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Abstract

Objectives. Undergraduate students frequently exceed guideline limits for alcohol intake in a single session and are highly susceptible to associated health, social, and economic problems. Psychological theory suggests that interventions aimed at reducing alcohol consumption should target both motivational and volitional phases of action to be effective. This study reports an integrated theory-based intervention aimed at reducing undergraduates' alcohol consumption in excess of guideline limits.

Design. The study adopted a 2 (motivation: mental simulation vs. no mental simulation) x 2 (volitional: implementation intention vs. no implementation intention) randomized controlled design presented in an online format.

Methods. Undergraduate students (N = 238; females, n = 133, *M* age = 20.11, *SD* = 2.09; males, n = 105, *M* age = 20.38, *SD* = 1.35) completed baseline psychological measures and self-reported alcohol consumption as units consumed and heavy episodic drinking occasions followed by the intervention manipulation (if any). One month later participants completed follow-up measures of the psychological variables and alcohol consumption.

Results. Significant reductions in alcohol consumption were observed at follow-up. Participants receiving a mental simulation intervention reported significantly fewer units of alcohol consumed and heavy episodic drinking occasions. Among participants with high baseline alcohol consumption, participants in the combined mental simulation and implementation intention intervention group consumed significantly fewer units than other groups.

Conclusion. Results support the use of these theory-based strategies to reduce alcohol drinking in excess of guideline limits among undergraduates. There was preliminary support for the interaction between the two strategies among heavier drinkers. Targeting both motivational and implemental phases of action poses a high probability for success in changing alcohol-related behaviour in this population.

Keywords: binge drinking, implementation intentions, mental simulations, planned behaviour, internet, randomized trial

A Theory-Based Intervention to Reduce Alcohol Drinking in Excess of Guideline Limits among Undergraduate Students

Excessive consumption of alcoholic beverages in a single-session, known as heavy episodic or 'binge' drinking, has been linked to numerous health, social, and economic problems in young people (Plant, Plant, Miller, Gmel, & Kuntsche, 2009). University and college undergraduate students comprise a segment of the young population that has high rates of alcohol consumption, particularly heavy episodic drinking, compared to their non-student counterparts (Bailer et al., 2009; Gill, 2002; Nelson, Xuan, Lee, Weitzman, & Wechsler, 2009). Research has demonstrated that heavy episodic drinking in this population not only leads to increased risk of the previously-cited health, social, and economic problems (Mundt, Zakletskaia, & Fleming, 2009), but is also related to impaired academic performance (Thombs et al., 2009) and drop-out (Martinez, Sher, & Wood, 2008). Universities and colleges are therefore faced with the serious challenge of managing the alcohol consumption of the student body and ameliorating the associated problems of heavy episodic drinking (Borsari, Murphy, & Barnett, 2007; Wechsler, Dowdall, Maenner, Gledhill-Hoyt, & Lee, 1998).

In response to the evidence linking high-levels of alcohol consumption and maladaptive outcomes in undergraduate students, governments (Department of Health, 2009b), university authorities (Health Challenge Wales and National Union of Students Wales, 2009), charities (Drinkaware, 2009), and student advice groups (StudentHealth Ltd., 2005) have developed guideline limits for daily alcohol consumption[1] and invested in awareness-raising campaigns to reduce alcohol consumption in excess of these limits (e.g., DCSF, 2008; Department of Health, 2008). However, such campaigns have generally not been based on formative theoretical research that identifies the important intervention components to target in order to attain successful behaviour change. In the research literature, there has been a multitude of brief interventions aimed at reducing alcohol consumption in undergraduate students. Considerable variation exists in the reported effectiveness of these interventions in reducing alcohol intake

making it difficult to draw conclusions as to the characteristics of interventions that successfully lead to alcohol reduction (Jenkins, McAlaney, & McCambridge, 2009; Tait & Hulse, 2003). These variations have been attributed to three main factors: (a) methodological problems such as failure to adopt a randomised controlled design (Bewick et al., 2008), lack of a sufficiently lengthy follow-up measure of alcohol intake (Tripodi, Bender, Litschge, & Vaughn, 2010), and assessment reactivity and social desirability (Bernstein, Bernstein, & Heeren, 2010; McCambridge, 2009); (b) a lack of theoretical basis of the intervention itself (Abraham, Southby, Quandte, Krahe, & van der Sluijs, 2007); and (c) use of factorial designs to isolate the components of the intervention that evoke the change in alcohol consumption (Michie, 2008). Means to address these factors should therefore be of high priority when designing and evaluating interventions to reduce alcohol consumption in young people.

One of the clear limitations of previous interventions is the lack of reporting of the theoretical background of the intervention or make sufficient comparisons to pinpoint exactly which components affect behaviour change (Carey, Scott-Sheldon, Elliott, Bolles, & Carey, 2009). Isolating the specific components that give rise to behaviour change has been highlighted as essential for the effective evaluation and replication of interventions in health psychology and behavioural medicine (Abraham & Michie, 2008; Michie et al., 2005). Adopting strategies based on formative theoretical research and including means to evaluate the components that lead to behaviour change should be a priority for interventions aimed at reducing alcohol intake among undergraduate students (Michie, 2008; Michie, Johnston, Francis, Hardeman, & Eccles, 2008).

The present study aims to evaluate the effectiveness of two theory-based intervention strategies to reduce drinking alcohol in excess of guideline limits on single occasions among undergraduate students as well as reducing overall alcohol consumption. The study will adopted a randomized controlled design and use an integrated theoretical approach to intervene at two stages in the decision-making process; the motivational and volitional stages. The study

will add to knowledge on the effectiveness of interventions aimed at reducing alcohol consumption by identifying specific components that give rise to behaviour change in the undergraduate student population as well as examining the efficacy of an integrated approach to intervention design using motivational and volitional strategies.

Theoretical Basis for Interventions

Theory-based interventions to change health-related behaviour have largely focused on two key processes that lead to action: motivation and implementation. In this section we outline the theory behind these processes and demonstrate how they may interact to bring about behaviour change. This will serve as the theoretical basis for our integrated intervention strategy aimed at reducing alcohol consumption in excess of guideline limits in undergraduate students.

Intention, motivation, and mental simulation. Failure to engage in health-related behaviour can be conceptualized as a problem of motivation and self-regulation (Hagger, 2010; Hall & Fong, 2010; Orbell, Hagger, Brown, & Tidy, 2006). Many theoretical approaches adopted to identify the factors that lead to engagement in health behaviours have motivation, or similar constructs like *intentions*, as a central component (Chatzisarantis, Hagger, Smith, & Phoenix, 2004). According to such theories, increasing motivation toward a given health behaviour will lead to a concomitant increase in behavioural engagement. Such theories can also help identify the psychological antecedents of motivation and can therefore be adopted to guide interventions designed to promote behavioural engagement. The theory of planned behaviour (Ajzen, 1985) typifies such an approach. The theory proposes that intentions are a function of three factors: attitudes, subjective norms, and perceived behavioural control. Attitudes are beliefs that the target behaviour will result in certain desirable outcomes. Subjective norms are beliefs that salient social agents want the actor to engage in the target behaviour. Perceived behavioural control reflects the extent to which people believe they have the resources to engage in the target behaviour and is akin to Bandura's (1977) self-efficacy

construct. Intentions are proposed to mediate the effects of these factors on actual behaviour, with the exception of perceived behavioural control which may also have a direct effect should it adequately reflect actual control (Ajzen, 1985). The theory has been shown to be effective in predicting variance in health-related behaviour (Armitage & Conner, 2001), including alcohol use in students (Collins & Carey, 2007; Cooke, Sniehotta, & Schuz, 2007; Murgraff, McDermott, & Walsh, 2001; Norman, Armitage, & Quigley, 2007; Norman & Conner, 2006). It has also been adopted as the basis of numerous interventions to change health-related behaviour (Ajzen & Manstead, 2007; Hardeman et al., 2002). An important feature of the theory is its flexibility as a general framework to explain the processes by which motivational interventions lead to behaviour change (Schwarzer, 2008). The theory may therefore serve to identify the psychological mediators of intervention strategies to change behaviour.

A motivational intervention technique that has been recently applied in health behaviour contexts and used on conjunction with the theory of planned behaviour is mental simulations (Armitage & Reidy, 2008). Mental simulations are mental rehearsals of future events and have shown efficacy in increasing motivation and behavioural engagement (Pham & Taylor, 1999; Taylor, Pham, Rivkin, & Armor, 1998). Two types of mental simulation have been identified. Outcome simulations require imagining the achievement of a salient behavioural outcome such as losing a certain amount of weight or drinking below a certain number of units of alcohol per week. Process simulations reflect rehearsing the behavioural steps required to achieve the outcome such as engaging in physical activity or a diet or restricting alcohol intake on some days of the week. Research has shown that process mental simulations tend to be most effective in changing behaviour and that the effects were mediated by increased planning and motivation (Escalas & Luce, 2003; Pham & Taylor, 1999). In the context of the theory of planned behaviour, Armitage and Reidy (2008) demonstrated that process simulations resulted in increased intentions (synonymous with motivation) and the effect of the simulations was mediated by the psychological antecedents of intentions, namely,

perceived behavioural control and subjective norms. While these studies found no effects for outcome simulations, there is evidence that imagining future success, an outcome oriented approach, leads to positive emotions and increased motivation to attain the goal and changing behaviour (Elliot, Shell, Bouas Henry, & Maier, 2005; Escalas & Luce, 2003; Vasquez & Buehler, 2007).

Armitage and Reidy (2008) suggest that the mechanism by which process simulations lead to increased intentions is through increased perceived behavioural control or self-efficacy. Process simulations focus on rehearsing the means to engage in the behaviour in the future and provide individuals with greater perceived ability to take the relevant actions. Similarly, outcome simulations are also hypothesised to affect intentions by increasing self-efficacy. By imagining a successful and desired outcome, the actor will have greater belief in his/her ability to attain the outcome and will be more motivated to do so. The lack of effectiveness of outcome simulations in influencing intentions and behaviour observed in previous research may be attributable to a lack of information of the necessary steps required to attain the outcome (Pham & Taylor, 1999). Although the outcome simulation may make a goal seem more salient and attainable, the actor has no means or concrete plan of action to reach it. The provision of an action plan alongside an outcome mental simulation may remedy this shortcoming and lead to more effective behavioural engagement. We will examine the role of action plans and their link to increased behavioural enactment next.

Volition and implementation. One of the problems with motivational interventions is that their effects on actual behaviour have been relatively modest (Hardeman et al., 2002). The limited success of such interventions has been attributed to the comparatively weak relationship between intentions and behaviour (Armitage & Conner, 2001; Hagger & Chatzisarantis, 2009; Hagger, Chatzisarantis, & Biddle, 2002; McEachan, Conner, Taylor, & Lawton, in press). Meta-analyses of motivational interventions aimed at changing intentions have corroborated these findings, demonstrating substantially larger effects on intentions than

actual behaviour (Webb & Sheeran, 2006). These data present a problem for interventions based on motivational theories as it seems that even though people may state 'good intentions' to engage in health-related behaviour, they do not always behave in accordance with their intentions.

Solutions to this problem have been presented in the form of implemental approaches to health-related behaviour change. Heckhausen and Gollwitzer (1987) presented an action-phase model which identifies two complimentary processes that lead to action: an intentional (motivational) phase and an implemental (volitional) phase. The intentional phase encompasses the processes that lead to the formation of intentions to engage in a behaviour captured in the theory of planned behaviour by the antecedents of intention. However, while intentions to engage in health-related behaviours may be a prerequisite for behavioural engagement, they are not always sufficient. The implemental phase outlines to process of how the identification of critical cues in the environment leads to the enactment of intentions and promotes strong links between the cue and the intended action. Proponents of the action-phase model have proposed that engaging in strategies that highlight a critical situation or contingency in which the behaviour will be initiated will be effective in promoting behavioural engagement (Gollwitzer, 1990). Such strategies, known as *implementation intentions*, require people to propose and write down when and where they will enact their planned behaviour (e.g., "*if* situation *Y* occurs, *then* I will perform response *Z*!"). Such exercises promote behavioural engagement by promoting increased accessibility of the critical cue in the environment (Aarts, Dijksterhuis, & Midden, 1999) and developing a link in memory between the critical situation (*Y*) and the planned action (*Z*) (Brandstätter, Lengfelder, & Gollwitzer, 2001). When intentions are furnished with implementation intentions, behavioural initiation is more efficient, guided by automatic processes, and less vulnerable to lapses in memory or reliant on conscious processing.

Augmenting intentions with implementation intentions has shown to be effective in promoting behavioural engagement in numerous health-related contexts such as cancer screening (Orbell, Hodgkins, & Sheeran, 1997; Prestwich et al., 2005), physical activity (Chatzisarantis, Hagger, & Thøgersen-Ntoumani, 2008; Luszczynska, 2006; Prestwich, Lawton, & Conner, 2003; Sniehotta et al., 2005), dietary behaviours (Chapman, Armitage, & Norman, 2009; Hagger & Montasem, 2009; Prestwich, Ayres, & Lawton, 2008; Prestwich, Perugini, & Hurling, 2009; Scholz, Schuz, Ziegelmann, Lippke, & Schwarzer, 2008), rehabilitation from surgery (Orbell & Sheeran, 2000), and alcohol consumption (Murgraff, Abraham, & McDermott, 2007). In addition, changes in behaviour as a result of forming implementation intentions have been shown to be independent of intentions (Orbell et al., 1997; Sheeran & Orbell, 1999). Instead, there is evidence that the effect of implementation intention manipulations on behaviour is mediated by the extent to which participants form plans to enact their intentions (Scholz et al., 2008). Such mediators demonstrate the mechanism underlying the effect and also the importance of compliance with the implementation intention technique (Michie, 2008).

An integrated approach. Integration of theoretical approaches is becoming increasingly important in health psychology and behavioural medicine in order to reduce redundancy and, most importantly, increase the complementarity of different approaches (Hagger, 2009). The action phase model serves as a basis for integrated approaches to health-related behaviour change by providing a framework for interventions that target the motivational and volitional phases (Schwarzer, 2008; Sheeran, Webb, & Gollwitzer, 2005). In such approaches, motivational strategies to increase intentions are complemented by implementation intentions that assist in the successful conversion of intentions into actual behaviour. The mechanism behind this combined intervention approach is that an intention is more likely to be enacted if an action plan has been formed to facilitate its execution. There is some, albeit limited, precedence for an integrated approach. Adopting motivational

intervention strategies in conjunction with implementation intentions has resulted in synergistic effects on taking reducing dietary fat (Prestwich et al., 2008) and participating in physical activity (Milne, Orbell, & Sheeran, 2002; Prestwich et al., 2003). Importantly, significant interaction effects were found such that the combination of motivational and implemental strategies was more effective in promoting behavioural engagement than each strategy alone (Prestwich et al., 2008; Prestwich et al., 2003). Furthermore, analysis of concurrent psychological measures demonstrated that the motivational interventions changed intentions, but the implementation intention intervention had no such effects. These studies not only demonstrate the combined effects of the intervention but also isolate the components that affect change in the behaviour (Michie, Rothman, & Sheeran, 2007). In the present study we adopted an integrated approach using motivational (outcome mental simulations) and volitional (implementation intentions) strategies to reduce alcohol consumption in excess of guideline limits on single occasions among undergraduates. It was expected that the combination of strategies would be more effective in reducing alcohol consumption than each of the strategies alone.

Overview of the Present Study

This article reports a theory-based intervention aimed at changing university undergraduates' alcohol consumption so that it is within guideline limits. The intervention adopted a randomized controlled two-factor design with a one-month follow-up period and was administered to a large sample of undergraduate students using an online communication method. Participants received the intervention via email and were directed via web-browser links to an online questionnaire followed by text-format intervention materials. Participants were randomized to one of four intervention conditions according to their university department membership. The four conditions reflected combinations of motivational and implemental behaviour-change components based on the action phase model. Specifically, participants received an outcome mental simulation or implementation exercise, a combination

of the two, or neither. All participants received measures of motivation, intention, and the theory of planned behaviour components. The key dependent variables were self-reported number of units of alcohol consumed over the one-month follow-up period and the number of occasions where participants consumed more than twice the daily guideline amounts, or number of heavy episodic drinking occasions. These outcomes have been identified as the most salient and frequently-cited in intervention alcohol intervention research in this population (Carey et al., 2009). We tested the effects of the intervention on the dependent alcohol-consumption variables using intention to treat with last observation carry-forward (LOCF, Shao & Zhong, 2004) and complete-case analyses.

It was hypothesised that participants receiving both the mental simulation and implementation intention manipulations would report drinking fewer units of alcohol and fewer heavy episodic drinking occasions in the one-month follow-up period. In keeping with previous interventions that have adopted designs integrating these two theory-based intervention components (Milne et al., 2002; Prestwich et al., 2008; Prestwich et al., 2003), it was also expected that participants allocated to the combined mental simulation and implementation intention condition would exhibit fewer units of alcohol consumed and fewer heavy episodic drinking occasions than either condition alone. Consistent with previous studies, we hypothesised that the implementation intention condition would have no impact on the psychological antecedents of intention, intentions, or motivation to keep alcohol drinking within guideline limits (Orbell et al., 1997; Sheeran, Milne, Webb, & Gollwitzer, 2005). However, we expected that the outcome mental simulation component would have significant effects on post-intervention attitudes, intentions, and motivation as hypothesised in theoretical accounts and previous empirical tests of mental simulations (Armitage, 2009; Pham & Taylor, 1999; Vasquez & Buehler, 2007). In addition, we anticipated that perceived behavioural control, intentions and motivation would serve to mediate the effects of the mental simulation intervention on the dependent variables. This is in keeping with previous research and theory

which suggests that the mechanism by which outcome simulations affect behaviour is via intentions and motivation (Pham & Taylor, 1999; Vasquez & Buehler, 2007).

Method

Participants

Participants were undergraduate students from 19 academic departments in the University of [location withheld for masked peer review process]. Email invitations to participate were distributed to 2,500 eligible participants. Seven hundred and nine participants (*M* age = 20.32, *SD* = 2.50; females, n = 414, *M* age = 20.37, *SD* = 2.64; males, n = 295, *M* age = 20.26, *SD* = 2.30) consented to participate in the study and completed the online questionnaire at baseline. For the intention to treat LOCF analyses, participants completing baseline measures of the key dependent variables were included in the analysis. Seventy-one participants did not provide baseline dependent variable data (n = 47) or data for key psychological variables used as covariates (n = 24) and were eliminated yielding a final sample of 638 participants (*M* age = 20.35, *SD* = 2.51; females, n = 370, *M* age = 20.38, *SD* = 2.63; males, n = 268, *M* age = 20.30, *SD* = 2.34). For the complete-case analysis, follow-up data were collected from 311 participants, a follow-up response rate of 43.86%. Data from 73 participants were excluded due to an excessive amount of data missing at random from the follow-up sample (> 5% of responses) leaving 238 complete cases (*M* age = 20.23, *SD* = 1.80; females, n = 133, *M* age = 20.11, *SD* = 2.09; males, n = 105, *M* age = 20.38, *SD* = 1.35). The flow of participants through the intervention protocol is illustrated in Figure 1.

Design and Procedure

The study adopted a 2 (mental simulation: present vs. absent) x 2 (implementation intention: present vs. absent) between-participants design using text-format manipulations distributed by email and communicated via online methods. Participants received the intervention manipulations alongside questionnaires with an assessment-only control group that received measures but no manipulations. Participants received baseline behavioural and

psychological measures and intervention manipulations (if any) at baseline with follow-up measures collected one-month later.

Departmental heads of 32 academic departments of the University of [location withheld for masked peer review process] were initially contacted requesting permission to participate in the study. Nineteen consented to participate: American and Canadian studies, biology, biomedical sciences, business studies, computer science, economics, English studies, geography, history, humanities, institute of science and society, institute of work, health, and organizations, law, mathematical sciences, modern languages and cultures, politics and international relations, sociology and social policy, and veterinary medicine science. A cluster-randomized controlled design was adopted with the academic departments randomly allocated to one of the four intervention conditions. Randomization was conducted using a computer-generated randomization programme and the algorithm was designed to ensure approximately equal numbers of eligible participants were recruited to each group (Urbaniak, Plous, & Lestik, 2007). Electronic invitations were distributed to all undergraduate students in each department asking recipients to participate in the study. Each invitation included a uniform resource locator (URL) link to an online questionnaire specific to the allocated condition.

Participants were initially presented with an online study information page and consent form on their web browser explaining the requirements of participation and the participant's right to withdraw at any time without prejudice. Participants were informed that they were participating in a survey on health and that they would be asked to respond to some questions relating to their alcohol behaviour. They were also informed that they would be invited to participate in second survey one month later. As an incentive, participants were informed that they would be entered into a prize draw with the opportunity to win €100 if they completed both parts of the questionnaire. Participants were required to check an assent box to confirm they had read the information and consented to participate. All participants were then presented with the following introductory statement: "The World Health Organisation (WHO)

recommends that safe limits for drinking alcoholic drinks are 4 units per day for men and 3 units per day for women. Drinking above these safe limits could lead to some health conditions in the long run." Next, they were directed to an online questionnaire containing baseline study measures followed by the intervention condition(s) (if allocated) presented after the questionnaire items. The questionnaire and intervention was developed using the *Survey Monkey* online survey and questionnaire tool and was designed for ease of use with the majority of responses requiring a mouse click and a few open-ended response boxes requiring typed responses. The questionnaire spanned 12 web-browser pages. Participants were sent two reminder emails to complete their follow-up questionnaires, one in the week leading up to the one-month follow-up period and one on the day that the data was due. The email contained a URL directing them to a second online survey containing psychological measures identical to those completed at baseline as well as follow-up behavioural measures.

Intervention Manipulations

Participants randomly allocated to the intervention conditions (mental simulation only, implementation intention only, combined mental simulation and implementation intention) were presented with the following common passage based on previous research (Jackson, 2008): "Considering these [WHO] health messages, we would like you to try to keep your regular alcohol intake so that it is within recommended limits on each individual occasion or session over the next month. To help you do this we ask you to take five minutes of your time to complete the next very simple mental exercise(s)".

Mental simulation. Participants allocated to the mental simulation condition were provided with an adapted version of an outcome simulation script developed by Pham and Taylor (1999). The script was modified to make reference to the target behaviour of keeping alcohol drinking within safe limits. Participants were presented with the following instructions:

"You are now asked to visualize yourself having achieved your goal of keeping your alcohol intake to within 'safe' limits on each individual occasion or session over the next

month, and imagine how you would feel. Imagine how much effort and willpower it has taken to achieve your goal of keeping your alcohol intake to within safe limits on each occasion or session and that you have successfully managed to do it. Imagine how satisfied you will feel. It is very important that you see yourself actually keeping your alcohol intake to within 'safe' limits on each occasion or session over the next month and keep that picture on your mind. Please type in the box below how you imagine will feel if you achieve your goal of keeping your alcohol intake within 'safe' limits on each individual occasion or session over the next month."

The instructions were followed by an open-ended response box for participants to type their responses. Responses were used as a manipulation check to evaluate compliance with the intervention.

Implementation intention. We adopted an "if…then…" format for the implementation intention manipulation (e.g., Orbell et al., 1997; Sheeran & Orbell, 1999). This format has been shown to be more effective in promoting behaviour change than global formats (Chapman et al., 2009). The format permits participants to develop their own contingencies to enact their plans, but they are constrained to produce their plans in the format that has been shown to be most effective in linking environmental cues to the desired action (Oettingen, Hönig, & Gollwitzer, 2000). In addition, we also presented an example to guide participants to the types of cues to action and behavioural alternatives that they might adopt. Participants allocated to the implementation intention condition were presented with the following instructions:

"You are more likely to carry out your intention to keep your alcohol intake to within safe limits on each occasion or session if you make a decision about the time and place you will do so and how you plan to do it. Decide now when and where you will need to keep your alcohol intake to within safe limits and how you will do it. We want you to plan to keep your alcohol drinking to within safe limits on each occasion or session over the next month, paying particular attention to the specific situations in which you will implement these plans. For

example, you may find it useful to say to yourself, '*If* I am in a bar/pub drinking with my friends and I am likely to drink over the daily safe limits for alcohol, *then* I will opt for a soft drink instead of an alcoholic drink to keep within the recommended safe limits.' Please type your plans in the response box below, following the format shown in the previous example ('if… then…')."

The instructions were followed by two response boxes for participants to type their response. To guide participants in making their responses using the "if…then…" format, the word "If…" preceded the first response box and the phrase "then I will…" preceded the second box. Again responses to the open-ended questions served as a manipulation check and as an indicator of whether participants had formed an implementation intention. The order of presentation of the mental simulation and implementation intention intervention manipulations was counter-balanced for participants allocated to the combined condition.

Measures

Self-reported alcohol behaviour. Self-report measures of the primary dependent variables of number of units of alcohol consumed and number of heavy episodic ('binge') drinking occasions in the previous four weeks were taken at baseline and follow-up. To ensure participants were clear as to the definitions of terms used in the questionnaire, they were presented with a series of definitions and a pictorial reference guide illustrating the volume of different alcoholic beverages equivalent to one unit of alcohol. In the guide, one unit was clearly defined as a 10ml volume measure of alcohol, daily 'safe' limits for alcohol were defined as 4 units for men and 3 units for women, and 'binge' drinking was defined as exceeding 10 units of alcohol for men or seven units on a single occasion (Murgraff, Parrott, & Bennett, 1999). The daily 'safe' limits and 'binge' drinking definitions and pictorial reference guide appeared as a header on each online page to remind participants of the definition of a unit. Number of units of alcohol was measured via a self-report measure that prompted participants to type the number of units they consumed each week over the previous month.

Number of heavy episodic drinking occasions was measured on a self-report measure requiring participants to type how many occasions they exceeded 10 units for men or seven units for women each week over the previous four weeks. Separate response boxes were provided for each week and responses were summed to give the total units of alcohol consumed and number of heavy episodic drinking occasions for the previous four weeks. In addition, participants completed the four-item Fast Alcohol Screening Test (FAST, Hodgson, Alwyn, John, Thom, & Smith, 2002) at baseline to assess extent of alcohol misuse. This instrument has rigorously evaluated and demonstrated validity and reliability as a brief means to evaluate the extent of heavy drinking (Hodgson et al., 2002).

Psychological measures. Measures of theory of planned behaviour constructs made reference to the target behaviour ("keeping alcohol drinking within safe limits"), in the time frame of interest ("one month"), and in the context that the behaviour was to be performed ("on each individual occasion or session"). This was so the measures adhered to the boundary condition of correspondence in the theory (Ajzen, 1985). 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".

Behavioural intentions were measured via three items using six-point Likert-type scales (e.g., "I intend to keep my alcohol drinking within safe limits on each individual occasion or session over the next month") with scale anchors 1 (*extremely unlikely*) and 6 (*extremely likely*) ($\alpha = .97$). Five six-point semantic differential items were used to measure attitudes in response to the following statement: "For me, keeping my alcohol drinking within safe limits on each individual occasion or session over the next month is…" One item measured affective aspects of attitude using *enjoyable-unenjoyable* bipolar adjectives, three items tapped instrumental attitudes using the adjective pairs: *worthwhile-not worthwhile*, *useful-of no use*, and *important-*

unimportant, and one item measured moral aspects of attitudes using *good-bad* adjectives (α = .90). Subjective norms were measured on three items (e.g., "Most people who are important to me (e.g., friends, family) would want me to keep my alcohol drinking within safe limits on each individual occasion or session over the next month") on six-point Likert-type scales anchored by 1 (*disagree*) and 6 (*agree*) (α = .87). Perceived behavioural control was assessed via three items using six-point Likert-type scales (e.g., "How much personal control do you think you have in keeping your alcohol drinking within safe limits on each individual occasion or session over the next month?") with scale anchors 1 (*no control at all*) and 6 (*complete control*) (α = .88).

Participants were also asked to report their motivation toward the target behaviour on three items (e.g., "How motivated are you to keep your alcohol drinking within safe limits on each individual occasion or session over the next month") with scale anchors 1 (*not at all motivated*) and 6 (*extremely motivated*) (α = .95). Finally, participants allocated to the implementation intention condition were asked to rate the extent to which they had planned to keep their alcohol drinking with safe limits on three items (e.g., "To what extent have you figured out exactly how you might keep your alcohol drinking to within safe limits on each individual occasion or session over the next month") with scale anchors 1 (*I have no idea*) and 6 (*I have figured out exactly*) (α = .92).

Results

Preliminary Analyses

Alcohol consumption. The average baseline number of units consumed by male (per week, *M* = 15.43, *SD* = 12.37; per month, *M* = 61.73, *SD* = 49.49;) and female (per week, *M* = 9.17, *SD* = 8.72; per month, *M* = 36.70, *SD* = 34.89) participants in the current study compared favourably with the weekly number of units reported in UK national statistics for young people aged 16 to 24 (male = 18.6; females = 10.8) (Goddard, 2006). However, the percentage of male (52.1%) and female (40.3%) participants who engaged in heavy episodic drinking (10 units for

men, 7 units for women) on more than three occasions in the four week period at baseline tended to be substantially higher than those reported in national statistics in the UK (male, 26%; female, 29%) and Europe (male, 22%; female, 15%) (Hibell et al., 2004). While levels of alcohol consumption in the present sample may be similar to those in the general population, a larger proportion engaged in heavy episodic drinking. As with their age-matched counterparts, the current sample therefore represented particularly high-risk groups with respect to alcohol consumption relative to national averages in older age groups. In addition, within their own age-group, a higher percentage of participants reported engaging in heavy episodic drinking and are therefore likely to be at risk of the maladaptive outcomes of that particular pattern of alcohol consumption.

Randomization checks. Randomization checks were conducted on baseline demographic, behavioural, and psychological measures. There were no significant differences across the intervention and control groups for gender distribution, number of heavy episodic drinking occasions, and perceived behavioural control. Participants in the combined mental simulation and implementation intention condition (*M* age = 21.63, *SD* = 3.55) were significantly older than those in the other conditions (mental simulation only, *M* age = 20.34, *SD* = 2.20; implementation intention only, *M* age = 19.88, *SD* = 1.78; control, *M* age = 20.12, *SD* = 2.43), $F(1, 634) = 13.81$, $p < .01$, $\eta^2_p = .02$. Although the effect size for the age difference was small, age was included as a covariate in subsequent analyses. There were significant main effects for implementation intentions on number of alcohol units consumed (implementation intention, *M* = 50.34, *SD* = 45.94; no implementation intention, *M* = 41.90, *SD* = 38.68; $F(1, 634) = 5.29$, $p < .05$, $\eta^2_p < .01$) and intentions (implementation intention, *M* = 4.07, *SD* = 1.53; no implementation intention, *M* = 3.83, *SD* = 1.49; $F(1, 634) = 4.76$, $p < .05$, $\eta^2_p = .01$). There were also significant main effects for mental simulations on attitudes (mental simulation, *M* = 4.22, *SD* = 1.18; no mental simulation, *M* = 3.99, *SD* = 1.22; $F(1, 634) = 7.63$, $p < .05$, $\eta^2_p = .01$), subjective norms (mental simulation, *M* = 4.51, *SD* = 0.99; no mental simulation, *M* =

4.29, *SD* = 1.00; $F(1, 634) = 9.00$, $p < .01$, $\eta^2_p = .01$), and motivation (mental simulation, *M* = 3.70, *SD* = 1.42; no mental simulation, *M* = 3.47, *SD* = 1.42; $F(1, 634) = 5.021$, $p < .05$, $\eta^2_p < .01$). While the effect sizes of these differences were small (typically $\eta^2_p \leq .01$) we included baseline alcohol consumption, intentions, attitudes, subjective norms, and motivation as covariates in the main analyses to ensure that these differences did not alter the effects of the intervention. There were no other differences across the intervention groups.

Attrition checks. We also checked for differences in the key study variables between participants that remained in the study after one month and those that were lost to follow-up. A multivariate analysis of variance (MANOVA) with attrition status (remained in the study vs. lost to follow-up) and intervention condition as independent variables and age, number of units of alcohol consumed, number of heavy episodic drinking occasions, intentions, attitudes, subjective norms, perceived behavioural control, and motivation as dependent variables revealed no significant main effect for attrition status or attrition x intervention condition interaction effect.

Manipulation checks. Participants' written responses to the mental simulation and implementation intention exercises were content analyzed to ensure that they had engaged sufficiently in the exercises. For the mental simulation manipulation, responses were coded according to whether participants specified outcomes and reported their feelings of satisfaction relating to keeping their alcohol intake within safe limits. The majority of participants reported their feelings regarding achieving the outcome of drinking within guideline limits. Only five participants did not report an outcome or recorded an inappropriate outcome. These were considered non-compliers but were included in subsequent analyses in their original randomized groups to provide a conservative estimate of intervention effectiveness. For the implementation manipulation, responses were coded as to whether participants wrote down a contingency alongside the "If…" prompt and a viable alternative next to the "Then I will…" prompt. Responses to the first prompt included relevant situations such as being in bars or

nightclubs and responses to the second prompt included strategies such as switching to non-alcoholic alternatives such as water or soft-drinks, coming up with reasons for not drinking, pacing oneself and stretching drinks over a longer period of time, or taking sufficient money to buy only a few drinks. The behaviours listed exhibited a high degree of congruence with behaviours identified as means to minimize harm from alcohol in previous research (Larimer et al., 2007; Ray, Turrisi, Abar, & Peters, 2009). The majority of participants reported adequate contingencies and plans according to instructions. Fourteen participants' data did not report a response to the prompts that was considered adequate. These included blank responses or statements that indicated an implementation intention had not been formed. As before, these participants were classified as non-compliers and remained in the analysis in the groups to which they were originally randomized.

The planning scale administered to participants allocated to the implementation intention manipulation was used to check the extent to which participants had formed plans to keep their alcohol intake to within safe limits. Average planning scores were significantly greater than the mid-point (3.5) on the scale (M = 3.98, SD = 1.47), $t(1,197) = 4.56$, $p < .01$, d = 0.65. Self-reported planning was significantly lower in the implementation intention only (M = 3.78, SD = 1.57) compared with the combined condition (M = 4.29, SD = 1.23), $t(1,197)$ = 2.41, $p < .05$, d = 0.34.

Main Analysis

Effect of interventions on behaviour. Data were analysed using both intention to treat LOCF and complete-case analyses. Specifically, a series of 2 (mental simulation: present vs. absent) x 2 (implementation intention: present vs. absent) analyses of covariance (ANCOVA) were conducted on the main dependent variables of self-reported units of alcohol and number of heavy episodic drinking occasions consumed in the month after the intervention. FAST scores, self-reported units of alcohol or number of heavy episodic drinking occasions, intentions, attitudes, subjective norms, motivation, and participants' age measured at baseline

were included as covariates. Intention to treat analyses revealed significant main effects for mental simulation on number of units of alcohol consumed ($F(1, 227) = 6.15$, $p < .05$, $\eta^2_p = .01$) and number of heavy episodic drinking occasions ($F(1, 227) = 4.27$, $p < .05$, $\eta^2_p = .01$). Participants receiving the mental simulation condition reported significantly fewer units consumed ($M = 42.11$, $SD = 42.54$) and heavy episodic drinking occasions ($M = 3.24$, $SD = 4.34$) relative to those that did not receive the manipulation (units of alcohol, $M = 47.77$, $SD = 41.84$; heavy episodic drinking occasions, $M = 3.81$, $SD = 4.87$). There was no significant main effect for implementation intentions or mental simulation x implementation intention interaction effect in either analysis. Similarly, complete-case analyses revealed significant main effects for mental simulation on number of units of alcohol consumed ($F(1, 227) = 9.26$, $p < .01$, $\eta^2_p = .04$) and number of heavy episodic drinking occasions ($F(1, 227) = 4.65$, $p < .05$, $\eta^2_p = .02$) with participants receiving the mental simulation condition reporting significantly fewer units consumed ($M = 32.11$, $SD = 33.06$) and heavy episodic drinking occasions ($M = 2.47$, $SD = 5.51$) compared to those that did not receive the manipulation (units of alcohol, $M = 43.29$, $SD = 41.81$; heavy episodic drinking occasions, $M = 3.56$, $SD = 5.24$). As in the previous analysis, there were no significant main effects for implementation intentions or mental simulation x implementation intention interactions. The mean number of units of alcohol and heavy episodic drinking occasions for both sets of analyses by intervention group are reported in Table 1.

Effects of intervention on psychological variables. The effects of the intervention on the psychological variables at follow-up was tested using a 2 (mental simulation: present vs. absent) x 2 (implementation intention: present vs. absent) multivariate ANCOVA with intention, attitude, subjective norms, perceived behavioural control, and motivation as the dependent variables and their respective baseline measures and FAST scores as covariates. The analysis revealed no significant main or interaction effects. The lack of significant effects of the intervention on the psychological variables precluded tests of mediation of the effects of the

intervention on behavioural dependent variables by the theory of planned behaviour and motivational variables (Baron & Kenny, 1986). Mean scores on the psychological variables for each group are reported in Table 1

Sub-group analyses. Further analyses were conducted to examine whether the intervention was more effective for participants with relatively high levels of alcohol consumption and numbers of heavy episodic drinking occasions at baseline. The sample was therefore coded according to upper and lower tertiles on the average number of units of alcohol consumed and number of heavy episodic drinking occasions at baseline (Altman & Bland, 1994). MANOVAs revealed that the upper and lower tertile groups were characterized by significantly higher numbers of units of alcohol consumed and heavy episodic drinking occasions, and lower levels of intentions, attitudes, subjective norms, perceived behavioural control, and motivation in the upper third relative to the lower third for the tertile split based on units of alcohol (Wilks' $\Lambda = 0.19$, $F(7, 133) = 82.20$, $p < .01$, $\eta^2_p = .81$) and number of heavy episodic drinking occasions (Wilks' $\Lambda = 0.28$, $F(7, 174) = 63.52$, $p < .01$, $\eta^2_p = .72$).

Next, we conducted a 2 (mental simulation: present vs. absent) x 2 (implementation intention: present vs. absent) x 2 (baseline number of alcohol units: high vs. low) ANCOVA controlling for FAST scores, number of units of alcohol consumed, intentions, attitudes, subjective norms, motivation, and age measured at baseline[2]. The analysis revealed a significant three-way interaction ($F(1, 132) = 4.22$, $p = .05$, $\eta^2_p = .03$). We probed this interaction by conducting separate two-way ANCOVAs for high and low numbers of units consumed at baseline. The analyses revealed no significant main or interaction effects for the sub-group consuming low numbers of units at baseline (all Fs < 1.00). There was, however, significant main effects for mental simulations ($F(1, 72) = 12.75$, $p < .01$, $\eta^2_p = .15$) and implementation intentions ($F(1, 72) = 6.17$, $p < .05$, $\eta^2_p = .08$), and a significant interaction effect ($F(1, 72) = 4.46$, $p < .05$, $\eta^2_p = .06$) for the sub-group consuming high numbers of units

at baseline. A focused contrast revealed a significant effect with the combined mental simulation and implementation intention group exhibiting significantly fewer units consumed at follow-up relative to the other intervention groups and the control group ($F(1, 75) = 21.12$, $p < .01$, $\eta^2_p = .22$)[3]. The ANCOVA with number of heavy episodic drinking occasions revealed no significant three-way interaction effect.

Discussion

This aim of the present study was to evaluate the effectiveness of a theory-based intervention to reduce the consumption of alcohol in excess of guideline limits in a single session among undergraduate students using an integrated motivational and volitional strategy. A randomized controlled design was adopted using mental simulation and implementation intention intervention strategies alone or synergistically to change alcohol consumption and number of heavy episodic drinking occasions in a one-month follow-up period. It was hypothesised that the combined mental simulation and implementation intention intervention would lead to greater reductions in the dependent variables than either strategy alone. The intervention was distributed via email and delivered using an online communication method with intervention materials presented after baseline questionnaire measures. Data were analysed using intention to treat LOCF and complete-case analyses.

Results revealed significant reductions in alcohol consumption in terms of number of units of alcohol consumed and number of heavy episodic drinking occasions in the one-month follow-up period. Participants receiving an outcome mental simulation exhibited a decrease in the numbers of units of alcohol consumed and heavy episodic drinking occasions one month later but no effects for the implementation intention strategy or the interaction of the two strategies. Although the effect sizes were larger for the complete-case analyses relative to the intention to treat analyses, the pattern of effects was identical. Follow-up sub-group analyses indicated that the intervention was more effective among participants who had higher levels of alcohol consumption at baseline. Specifically, participants in the upper third for baseline

alcohol consumption that received both mental simulation and implementation intention interventions reported consuming significantly fewer units than those in the other intervention conditions. The interventions had no effects on motivation or variables from the theory of planned behaviour.

The most prominent finding in the present investigation was the pervasive effect of mental simulations on alcohol consumption and heavy episodic drinking. The adoption of an *outcome* mental simulation technique is a unique feature of this research. The literature examining the efficacy of mental simulations to change behaviour has tended to find much larger effects for *process* mental simulations relative to outcome simulations (Armitage & Reidy, 2008; Pham & Taylor, 1999). Reasons proposed for this is that process simulations tend to focus on the rehearsal of concrete behavioural steps that bring a person closer to attaining their behavioural goal or outcome. Such rehearsal tends to increase self-efficacy and perceptions of control over behavioural engagement. However, there is literature demonstrating that imagining successful future outcomes promotes increased motivation and behavioural engagement (Andersson & Moss, in press; Elliot et al., 2005; Vasquez & Buehler, 2007). The mechanism behind these simulations is that perceptions of prospective success in goal achievement and control over outcomes are promoted through the visualization future outcome attainment. Again, this is proposed to influence self-efficacy beliefs. While outcome mental simulations were effective in reducing alcohol consumption and heavy episodic drinking occasions in the present study, we did not find evidence for any mediation by psychological variables such as motivation and perceived behavioural control and were therefore unable to corroborate the proposed mechanism.

Based on Heckhausen and Gollwitzer's (1987) action phase model, we also proposed that an intervention that included a mental simulation component to increase motivation to reduce alcohol consumption in excess of guideline limits and an implementation intention component to match appropriate cues and alternatives to behavioural enactment would have

synergistic effects on alcohol consumption. The hypothesised interaction effect was based on two premises. First, people with positive intentions to change their behaviour to attain a goal or outcome formed in the motivational phase often do not convert their intentions into actual behaviour due to memory lapses (Orbell et al., 1997) or vaguely-conceived plans to enact the behaviour (Sheeran, Milne et al., 2005). Second, cues and contingencies stated in action plans during the volitional phase would only be relevant if an individual had formed intentions to attain their goal (Milne et al., 2002).

However, we found only limited support for the interaction effect in the present study. Overall, mental simulations was the only intervention component to have an effect on reducing units of alcohol consumed and number of heavy episodic drinking occasions. It was only when we segregated the sample according to levels of alcohol consumption that we found a significant interaction effect. Among participants with high levels of alcohol consumption, the combination of mental simulations and implementation intentions lead to a significant decrease in units of alcohol consumed relative to the either component alone and the control group. The interaction corroborates previous health-related research adopting combined motivational and volitional intervention components to change behaviour (Milne et al., 2002; Prestwich et al., 2008; Prestwich et al., 2003). Our finding is unsurprising as people with high alcohol intake are likely to have lower levels of motivation and intention to keep their drinking within guideline limits, a fact that was corroborated in our classification analysis. Therefore, it is likely that an intervention strategy that induces people to simulate the expected outcome of reducing alcohol intake compliments an implementation intention strategy in reducing alcohol consumption in groups with high alcohol intake and relatively low intentions to change.

An advantage of the present investigation is that it has high levels of ecological validity and provides evidence of a high likelihood of success if the intervention were to be implemented on a wider scale across colleges and universities. We used existing networks (i.e., email circulars to University departments) to recruit participants and administer the

intervention materials at minimal cost in terms of materials and human resources. This demonstrates the practical feasibility and cost effectiveness of the intervention. Furthermore, the open-ended manipulation checks indicated that most participants allocated to the mental simulation, implementation intention, or combined intervention groups engaged with the exercises and were therefore identified as compliant. Although a small minority were coded as non-compliers, we retained them in our analyses to provide a conservative estimate of the efficacy of the intervention. This demonstrates that naturally-occurring levels of non-compliance do not appear to affect the efficacy of the intervention in changing behaviour.

Limitations and Future Directions

The present study has a number of strengths. A rigorous randomized controlled design was adopted with a clear theoretical basis for the intervention strategies. In addition, the design permitted the evaluation of motivational and intervention strategies alone or synergistically relative to an assessment-only control group. This is important as it permits a clearer evaluation as to whether interventions targeting each phase in the action phase model (Heckhausen & Gollwitzer, 1987) are effective independently or interact to produce lower alcohol consumption. In addition, present analyses provided relatively conservative estimates of the power of the intervention because participants that did not comply with the intervention were included in follow-up analysis in the same group to which they were randomized. In addition, a minority of participants reported that they did not drink alcohol at all at baseline (7.3%). These participants were also included in analyses in the groups to which they were originally randomized to ensure that naturally-occurring levels of abstinence were accounted for and did not affect the efficacy of the intervention. Finally, we used an intention to treat analytic strategy to test the effectiveness of the intervention despite the relatively high levels of participant drop-out. In summary, the adoption of an appropriate theoretical basis, careful study design, and conservative analytic methods illustrates the value of the present study to

understand the intervention components that lead to behaviour change in the context of alcohol consumption in undergraduate students.

However, it would be remiss to omit potential limitations of the present study and how they might be overcome in future. First, neither intervention strategy had an effect on motivation, intentions, or other psychological variables from the theory of planned behaviour. The lack of effects precluded a search for mediators of the intervention effects on the alcohol-related dependent variables. For the outcome mental simulation manipulation, we expected that the manipulation would have significant effects on perceived behavioural control, intentions, and motivation, as suggested by previous research (Armitage & Reidy, 2008; Taylor et al., 1998), and that these variables would mediate the effect of the intervention on the alcohol-related outcome measures. It is possible that the effects of outcome mental simulations on alcohol behaviour may not be due to changes in any of these variables. For example, it may be that the effect would be through the enhancement of positive emotion, outcome expectations or self-efficacy beliefs measured in accordance with Bandura's (1977) conceptualization of the construct. Visualizing future success is likely to lead to positive affect and increased expectancies that the behaviour will result in desirable outcomes. For the implementation intention manipulation, our hypothesis that the intervention would have no effects on intentions or other psychological variables was supported by the present data. This is because implementation intentions are proposed to affect the enactment of intentions in the volitional phase rather than changing intentions itself. In addition, although we demonstrated that participants receiving the implementation intention manipulation scored highly on a planning scale, the scale was not administered to all participants so no group-level comparisons or mediation analyses could be conducted as recommended in other research (Luszczynska, 2006). A priority for future investigation would be the inclusion of mediators of the effects of the intervention on outcome variables.

Second, the present research adopted a one-month follow-up period. This is a relatively brief follow-up period to evaluate the effectiveness of an intervention. This precludes equivocal judgement that the current intervention has the propensity bring about long-lasting changes in alcohol consumption. Interventions adopting one of the component intervention strategies adopted in the present study have typically adopted short-range predictions of behaviour ranging from one or two weeks (Armitage, 2007; Chapman et al., 2009) to one month (Chatzisarantis et al., 2008; Prestwich et al., 2008). Fewer interventions have examined long-range behavioural prediction, but those that have demonstrate high-levels of adherence in health related behaviours (De Vet, Oenema, Sheeran, & Brug, 2009; Luszczynska, 2006), including alcohol consumption (Murgraff et al., 2007). Furthermore, no study adopting integrated motivational and implemental interventions has examined behaviour change over a follow-up period of greater than five weeks (Milne et al., 2002; Prestwich et al., 2003). Investigators should seek to provide longer-range follow-up in investigations using combined motivational and volitional interventions based on the action phase model to evaluate whether these relatively simple, cost-effective interventions achieve lasting change on behavioural outcomes in research on alcohol intake.

Third, the present study did not include a no-measurement control group. The control group received baseline and follow-up psychological and behavioural measures relating to alcohol consumption, termed an ‘assessment-only’ control group. There was therefore potential for the introduction of the measures to act as an intervention in itself and affect change in drinking behaviour. The role of such measures in affecting behaviour change is a topic of debate in the literature on behavioural medicine with studies reporting significant effects of questionnaire measures on psychological and behavioural outcomes (Godin, Sheeran, Conner, & Germain, 2008) and others reporting no effects (O'Sullivan, Orbell, Rakow, & Parker, 2004). Researchers should seek to replicate the current intervention and include a no-measurement

control group to rule out the potential effect of measures to change alcohol consumption (McCambridge, 2009).

Finally, while we adopted measures of behaviour as the dependent variable at baseline and follow-up, the measures relied on participants to self-report their alcohol intake and number of heavy episodic drinking occasions. Considerable emphasis has been placed on the adoption of behavioural dependent variables to evaluate the effectiveness of interventions and experimental manipulations (Decade of Behavior, 2009). However, the adoption of self-report measures has considerable potential to introduce systematic error into data sets (Baumeister, Vohs, & Funder, 2007). While we took care to adopt self-report measures that have demonstrated satisfactory predictive validity in previous studies (Cooke et al., 2007; Murgraff et al., 2001; Norman & Conner, 2006), it must be acknowledged as a limitation. The literature on alcohol-related interventions and compliance is replete with self-report behavioural measures as objective measures of alcohol compliance are elusive and costly in terms of equipment and human resources. The development of easily administered objective measures of alcohol intake for the normal population similar to measures of expired carbon monoxide for smoking or pedometers for walking other than observation would be a very useful tool for use in future research.

Conclusions

The present study demonstrated the efficacy of outcome mental simulation as an intervention strategy to reduce alcohol consumption and heavy episodic drinking among undergraduate students. Practically, psychologists, health professionals, and University health services could implement such interventions in a relatively easy, cost-effective way by embedding links to the outcome simulation strategy into emails and other online materials that are distributed to students. This would be useful during University induction weeks and early in the University year before students are socialised into ‘typical’ student drinking patterns (Carpenter et al., 2008). Current findings also indicate that combining implementation

intention with outcome mental simulations will be particularly effective among undergraduates with high alcohol intake. It may, therefore, be useful to include an implementation intention exercise alongside the outcome simulation strategy in online materials. However, it may be more effective if the combined intervention is targeted at those with high alcohol intake. University health services which offer alcohol screening enabling them to identify students with high alcohol intake are recommended to present materials containing the combined intervention exercises for maximum effectiveness.

References

Aarts, H., Dijksterhuis, A., & Midden, C. (1999). To plan or not to plan? Goal achievement or interrupting the performance of mundane behaviors. *European Journal of Social Psychology, 29*, 971-979.

Abraham, C., & Michie, S. (2008). A taxonomy of behavior change techniques used in interventions. *Health Psychology, 27*, 379-387.

Abraham, C., Southby, L., Quandte, S., Krahe, B., & van der Sluijs, W. (2007). What's in a leaflet? Identifying research-based persuasive messages in European alcohol-education leaflets. *Psychology & Health, 22*, 31-60.

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., & Manstead, A. S. R. (2007). Changing health-related behaviors: An approach based on the theory of planned behavior. In K. van den Bos, M. Hewstone, J. de Wit, H. Schut & M. Stroebe (Eds.), *The scope of social psychology: Theory and applications* (pp. 43-63). New York: Psychology Press.

Altman, D. G., & Bland, J. M. (1994). Statistics Notes: Quartiles, quintiles, centiles, and other quantiles. *British Medical Journal, 309*.

Andersson, E. K., & Moss, T. P. (in press). Imagery and implementation intention: A randomised controlled trial of interventions to increase exercise behaviour in the general population. *Psychology of Sport and Exercise*.

Armitage, C. J. (2007). Effects of an implementation intention-based intervention on fruit consumption. *Psychology & Health, 22*, 917-928.

Armitage, C. J. (2009). Is there utility in the Transtheoretical Model? *British Journal of Health Psychology, 14*, 195-210.

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.

Armitage, C. J., & Reidy, J. G. (2008). Use of mental simulations to change theory of planned behaviour variables. *British Journal of Health Psychology, 13*, 513-524.

Bailer, J., Stubinger, C., Dressing, H., Gass, P., Rist, F., & Kuhner, C. (2009). Increased prevalence of problematic alcohol consumption in university students. *Psychotherapie Psychosomatik Medizinische Psychologie, 59*, 376-379.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*, 191-215.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173-1182.

Baumeister, R. F., Vohs, K. D., & Funder, D. C. (2007). Psychology as the science of self-reports and finger movements: Whatever happened to actual behavior? *Perspectives on Psychological Science, 2*, 396-403.

Bernstein, J. A., Bernstein, E., & Heeren, T. C. (2010). Mechanisms of change in control group drinking in clinical trials of brief alcohol intervention: Implications for bias toward the null. *Drug and Alcohol Review, 29*, 498-507.

Bewick, B. M., Trusler, K., Barkham, M., Hill, A. J., Cahill, J., & Mulhern, B. (2008). The effectiveness of web-based interventions designed to decrease alcohol consumption - A systematic review. *Preventive Medicine, 47*, 17-26.

Borsari, B., Murphy, J. G., & Barnett, N. P. (2007). Predictors of alcohol use during the first year of college: Implications for prevention. *Addictive Behaviors, 32*, 2062-2086.

Brandstätter, V., Lengfelder, A., & Gollwitzer, P. M. (2001). Implementation intentions and efficient action initiation. *Personality and Social Psychology Bulletin, 81*, 946-960.

Carey, K. B., Scott-Sheldon, L. A. J., Elliott, J. C., Bolles, J. R., & Carey, M. P. (2009). Computer-delivered interventions to reduce college student drinking: A meta-analysis. *Addiction, 104,* 1807-1819.

Carpenter, R., Fishlock, A., Mulroy, A., Oxley, B., Russell, K., Salter, C., Williams, N., & Heffernan, C. (2008). After 'Unit 1421': an exploratory study into female students' attitudes and behaviours towards binge drinking at Leeds University. *Journal of Public Health, 30,* 8-13.

Chapman, J., Armitage, C. J., & Norman, P. (2009). Comparing implementation intention interventions in relation to young adults' intake of fruit and vegetables. *Psychology and Health, 24,* 317-332.

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.

Chatzisarantis, N. L. D., Hagger, M. S., & Thøgersen-Ntoumani, C. (2008). Effects of implementation intentions and self concordance on health behavior. *Journal of Applied Biobehavioral Research, 13,* 198-214.

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.

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.

DCSF. (2008). *Youth alcohol action plan*. London: Department of Children, Schools and Families and The Stationary Office.

De Vet, E., Oenema, A., Sheeran, P., & Brug, J. (2009). Should implementation intentions interventions be implemented in obesity prevention: The impact of if-then plans on

daily physical activity in Dutch adults. *International Journal of Behavioral Nutrition and Physical Activity, 6*, 11.

Decade of Behavior. (2009, January 1, 2000). The decade of behavior 2000-2010. Retrieved August 1, 2009, from http://www.decadeofbehavior.org

Department of Health. (2008, January 1, 2008). Alcohol: Know your limits. Retrieved September 1, 2009, from http://units.nhs.uk/

Department of Health. (2009a). *Annual Report of the Chief Medical Officer 2008*. London: Department of Health.

Department of Health. (2009b). *Safe. Sensible. Social. The next steps in the National Alcohol Strategy*. London: Home Office.

Drinkaware. (2009, October 15, 2009). Alcohol and you - Students. Retrieved November 1, 2009, from http://www.drinkaware.co.uk/alcohol-and-you/students

Elliot, A. J., Shell, M. M., Bouas Henry, K., & Maier, M. A. (2005). Achievement goals, performance contingencies, and performance attainment: An experimental test. *Journal of Educational Psychology, 97*, 630-640.

Escalas, J. E., & Luce, M. F. (2003). Process versus outcome thought focus and advertising. *Journal of Consumer Psychology, 13*, 246-254.

Gill, J. S. (2002). Reported levels of alcohol consumption and binge drinking within the UK undergraduate student population over the last 25 years. *Alcohol and Alcoholism, 37*, 109-120.

Goddard, E. (2006). *Smoking and drinking among adults, 2006. General Household Survey 2006.* London: Office for National Statistics.

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.

Gollwitzer, P. M. (1990). Action phases and mind-sets. In E. T. Higgins & R. M. Sorrentino (Eds.), *Handbook of motivation and cognition: Foundations of social behavior* (Vol. 2, pp. 53-92). New York: Guildford Press.

Hagger, M. S. (2009). Theoretical integration in health psychology: Unifying ideas and complimentary explanations. *British Journal of Health Psychology, 14*, 189-194.

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

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.

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., & Montasem, A. (2009). Implementing intentions to drink a carbohydrate-electrolyte solution during exercise. *Journal of Sports Sciences, 27*, 963-974.

Hall, P. A., & Fong, G. T. (2010). Temporal Self-regulation Theory: Looking forward. *Health Psychology Review, 4*, 83-92.

Hardeman, W., Johnston, M., Johnston, D. W., Bonetti, D., Wareham, N. J., & Kinmonth, A. L. (2002). Application of the theory of planned behaviour change interventions: A systematic review. *Psychology and Health, 17*, 123-158.

Health Challenge Wales and National Union of Students Wales. (2009, October 19, 2009). Don't let your drinking define you. Retrieved November 1, 2009, from http://www.nus.org.uk/en/News/News/Alcohol-and-the-Student-Experience/

Heckhausen, H., & Gollwitzer, P. M. (1987). Thought contents and cognitive functioning in motivational and volitional states of mind. *Motivation and Emotion, 11*, 101-120.

Hibell, B., Andersson, B., Bjarnason, T., Ahlström, S., Balakireva, O., Kokkevi, A., & Morgan, M. (2004). *The ESPAD report 2003: Alcohol and other drug use among students in 35 European countries*. Stockholm, Sweden: Pompidou Group at the Council of Europe.

Hodgson, R. J., Alwyn, T., John, B., Thom, B., & Smith, A. (2002). The fast alcohol screening test. *Alcohol and Alcoholism, 37*, 61-66.

Jackson, K. M. (2008). Heavy episodic drinking: Determining the predictive utility of five or more drinks. *Psychology of Addictive Behaviors, 22*, 68-77.

Jenkins, R. J., McAlaney, J., & McCambridge, J. (2009). Change over time in alcohol consumption in control groups in brief intervention studies: systematic review and meta-regression study. *Drug and Alcohol Dependence, 100*, 107-114.

Larimer, M. E., Lee, C. M., Kilmer, J. R., Fabiano, P. M., Stark, C. B., & Geisner, I. M., et al. (2007). Personalized mailed feedback for college drinking prevention: A randomized clinical trial. *Journal of Consulting and Clinical Psychology, 75*, 285−293.

Luszczynska, A. (2006). An implementation intentions intervention, the use of a planning strategy, and physical activity after myocardial infarction. *Social Science & Medicine, 62*, 900-908.

Martinez, J. A., Sher, K. J., & Wood, P. K. (2008). Is heavy drinking really associated with attrition from college? The alcohol-attrition paradox. *Psychology of Addictive Behaviors, 22*, 450-456.

McCambridge, J. (2009). Research assessments: instruments of bias and brief interventions of the future? *Addiction, 104*, 1311-1312.

McEachan, R. R. C., Conner, M. T., Taylor, N., & Lawton, R. J. (in press). Prospective prediction of health-related behaviors with the Theory of Planned Behavior: A meta-analysis. *Health Psychology Review*.

Michie, S. (2008). What works and how? Designing more effective interventions needs answers to both questions. *Addiction, 103*, 886-887.

Michie, S., Johnston, M., Abraham, C., Lawton, R., Parker, D., & Walker, A. (2005). Making psychological theory useful for implementing evidence based practice: A consensus approach. *Quality and Safety in Health Care, 14*, 26-33.

Michie, S., Johnston, M., Francis, J., Hardeman, W., & Eccles, M. (2008). From theory to intervention: Mapping theoretically derived behavioural determinants to behaviour change techniques. *Applied Psychology-an International Review-Psychologie Appliquee-Revue Internationale, 57*, 660-680.

Michie, S., Rothman, A., & Sheeran, P. (2007). Current issues and new directions in Psychology and Health: Advancing the science of behavior change. *Psychology and Health, 22*, 249-253.

Milne, S. E., Orbell, S., & Sheeran, P. (2002). Combining motivational and volitional interventions to promote exercise participation: Protection motivation theory and implementation intentions. *British Journal of Health Psychology, 7*, 163-184.

Mundt, M. P., Zakletskaia, L. I., & Fleming, M. F. (2009). Extreme college drinking and alcohol-related injury risk. *Alcoholism-Clinical and Experimental Research, 33*, 1532-1538.

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.

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.

Murgraff, V., Parrott, A., & Bennett, P. (1999). Risky, single-occasion drinking among young people - Definition, correlates, policy and intervention: A broad overview of the research findings. *Alcohol and Alcoholism, 34*, 3-14.

Nelson, T. F., Xuan, Z. M., Lee, H., Weitzman, E. R., & Wechsler, H. (2009). Persistence of heavy drinking and ensuing consequences at heavy drinking colleges. *Journal of Studies on Alcohol and Drugs, 70*, 726-734.

Norman, P., Armitage, C. J., & Quigley, C. (2007). The theory of planned behavior and binge drinking: Assessing the impact of binge drinker prototypes. *Addictive Behaviors, 32*, 1753-1768.

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.

O'Sullivan, I., Orbell, S., Rakow, T., & Parker, R. (2004). Prospective research in health service settings: Health psychology, science and the 'Hawthorne' effect. *Journal of Health Psychology, 9*, 355-359.

Oettingen, G., Hönig, G., & Gollwitzer, P. M. (2000). Effective self-regulation of goal attainment. *International Journal of Educational Research, 33*, 705-732.

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.

Orbell, S., Hodgkins, S., & Sheeran, P. (1997). Implementation intentions and the Theory of Planned Behavior. *Personality and Social Psychology Bulletin, 23*, 945-954.

Orbell, S., & Sheeran, P. (2000). Motivational and volitional components in action initiation: A field study of the role of implementation intentions. *Journal of Applied Social Psychology, 30*, 780-797.

Pham, L. B., & Taylor, S. E. (1999). From thought to action: Effects of process- versus outcome-based mental simulations on performance. *Personality and Social Psychology Bulletin, 26,* 250-260.

Plant, M. A., Plant, M. L., Miller, P., Gmel, G., & Kuntsche, S. (2009). The social consequences of binge drinking: A comparison of young adults in six European countries. *Journal of Addictive Diseases, 28,* 294-308.

Prestwich, A., Ayres, K., & Lawton, R. (2008). Crossing two types of implementation intentions with a protection motivation intervention for the reduction of saturated fat intake: A randomized trial. *Social Science & Medicine, 67,* 1550-1558.

Prestwich, A., Conner, M., Lawton, R., Bailey, W., Litman, J., & Molyneaux, V. (2005). Individual and collaborative implementation intentions and the promotion of breast self-examination. *Psychology & Health, 20,* 743-760.

Prestwich, A., Lawton, R., & Conner, M. (2003). The use of implementation intentions and the decision balance sheet in promoting exercise behaviour. *Psychology and Health, 10,* 707-721.

Prestwich, A., Perugini, M., & Hurling, R. (2009). Can the effects of implementation intentions on exercise be enhanced using text messages? *Psychology & Health, 24,* 677-687.

Ray, A. E., Turrisi, R., Abar, B., & Peters, K. E. (2009). Social-cognitive correlates of protective drinking behaviors and alcohol-related consequences in college students. *Addictive Behaviors, 34,* 911-917.

Rosenthal, R., & Rosnow, R. L. (1985). *Contrast analysis: Focused comparisons in the analysis of variance*. New York: Cambridge University Press.

Scholz, U., Schuz, B., Ziegelmann, J. R., Lippke, S., & Schwarzer, R. (2008). Beyond behavioural intentions: Planning mediates between intentions and physical activity. *British Journal of Health Psychology, 13,* 479-494.

Schwarzer, R. (2008). Models of health behaviour change: Intention as mediator or stage as moderator? *Psychology and Health, 23*, 259-263.

Shao, J., & Zhong, B. (2004). Last observation carry-forward and last observation analysis. *Statistics in Medicine, 22*, 2429-2441.

Sheeran, P., Milne, S., Webb, T. L., & Gollwitzer, P. M. (2005). Implementation intentions and health behaviours. In M. Conner & P. Norman (Eds.), *Predicting health behaviour: Research and practice with social cognition models* (2nd ed., pp. 276–323). Buckingham: Open University Press.

Sheeran, P., & Orbell, S. (1999). Implementation intentions and repeated behaviour: Augmenting the predictive validity of the theory of planned behaviour. *European Journal of Social Psychology, 29*, 349-369.

Sheeran, P., Webb, T. L., & Gollwitzer, P. M. (2005). The interplay between goal intentions and implementation intentions. *Personality and Social Psychology Bulletin, 31*, 87-98.

Sniehotta, F. F., Scholz, U., Schwarzer, R., Fuhrmann, B., Kiwus, U., & Voller, H. (2005). Long-term effects of two psychological interventions on physical exercise and self-regulation following coronary rehabilitation. *International Journal of Behavioral Medicine, 12*, 244-255.

StudentHealth Ltd. (2005, August 1, 2005). Alcohol and drinking - current daily guidelines for sensible drinking. Retrieved September 1, 2009, from http://www.studenthealth.co.uk/advice/advice.asp?adviceID=28

Tait, R. J., & Hulse, G. K. (2003). A systematic review of the effectiveness of brief interventions with substance using adolescents by type of drug. *Drug and Alcohol Review, 22*, 337-346.

Taylor, S. E., Pham, L. B., Rivkin, I., & Armor, D. A. (1998). Harnessing the imagination: Mental simulation and self-regulation of behavior. *American Psychologist, 53*, 429-439.

Thombs, D. L., Olds, R. S., Bondy, S. J., Winchell, J., Baliunas, D., & Rehm, J. (2009). Undergraduate drinking and academic performance: A prospective investigation with objective measures. *Journal of Studies on Alcohol and Drugs, 70,* 776-785.

Tripodi, S. J., Bender, K., Litschge, C., & Vaughn, M. G. (2010). Interventions for Reducing Adolescent Alcohol Abuse A Meta-analytic Review. *Archives of Pediatrics & Adolescent Medicine, 164,* 85-91.

Urbaniak, G. C., Plous, S., & Lestik, M. (2007, January 1, 1997). Research randomiser. Retrieved March 1, 2008, from www.randomizer.org

Vasquez, N. A., & Buehler, R. (2007). Seeing future success: Does imagery perspective influence achievement motivation? *Personality and Social Psychology Bulletin, 33*, 1392-1405.

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.

Wechsler, H., Dowdall, G. W., Maenner, G., Gledhill-Hoyt, J., & Lee, H. (1998). Changes in binge drinking and related problems among American college students between 1993 and 1997. *Journal of the American College of Health, 47*, 57–68.

Footnotes

[1]Numerous guideline limits for alcohol exist. For the purpose of the present study we adhered to guideline limits published by StudentHealth (StudentHealth Ltd., 2005) and the UK government (Department of Health, 2009a) of 4 units for men and 3 units for women. In addition, we defined heavy episodic ('binge') alcohol drinking as 10 units in one session for men and 7 for women.

[2]Sample sizes were 64 for the sub-group consuming low numbers of units of alcohol at baseline (control condition, n = 14; implementation intention only condition, n = 25; mental simulation condition only, n = 15; combined implementation intention and mental simulation condition, n = 10), 83 for the sub-group consuming high numbers of units of alcohol at baseline (control condition, n = 32; implementation intention only condition, n = 25; mental simulation condition only, n = 21; combined implementation intention and mental simulation condition, n = 5), 83 for the sub-group with low frequency of heavy episodic drinking occasions at baseline (control condition, n = 23; implementation intention only condition, n = 30; mental simulation condition only, n = 16; combined implementation intention and mental simulation condition, n = 14), and 99 for the sub-group with high frequency of heavy episodic drinking occasions at baseline (control condition, n = 38; implementation intention only condition, n = 24; mental simulation condition only, n = 29; combined implementation intention and mental simulation condition, n = 8).

[3]The focused contrast tested the efficacy of the combined intervention condition relative to the mental simulation only, implementation intention only, and control conditions. The combined mental simulation and implementation intention condition was allocated a weight of -3 and the mental simulation only, implementation intention only, and control conditions each allocated a weight of +1 according to Rosenthal and Rosnow's (1985) recommendations. Univariate follow-up tests supported the focused contrast finding for participants with high numbers of units of alcohol consumed at baseline. Specifically, fewer

units of alcohol were consumed at follow up in the combined mental simulation and implementation intention condition (M = 44.33, SD = 35.73) relative to the mental simulation only (M = 71.29, SD = 33.10; $F(1, 23) = 6.16$, $p < .05$, $\eta^2_p = .21$), implementation intention only (M = 74.43, SD = 34.70; $F(1, 23) = 9.67$, $p < .01$, $\eta^2_p = .29$), and control (M = 88.55, SD = 43.78; $F(1, 35) = 11.80$, $p < .01$, $\eta^2_p = .25$) conditions.

Table 1

Baseline-Adjusted Means and Standard Errors of Psychological and Behavioural Variables by Condition

Variable	Intervention condition							
	Implementat--ion Intention		Mental simulation		Combined		Control	
	M	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*
Intention[a]	4.12	1.51	4.08	1.59	4.21	1.44	3.85	1.44
Attitude[a]	4.13	1.25	3.93	1.34	4.15	1.44	4.05	1.09
Subjective norms[a]	4.32	1.07	4.41	0.92	4.34	0.84	4.18	0.78
PBC[a]	4.73	1.02	4.71	1.21	4.80	1.02	4.75	0.95
Motivation[a]	3.60	1.45	3.65	1.43	3.85	1.23	3.52	1.34
Alcohol units[b]								
Intention to treat analysis[c]	45.78	1.23	43.64	1.20	43.45	1.56	47.49	0.96
Complete-case analysis[a]	40.31	2.56	33.81	2.73	30.41	4.02	46.26	2.34
Heavy drinking episodes[d]								
Intention to treat analysis[c]	4.00	0.27	3.26	0.21	3.40	0.27	3.62	0.17
Complete cases analysis[a]	3.91	0.49	2.59	0.52	2.36	0.77	3.21	0.44

Note. Statistics reported are baseline-adjusted means and standard deviations. PBC = Perceived behavioural control; [a]Cell n's = 68, 60, 29, 81. [b]Self-reported number of units of alcohol. [c]Cell n's = 149, 155, 96, 238. [d]Self-reported frequency of occasions where alcohol consumption exceeded 10 units for men and 7 units for women.

Figure 1. Participant flow diagram.