British Journal of Health Psychology (2012), 17, 379–407

The British Psychological Society

www.wileyonlinelibrary.com

Predicting alcohol consumption and binge drinking in company employees: An application of planned behaviour and self-determination theories

Martin S. Hagger[1]*, Adam J. Lonsdale[2], Vello Hein[3], Andre Koka[3], Taru Lintunen[4], Heidi Pasi[4], Magnus Lindwall[5], Lisa Rudolfsson[5] and Nikos L. D. Chatzisarantis[6]

[1]School of Psychology and Speech Pathology, Curtin University, Perth, Australia
[2]Personality, Social Psychology, and Health Research Group, School of Psychology, University of Nottingham, UK
[3]Faculty of Exercise and Sports Sciences, University of Tartu, Estonia
[4]Department of Physical Education, University of Jyväskylä, Finland
[5]Department of Psychology, University of Gothenburg, Sweden
[6]National Institute of Education, Nanyang Technical University, Singapore

Objectives. This study tested an integrated model of the psychosocial determinants of alcohol-related behaviour among company employees from four nations. A motivational sequence was proposed in which motivational orientations from self-determination theory influenced intentions to consume alcohol within guideline limits and alcohol-related behaviour via the mediation of the theory of planned behaviour variables of attitude, subjective norms, and perceived behavioural control (PBC).

Design. A three-wave prospective design using self-reported psychological and behavioural measures.

Methods. Company employees ($N = 486$, males $= 225$, females $= 261$; M age $= 30.41$, $SD = 8.31$) from four nations (Estonia, Finland, Sweden, and UK) completed measures of autonomous and controlled motivation from self-determination theory, attitudes, subjective norms, PBC, intentions from the theory of planned behaviour, and self-reported measures of past alcohol consumption and binge-drinking occasions at the first time point (time 1). Follow-up psychological and behavioural measures were taken one month later (time 2) and follow-up behavioural measures taken a further 2 months later (time 3).

*Correspondence should be addressed to Martin S. Hagger, School of Psychology and Speech Pathology, Curtin University, GPO Box U1987, Perth, WA 6845, Australia (e-mail: martin.hagger@curtin.edu.au).

DOI:10.1111/j.2044-8287.2011.02043.x

Results. Path analyses supported the motivational sequence with identified regulation (time 1), predicting intentions (time 1), and alcohol units consumed (time 2). The effects were indirect via the mediation of attitudes and PBC (time 1). A similar pattern of effects was found for the effect of time 2 psychological variables on time 3 units of alcohol consumed. There was little support for the effects of the psychological variables on binge-drinking behaviour.

Conclusions. Findings provide new information on the psychosocial determinants of alcohol behaviour in company employees and the processes involved. Results may provide impetus for the development of interventions to reduce alcohol consumption.

Substantial epidemiological data have linked excess alcohol use with numerous health risks, including liver cirrhosis, cardiovascular disease, and cancers (Corrao, Bagnardi, Zambon, & Arico, 1999). Excessive alcohol use is also associated with unintentional injury, social disorder, and lower occupational productivity (Blum, Roman, & Martin, 1993; Roos, Lahelma, & Rahkonen, 2006). Risky patterns of alcohol consumption such as high-risk single-session alcohol drinking, known as 'binge drinking', are also on the increase (Matano *et al.*, 2003). This pattern of alcohol consumption is associated with elevated risk of the deleterious health, social, and economic consequences associated with excess alcohol consumption (Roche, Pidd, Berry, & Harrison, 2008). Furthermore, excess alcohol consumption and binge drinking are associated with increased absenteeism in the workplace (Bacharach, Bamberger, & Biron, 2010; Matano *et al.*, 2003). Systematic (Thavorncharoensap, Teerawattananon, Yothasamut, Lertpitakpong, & Chaikledkaew, 2009) and narrative (Baumberg, 2006) reviews have demonstrated the extreme financial burden to companies and organizations presented by absenteeism due to excessive employee alcohol consumption. Given the health problems, increased absenteeism and cost, and low productivity linked to excessive alcohol use and binge drinking in employees, research is essential to identify the environmental, demographic, and psychosocial predictors of alcohol consumption in this population. It is also important to identify the processes by which these factors influence behaviour such as the mediation of the impact of distal (demographic and dispositional) variables by proximal (psychological states) on behaviour and salient outcomes (Plotnikoff, Pickering, Rhodes, Courneya, & Spence, 2010).

Theoretical models developed in the field of social psychology may have utility in this regard as they enable the identification of the relevant factors likely to influence decision making and behaviour for numerous health-related behaviours and in multiple contexts (Conner & Norman, 2005). Identifying the influential factors and relevant processes will assist in informing workplace interventions to modify and change behaviour with respect to alcohol intake (Norman & Conner, 2006). Such interventions may have a concomitant effect on important outcomes such as increasing the health of employees and reducing absenteeism in the workplace. The aim of the present study is to identify the psychosocial factors that influence alcohol consumption and binge drinking in company employees from middle-socio-economic backgrounds in four nations: Estonia, Finland, Sweden, and the UK. The study will adopt an integrated model based on two social psychological theories that have been applied frequently to health behaviour: the theory of planned behaviour and self-determination theory. Adopting these theories is advantageous as they have been effective in identifying the psychosocial factors that explain variance in health-related behaviours and explaining the processes and mechanisms by which these factors influence health behaviour (Armitage & Conner, 2001; Hagger & Chatzisarantis, 2009).

Psychosocial influences on alcohol intake

Research examining the psychosocial influences on alcohol consumption and binge drinking has tended to focus on a limited number of theoretical approaches and has been largely confined to undergraduate, high school, and adolescent samples (Benahron, White, & Phillips, 1995; Collins & Carey, 2007; Keller, Maddock, Laforge, Velicer, & Basler, 2007). This research has identified numerous psychosocial factors related to alcohol intake such as intentions, attitudes, perceived control, self-efficacy, pros and cons, and social norms. Furthermore, these factors tend to largely mediate the effects of demographic factors on alcohol consumption and have been the targets of theory-based interventions (Murgraff, Abraham, & McDermott, 2007). There is, by comparison, relatively little research examining the psychosocial factors that influence alcohol consumption and binge drinking in non-student samples (McMahon, McAlaney, & Edgar, 2007; Orbell *et al.*, 2009), particularly company employees. This is an important population given evidence that substantial numbers of employees, particularly those aged 35 years or less, have high levels of alcohol consumption and risky drinking patterns including binge drinking (Roche *et al.*, 2008). There have also been calls for the adoption of psychosocial models to examine the antecedents of alcohol consumption and binge drinking among employees (Walsh, Rudd, Biener, & Mangione, 1993), and the development of interventions based on the findings of such research that can be administered in a workplace context (Webb, Shakeshaft, Sanson-Fisher, & Havard, 2009). The present study aims to address this gap in the literature by examining the psychosocial influences on company employees' alcohol-related behaviour.

Development of an integrated theoretical model

Researchers with aims of identifying the psychosocial antecedents of health-related behaviour have typically confined their approach to single theories or explanatory systems. While such approaches have shown utility, such a unilateral approach may be limited for two reasons (Hagger, 2009). First, single-theory approaches do not resolve the redundancy in the predictors of health behaviour in the literature such as factors that have the same definition and content but different labels. Second, there is limited scope for the integration of different approaches to provide complementary explanations of the behavioural phenomena under scrutiny. Researchers have advocated the adoption of such integrated approaches to provide more comprehensive explanations of the factors and mechanisms that influence health behaviour (Chatzisarantis, Hagger, Smith, & Phoenix, 2004; Lippke & Plotnikoff, 2009; Sniehotta, 2009), including behaviours such as alcohol consumption and binge drinking (Kuther, 2002; Quinlan, Jaccard, & Blanton, 2006). Theoretical integration is highly valued as it contributes to the development of comprehensive yet parsimonious explanations of health behaviour.

A recent integrated approach that has been shown to have utility is the incorporation of self-determination theory, an 'organismic' motivational theory, into the 'traditional' social-cognitive framework of the theory of planned behaviour. The basis of this integration is that self-determination theory provides information on the origins of the social cognitive constructs that influence behaviour from the theory of planned behaviour. Similarly, the social cognitive constructs in the theory of planned behaviour delineate the mechanisms by which motivational constructs from self-determination theory influence behaviour. In this section, we will outline the theoretical basis of this integrated model and demonstrate its relevance to understanding the psychosocial determinants of alcohol consumption.

The theory of planned behaviour

The core theoretical framework adopted for the integrated model is the theory of planned behaviour (Ajzen, 1985). Central to the theory is the construct of intentions that is a motivational variable and reflects the degree of effort an individual is prepared to invest in pursuing a target behaviour (e.g., reducing alcohol intake). Intention is hypothesized to be the immediate predictor of actual behaviour. Intention is a function of three belief-based social-cognitive variables, namely, attitudes, subjective norm, and perceived behavioural control (PBC). Attitude reflects individuals' beliefs that the target behaviour will lead to certain desirable outcomes, subjective norm reflects social pressures emanating from significant others for the individual to participate in the target behaviour, and PBC reflects individuals' beliefs as to whether they have the capacity and personal resources to successfully engage in the target behaviour. Intentions are proposed to mediate the effects of attitudes, subjective norms, and PBC on actual behaviour. There is also a hypothesized direct effect of PBC on actual behaviour, which is proposed to operate in cases where PBC approximates actual control (Ajzen, 2002a). Numerous meta-analytic syntheses of research adopting the theory to health-related contexts have supported the hypothesized effects (e.g., Armitage & Conner, 2001; Hagger, Chatzisarantis, & Biddle, 2002). In the context of alcohol consumption and binge drinking, the theory of planned behaviour has been shown to have utility in predicting variance in students' self-reported alcohol intake (Jamison & Myers, 2008; McMillan & Conner, 2003; Murgraff, McDermott, & Walsh, 2001; Park, Klein, Smith, & Martell, 2009) and binge drinking (Collins & Carey, 2007; Cooke, Sniehotta, & Schuz, 2007; Huchting, Lac, & LaBrie, 2008; Norman & Conner, 2006). However, there are relatively few studies that have adopted the theory to study alcohol intake and drinking patterns in non-student populations (Orbell *et al.*, 2009).

Self-determination theory

Self-determination theory is a theory of human motivation in the 'organismic' or humanistic tradition (Deci & Ryan, 1985). Central to the theory is the distinction between self-determined or *autonomous* and non-self-determined or *controlled* forms of motivation. This distinction is often viewed on a continuum reflecting the perceived origin or cause of an individual's behaviour in a given context, known as the *perceived locus of causality* (PLOC, Ryan & Connell, 1989). Autonomous motivation reflects acting to satisfy personally relevant goals. The prototypical form of autonomous motivation is *intrinsic motivation*, which lies at one extreme of the PLOC continuum and represents behavioural engagement for no external contingency or reinforcement. *Identified regulation* is an autonomous form of motivation that lies adjacent to intrinsic motivation on the continuum and represents motivation to engage in a behaviour because it services internally referenced and highly valued goals. *External regulation,* the prototypical form of controlled motivation, is located at the opposite extreme to intrinsic motivation on the continuum and reflects engaging in behaviours due to external reinforcement such as obtaining a reward or avoiding punishment. Adjacent to external regulation lies *introjected regulation*; a controlled form of motivation that reflects behavioural engagement due to perceived internal pressures such as avoiding shame or guilt, or gaining contingent self-worth or pride. Research has shown autonomous forms of motivation to be significantly related to adaptive outcomes and persistence in health behaviour (Chatzisarantis, Hagger, Biddle, Smith, & Wang, 2003). However, as with the theory of planned behaviour, relatively few studies have adopted self-determination

theory to explain alcohol-related behaviour and those that have tend to focus on student samples (Chawla, Neighbors, Logan, Lewis, & Fossos, 2009; Neighbors, Walker, & Larimer, 2003).

The basis for integration

There is an increasing body of research that has demonstrated that self-determination theory can be incorporated into the framework of the theory of planned behaviour (for review see Hagger & Chatzisarantis, 2009). Such integration is based on the premise that combining theories provides a more comprehensive explanation of the factors and processes that influence behaviour (Hagger, 2009). There are three conceptual bases for this integration. First, when forming the belief-based judgments in the theory of planned behaviour, individuals draw from the motivational orientations outlined by self-determination theory. For example, individuals with autonomous motives for participating in a health-related behaviour, such as reducing alcohol intake, will likely form attitudes congruent with autonomously valued outcomes such as promoting good health and anticipating a productive day following drinking by avoiding a hangover (McLachlan & Hagger, 2010a). Second, motivational orientations from self-determination theory reflect an individual's perceived motivational orientation in a given context, while the theory of planned behaviour constructs reflect an individual's expectancies regarding *future* behavioural engagement. It is therefore expected that individuals citing autonomous reasons for participating in a given behaviour (e.g., reducing alcohol intake), are more likely to form attitudes and control perceptions that are congruent with their motivational orientations and form intentions to engage in future behaviours to fulfil their motives. Third, the motivational orientations from self-determination theory need to be channelled into intentions towards specific behaviours that will service the goals and outcomes consistent with their motivational orientation (Elliot, McGregor, & Thrash, 2002). Intentions, therefore, reflect the overall desire to engage in a target behaviour as a result of the impetus created by the motivational orientations from self-determination theory.

The proposed theoretical integration has led to the development of a model to predict and explain health-related behaviour. The model specifies a motivational sequence in which the proximal predictors of intention from the theory of planned behaviour mediate the effects of autonomous motives from self-determination theory on intentions and actual behaviour. Therefore, the motivational orientations toward a particular health-related behaviour are related to behavioural engagement because they likely promote the formation of beliefs about future behavioural engagement consistent with the motives. These beliefs exert a direct effect on intention formation and intentions, in turn, are related to actual behaviour. A recent meta-analysis of 36 studies adopting the model confirmed the expected motivational sequence in a number of health-related behaviours (Hagger & Chatzisarantis, 2009).

The present study

The aim of the present study was to examine the effects of psychosocial variables related to keeping alcohol intake within guideline limits on two alcohol-related behavioural variables: number of units of alcohol consumed and number of binge-drinking occasions. The investigation was conducted on samples of company employees from four nations: Estonia, Finland, Sweden, and the UK. A further purpose was to examine the process by

which these variables predict alcohol-related behaviour. An integrated theoretical model comprising constructs from the theory of planned behaviour and self-determination theory was adopted. The study was prospective in design with psychological variables and past behavioural experience measured at an initial time point (time 1), psychological variables and behaviour measured 1 month later (time 2), and a further follow-up measure of behaviour 3 months later (time 3).

In the proposed motivational sequence, autonomous forms of motivation from self-determination theory (i.e., intrinsic motivation and identified regulation) were expected to exert a positive influence on attitudes and PBC from the theory of planned behaviour, while more controlled motives (i.e., external and introjected regulation) were expected to influence subjective norms (H_1). Attitudes, subjective norms, and PBC were expected to predict intentions to engage in the alcohol-related behaviours (H_2). Intentions were proposed to predict the behavioural variables of number of units consumed and frequency of binge-drinking occasions (H_3). Similarly, to the extent that the PBC variable reflects actual behavioural control, PBC was hypothesized to directly predict both behavioural variables (H_4). The attitudes, subjective norms, and PBC variables were expected to mediate the effects of the autonomous motivational constructs on intentions (H_5) such that the direct effects of the autonomous forms of motivation on intentions were, by comparison, small or non-significant. No direct effects of the attitudes, subjective norms, and PBC variables on the behavioural variables were expected because intentions were hypothesized to mediate these effects in accordance with the theory of planned behaviour (H_6). In addition, no direct effect of autonomous forms of motivation on the behavioural variables was hypothesized. Instead, the motivational sequence comprising the theory of planned behaviour variables of attitudes, subjective norms, PBC, and intentions was expected to mediate the effect of autonomous forms of motivation on behavioural outcomes. This would be supported by a significant indirect effect of autonomous forms of motivation on alcohol-related behaviour (H_7). The pattern of effects was expected to be independent of the effects of past experience with alcohol-related behaviours (H_8) and key demographic variables: age, gender, and national group (H_9). Finally, the same pattern of effects was expected when predicting time 2 behavioural outcomes from time 1 psychological and demographic variables and time 3 behavioural outcomes from time 2 variables.

Method

Participants

Participants were company employees who volunteered to participate in a 'health survey'. Contact with employees was made through senior members of staff such as company directors or managers who advertised the opportunity to participate in the study to their employees. Companies were identified based on their size and proximity to the Universities of Tartu (Estonia), Jyväskyla (Finland), Gothenberg (Sweden), and Nottingham (UK) located in the Tartu County, Central Finland, Västra Götaland County, and Nottinghamshire: regions of Estonia, Sweden, Finland, and the UK, respectively.

These national groups were targeted as recent survey data have shown elevated levels of heavy alcohol drinking patterns in these nations relative to other European nations, particularly among young people (Hemström, Leifman, & Ramstedt, 2001; Makela *et al.*, 2006; McKee *et al.*, 2000; Popova, Rehm, Patra, & Zatonski, 2007). For example, Popova *et al.* (2007) noted that new EU member states, including Estonia, had significantly higher

levels of heavy drinking compared with EU averages. Similarly, Makela *et al.* (2006) found that young people in Finland and Sweden (aged 20–24 years) had elevated frequencies of heavy episodic drinking relative to other European countries. The preponderance of binge drinking in the UK has been well documented with the highest reported levels in Europe along with Ireland (Hemström *et al.*, 2001). Overall, survey data presents a north-south gradient for frequency of binge drinking in Europe with Northern and Eastern European nations highest (Anderson & Baumberg, 2006).

The companies were selected as they were large employers in the region providing the opportunity to recruit a substantive sample of employees from middle-income backgrounds. Six hundred and fifty-nine employees agreed to participate in the study and completed baseline measures (males = 296, females = 365; *M* age = 30.99, *SD* = 8.89, range = 46). Employees were sourced from seven companies in Estonia ($n = 189$, males = 121, females = 68; *M* age = 29.97, *SD* = 5.88, range = 27), 14 companies in Finland ($n = 184$, males = 63, females = 121; *M* age = 28.46, *SD* = 3.58, range = 27), 10 companies in Sweden ($n = 73$, males = 25, females = 48; *M* age = 25.46, *SD* = 3.83, range = 16), and three companies in the UK ($n = 215$, males = 87, females = 128; *M* age = 35.95, *SD* = 12.51, range = 46). The companies that consented to participate in the study were largely based in the managerial, caring profession, and clerical work sectors with employees mainly engaged in office work. None of the participants were occupied in manual labour jobs. Data from employer records indicated that participants ranged in job status from senior management to entry-level office worker (e.g., secretary, clerical worker). The average monthly salary of the participants was €800 for the Estonian sample, €2,800 for the Finnish sample, €1,900 for the Swedish sample, and €1,500 for the UK sample. This indicates that the majority of employees could be classified as white-collar workers and of a middle socio-economic background based on figures from the relevant governmental agencies in the participating countries: Statistics Estonia, Statistic Finland, Statistics Sweden, and the Office of National Statistics in the UK.[1]

Design and procedure

The study adopted a prospective survey design with participants completing a questionnaire packet containing theory-based psychological and alcohol-related behaviour measures and demographic information at an initial time point, time 1 (T1). Participants then received the same psychological and behavioural measures at a first follow-up time point 1 month later, time 2 (T2), and behavioural measures only at a second follow-up time point 3 months later, time 3 (T3). Researchers testing theoretical models such as the theory of planned behaviour have been criticized for confining their studies to predicting behaviour over a period of less than 4 weeks (Hagger *et al.*, 2002). The 1- and 3-month follow-up periods were included to test behavioural prediction over a longer time period. Permission from senior staff members and employee informed consent were obtained prior to data collection. Participants were informed in advance that they were participating in the survey and would be asked to complete a battery of questionnaires over a series of weeks. Data were collected in isolated office conditions

[1] *It must be stressed that the reported data for job descriptions and annual income are broad, generalized descriptions based on employee records of the companies from which the samples were drawn and not an analysis of individual sample characteristics. Such data were classified as confidential by employers and not collected. This should be considered a limitation of the study, as we were unable to test for the effects of job type and income on alcohol consumption, demographic, and Time 1 psychological variables.*

to ensure participants were afforded sufficient privacy given the potential sensitivity of the information provided. All of the questionnaires were completed anonymously to preserve confidentiality and questionnaires were matched using birth date and gender.

Measures[2]

Measures of theory of planned behaviour and self-determination theory constructs made reference to the target behaviour ('keeping alcohol drinking within safe limits'), in the time frame of interest ('3 months'), and in the context that the behaviour was to be performed ('on each individual occasion or session'). The target behaviour was defined for participants in an initial set of instructions preceding the measures: 'The World Health Organization has published guidelines for the amount of alcohol considered safe to drink. Guideline safe limits are four units of alcohol per day for males and three units per day for females'. Measures of the psychological variables from both theories were derived from those developed in previous research. Measures of the regulation styles from self-determination theory were derived from a modified version of Ryan and Connell's (1989) PLOC scale, while measures of the theory of planned behaviour measures were developed using standardized guidelines published by Ajzen (2003) and closely followed those used in previous research on this theory in the context of alcohol cessation (e.g., Murgraff *et al.*, 2001; Norman & Conner, 2006).

Autonomous motivation

Measures of autonomous and controlled forms of motivation toward keeping alcohol intake within safe limits were developed using Ryan and Connell's (1989) PLOC scale as a template. The scale measured four types of motivation from the PLOC, each varying in the degree of self-determination or autonomy on a continuum ranging from high to low autonomy. The types of motivation were: *intrinsic motivation* (e.g., 'I enjoy keeping my alcohol drinking within safe limits'), *identified regulation* (e.g., 'I drink alcohol within safe limits because I value the benefits of keeping my alcohol intake within safe limits'), *introjected regulation* (e.g., 'I feel ashamed when I do not keep my alcohol drinking within safe limits'), and *external regulation* (e.g., 'I keep my alcohol drinking within safe limits because other people say I should'). Four items tapped each motivation type and responses were made on four-point scales ranging from 1 ('not true at all') to 4 ('very true'). The internal reliabilities for these scales were satisfactory across the four national samples for the intrinsic motivation (British sample, $\alpha = .90$; Estonian sample, $\alpha = .89$; Finnish sample, $\alpha = .85$; Swedish sample, $\alpha = .80$), identified regulation ($\alpha = .78$; .74; .76; .80), introjected regulation ($\alpha = .83$; .77; .77; .75), and external regulation ($\alpha = .84$; .78; .80; .63) scales.

Intentions

The measure of intentions comprised three items (e.g., 'I intend to keep my alcohol drinking within safe limits on each individual occasion or session over the next 3 months') rated on seven-point scales anchored by 1 ('extremely unlikely') to 7 ('extremely likely'). Internal consistency statistics for this scale were satisfactory across the samples ($\alpha = .96$; .94; .96; .98).

[2]*Complete study measures are available on request from the first author.*

Attitudes

Attitudes were measured using five seven-point semantic differential scales with the bipolar adjectives in response to the common stem: 'For me, keeping my alcohol drinking within safe limits on each individual occasion or session over the next 3 months is . . . ' One item measured affective aspects of attitude using the *unenjoyable-enjoyable* adjective pair, three items tapped instrumental attitudes using the *worthwhile-not worthwhile*, *of no use-useful*, and *unimportant-important* bipolar adjectives, and one item measured moral aspects of attitudes using the *bad-good* adjective pair. These items achieved satisfactory internal consistency in all samples ($\alpha = .88; .92; .91; .84$).

Subjective norms

Subjective norms were measured by four items [e.g., 'Most people who are important to me (e.g., friends, family, etc.)] would want me to keep my alcohol drinking within safe limits on each individual occasion or session over the next 3 months') on seven-point scales with 1 ('strongly disagree') to 7 ('strongly agree') end-points. The internal reliability of this scale was satisfactory for all samples (T1 $\alpha = .90; .74; .63; .86$).

Perceived behavioural control

Three items comprised the measure of PBC (e.g., 'How much personal control do you have over keeping your alcohol drinking within safe limits on each individual occasion or session over the next 3 months?') measured on seven-point scales ranging from 1 ('no control') to 7 ('complete control'). The internal consistency of this scale was adequate for this scale across the samples ($\alpha = .86; .86; .71; .80$).

Past behaviour

Previous level of alcohol consumption was measured at T1 using the four-item Fast Alcohol Screening Test (FAST, Hodgson, Alwyn, John, Thom, & Smith, 2002). This instrument has rigorously evaluated and demonstrated validity and reliability as a brief means to evaluate the extent of alcohol consumption (Hodgson *et al.*, 2002). In addition, participants also self-reported their T1 frequency of binge-drinking occasions in the previous 4 weeks. Participants were required to write down how many occasions they exceeded 10 units for men or seven units for women each week over the previous 4 weeks. Separate response boxes were provided for each week and responses were summed to give the total number of binge-drinking occasions for the previous 4 weeks. Participants were presented with a pictorial reference guide illustrating the volume of different alcoholic beverages equivalent to one unit of alcohol. The guide was printed as a header on each page of the questionnaire to remind participants of the definition of a unit.

Self-reported alcohol behaviour

Self-reported measures of the target behavioural dependent variables of number of units of alcohol consumed and number of binge-drinking occasions in the past 4 weeks were taken at T2 and T3. Number of units of alcohol was measured via a self-report measure that prompted participants to write down the number of units they consumed each week over the previous 4 weeks. Separate response boxes were provided for each

week and responses were summed to give the total number of units consumed in the previous 4 weeks. Number of binge-drinking occasions was measured using the same self-report measure administered at T1. Participants were again presented with the pictorial reference guide to remind them of the unit equivalence of different alcoholic beverages. Segmented retrospective reports of alcohol consumption have demonstrated validity and reliability in previous studies on alcohol consumption (e.g., Collins & Carey, 2007).

Translation

Language-specific questionnaires for use with the Estonian, Finnish, and Swedish samples were developed using a back-translation procedure (Brislin, 1986). An initial draft of the translated questionnaires was produced by a bilingual translator, which was then back translated into English by two independent bilingual translators. These back-translated versions of the instruments were then compared with the initial English version and any inconsistencies marked and corrected in a further translation. This iterative approach to the back-translation procedure was replicated until the original and back-translated versions were virtually identical.

Results

Participants

Attrition across the time points due to absences, inaccessibility, and missing data resulted in final sample sizes of 131 participants in the UK sample (males = 54, females = 77; *M* age = 35.56, *SD* = 12.56, range = 46; attrition rate = 39.10%), 154 participants in the Estonian sample (males = 94, females = 60; *M* age = 29.76, *SD* = 5.63, range = 26; attrition rate = 16.90%; missing cases, $n = 3$), 136 participants in the Finnish sample (males = 55, females = 81; *M* age = 28.38, *SD* = 3.60, range = 17; attrition rate = 26.10%), and 65 participants in the Swedish sample (males = 22, females = 43; *M* age = 25.80, *SD* = 3.67, range = 16; attrition rate = 9.6%, missing cases = 1). The final overall sample comprised 486 participants (males = 225, females = 261; *M* age = 30.41, *SD* = 8.31; range = 46; attrition rate = 25.87%).

We conducted a number of tests to establish whether attrition was random or indicated a systematic bias in responses. A series of MANOVAs with the T1 psychological variables from the theory of planned behaviour and self-determination theory, FAST scores, and number of binge-drinking occasions as dependent variables and compliance (provided responses at T1 only vs. provided responses at both time points) and national group membership as independent variables revealed no significant main effects for compliance or a compliance × national group interaction effects (all *F*'s < 1.7). This provided evidence that there was no systematic variation in these variables attributable to compliance and that the lack of variation was consistent across the national groups. Similarly, an ANOVA and chi-square analysis revealed no significant differences in age and gender distribution, respectively, across the baseline only and followed-up samples and this was also consistent across national groups.

However, a univariate *F*-test revealed significant age differences in the demographic variables across the national groups ($F(3, 486) = 31.38$, $p < .01$, $\eta^2 = .16$). Bonferroni univariate *post hoc* tests revealed that the British participants were significantly older than participants in the other samples, the Swedish participants were significantly younger than participants in the other samples, and the Estonian and Finnish participants

did not differ in age. Chi-square analysis revealed a greater proportion of males than females in the Estonian sample, while the opposite was true for the other samples ($\chi^2(3) = 20.75$, $p < .01$, Cramér's V = 0.94). However, single-category chi-square analyses within each sample revealed that the gender distribution of the samples was not significantly different from chance.

Preliminary analyses

Alcohol consumption

Means and standard deviations of the study variables for each national group are presented in Table 1. In terms of group comparisons, a univariate ANOVA with FAST score as the dependent variable and national group as the independent variable revealed a significant difference ($F(3, 486) = 2.77$, $p < .05$, $\eta^2 = .02$). Univariate least significant difference (LSD) follow-up tests revealed that FAST scores were significantly lower in the Finnish sample relative to the UK sample. There were no other significant differences. Significant differences were also found for identical ANOVAs with total number of units of alcohol consumed over the prior month at the T2 ($F(3, 482) = 12.58$, $p < .01$, $\eta^2 = .07$) and T3 ($F(3, 455) = 8.53$, $p < .01$, $\eta^2 = .05$) follow-up points. LSD follow-up tests for T2 indicated that the number of units of alcohol consumed in the UK sample was significantly higher than the number of units in all the other samples and the number of units in the Finnish sample was significantly lower compared with all the other samples. LSD follow-up tests for T3 revealed a similar pattern of results, the only exception was that the Swedish sample did not differ in units consumed from the Estonian or British samples. An identical ANOVA with T1 frequency of binge-drinking occasions as the dependent variable revealed that levels were significantly higher in the UK and Swedish samples relative to the Estonian sample and number of binge-drinking occasions were significantly higher in the UK sample compared to the Finnish sample. Identical ANOVAs with binge-drinking frequency at T2 and T3 as the dependent variable revealed a similar pattern of results, the only exception was the levels of binge drinking in the Finnish sample were significantly lower than the British and Swedish samples.

We also made observational comparisons between T2 levels of alcohol consumption in the current samples and normative statistics for alcohol consumption derived from recent national surveys in each national group.[3]In the UK, alcohol consumption is typically measured in terms of alcohol units per week, so we converted T2 units of alcohol consumed per month to weekly averages for comparison purposes. Average weekly alcohol consumption in units for UK participants at T2 (full sample, $M = 9.17$, $SD = 8.95$; males, $M = 12.72$, $SD = 10.87$; females, $M = 6.68$, $SD = 6.27$) was lower than the weekly average for adults reported in a UK national survey (full sample, $M = 12.40$; males = 15.60; females, $M = 9.50$) (Office for National Statistics, 2009). Survey data for other national groups were expressed in grams of alcohol per day or week. As a consequence, we converted the numbers of units reported at T2 in the current study to

[3] *The available statistics on alcohol consumption from the national surveys varied in terms of data available and the unit of measurement. For the UK statistics, alcohol consumption was expressed in units of alcohol, so only a conversion from months to weeks was required. For the Estonian, Finnish, and Swedish statistics we converted self-reported units to number of grams of alcohol consumed. This was done using a conversion rate of 7.9 g/alcohol per unit, the standard weight of alcohol in the 10 mL volume that comprises a unit. For the UK data only mean consumption levels were available without standard deviations. For the Estonian and Finnish data, no full sample estimates were available while for the Swedish sample only a full sample score with no standard deviation statistic was available.*

Table 1. Descriptive statistics of study variables in each sample

	Sample									
	Estonia		Finland		Sweden		UK		Full sample	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
FAST scores	2.14	1.99	1.79[a]	1.72	2.15	1.84	2.51[a]	0.66	2.15	2.04
Alcohol units (T2)	23.03[a,b]	31.77	15.54[a,c,d]	15.24	26.41[c,e]	25.13	36.68[b,d,e]	35.78	25.07	29.54
Alcohol units (T3)	20.79[a]	38.06	14.36[b,c]	16.21	24.38[b]	25.39	33.27[a,c]	32.70	22.85	30.96
Binge-drinking occasions (T1)	0.82[a,b]	2.54	1.07[c]	2.14	1.69[a]	2.39	1.89[b,c]	3.10	1.30	2.62
Binge-drinking occasions (T2)	0.71[a,b]	1.56	0.51[c,d]	0.93	1.57[a,c]	1.95	1.13[b,d]	2.14	0.88	1.69
Binge-drinking occasions (T3)	0.54[a,b]	1.90	0.50[c,d]	0.94	1.45[a,c]	2.28	1.04[b,d]	1.94	0.78	1.79
Intention (T1)	4.05	1.38	4.07	1.74	4.13	1.69	4.18	1.38	4.10	1.54
Intention (T2)	4.16	1.35	3.81	1.81	3.79	1.63	4.22	1.32	4.03	1.53
Attitude (T1)	4.49	0.97	4.38	1.09	4.45	0.94	4.42	1.03	4.44	1.01
Attitude (T2)	4.60[a,b,c]	0.93	4.36[a,d]	0.95	4.31[b,e]	1.09	4.84[c,d,e]	1.05	4.56	1.01
Subjective norm (T1)	4.19[a,b]	1.05	4.97[a,c,d]	0.87	4.11[c,e]	1.38	4.56[b,d,e]	1.06	4.50	1.11
Subjective norm (T2)	4.30[a,b]	1.02	5.03[a,c,d]	0.74	3.96[b,c,e]	1.39	4.51[d,e]	0.86	4.52	1.03
PBC (T1)	4.48[a,b,c]	1.05	5.37[a,d]	0.77	5.06[b]	0.83	4.78[c,d]	1.05	4.89	1.01
PBC (T2)	4.55[a,b,c]	0.99	5.34[a,d,e]	0.65	5.02[b,d]	0.84	4.92[c,e]	0.99	4.94	0.93
Intrinsic motivation (T1)	3.06[a]	0.78	2.79[a]	0.79	2.89	0.76	3.01	0.81	2.95	0.80
Intrinsic motivation (T2)	3.16[a]	0.80	2.95[a,b]	0.83	2.94	0.82	3.17[b]	0.78	3.08	0.81
Identified regulation (T1)	2.56[a]	0.67	2.26[a]	0.67	2.40	0.68	2.41	0.68	2.41	0.68
Identified regulation (T2)	2.61[a]	0.72	2.52	0.73	2.35[a,b]	0.65	2.67[b]	0.65	2.57	0.70
Introjected regulation (T1)	1.76[a]	0.64	1.38[a,b,c]	0.54	1.80[b]	0.72	1.79[c]	0.82	1.66	0.70
Introjected regulation (T2)	1.74[a,b]	0.63	1.56[a,c]	0.74	1.73	0.77	1.86[b,c]	0.82	1.73	0.74
External regulation (T1)	1.41[a]	0.54	1.23[a,b]	0.44	1.25[c]	0.37	1.55[b,c]	0.66	1.38	0.55
External regulation (T2)	1.41[a,b]	0.52	1.26[a,c]	0.39	1.32[d]	0.45	1.69[b,c,d]	0.69	1.43	0.55

Note. T1 = time 1 (baseline); T2 = time 2 (1-month follow-up); T3 = time 3 (3-month follow-up); FAST = fast alcohol screening test; PBC = perceived behavioural control.Variables sharing common superscripts in each row are significantly different from each other, $p < .05$.

grams of alcohol and calculated daily or weekly averages. Average alcohol consumption in grams per day for Estonian participants at T2 (males, $M = 8.94$, $SD = 11.76$; females, $M = 3.73$, $SD = 3.82$) was also substantially lower than survey averages (males, $M = 29.0$, $SD = 42.0$; females, $M = 6.0$, $SD = 12.0$) (McKee *et al.*, 2000). For the Finnish sample, participants' alcohol consumption in grams per week at T2 (males, $M = 40.94$, $SD = 35.32$; females, $M = 20.76$, $SD = 26.17$) was markedly lower than survey data (males, $M = 145.0$, $SD = 146.0$; females, $M = 67.0$, $SD = 77.0$) (Pärna, Rahu, Helakorpi, & Tekkel, 2010). Finally, data for the Swedish sample indicated that the average alcohol consumption in grams per day at T2 (total sample, $M = 7.44$, $SD = 9.62$; males, $M = 8.34$, $SD = 7.70$; females, $M = 7.68$, $SD = 8.45$) was also substantially lower than the average daily consumption (total sample, $M = 21.83$) reported in Swedish survey data (WHO, 2004). In sum, the levels of alcohol consumption reported by participants in the current samples that were below average levels cited in national survey data.

Psychological variables

Means and standard deviations for the psychological variables are provided in Table 1. A MANOVA with the psychological variables as dependent variables and nationality as the independent variable revealed as significant multivariate main effect for nationality for variables at T1 (Wilks' $\Lambda = .63$, $F(24, 1378) = 9.91$, $p < .01$, $\eta^2 = .15$) and T2 (Wilks' $\Lambda = .55$, $F(24, 1378) = 13.35$, $p < .01$, $\eta^2 = .18$). Univariate LSD follow-up tests revealed significant differences for the PBC, subjective norms, and PLOC variables, but not attitudes or intentions, at T1 and for the attitude, PBC, subjective norms, and PLOC variables, but not intentions, for T2. The differences are indicated in Table 1. As a result of these differences, we statistically controlled for nationality in subsequent path analyses.

Correlations

Zero-order correlations among the study variables at both time points are provided in Table 2. Predictable patterns of correlations among the study variables were evident. The behavioural measures (FAST scores, units of alcohol consumed, and number of binge-drinking occasions) all exhibited positive and significant intercorrelations with relatively large effect sizes. The theory of planned behaviour variables were significantly and positively correlated. The self-determination theory constructs exhibited a simplex-like pattern of relations in keeping with the expectations that the PLOC represents a continuum ranging from high-to-low levels of autonomous motivation (Chatzisarantis *et al.*, 2003; Ryan & Connell, 1989). Intentions, attitudes, subjective norms, and PBC tended to exhibit significant correlations with the more autonomous forms of regulation (intrinsic motivation and identified regulation) from the PLOC. The identified regulation construct consistently exhibited the strongest relations. The theory of planned behaviour constructs and the autonomous forms of regulation from self-determination theory were significantly and negatively related to all of the behavioural measures. The direction of the correlations is consistent with hypotheses, as the psychological measures were framed as perceptions relating to maintaining alcohol intake within guideline limits while the behavioural measures indicated the extent of alcohol consumption. Overall, the pattern of relations is consistent with expectations and provided the basis for subsequent multivariate tests of relations among the constructs according to the proposed integrated model.

Table 2. Summary of intercorrelations for study variables

Variable	α[a]	1	2	3	4	5	6	7	8	9	10	11	12	α[b]
1. Past alcohol behaviour[c]	–	–	.79**	.55**	.38**	−.51**	−.44**	−.36**	−.46**	−.21**	−.33**	−.07	.18**	–
2. Units[d]	–	.50**	–	.39**	.48**	−.50**	−.50**	−.37**	−.47**	−.24**	−.32**	−.05	.18**	–
3. Past binge-drinking occasions[e]	–	.53**	.37**	–	.51**	−.37**	−.25**	−.14**	−.27**	−.22**	−.25**	−.08	.06	–
4. Binge-drinking occasions[f]	–	.45**	.53**	.50**	–	−.32**	−.21**	−.17**	−.26**	−.24**	−.23**	−.04	.11*	–
5. Intention	.95	−.59**	−.52**	−.41**	−.41**	–	.77**	.52**	.54**	.45**	.61**	.26**	.03	.95
6. Attitude	.89	−.46**	−.44**	−.29**	−.33**	.74**	–	.55**	.48**	.51**	.67**	.28**	.06	.88
7. Subjective norm	.73	−.23**	−.27**	−.13**	−.25**	.45**	.44**	–	.48**	.28**	.47**	.21**	.12**	.72
8.PBC	.80	−.59**	−.48**	−.30**	−.36**	.65**	.50**	.47**	–	.25**	.34**	.04	−.21**	.78
9. Intrinsic motivation	.87	−.31**	−.20**	−.27**	−.24**	.37**	.44**	.19**	.24**	–	.62**	.24**	.01	.89
10. Identified regulation	.65	−.30**	−.27**	−.24**	−.20**	.51**	.61**	.31**	.27**	.61**	–	.46**	.15**	.68
11. Introjected regulation	.78	.04	.03	−.06	.01	.11*	.24**	.12**	−.04	.31**	.48**	–	.53**	.79
12. External regulation	.80	.28**	.22**	.07	.12**	−.12**	−.08	.08	−.22**	.11*	.16**	.45**	–	.79

Note. Units = average number of units of alcohol consumed; PBC = perceived behavioural control. Intercorrelations for psychological constructs measured at baseline (T1) and behavioural measures at 1-month follow up (T2) are presented below the diagonal, and intercorrelations for psychological constructs measured at 1-month follow-up (T2) and behavioural measures at 3-month follow-up (T3) are presented above the diagonal.

[a]Cronbach's alpha coefficients for psychological variables measured at T1.

[b]Cronbach's alpha coefficients for psychological variables measured at T2.

[c]For correlations presented below the diagonal (T1/T2 correlations), past alcohol behaviour is represented by FAST scores measured at T1 and for correlations presented above the diagonal (T2/T3 correlations) past alcohol behaviour is represented by units of alcohol consumed measured at T2.

[d]For T1/T2 correlations, this variable is represented by units of alcohol consumed measured at T2 and for T2/T3 correlations this variable is represented by units of alcohol consumed measured at T3.

[e]For T1/T2, this variable is represented by frequency of binge-drinking occasions measured at T1 and for T2/T3 correlations this variable is represented by frequency of binge-drinking occasions measured at T2.

[f]For T1/T2 correlations, this variable is represented by frequency of binge-drinking occasions measured at T2 and for T2/T3 correlations this variable is represented by frequency of binge-drinking occasions measured at T3.

*$p < .05$; **$p < .01$.

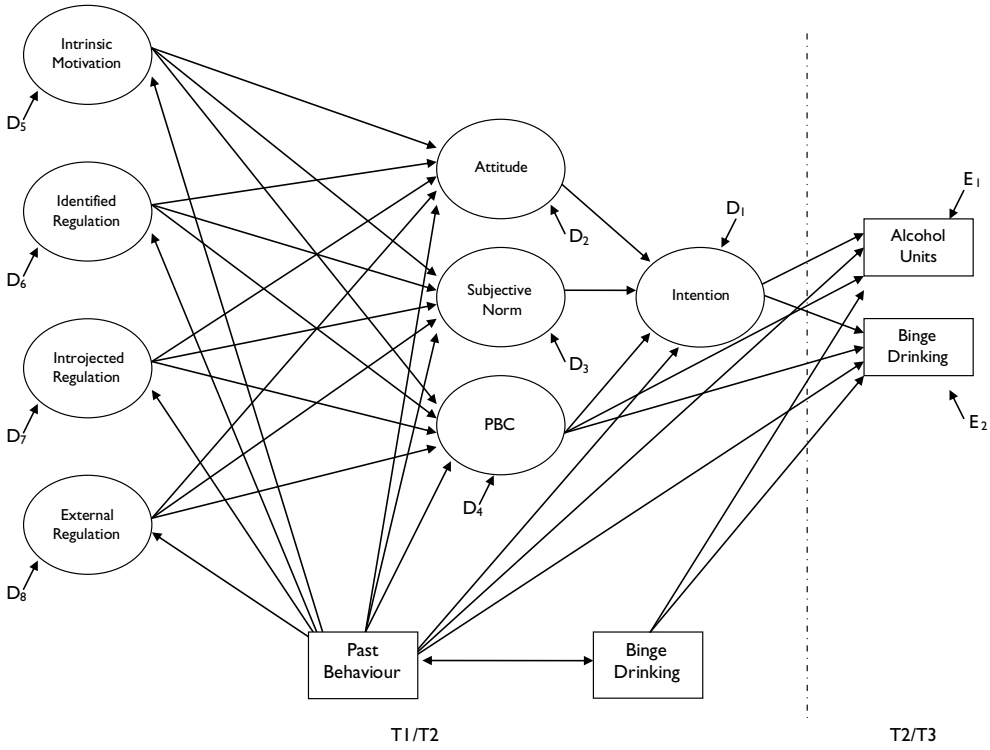

Figure 1. Path analytic model predicting alcohol-related outcomes from theory of planned behaviour and self-determination theory variables. Ellipses represent latent variables using quasi-measurement model with error variance set to be a function of the variable alpha reliability coefficient according to the formula: (1-alpha) × variance. Rectangles represent non-latent observed variables. Measurement aspects of the model not shown. D = Error in prediction (disturbance) term associated with endogenous latent variables; E = Error in prediction term associated with endogenous non-latent observed variables. T1 = time 1 (baseline); T2 = time 2 (1-month follow-up); T3 = time 3 (3-month follow-up); PBC = Perceived behavioural control; Past behaviour = Fast alcohol screening test (FAST) measured at T1 for the T1→T2 model and units of alcohol consumed at T2 for the T2→T3 model. The following parameters are omitted for clarity: Effects of age, gender, and national group on study variables and disturbance covariances among theory of planned behaviour and self-determination theory variables.

Main analysis

Data analytic strategy

The hypothesized relationships among the proposed model constructs shown in Figure 1 were tested using path analysis. In the model, we specified single-indicator latent variables with the error variance set to be a function of the variable alpha reliability coefficient according to the formula: (1-alpha) × variance. The use of a quasi-measurement model is advantageous as it provides a means to statistically control for measurement error. The alpha coefficients used in the analysis are provided in Table 2. The demographic and dependent variables remained as non-latent observed constructs. In addition to the theoretically derived relationships in the model, we also controlled for the effect of previous alcohol-related behaviour by including past behaviour as an independent predictor of all of the constructs in the model as recommended when adopting integrated

models based on the theory of planned behaviour and self-determination theory (Hagger & Chatzisarantis, 2009), and in accordance with Ajzen's (2002b) recommendations on the residual effects of past behaviour.

The path analysis model was estimated by simultaneous process and a robust maximum likelihood (ML) method[4]using the EQS computer program (Bentler, 2004). We conducted two separate path analyses[5]: the first predicted the T2 alcohol behaviour dependent variables from T1 psychological constructs and the second predicted T3-dependent variables from T2 psychological constructs. Goodness-of-fit of the proposed models with the data was evaluated using the goodness-of-fit chi-square. However, since the chi-square is sensitive to sample size, increasing the probability of making a type II error (rejecting a well fitting or acceptable model), we also used a series of recommended indices of good-fit: the comparative fit index (CFI), the non-normed fit index (NNFI), the standardized root mean squared residuals (SRMSR), and the root mean square error of approximation (RMSEA). A cut-off value of .90 or above for the CFI and NNFI is indicative of an acceptable model, although a value greater than .95 is preferable. Values approaching .08 or less for the SRMSR and RMSEA are deemed satisfactory for a well-fitting model (Browne & Cudeck, 1993; Hu & Bentler, 1999).

Model fit and explained variance

The analyses revealed models with acceptable fit with the data for both the T1→T2 ($\chi^2 = 115.24$, df = 34, $p < .001$; CFI = .97; NNFI = .96; SRMSR = .03; RMSEA = .07) and T2→T3 ($\chi^2 = 156.55$, df = 34, $p < .001$; CFI = .96; NNFI = .95; SRMSR = .04; RMSEA = .08) versions of the model.[6]Table 3 shows the R-squared values for all of the dependent variables in the path models. Overall, the models accounted for 41.32% and 31.44% of the variance in number of units consumed and binge-drinking occasions, respectively, in the T1→T2 model, and 66.94% and 29.27% of the variance, respectively, for the

[4]*Prior to estimating the models, we conducted recommended tests for violations of the assumption of multivariate normality. The tests indicated that the data were associated with substantial multivariate kurtosis (Mardia's coefficient = 27.85 for T1→T2 model and 25.89 for the T2→T3 model). As a consequence, we estimated the models using a robust maximum likelihood (ML) estimation method that corrects the goodness-of-fit chi-square and standard errors for possible violations from normality by weighting them on the basis of kurtosis estimates (Satorra & Bentler, 1988). Notwithstanding the adoption of the scaled chi-square and robust standard errors to evaluate model fit, we also checked to see the extent to which the non-normality affected model fit estimates. We calculated a scaling correction factor (SCF) that is the standard ML chi-square for the model divided by the scaled chi-square. When data are normally distributed, the SCF will equal unity as the standard ML and scaled chi-square estimates are equivalent. The greater the SCF, the greater the extent to which multivariate non-normality has affected the data. An SCF value of 1.50 suggests that the standard ML chi-square is 50% greater than the scaled chi-square. Newsom (2010) recommends that an SCF value of 1.10 or greater is indicative of problematic levels of multivariate non-normality. Based on this criterion, we concluded that the SCF values for the T1→T2 (SCF = 1.02) and T2→T3 (SCF = 1.04) models did not raise concerns over the potential for multivariate non-normality to adversely affect results. As a final measure, we also corrected for departures of normality in the dependent variables by transforming the number of units of alcohol consumed and binge-drinking variables using a natural logarithmic function.*

[5]*We estimated the effects of T1 psychological and past behaviour variables on T2 behavioural outcomes and the effects of T2 psychological and past behaviour variables on T3 behavioural outcomes in separate models as a large autoregressive model would have resulted in an unfavourable participant:parameter ratio and substantially undermined the statistical power of the model.*

[6]*As is customary in models that include multiple predictor variables that are not expected to be empirically or conceptually orthogonal, we estimated the model with correlations among the residuals (error terms) associated with the conceptually related mediating variables in the model. Specifically, we included correlations among the residuals of the self-determination theory (intrinsic motivation, identified regulation, introjected regulation, and external regulation) and theory of planned behaviour (attitudes, subjective norms, and PBC) variables as free parameters in the model. Goodness-of-fit statistics for the models excluding these correlated residuals fell below the acceptable cut-off criteria for goodness-of-fit for the T1→T2 ($\chi^2 = 1057.14$, df = 53, $p < .01$; CFI = .64; NNFI = .64; SRMSR = .16, RMSEA = .20) and T2→T3 ($\chi^2 = 1069.20$, df = 53, $p < .01$; CFI = .66; NNFI = .65; SRMSR = .16, RMSEA = .21) models.*

Table 3. Explained variance in dependent variables

	Time frame	
Variable	T1→T2 R^2	T2→T3 R^2
Units	.41**	.67**
Binge drinking	.31**	.29**
Intention	.69**	.66**
Attitude	.49**	.55**
Subjective norm	.15**	.29**
PBC	.41**	.30**
Intrinsic motivation	.10**	.07**
Identified regulation	.10**	.15**
Introjected regulation	.01	.03*
External regulation	.13**	.11**

Note. T1 = time 1 (baseline); T2 = time 2 (1-month follow-up); T3 = time 3 (3-month follow-up); Units = average number of units of alcohol consumed; PBC = perceived behavioural control.
*$p < .05$; **$p < .01$.

same variables in T2→T3 model. Similarly, the theory of planned behaviour variables accounted for a substantial amount of variance in the intention variable in both models. Furthermore, the self-determination theory variables accounted for substantial amounts of the variance in the attitude, subjective norm, and PBC variables in both models.

Tests of direct effects (Hypotheses H_1, H_2, H_3, and H_4)

Standardized path coefficients for the T1→T2 and T2→T3 path models are presented in Table 4 and were used to evaluate the hypothesized direct effects in the model. In keeping with the hypotheses of the proposed integrated model, there were significant effects for identified regulation, an autonomous form of motivation, on attitudes and PBC in both models, as predicted (H_1). There were, however, no direct effects of intrinsic motivation on the theory of planned behaviour variables with the exception of a small, significant effect on attitudes in the T2→T3 model. Identified regulation also predicted subjective norms in both models, which is in contrast to hypotheses and previous research. There were also significant effects for external regulation on subjective norms in both path models, as predicted in H_1, and small but significant negative effects for external regulation on attitudes in the T1→T2 model and PBC in the T2→T3 model. The latter findings were not expected, although we did not formulate formal hypotheses with respect to these constructs. In keeping with the theory of planned behaviour and current hypotheses (H_2), attitudes, subjective norms, and PBC significantly predicted intention in both models, although the effects for subjective norms were, by comparison, small. In keeping with hypotheses (H_3), intentions had significant direct effects on number of alcohol units consumed in both models, but did not predict binge drinking in either model. Finally, PBC had a significant direct effect on number of alcohol units consumed for the T2→T3 model only, which only provides very limited support for our hypothesis (H_4).

Table 4. Standardized path coefficients for path models

Parameter[a]	Time frame T1→T2 β	Time frame T2→T3 β
Intention→Units	−.27**	−.12**
Intention→Binge drinking	−.10	−.07
PBC→Units	−.10	−.09*
PBC→Binge drinking	−.11	−.06
Attitude→Intention	.49**	.57**
Subjective norm→Intention	.06*	.08*
PBC→Intention	.28**	.16**
Intrinsic motivation→Attitude	.05	.15**
Identified regulation→Attitude	.52**	.45**
Introjected regulation→Attitude	.02	.08
External regulation→Attitude	−.08*	.01
Intrinsic motivation→Subjective norm	−.04	−.01
Identified regulation→Subjective norm	.31**	.41**
Introjected regulation→Subjective norm	−.06	−.07
External regulation→Subjective norm	.13**	.16**
Intrinsic motivation→PBC	.04	.04
Identified regulation→PBC	.14**	.26**
Introjected regulation→PBC	−.07	−.03
External regulation→PBC	−.02	−.14**
Binge drinking (T1/T2)→Binge drinking (T2/T3)	.36**	.43**
Binge drinking (T1/T2)→Units (T2/T3)	.13**	−.06
FAST (T1)/Units (T2)→Units	.23**	.71**
FAST (T1)/Units (T2)→Binge drinking	.13*	.08
FAST (T1)/Units (T2)→Intention	−.13**	−.11*
FAST (T1)/Units (T2)→Attitude	−.23**	−.28**
FAST (T1)/Units (T2)→Subjective norm	−.16**	−.25**
FAST (T1)/Units (T2)→PBC	−.49**	−.31**
FAST (T1)/Units (T2)→Intrinsic motivation	−.31**	−.23**
FAST (T1)/Units (T2)→Identified regulation	−.31**	−.36**
FAST (T1)/Units (T2)→Introjected regulation	.04	−.10*
FAST (T1)/Units (T2)→External regulation	−.14**	−.10*

Note. Units = average number of units of alcohol consumed; T1 = time 1 (baseline); T2 = time 2 (1-month follow-up); T3 = time 3 (3-month follow-up); FAST = fast alcohol screening test; PBC = perceived behavioural control.[a]Parameter estimates for the effects of FAST scores at T1 on study variables are exclusive to the T1→T2 model and effects of units of alcohol consumed at T2 on study variables are exclusive to the T2→T3 model.
*$p < .05$; **$p < .01$.

Tests of indirect effects (Hypotheses H_5, H_6, and H_7)

An important aspect of the present model is the degree to which the distal psychological variables from self-determination theory impact on the dependent psychological variables from the theory of planned behaviour and the behavioural variables in accordance with the hypothesized model. This was tested by examining the indirect effects of the distal psychological constructs on the dependent psychological and behavioural variables. The indirect effects were computed by the EQS software using Sobel's (1982)

Table 5. Indirect effects for path models

Parameter	Time frame	
	T1→T2 β	T2→T3 β
Attitude→Units	−.14**	−.07**
Subjective norm→Units	−.02	−.01
PBC→Units	−.08**	−.02
Attitude→Binge drinking	−.05	−.04
Subjective norm→Binge drinking	−.01	−.01
PBC→Binge drinking	−.03	−.01
Intrinsic motivation→Intention	.04	.09**
Identified regulation→Intention	.31**	.33**
Introjected regulation→Intention	−.01	−.02
External regulation→Intention	−.04	.00
Intrinsic motivation→Units	−.01	−.01
Intrinsic motivation→Binge drinking	−.01	−.01
Identified regulation→Units	−.10**	−.06**
Identified regulation→Binge drinking	−.05**	−.04*
Introjected regulation→Units	.01	.00
Introjected regulation→Binge drinking	.01	.00
External regulation→Units	.01	.01
External regulation→Binge drinking	.01	.01

Note. T1 = time 1 (baseline); T2 = time 2 (1-month follow-up); T3 = time 3 (3-month follow-up); Units = average number of units of alcohol consumed; PBC = perceived behavioural control.
*$p < .05$; **$p < .01$.

formula[7] and are presented in Table 5. We hypothesized (H_5) that the autonomous forms of motivation would predict intentions via the mediation of the immediate antecedents of intentions: attitudes, subjective norms, and PBC. Consistent with this hypothesis, significant indirect effects of identified regulation on intentions were found in both models. Furthermore, there was a significant indirect effect of intrinsic motivation on intentions in the T2→T3 model. This provided overall support for the hypothesized effects. We also hypothesized (H_6) that intentions would mediate the effects of the attitude, subjective norm, and PBC variables on the behavioural-dependent variables in accordance with the theory of planned behaviour. Consistent with this hypothesis, we found significant, negative indirect effects of attitudes on number of units of alcohol consumed in both models. There was also a significant, negative indirect effect of PBC on number of units in the T1→T2 model only; the effect of PBC on number of units in the T2→T3 model was, therefore, direct only. These findings lent partial support for the hypothesis. Finally, we hypothesized (H_7) that the effects of the autonomous forms of motivation would have significant indirect effects on the behavioural variables via the motivational sequence specified in the integrated model. Identified regulation had significant indirect effects on number of units consumed and binge-drinking occasions

[7] *The Sobel (1982) test for mediation effects is acknowledged as a relatively conservative one and is associated with low power to detect a true effect (MacKinnon, Warsi, & Dwyer, 1995). This is, however, appropriate in the present study, as we were interested in identifying robust estimates of indirect effects of the distal psychological variables on the behavioural outcomes.*

in both models. There were no other significant indirect effects. Again, this provided support for the majority of the effects stipulated in the hypothesis.

Effects of past behaviour and demographics (Hypotheses H_8 and H_9)

We hypothesized that the proposed effects of the integrated model would hold even when controlling for past behaviour (H_8) and the demographic variables of age, gender, and national group (H_9). Past behaviour, as characterized by FAST scores and T1 binge-drinking frequency for the T1→T2 model and by T2 units consumed and T2 binge-drinking frequency for the T2→T3 model, had significant effects on a majority of the study variables in both path models. The demographic variables had few significant effects. Importantly for the proposed motivational sequence, the proposed pattern of effects among the psychological and behavioural variables held after controlling for these variables.

Discussion

This aim of the present study was to test an integrated theoretical model of the psychosocial determinants of alcohol-related behaviour among company employees from four nations. The study adopted a prospective design with psychological variables from the theory of planned behaviour and self-determination theory measured at time 1 (T1) proposed to be predictors of units of alcohol consumed and binge drinking 1 month later (time 2; T2) and psychological variables measured at T2 predicting alcohol behaviour a further 2 months later (time 3; T3). Path analytic models supported the hypotheses of the proposed model. Identified regulation, an autonomous form of motivational regulation, was a significant predictor of both attitudes and PBC as hypothesized. This was the case for the models estimated to predict alcohol behaviour at T2 (T1→T2) and T3 (T2→T3). External regulation, a controlling form of motivational regulation, also had a significant effect on subjective norms, as hypothesized for both models. Attitudes, subjective norms, and PBC were significant predictors of intention in accordance with the theory of planned behaviour in both models. Intentions significantly and negatively predicted number of units of alcohol consumed, but not binge drinking, in both models. In terms of the motivational sequence that specified indirect effects of the distal self-determination and planned behaviour theory variables on intentions and behaviour, there were significant and negative indirect effects of attitude and identified regulation on number of alcohol units consumed for both models. Identified regulation also had significant indirect effects on intentions for both models. Identified regulation, but not attitudes, had significant and negative effects on binge drinking in both models. There was a significant indirect effect of intrinsic motivation on intentions for the T2→T3 model.

Present findings indicate that identified regulation with respect to keeping alcohol intake within guideline limits is the most influential variable in the prediction of intentions and alcohol behaviour in this sample of company employees. The role of identified regulation, rather than intrinsic motivation, as the most influential predictor is unsurprising. Intrinsic motivation reflects the pursuit of behaviour for internally referenced reasons such as enjoyment, interest, and choice. As such intrinsically motivated action tends to be spontaneous and uninhibited. It is less likely that individuals would perceive maintaining their alcohol intake within guideline limits as intrinsically motivating, as abstaining from alcohol involves the active and deliberate inhibition of

the well-habituated impulse to consume alcoholic beverages in social situations (Hagger, Wood, Stiff, & Chatzisarantis, 2009, 2010). The suppression of such impulses is unlikely to be spontaneous and non-conscious like many intrinsically motivated behaviours, but more a function of reflective processes and active self-regulation (Hagger, 2010; Hall & Fong, 2010; Hofmann, Friese, & Wiers, 2008). As a result, identified regulation, a variable that reflects goal-directed motives to attain some valued outcome, is more likely to be influential in moderating alcohol intake within guideline limits. The significant prediction of alcohol behaviour by identified regulation within the model is entirely consistent with this explanation.

Furthermore, the impact of identified regulation motives on alcohol-related behaviour was mediated by attitudes, PBC, and, ultimately, intentions. This is consistent with the proposed motivational sequence in the integrated model and supports previous tests of the model in other behavioural contexts (Hagger & Chatzisarantis, 2009; Jacobs, Hagger, Streukens, De Bourdeaudhuij, & Claes, 2011). In relation to the previous argument, it is not surprising that the motivational orientations are mediated by the immediate social cognitive constructs related to intentional action from the theory of planned behaviour. The theory offers a reflective, deliberative explanation of human behaviour, and, given that identified regulation is likely involved in a reflective process toward reducing alcohol intake for personally relevant motives, the mediation of the effect of identified regulation on alcohol-related behaviour by intentions corroborates the deliberative nature of this pathway. In addition, it is important to note that the attitude construct was predominantly measured using cognitive, rather than affective, items (Hagger & Chatzisarantis, 2005; Lawton, Conner, & McEachan, 2009) and that this variable was largely responsible for mediating the effects of identified regulation on intentions and alcohol consumption. Cognitive measures of attitude reflect instrumental reasons for engaging in future behaviour and therefore correspond closely with items measuring of identified regulation, which make reference to generalized motivation based on the instrumental value of the behaviour. The close conceptual and measurement correspondence provides an explanation for the close relationship between these constructs and the consistent mediation effects found in the current model. Finally, the lack of direct effects for the motivational constructs from self-determination theory on behaviour indicates that such motives do not have any spontaneous or impulsive effects on alcohol consumption (Hagger, Chatzisarantis, & Harris, 2006).

While the prediction of units of alcohol consumed by the distal and immediate constructs from the proposed integrated model was supported by the data for the T1→T2 and T2→T3 models, there was no effect of intentions on binge drink in behaviour in either model. A vast majority of the explained variance in binge-drinking behaviour was attributable to past behaviour rather than any of the psychological constructs. A possible reason for this is the lack of correspondence between the psychological and behavioural measure (Ajzen, 1985; Courneya & McAuley, 1993). In this study, the psychological measures made reference to maintaining alcohol consumption within guideline limits. This is clearly relevant to an outcome measure that taps alcohol consumption, but corresponds less to a measure of alcohol consumption that makes reference to a specific pattern of heavy drinking, namely, binge drinking. While a component of interventions aimed at moderating alcohol consumption may be to minimize the frequency of occasions when a large amount of alcohol is consumed in quick succession, there remains the possibility that individuals may consume a high number of units on a given occasion, but maintain their overall level of alcohol to within guideline limits.

Another difference observed across the two models is the larger percentage of explained variance in number of units consumed for the T1→T2 model relative to the T2→T3 model. The correspondence rule suggests that a longer time frame between the measurement of psychological constructs and behaviour should result in progressively weaker prediction and variance explained in behaviour relative to shorter time frames (Ajzen, 1985; Courneya & McAuley, 1993). Present findings are opposite to this entropic pattern of prediction such that greater variance was explained in number of units of alcohol consumed in the T2→T3 model (a 2-month time frame) compared to the T1→T2 model (a 1-month time frame). However, breaking down the contribution of the variables explaining this variance revealed that the past behaviour variables accounted for 5.82% of the variance in units of alcohol consumed for the T1→T2 model and 28.94% of the variance in the same variable for the T2→T3 model. In contrast, the unique contribution of intentions to the explained variance in units consumed was larger for the T1→T2 model (3.52%) compared to the T2→T3 model (<1%). This suggests that the greater explained variance in units of alcohol consumed in the T2→T3 can be ascribed to the effects of the past behaviour variables, while the psychological variables accounted for more of the explained variance in the T1→T2 model compared to the T1→T3 as predicted by the correspondence rule. Numerous interpretations of the effects of past behaviour on future behaviour in such models have been proposed. One proposal is that these effects reflect the influence of unmeasured variables. It is possible that the longer time period increases the potential for extraneous variables to affect the system. Another is the possibility that this reflects additional variance explained by reactance to the distribution of measures at T1. There is evidence to suggest that the introduction of measures has the propensity to evoke change in behaviour and this is a real possibility in this and all research adopting survey designs (Godin, Sheeran, Conner, & Germain, 2008).

Notwithstanding these caveats, prediction of alcohol consumption over an extended period of time is important if interventions are to be developed that explicitly target variables likely to produce future changes in behaviour (Hagger, Lonsdale, & Chatzisarantis, 2011; Hagger *et al*., 2011). In the present study, it seems that psychological constructs such as identified regulation and attitudes are effective in accounting for significant variance in alcohol consumption over time, at both time points. Therefore, a key practical recommendation arising from this research would be to develop interventions that target these specific constructs. Fortunately, there are intervention components that have been developed to specifically target each of these components (Abraham & Michie, 2008). Attitudes can be changed by providing persuasive communications that are matched with the salient outcomes and behavioural beliefs of the target behaviour (e.g., Chatzisarantis & Hagger, 2005). For example, print media communications such as leaflets or internet pages might highlight the benefits and advantages of keeping alcohol consumption within guideline limits such as maintaining a clear head, avoiding a hangover the next day, saving money, and avoiding injury. Identified regulation can be manipulated by presenting these outcomes in a manner that promotes their personal relevance and importance to the actor (McLachlan & Hagger, 2010b; Resnicow *et al.*, 2008). As a consequence, such communications would highlight the levels of satisfaction and personal gain that a person may expect by keeping their alcohol consumption to within guideline limits. The present model therefore paves the way for the development of 'hybrid' interventions that adopt techniques from more than one theory to change behaviour. Intervention components that target behavioural beliefs should affect behaviour through the mediation of attitudes and components that target

identified regulation should affect behaviour via the mediation of autonomous forms of motivation. Future research should adopt such interventions in the context of reducing alcohol consumption based on the current findings.

Finally, the pattern of effects exhibited in the present integrated model of alcohol behaviour was independent of the effects of past behaviour and demographic variables. Although it is clear from the zero-order correlations that the past behaviour variables were significantly related to the alcohol behaviour at T2 and T3, present findings indicate that, notwithstanding these associations, the psychological constructs were effective in predicting alcohol behaviour. This is important in terms of providing confirmation of the predictive validity of the proposed integrated model. If the inclusion of past behaviour extinguished the links between the psychological constructs and behaviour, it would invalidate the model and confirm that behavioural engagement was merely a function of previous experience. Furthermore, a lack of prediction of the psychological variables would leave no potential guidance for those developing interventions to reduce alcohol consumption. Producing interventions based on psychological constructs that account for no variance in future behaviour would be a futile endeavour.

Strengths and limitations

The present study has a number of strengths. It adopts an original approach by utilizing a theoretically sound integrated model to predict alcohol consumption and binge-drinking behaviour in company employees from four European nations. The findings are unique as there are relatively few studies that have integrated social cognitive and motivational theories to arrive at a comprehensive model of health-related behaviour. There is also a relative dearth of studies examining the psychosocial predictors of alcohol-related behaviour in occupational contexts. The findings are likely to have utility in developing hybrid interventions using intervention techniques from both component theories to reduce alcohol consumption.

It is, however, important to mention the limitations of the present study. These include the lack of correspondence between the behavioural measure of binge drinking and the psychological measures, the reliance on self-report measures, the relatively small sample sizes which precluded the testing of the integrated model within each national group, the relatively moderate average alcohol consumption among the employees, the correlational nature of the data set, and the relatively small effect sizes.

We alluded to the correspondence issue in the previous section. A remedy would be to develop psychological measures that made specific reference to binge drinking and adopt those measures as predictors of binge-drinking behaviour. Related to this, it should also be acknowledged that the FAST measure used as a control for baseline alcohol consumption at T1 also lacked correspondence with the measure of alcohol units at T2. Although we used a measure of units consumed with high correspondence with the dependent behavioural measure in the T2→T3 model, it is important to acknowledge that the lack of correspondence in the T1→T2 model might have attenuated the amount of variance explained by the psychological variables (Ajzen, 2002b).

The present study also relied exclusively on self-report measures. Although the psychological measures adopted have demonstrated predictive and nomological validity with objective measures of behaviour in the context of alcohol (Chatzisarantis & Hagger, 2010) as well as other contexts (e.g., Orbell, Hagger, Brown, & Tidy, 2006), they are still subject to response bias and have the potential to bias inflate relations in statistical analyses. In addition, segmented retrospective self-report measures of alcohol-related

behaviour such as those used in the present study have also been shown to provide valid estimates of behaviour concurrent to more objective measures such as observation (Alcohol Research Group, 2005). Nevertheless, such measures also have the propensity to introduce systematic error in analyses. This has been a problem noted in other studies examining the predictors of alcohol consumption, given the difficulty of obtaining objective measures of alcohol consumption (e.g., Collins & Carey, 2007; Cooke *et al.*, 2007; Huchting *et al.*, 2008) and should be considered a limitation of the present study.

With respect to the sample size, although it would have been preferable to have a sufficiently large sample size to conduct analyses within each national group, we included national group membership as a control variable in the present model which meant that the relations found were independent of any differences due to group membership. In addition, the average alcohol consumption of the employees in the current sample was just below to the average consumption levels reported in survey data for each national group, although in some cases it was substantially lower. Furthermore, there was also a high degree of variability indicating that the sample contained people with consumption levels that could be considered harmful as well as those who were abstinent. While the alcohol consumption of participants in the present study may be somewhat lower than average, the levels of alcohol consumed are still associated with increased risk of some chronic illnesses (Mukamal & Rimm, 2008). It would, however, be useful to replicate the current model among groups of people whose average alcohol consumption was considered harmful or 'unsafe'. This would corroborate the effects of the psychological variables on alcohol consumption, proposed in the current model, among those who would likely gain most from interventions targeting these variables.

It should also be noted that little specific socio-demographic data were collected from the employees in the current sample such as personal and parental income and educational background, residential postcode, and assets, precluding the control for such variables in the data analysis. While a strength of the present study is the focus on a sample with a demographic profile that is distinctly different from undergraduate students, a group so frequently the focus of studies on alcohol behaviour, it must be acknowledged that the lack of socio-demographic data make it unfeasible to generalize current findings to all corporate employees. Future researchers should be conscious of the need to secure approval for, and include measures of, socio-demographics in order to control for these variables in such research.

Although the present study adopted a prospective design predicting behaviour across two time points, the data are correlational in nature. This means the pattern of effects in the hypothesized model are derived from theory alone and causal predictions with respect to the direction of influence cannot be inferred on the basis of current data. This raises the prospect that a number of alternative models could be specified that demonstrate adequate fit with the present data. Such models would be empirically and statistically acceptable even though they may be theoretically implausible. In other words, the present data do not provide the basis to systematically reject alternative models that specify a different causal ordering of the proposed variables based on statistical criteria alone. Support for the causal ordering of the effects should therefore be investigated through the manipulation or change of psychological constructs by means of experimentation or intervention and examining the effects on behaviour (e.g., Chatzisarantis & Hagger, 2009).

Finally, while there were significant effects of the theoretical constructs in the present model on alcohol consumption, many of the effects were comparatively modest in effect size. Although the model was accounting for a sizable proportion of the variance in the

alcohol-related dependent variables, the explained variance attributable to psychological constructs was relatively small. This means that interventions that exerted a large change in the psychological antecedents such as attitudes or identified regulation would have a comparatively much smaller effect on behaviour itself. This has been corroborated in previous research that has demonstrated that interventions based on the theory of planned behaviour tend to have stronger effects on intentions than on behaviour itself (Webb & Sheeran, 2006). This is a criticism that has been levelled at a number of theoretical approaches to health-related behaviour (Armitage & Conner, 2001; Hagger *et al.*, 2002). A solution might lie in the development of comprehensive integrated theoretical models that incorporate many of the factors shown to be efficacious in research across the field (Hagger, 2009).

Acknowledgement

The research was supported by grant #EA 07 10 from the European Research Advisory Board awarded to Martin S. Hagger.

References

Abraham, C., & Michie, S. (2008). A taxonomy of behavior change techniques used in interventions. *Health Psychology*, *27*, 379–387. doi:10.1037/0279-6133.27.3.379

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl & J. Beckmann (Eds.), *Action-control: From cognition to behavior* (pp. 11–39). Heidelberg: Springer.

Ajzen, I. (2002a). Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. *Journal of Applied Social Psychology*, *32*, 1–20.

Ajzen, I. (2002b). Residual effects of past on later behavior: Habituation and reasoned action perspectives. *Personality and Social Psychology Review*, *6*, 107–122.

Ajzen, I. (2003). Constructing a TPB questionnaire: Conceptual and methodological considerations. Retrieved from http://www-unix.oit.umass.edu/~aizen

Alcohol Research Group. (2005). *Improving alcohol consumption self-report measurement*. Berkeley, CA: National Alcohol Research Center.

Anderson, P., & Baumberg, B. (2006). *Alcohol in Europe*. London, UK: Institute of Alcohol Studies.

Armitage, C. J., & Conner, M. (2001). Efficacy of the theory of planned behaviour: A meta-analytic review. *British Journal of Social Psychology*, *40*, 471–499.

Bacharach, S. B., Bamberger, P., & Biron, M. (2010). Alcohol consumption and workplace absenteeism: The moderating effect of social support. *Journal of Applied Psychology*, *95*, 334–348. doi:10.1037/a0018018

Baumberg, B. (2006). The global economic burden of alcohol: A review and some suggestions. *Drug and Alcohol Review*, *25*, 537–551. doi:10.1080/09595230600944479

Benahron, V., White, D., & Phillips, K. (1995). Encouraging drinking at safe limits on single occasions – The potential contribution of protection motivation theory. *Alcohol and Alcoholism*, *30*, 633–639.

Bentler, P. M. (2004). *EQS structural equations modeling software (Version 6.1) [Computer Software]*. Encino, CA: Multivariate Software.

Blum, T. C., Roman, P. M., & Martin, J. K. (1993). Alcohol-consumption and work performance. *Journal of Studies on Alcohol*, *54*, 61–70.

Brislin, R. W. (1986). The wording and translation of research instruments. In W. J. Lonner & J. W. Berry (Eds.), *Field methods in educational research* (pp. 137–164). Newbury Park, CA: Sage.

Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 136–162). Newbury Park, CA: Sage.

Chatzisarantis, N. L. D., & Hagger, M. S. (2005). Effects of a brief intervention based on the theory of planned behavior on leisure time physical activity participation. *Journal of Sport and Exercise Psychology*, *27*, 470–487.

Chatzisarantis, N. L. D., & Hagger, M. S. (2009). Effects of an intervention based on self-determination theory on self-reported leisure-time physical activity participation. *Psychology and Health*, *24*, 29–48. doi:10.1080/08870440701809533

Chatzisarantis, N. L. D., & Hagger, M. S. (2010). Effects of implementation intentions linking suppression of alcohol consumption to socialising goals on alcohol-related decisions. *Journal of Applied Social Psychology*, *40*, 1618–1634. doi:10.1111/j.1559–1816.2010.00632.x

Chatzisarantis, N. L. D., Hagger, M. S., Biddle, S. J. H., Smith, B., & Wang, C. K. J. (2003). A meta-analysis of perceived locus of causality in exercise, sport, and physical education contexts. *Journal of Sport and Exercise Psychology*, *25*, 284–306.

Chatzisarantis, N. L. D., Hagger, M. S., Smith, B., & Phoenix, C. (2004). The influences of continuation intentions on the execution of social behaviour within the theory of planned behaviour. *British Journal of Social Psychology*, *43*, 551–583. doi:10.1348/0144666042565399

Chawla, N., Neighbors, C., Logan, D., Lewis, M. A., & Fossos, N. (2009). Perceived approval of friends and parents as mediators of the relationship between self-determination and drinking. *Journal of Studies on Alcohol and Drugs*, *70*, 92–100.

Collins, S. E., & Carey, K. B. (2007). The theory of planned behavior as a model of heavy episodic drinking among college students. *Psychology of Addictive Behaviors*, *21*, 498–507. doi:10.1037/0893–164X.21.4.498

Conner, M., & Norman, P. (2005). *Predicting health behaviour: Research and practice with social cognition models*. Buckingham, UK: Open University Press.

Cooke, R., Sniehotta, F., & Schuz, B. (2007). Predicting binge-drinking behaviour using an extended TPB: Examining the impact of anticipated regret and descriptive norms. *Alcohol and Alcoholism*, *42*, 84–91. doi:10.1093/alcalc/agl115

Corrao, G., Bagnardi, V., Zambon, A., & Arico, S. (1999). Exploring the dose-response relationship between alcohol consumption and the risk of several alcohol-related conditions: A meta-analysis. *Addiction*, *94*, 1551–1573. doi:10.1046/j.1360–0443.1999.9410155111.x

Courneya, K. S., & McAuley, E. (1993). Predicting physical activity from intention: Conceptual and methodological issues. *Journal of Sport and Exercise Psychology*, *15*, 50–62.

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum Press.

Elliot, A. J., McGregor, H. A., & Thrash, T. M. (2002). The need for competence. In E. L. Deci & R. M. Ryan (Eds.), *Handbook of self-determination research* (pp. 361–387). Rochester, NY: University of Rochester Press.

Godin, G., Sheeran, P., Conner, M., & Germain, M. (2008). Asking questions changes behavior: Mere measurement effects on frequency of blood donation. *Health Psychology*, *27*, 179–184. doi:10.1037/0278–6133.27.2.179

Hagger, M. S. (2009). Theoretical integration in health psychology: Unifying ideas and complimentary explanations. *British Journal of Health Psychology*, *14*, 189–194. doi:10.1348/135910708 × 397034

Hagger, M. S. (2010). Self-regulation: An important construct in health psychology research and practice. *Health Psychology Review*, *4*, 57–65. doi:10.1080/17437199.2010.503594

Hagger, M. S., & Chatzisarantis, N. L. D. (2005). First- and higher-order models of attitudes, normative influence, and perceived behavioural control in the theory of planned behaviour. *British Journal of Social Psychology*, *44*, 513–535. doi:10.1348/014466604 × 16219

Hagger, M. S., & Chatzisarantis, N. L. D. (2009). Integrating the theory of planned behaviour and self-determination theory in health behaviour: A meta-analysis. *British Journal of Health Psychology*, *14*, 275–302. doi:10.1348/135910708 × 373959

Hagger, M. S., Chatzisarantis, N. L. D., & Biddle, S. J. H. (2002). A meta-analytic review of the theories of reasoned action and planned behavior in physical activity: Predictive validity

and the contribution of additional variables. *Journal of Sport and Exercise Psychology*, *24*, 3–32.

Hagger, M. S., Chatzisarantis, N. L. D., & Harris, J. (2006). From psychological need satisfaction to intentional behavior: Testing a motivational sequence in two behavioral contexts. *Personality and Social Psychology Bulletin*, *32*, 131–138. doi:10.1177/0146167205279905

Hagger, M. S., Lonsdale, A. J., & Chatzisarantis, N. L. D. (2011). A theory-based intervention to reduce alcohol drinking in excess of guideline limits among undergraduate students *British Journal of Health Psychology*. Advance online publication. doi:10.1111/j.2044–8287.2010.02011.x

Hagger, M. S., Lonsdale, A. J., Koka, A., Hein, V., Pasi, H., Lintunen, T., & Chatzisarantis, N. L. D. (2011). An intervention to reduce alcohol consumption in undergraduate students using implementation intentions and mental simulations: A cross-national study. *International Journal of Behavioral Medicine*. Advance online publication. doi:10.1007/s12529-011-9163-8

Hagger, M. S., Wood, C., Stiff, C., & Chatzisarantis, N. L. D. (2009). The strength model of self-regulation failure and health-related behavior. *Health Psychology Review*, *3*, 208–238. doi:10.1080/17437190903414387

Hagger, M. S., Wood, C., Stiff, C., & Chatzisarantis, N. L. D. (2010). Ego depletion and the strength model of self-control: A meta-analysis. *Psychological Bulletin*, *136*, 495–525. doi:10.1037/a0019486

Hall, P. A., & Fong, G. T. (2010). Temporal self-regulation theory: Looking forward. *Health Psychology Review*, *4*, 83–92. doi:10.1080/17437199.2010.487180

Hemström, Ö., Leifman, H., & Ramstedt, M. (2001). The ECAS-survey on drinking patterns and alcohol-related problems. In T. Norström (Ed.), *Alcohol in postwar Europe: Consumption, drinking patterns, consequences and policy responses in 15 European countries* (pp. 115–136). Stockholm: National Institute of Public Health.

Hodgson, R. J., Alwyn, T., John, B., Thom, B., & Smith, A. (2002). The fast alcohol screening test. *Alcohol and Alcoholism*, *37*, 61–66. doi:10.1093/alcalc/37.1.61

Hofmann, W., Friese, M., & Wiers, R. W. (2008). Impulsive versus reflective influences on health behavior: A theoretical framework and empirical review. *Health Psychology Review*, *2*, 111–137. doi:10.1080/17437190802617668

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*, 1–55.

Huchting, K., Lac, A., & LaBrie, J. W. (2008). An application of the theory of planned behavior to sorority alcohol consumption. *Addictive Behaviors*, *33*, 538–551. doi:10.1016/j.addbeh.2007.11.002

Jacobs, N., Hagger, M. S., Streukens, S., De Bourdeaudhuij, I., & Claes, N. (2011). Testing an integrated model of the theory of planned behaviour and self-determination theory for different energy-balance related behaviours and intervention intensities. *British Journal of Health Psychology*, *16*, 113–134. doi:10.1348/135910710 × 519305

Jamison, J., & Myers, L. B. (2008). Peer-group and price influence students drinking along with planned behaviour. *Alcohol and Alcoholism*, *43*, 492–497. doi:10.1093/alcalc/agn033

Keller, S., Maddock, J. E., Laforge, R. G., Velicer, W. F., & Basler, H. D. (2007). Binge drinking and health behavior in medical students. *Addictive Behaviors*, *32*, 505–515. doi:10.1016/j.addbeh.2006.05.017

Kuther, T. L. (2002). Rational decision perspectives on alcohol consumption by youth – Revising the theory of planned behavior. *Addictive Behaviors*, *27*, 35–47. doi:10.1016/S0306–4603(00)00161–1

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

Lippke, S., & Plotnikoff, R. C. (2009). The protection motivation theory within the stages of the transtheoretical model – Stage-specific interplay of variables and prediction of stage transitions. *British Journal of Health Psychology*, *14*, 211–229. doi:10.1348/135910708 × 399906

MacKinnon, D. P., Warsi, G., & Dwyer, J. H. (1995). A simulation study of mediated effect measures. *Multivariate Behavioral Research*, *30*, 41–62.

Makela, P., Gmel, G., Grittner, U., Kuendig, H., Kuntsche, S., Bloomfield, K., & Room, R. (2006). Drinking patterns and their gender differences in Europe. *Alcohol and Alcoholism*, *41*, I8-I18. doi:10.1093/alcalc/ag071

Matano, R. A., Koopman, C., Wanat, S. F., Whitsell, S. D., Borggrefe, A., & Westrup, D. (2003). Assessment of binge drinking of alcohol in highly educated employees. *Addictive Behaviors*, *28*, 1299–1310. doi:10.1016/s0306-4603(02)00248-4

McKee, M., Pomerleau, J., Robertson, A., Pudule, I., Grinberga, D., Kadziauskiene, K., & Vaask, S. (2000). Alcohol consumption in the Baltic Republics. *Journal of Epidemiology and Community Health*, *54*, 361–366. doi:10.1136/jech.54.5.361

McLachlan, S., & Hagger, M. S. (2010a). Associations between motivational orientations and chronically accessible outcomes in leisure-time physical activity: Are appearance-related outcomes controlling in nature? *Research Quarterly for Exercise and Sport*, *81*, 102–107.

McLachlan, S., & Hagger, M. S. (2010b). Effects of an autonomy-supportive intervention on tutor behaviors in a higher education context. *Teaching and Teacher Education*, *26*, 1205–1211. doi:10.1016/j.tate.2010.01.006

McMahon, J., McAlaney, J., & Edgar, F. (2007). Binge drinking behaviour, attitudes and beliefs in a UK community sample: An analysis by gender, age and deprivation. *Drugs-Education Prevention and Policy*, *14*, 289–303. doi:10.1080/09687630701288461

McMillan, B., & Conner, M. (2003). Using the theory of planned behaviour to understand alcohol and tobacco use in students. *Psychology, Health and Medicine*, *8*, 317–328. doi:10.1080/1354850031000135759

Mukamal, K. J., & Rimm, E. B. (2008). Alcohol consumption: Risks and benefits. *Current Atherosclerosis Reports*, *10*, 536–543. doi:10.1007/s11883-008-0083-2

Murgraff, V., Abraham, C., & McDermott, M. (2007). Reducing Friday alcohol consumption among moderate, women drinkers: Evaluation of a brief evidence-based intervention. *Alcohol and Alcoholism*, *42*, 37–41. doi:10.1093/alcalc/agl083

Murgraff, V., McDermott, M. R., & Walsh, J. (2001). Exploring attitude and belief correlates of adhering to the new guidelines and low-risk single-occasion drinking: An application of the theory of planned behaviour. *Alcohol and Alcoholism*, *36*, 135–140. doi:10.1093/alcalc/36.2.135

Neighbors, C., Walker, D. D., & Larimer, M. E. (2003). Expectancies and evaluations of alcohol effects among college students: Self-determination as a moderator. *Journal of Studies in Alcohol*, *64*, 292–300.

Newsom, J. (2010). *Practical approaches to dealing with nonnormal and categorical variables*. Retrieved from http://www.upa.pdx.edu/IOA/newsom/semclass/ho_estimate2.pdf

Norman, P., & Conner, M. (2006). The theory of planned behaviour and binge drinking: Assessing the moderating role of past behaviour within the theory of planned behaviour. *British Journal of Health Psychology*, *11*, 55–70. doi:10.1348/135910705 × 43741

Office for National Statistics. (2009). *Opinions survey report no. 42. Drinking: Adults' behaviour and knowledge in 2009.* Newport, Wales: Office for National Statistics.

Orbell, S., Hagger, M. S., Brown, V., & Tidy, J. (2006). Comparing two theories of health behavior: A prospective study of non-completion of treatment following cervical cancer screening. *Health Psychology*, *25*, 604–615. doi:10.1037/0278-6133.25.5.604

Orbell, S., Lidierth, P., Henderson, C. J., Geeraert, N., Uller, C., Uskul, A. K., & Kyriakaki, M. (2009). Social-cognitive beliefs, alcohol, and tobacco use: A prospective community study of change following a ban on smoking in public places. *Health Psychology*, *28*, 753–761. doi:10.1037/a0016943

Park, H. S., Klein, K. A., Smith, S., & Martell, D. (2009). Separating subjective norms, university descriptive and injunctive norms, and US descriptive and injunctive norms for drinking behavior intentions. *Health Communication*, *24*, 746–751. doi:10.1080/10410230903265912

Pärna, K., Rahu, K., Helakorpi, S., & Tekkel, M. (2010). Alcohol consumption in Estonia and Finland: Finbalt survey 1994–2006. *BMC Public Health*, *10*, 261. doi:10.1186/1471-2458-10-261

Plotnikoff, R. C., Pickering, M. A., Rhodes, R. E., Courneya, K. S., & Spence, J. C. (2010). A test of cognitive mediation in a 12-month physical activity workplace intervention: Does it explain behavior change in women? *International Journal of Behavioral Nutrition and Physical Activity*, *7*, 32. doi:10.1186/1479-5868-7-32

Popova, S., Rehm, J., Patra, J., & Zatonski, W. (2007). Comparing alcohol consumption in central and eastern Europe to other European countries. *Alcohol and Alcoholism*, *42*, 465–473. doi:10.1093/alcalc/agl124

Quinlan, S. L., Jaccard, J., & Blanton, H. (2006). A decision theoretic and prototype conceptualization of possible selves: Implications for the prediction of risk behavior. *Journal of Personality*, *74*, 599–630. doi:10.1111/j.1467-6494.2006.00386.x

Resnicow, K., Davis, R. E., Zhang, G., Konkel, J., Strecher, V. J., Shaikh, A. R., & Wiese, C. (2008). Tailoring a fruit and vegetable intervention on novel motivational constructs: Results of a randomized study. *Annals of Behavioral Medicine*, *35*, 159–169. doi:10.1007/s12160-008-9028-9

Roche, A. M., Pidd, K., Berry, J. G., & Harrison, J. E. (2008). Workers' drinking patterns: The impact on absenteeism in the Australian work-place. *Addiction*, *103*, 738–748. doi:10.1111/j.1360-0443.2008.02154.x

Roos, E., Lahelma, E., & Rahkonen, O. (2006). Work-family conflicts and drinking behaviours among employed women and men. *Drug and Alcohol Dependence*, *83*, 49–56. doi:10.1016/j.drugalcdep.2005.10.009

Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality and Social Psychology*, *57*, 749–761. doi:10.1037/0022-3514.57.5.749

Satorra, A., & Bentler, P. M. (1988). *Scaling corrections for statistics in covariance structure analysis*. Los Angeles, CA: University of California at Los Angeles, Department of Psychology.

Sniehotta, F. F. (2009). Towards a theory of intentional behaviour change: Plans, planning and self-regulation. *British Journal of Health Psychology*, *14*, 261–273. doi:10.1348/135910708 × 389042

Sobel, M. E. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. In S. Leinhardt (Ed.), *Sociological Methodology* (pp. 290–312). San Francisco, CA: Jossey-Bass.

Thavorncharoensap, M., Teerawattananon, Y., Yothasamut, J., Lertpitakpong, C., & Chaikledkaew, U. (2009). The economic impact of alcohol consumption: A systematic review. *Substance Abuse Treatment Prevention and Policy*, *4*, 11. doi:2010.1186/1747-597x-4-20

Walsh, D. C., Rudd, R. E., Biener, L., & Mangione, T. (1993). Researching and preventing alcohol problems at work: Toward an integrative model. *American Journal of Health Promotion*, *7*, 289–295.

Webb, G., Shakeshaft, A., Sanson-Fisher, R., & Havard, A. (2009). A systematic review of work-place interventions for alcohol-related problems. *Addiction*, *104*, 365–377. doi:10.1111/j.1360-0443.2008.02472.x

Webb, T. L., & Sheeran, P. (2006). Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence. *Psychological Bulletin*, *132*, 249–268. doi:10.1037/0033-2909.132.2.249

WHO. (2004). *Global status report on alcohol*. Geneva: World Health Organization Department of Mental Health and Substance Abuse.

Received 4 June 2010; revised version received 17 June 2011