2012). All  
15 variables in the model were latent variables indicated by their corresponding item(s),  
16 including past behaviour, pre-drinking frequency, and demographic variables (age, gender).  
17 We controlled for past behaviour, gender, and age in analyses by specifying paths from these  
18 variables to each of the other variables in the hypothesized model (e.g., Keatley, Clarke, &  
19 Hagger, 2013b). Table 1 contains descriptive and model evaluation statistics, and zero-order  
20 correlations between modelled variables.

21 Evaluation of the model was made at the measurement and structural levels according  
22 to published criteria for VB-SEM models (Vinzi, Chin, Henseler, & Wang, 2010). In  
23 summary, the model is considered suitable if: composite reliability ( $\alpha$ ) and internal  
24 consistency of measures ( $\rho$ ) exceed .70; when average variance explained (AVE) in each

1 latent variable exceeds .50, and; the AVE for each variable exceeds the value of the  
2 correlation between that variable and all others in the model (Vinzi et al., 2010). Full  
3 colinearity variance inflation factor (FCVIF) values lower than 3.30 indicate no model issues  
4 with multicollinearity (Kock, 2012). Model fit is evaluated by the  $Q^2$  coefficient exceeding  
5 zero for endogenous variables, significant average  $R^2$  (ARS) and average path coefficient  
6 (APC) values (Kock, 2012), and the goodness-of-fit statistic (.10, .25, and .36 correspond to  
7 small, medium, and large effect sizes; Tenenhaus, Amato, & Vinzi, 2004). Hypothesized  
8 mediation effects were tested by calculating indirect effects from a bootstrapped resampling  
9 method with 100 replications (Kock, 2012). Mediation was confirmed by the presence of a  
10 statistically-significant indirect effect, with the direct effect being either statistically  
11 significant (partial mediation) or non-significant (full mediation).

## 12 **Results**

### 13 **Participants**

14 A total of 286 (83.9%) of the follow-up sample reported pre-drinking within the  
15 previous four weeks, and were included in the final analysis ( $M_{age} = 21.45$  years  $SD = 4.35$   
16 years; 94 male, 190 female). The majority (79.2%) identified as being of Caucasian  
17 Australian ethnicity. Descriptive statistics and zero-order latent factor correlations for the  
18 study variables are given in Table 1.

### 19 **Structural Equation Model**

20 Model evaluation statistics for the measurement and structural levels are included in  
21 Table 1. The majority of conditions for model evaluation were satisfied, except for a single  
22 indicator of the perceived behavioural control factor, which drastically reduced scale  
23 reliability and was removed, and subjective norm factor which was marginally below the .70

1 criteria for reliability ( $\rho = .69$ ). All  $Q^2$  coefficients exceeded zero, indicating sufficient  
2 predictive validity in endogenous variables (Kock, 2012). The model predicted 54% ( $R^2_{Adj} =$   
3  $.53$ ) of the variance in student intentions to pre-drink over the next four weeks at baseline,  
4 and 20% ( $R^2_{Adj} = .18$ ) of the variance in pre-drinking frequency at follow-up. Fit statistics  
5 used to assess VB-SEM models were satisfactory ( $ARS = .285$ ;  $ARS_{Adj} = .273$ ;  $APC =$   
6  $.168$ ;  $p < .001$ ;  $GoF = .458$ ).

7         Direct effects pertaining to the motivational sequence of the integrated model are  
8 depicted in Figure 2. Autonomous motivation was statistically significantly and positively  
9 related to attitude and subjective norm, but did not statistically significantly predict perceived  
10 behavioural control ( $p = .098$ ), providing partial support for our hypothesis ( $H_1$ ). Contrary to  
11 our hypotheses ( $H_2$  and  $H_3$ ), controlled motivation did not have a statistically significant  
12 effect on subjective norm ( $p = .118$ ), but was statistically significantly and negatively related  
13 to attitude and perceived behavioural control. Consistent with the theory of planned  
14 behaviour relationships, pre-drinking intention was statistically-significantly predicted by  
15 attitude and subjective norm, and negatively predicted by perceived behavioural control,  
16 supporting our hypothesis ( $H_4$ ). Intention statistically significantly and positively predicted  
17 pre-drinking frequency; perceived behavioural control statistically-significantly and  
18 negatively predicted pre-drinking behaviour, supporting our hypothesis ( $H_5$ ), indicating that  
19 participants' perceived behavioural control approximated their actual control over pre-  
20 drinking.

21         Mediation analyses were conducted by isolating each proposed mediating path and  
22 observing the direct, indirect, and total effects and observing whether the mediation was  
23 complete (only indirect effect is statistically significant) or partial (both direct and indirect  
24 effects are statistically significant) (Kock, 2011). Table 2 lists the hypothesized direct,  
25 indirect, and total effects. Broadly consistent with  $H_6$ , we found statistically significant direct

1 and indirect effects of autonomous motivation on intention, indicating that this relationship  
2 was partially mediated by attitude and subjective norm, but not by, perceived behavioural  
3 control<sup>3</sup>. We found no support for the mediating effects of controlled motivation on intentions  
4 mediated by subjective norms, leading us to reject our hypothesis (H<sub>7</sub>). There were also no  
5 indirect effects of controlled motivation on intention mediated by attitudes and perceived  
6 behavioural control in support of our hypothesis (H<sub>8</sub>).

7 Autonomous motivation had a statistically-significant direct effect on intention (i.e.,  
8 the effect was not completely mediated), yet we found no direct effects for controlled  
9 motivation on intention, indicating only partial support for our hypothesis (H<sub>9</sub>). We found no  
10 support for three-segment paths from autonomous motivation to pre-drinking behaviour,  
11 mediated by attitude, subjective norm, perceived behavioural control, and intention, leading  
12 us to reject our hypothesis (H<sub>10</sub>). The effect of autonomous motivation on pre-drinking  
13 behaviour through perceived behavioural control only was also non-significant, leading us to  
14 reject out hypothesis (H<sub>11</sub>). We found no support for mediation of the path from controlled  
15 motivation to pre-drinking behaviour through subjective norm and intention, leading us to  
16 reject out hypothesis (H<sub>12</sub>). The effects were not observed through attitude and perceived  
17 behavioural control and intention, supporting our hypothesis (H<sub>13</sub>). Only the indirect pathway  
18 from controlled motivation to behaviour through perceived behavioural control was  
19 statistically significant; indicating complete mediation and leading us to reject our hypothesis  
20 (H<sub>14</sub>).

## 21 Discussion

<sup>3</sup>We also assessed the relative contribution of each of the variables from self-determination theory and the theory of planned behaviour in predicting pre-drinking intention. Of the significant predictors, autonomous motivation, attitudes, and subjective norm explained 12%, 30%, and 7% of the variance in pre-drinking intention, respectively, providing support for motivational sequence of the model.



1           The purpose of the present study was to test the effectiveness of an integrated model  
2 based on self-determination theory and the theory of planned behaviour in predicting pre-  
3 drinking intentions and actual pre-drinking behaviour. Findings supported hypotheses of the  
4 proposed model, with notable exceptions that have important ramifications for determining  
5 the adequacy of the model and its underlying theoretical bases in the context of pre-drinking.  
6 Overall, results indicated that individuals form pre-drinking attitudes and subjective norms  
7 that are consistent with autonomous reasons for acting (e.g., valuing benefits, enjoyment),  
8 and that these influence intentions to pre-drink. These results are consistent with research by  
9 Sheeran et al. (1999), who found attitudinally-controlled intentions tended to be reflective of  
10 self-determined motives than normatively-controlled intentions. The effect of autonomous  
11 motivation on subjective norm also provides support for Amiot et al. (2013), who found that  
12 individuals can be autonomously motivated to comply with social influences in engaging in  
13 harmful behaviours. That perceived behavioural control was not predicted by autonomous  
14 motivation suggests individuals' perceptions of control are not consistent with autonomous  
15 reasons for pre-drinking (i.e., participants may value the benefits of pre-drinking, yet this is  
16 unrelated to their perceptions of control).

17           Our results indicate that exhibiting controlled motivation to engage in pre-drinking  
18 behaviour is related to appraising the behaviour in a negative light and beliefs in a lack of  
19 control over pre-drinking. An individual who regulates behaviour through external  
20 contingencies (e.g., "I will feel embarrassed if I do not pre-drink"), may form negative  
21 attitudes towards pre-drinking behaviour (e.g., "harmful", "bad") and may feel less control  
22 over pre-drinking (e.g., "it is up to me whether or not I pre-drink") over the behaviour.  
23 However, the effects of controlled motivation on attitude were small (i.e.,  $\beta = -.08$ ),  
24 compared to those of autonomous motivation on attitude. This is consistent with research  
25 showing autonomous motivation tends to be a stronger predictor of intention compared to

1 controlled motivation (Brickell, Chatzisarantis, & Pretty, 2006; N. L. Chatzisarantis, Hagger,  
2 & Smith, 2007; Hagger, Lonsdale, Hein, et al., 2011; Sheeran et al., 1999) That controlled  
3 motivation exerts a stronger effect on perceived behavioural control suggests pre-drinking  
4 may influence control beliefs that have a more substantial direct effect on behaviour, than  
5 through intention.

6 The null effect of controlled motivation on subjective norm and subsequent rejection  
7 of this hypothesis is inconsistent with descriptions of subjective norms as representing  
8 perceived social approval of engaging in behaviour, characteristic of controlled forms of  
9 motivation (Hagger, Lonsdale, Hein, et al., 2012). However, it may be that subjective norms  
10 are interpreted as more consistent with autonomous reasons for pre-drinking, rather than  
11 controlled. Finally, perceived behavioural control was negatively predicted by controlled  
12 motivation. This may mean that engaging in pre-drinking for controlled reasons (e.g., to  
13 conform, or avoid guilt) is influential in determining lower personal perceptions of control  
14 than determining perceived social approval.

15 With regards to the mediation effects, the relationship between autonomous  
16 motivation and intention was partially mediated through attitude and subjective norm,  
17 suggesting that these beliefs are somewhat aligned with overall autonomous motives to  
18 engage in pre-drinking, such as fulfilling personally-relevant goals and the perceived social  
19 approval of others, supporting our hypotheses regarding these effects. Partial mediation  
20 indicates that there may be two processes by which distal motives from self-determination  
21 theory affect behaviour: a mediated route that includes intentions and its proximal predictors  
22 and a more direct route, that may spontaneously influence intention independent of the  
23 formation of belief-based evaluations of pre-drinking (Hagger, Chatzisarantis, & Harris,  
24 2006a). The statistically-significant partial mediation of subjective norm on the autonomous  
25 motivation-intention is consistent with Amiot et al.'s (2013) findings and suggests that beliefs

1 regarding social influences may be more internalized, and, therefore, less likely interpreted as  
2 controlling in our sample. This indicates that subjective norm may not constitute self-esteem-  
3 based rationales for behavioural engagement.

4 Consistent with the theory of planned behaviour, we found statistically-significant  
5 effects of attitude, subjective norm, and perceived behavioural control on pre-drinking  
6 intention. Although intention was a statistically-significant predictor of pre-drinking  
7 frequency in our model, the effect was small and was indicative of a substantial intention-  
8 behaviour gap (i.e., only 34% of the variance in behaviour was explained), suggesting the  
9 model is not adequate in explaining pre-drinking behaviour. Although this contrasts with the  
10 findings of Cooke et al. (2014), their meta-analysis revealed that theory of planned behaviour  
11 relationships were moderated by the type of alcohol consumption behaviour, which may be  
12 evident in pre-drinking behaviour. Alternatively, Ajzen (2011) states that behaviours that  
13 have a considerable intention-behaviour gap may be considered non-reasoned in nature, and  
14 current results seem to support the notion that our sample may engage in pre-drinking without  
15 forming an explicit intention to do so. This is supported by the fact that some of the social  
16 cognitive variables from the model predict behaviour directly independent of intentions,  
17 which is a clear sign of less deliberative and more spontaneous effects on behaviour (Hagger,  
18 2013; Hagger & Chatzisarantis, 2014; Keatley, Clarke, & Hagger, 2011, 2013a) stronger  
19 direct effect of perceived behavioural control on pre-drinking frequency, and lack of support  
20 for an indirect effect of perceived behavioural control through intention. It may be that  
21 participants who reported higher perceived behavioural control may have not engaged in pre-  
22 drinking over the four weeks from baseline, and, participants with low control over pre-  
23 drinking may have engaged in pre-drinking more frequently over the period between baseline  
24 and follow-up. Results indicate that students tend to spontaneously or impulsively engage in  
25 pre-drinking when barriers to doing so are removed, as there was no mediation of intention

1 on the effect of perceived behavioural control on pre-drinking frequency (e.g., Hagger,  
2 Anderson, Kyriakaki, & Darkings, 2007). Given the reported financial hardship experienced  
3 by Australian university students (Richard, Bexley, Devline, & Marginson, 2007) and  
4 research indicating the price of alcohol is an important factor determining university students  
5 alcohol consumption behaviour (Caudwell & Hagger, 2014; Miller & Droste, 2013), it is  
6 likely that the cost of drinking or financial situation of students may be a good example of  
7 these barriers. Generally speaking, the significant direct effect of past behaviour on pre-  
8 drinking frequency suggests substantial variance is unaccounted for by the model variables.

9         To speculate on the basis of the current data, dual-systems models of behaviour may  
10 provide a worthwhile avenue for future research with regards to the prediction of pre-  
11 drinking. Dual systems models posit that behaviour is influenced by reflective and impulsive  
12 systems (Perugini, Richetin, & Zogmaister, 2010; Strack & Deutsch, 2004). Reflective  
13 systems are thought to involve conscious deliberation leading to action (Strack & Deutsch,  
14 2004); explicit processes which we aim to measure using constructs such as those from the  
15 theory of planned behaviour. Conversely, impulsive systems are characterized by perceptual,  
16 cue-based influences on behaviour (Strack & Deutsch, 2004). Researchers using measures of  
17 implicit motivational constructs, such as the implicit association test and go/no-go association  
18 task, have demonstrated their effectiveness in predicting a range of alcohol consumption  
19 outcomes (Caudwell & Hagger, 2014; Keatley et al., 2013b; Lindgren et al., 2012; Thush &  
20 Wiers, 2007; Wiers et al., 2007). Given the weak intention-behaviour relationship observed in  
21 the present study and considerable effect of past behaviour, it is worth ascertaining the  
22 influence of constructs from the impulsive system in predicting pre-drinking. Alternatively,  
23 the prototype-willingness model (Gibbons & Gerrard, 1995) incorporates the construct of  
24 behavioural *willingness* (i.e., “how likely are you to engage in behaviour X”) alongside the  
25 construct of intention. Recent meta-analyses of the effects of prototypes and willingness on

1 intentions and behaviour in health-related contexts supports the utility of both willingness and  
2 intention in predicting behaviour, particularly so in the context of alcohol consumption  
3 behaviour (Todd, Kothe, Mullan, & Monds, 2014; van Lettow, de Vries, Burdorf, & van  
4 Empelen, 2014). A recent “modified” dual-processing approach to the prototype willingness  
5 model (Gerrard, Gibbons, Houlihan, Stock, & Pomery, 2008) suggests some behaviours such  
6 as binge drinking may be “neither entirely planful nor entirely impulsive” (Gibbons,  
7 Kingsbury, Gerrard, & Wills, 2011, p. 159), yet still performed with volition (Gerrard et al.,  
8 2008). These model developments may therefore provide an alternative framework for future  
9 research.

10         The finding that engaging in pre-drinking behaviour is consistent with a sense of self  
11 and the satisfaction of psychological needs is a matter of concern, considering pre-drinking  
12 alcohol consumption is associated with alcohol-related harm (e.g., Paves, Pedersen, Hummer,  
13 & LaBrie, 2012). This represents a potential conflict in motives and outcomes in that pre-  
14 drinking appears to be consistent with autonomous motives and psychological need  
15 satisfaction, and therefore likely to be adhered to; whereas some of the outcomes associated  
16 with pre-drinking are harmful, and therefore inconsistent with other self-relevant motives  
17 such as maintaining good health. Autonomously-motivated pre-drinkers may not be aware of  
18 the health risks associated with pre-drinking (e.g., Labhart, Graham, Wells, & Kuntsche,  
19 2013; Reed et al., 2011) or they may not be perceive them to apply to themselves (see Pavey  
20 & Sparks, 2010). Future self-determination theory research should, therefore, focus on  
21 behaviours in which individuals may be *less* likely to pursue positive health goals, such as  
22 reducing excessive drinking, because they are in fact autonomously motivated to pursue these  
23 health-risk behaviours (e.g., Amiot et al., 2013).

## 24 **Strengths, Limitations, and Avenues for Future Research**

1           The present study has a number of strengths including: (1) a focus on an under-  
2 researched behaviour, pre-drinking, which represents a substantive and documented risk to  
3 the health of students; (2) the adoption and application of an integrated theoretical model and  
4 variance-based structural equation analyses that permitted comprehensive test of the  
5 processes by which motivational and belief-based variables impacted on pre-drinking  
6 intentions and behaviour; (3) the adoption of a prospective design that allowed the prediction  
7 of future pre-drinking behaviour; and (4) the recruitment of a sample of undergraduate  
8 students of sufficient size to test hypothesized effects.

9           Some limitations in the present study must be noted. Even though a prospective  
10 design was adopted, the current data are correlational and, as with all studies adopting such  
11 designs, this places limits on the inference of causality in effects tested in the proposed model  
12 (Hagger & Chatzisarantis, 2009a). In addition, the current sample was not randomly recruited  
13 or stratified and this places limits on the generalizability of the findings. However, the  
14 distribution and prevalence of pre-drinking activity and overall alcohol consumption of  
15 participants in the present study appear broadly consistent with other research (Hummer et  
16 al., 2013; LaBrie et al., 2012; Zamboanga et al., 2010) providing some evidence that the  
17 current sample's pre-drinking behaviour was characteristic of the target population.

18           An innovation of the current study is its focus on motivation to engage in pre-drinking  
19 behaviour, with findings inconsistent with previous research linking autonomous motivation  
20 to the avoidance of risky alcohol consumption (see Neighbors et al., 2007). Given the  
21 established links between autonomous motivation and health-promoting behaviours, the  
22 finding that autonomous motivation is related to the formation of positive attitudes and  
23 intentions to pre-drink presents an issue for self-determination theory research that largely  
24 focuses on behaviours and outcomes that are adaptive and conducive to optimal functioning  
25 (Amiot et al., 2013; Ng et al., 2012). Future applications of the integrated model in the area of

1 pre-drinking should seek to resolve this theoretical paradox. This may be by simultaneously  
2 examining autonomous and controlled forms of motivation from self-determination theory  
3 toward participation in, and avoidance of, pre-drinking. This could potentially assist in  
4 helping to resolve the apparent conflict between the motivational factors that underpin  
5 approach and avoidance of pre-drinking behaviour.

6 Theory-based interventions may focus on changing beliefs toward pre-drinking,  
7 perhaps by introducing the risk associated with excessive alcohol consumption and pre-  
8 drinking or educating students about estimating and employing safe levels of drinking (see  
9 De Visser & Birch, 2012; Pavey & Sparks, 2010). The key to interventions based on current  
10 findings may lie in making health information more salient and promoting autonomous  
11 reasons for pursuing healthy choices with respect to alcohol, which may shift attitudes toward  
12 reducing excessive drinking in pre-drinkers. However, given the intention-behaviour  
13 discrepancy or 'gap' in the present study, there may be little merit in solely attempting to  
14 change precursors of behavioural intention if this will not engender behaviour change  
15 (Hagger, Lonsdale, & Chatzisarantis, 2011, 2012; Hagger, Lonsdale, Koka, et al., 2012;  
16 Hagger & Luszczynska, 2013; Webb & Sheeran, 2006). Research that investigates some of  
17 the aspects related to individuals' perceptions of control over pre-drinking (i.e., behavioural  
18 barriers) that are unrelated to their intentions may therefore present an important avenue for  
19 future research. Furthermore, dual-systems models of behaviour that take into account the  
20 measurement of reflective and impulsive determinants of behaviour may allow insights into  
21 the factors precipitating pre-drinking (e.g., Caudwell & Hagger, 2014; Keatley et al., 2011;  
22 Keatley et al., 2013b). Inclusion of such measures and may seek to increase the variance  
23 accounted for in outcome measures of alcohol consumption, and provide important avenues  
24 for theory-based interventions (e.g., Houben, Havermans, Nederkoorn, & Jansen, 2012;  
25 Houben, Nederkoorn, Wiers, & Jansen, 2011).

1           In conclusion, the present study identifies some influential motivational and social-  
2 cognitive pathways to pre-drinking behaviour that appear somewhat inconsistent with  
3 previous research on other alcohol consumption behaviours. Individuals have autonomous  
4 motives and strong attitudes toward pre-drinking; and subjective norms seem to be closely  
5 aligned with autonomous motives rather than more controlling forms of motivation. Given  
6 the prediction of behaviour directly by perceived behavioural control and past behaviour,  
7 researchers should consider looking to theories that incorporate impulsive processes that may  
8 influence alcohol consumption behaviour beyond intentional or deliberative processes  
9 (Hofmann, Friese, & Wiers, 2011). This study provides a novel contribution to the increasing  
10 research focused on pre-drinking as a potentially dangerous pattern of alcohol consumption  
11 behaviour common in undergraduate populations.  
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Table 1.

*Descriptive and Model Evaluation Statistics and Zero-order Correlation Matrix for Latent Variables in the Hypothesized Model*

	1. Past behaviour	2. Age	3. Gender	4. Autonomous Motivation	5. Controlled Motivation	6. Attitude	7. Subjective Norm	8. PBC	9. Intention	10. Pre-drinking Frequency
<i>M</i>	6.70	21.45	-	2.54	1.37	4.27	4.32	5.05	4.15	.50
<i>SD</i>	7.75	4.36	-	0.64	0.46	1.06	0.82	0.85	1.5	0.73
<i>R</i> <sup>2</sup>	-	-	-	.241	.026	.517	.211	.264	.536	.196
$\rho$	.871	-	-	.906	.899	.894	.829	.922	.978	.864
$\alpha$	.802	-	-	.880	.870	.851	.690	.830	.966	.790
<i>FCVIF</i> <sup>b</sup>	1.582	1.217	1.088	2.400	1.381	2.683	1.473	1.451	2.236	1.290
<i>q</i> <sup>2</sup>	-	-	-	.245	.027	.516	.212	.269	.535	.190
1	(.793)									
2	.135*	(1)								
3	-.215**	.002	(1)							
4	.445**	-.134*	-.030	(.741)						
5	.096	-.111	-.057	.301**	(.730)					
6	.388**	-.208**	-.076	.695**	.145*	(.792)				
7	.258**	-.215**	-.015	.404**	.191**	.472**	(.787)			
8	-.210**	.192**	-.019	-.301**	-.440**	-.224**	-.044	(.924)		
9	.356**	-.242**	.006	.614**	.175**	.694**	.466**	-.258**	(.968)	
10	.364**	-.034	-.032	.352**	.217**	.322**	.127*	-.293**	.279**	(.784)

*Note.* \* $p < .05$ , \*\* $p < .01$ . PBC = Perceived Behavioural Control;  $\rho$  = composite reliability;  $\alpha$  = Cronbach's alpha; FCVIF, Full Colinearity Variance Inflation Factor;  $q^2$  = Q-squared coefficient of predictive utility. The squared average variance extracted (AVE) statistic for each latent variable is presented on the principal diagonal of the correlation matrix.

Table 2

*Mediation Analyses Showing the Direct, Indirect, and Total Effects for the Hypothesized Model Paths*

Path	Direct ( $f^2$ )	$p$	Mediator	Indirect ( $f^2$ )	$p$	Total ( $f^2$ )	$p$	Mediation
AM-Int	.188 (.116)	<.001	Att	.281 (.173)	<.001	.470 (.288)	<.001	Partial
			SN	.041 (.025)	.009	.229 (.141)	<.001	Partial
			PBC	.005 (.003)	.198	.194 (.119)	<.001	None
CM-Int	.015 (.003)	.353	Att	-.043 (.007)	.022	-.028 (.005)	.225	None
			SN	.011 (.002)	.138	.026 (.004)	.261	None
			PBC	.030 (.005)	.058	.045 (.008)	.109	None
PBC-PD	-.156 (.046)	.014	Int	-.010 (.003)	.127	-.166 (.049)	.008	None
AM-PD	.162 (.057)	.006	Att-Int	.016 (.006)	.281	.179 (.063)	<.001	None
			SN-Int	.002 (.001)	.310	.164 (.058)	.004	None
			PBC-Int	<.001 (<.001)	.342	.196 (.069)	.002	None
			PBC	.016 (.006)	.123	.178 (.063)	.004	None
			Int	.010 (.003)	.275	.172 (.060)	.001	None
CM-PD	.102 (.022)	.064	Att-Int	-.005 (.001)	.121	.097 (.021)	.076	None
			SN-Int	.001 (<.001)	.235	.103 (.022)	.060	None
			PBC-Int	.004 (.001)	.124	.168 (.037)	.012	None
			PBC	.060 (.013)	.024	.162 (.035)	.015	Complete
			Int	.006 (.001)	.186	.108 (.023)	.052	None

*Note.* AM= autonomous motivation; Int = intention; CM = controlled motivation; PBC = perceived behavioural control; PD = pre-drinking frequency; Att = Attitude; SN = Subjective Norm.

Indirect effects calculated via bootstrap resampling method. Effects are shown controlling for past behaviour, age, and gender.