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Processing of alcohol-related health-threat in at-risk drinkers:

An online study of gender-related self-affirmation effects

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ABSTRACT

Aims: Defensiveness in response to threatening health-information related to excessive alcohol consumption prevents appropriate behaviour change. Alternatively, self-affirmation may improve cognitive-affective processing of threatening information, thus contributing to successful self-regulation.

Method: Effects of an online self-affirmation procedure were examined in at-risk university student drinkers. Participants were randomly assigned to a self-affirmation (writing about personally-relevant values) or control task (writing about values relevant to another person) prior to presentation of alcohol-related threatening information. Assessment of prosocial feelings (e.g. 'love') after the task, served as a manipulation check. Generic and personalised information regarding the link between alcohol-use and cancer was presented, followed by assessment of perceived threat, message avoidance and derogation. Page dwell-times served as indirect indices of message engagement. Alcohol consumption and intention to drink less were assessed during the first online session and at one-week and one-month follow-up.

Results: Although, self-affirmation resulted in higher levels of prosocial feelings immediately after the task, there was no effect on behaviour in the self-affirmation group. Effects on intention were moderated by gender, such that men showed *lower* intention immediately after self-affirmation, but this increased at one-week follow-up. Women's intention to reduce consumption in the self-affirmation group *reduced* over time. Trend-level effects on indices of derogation and message acceptance were in the predicted direction only in men.

Conclusions: It is feasible to perform self-affirmation procedures in an online environment with at-risk drinkers. However use of internet-based procedures with this population may

give rise to (gender-dependent) effects that are substantially diluted compared to lab-based experiments.

SHORT SUMMARY

An online self-affirmation procedure was used with the aim of reducing defensiveness to alcohol-related health-threats. Reduced defensiveness was found, but only in men, who showed small effects on threat-engagement and message derogation. Therefore, effects seen in the lab may be diluted when online procedures are used, particularly in at-risk drinkers.

INTRODUCTION

Autobiographical cohesion is achieved through cognitive processes that maintain consistency between beliefs and behaviours. When important beliefs are challenged, there is a tendency to respond defensively (Chaiken, 1992) so that 'self-integrity' is maintained (Steele, 1988). However, while these processes ensure that self-worth is protected in the face of psychological threats, such homeostasis comes at a cost (Cohen and Sherman, 2014). For example, rigidly adhering to dysfunctional beliefs (e.g. believing that health advice on smoking or heavy drinking is exaggerated or is irrelevant to oneself) may inhibit self-regulatory behaviour. Such beliefs survive despite contradictory evidence through processes such as denial, avoidance and derogation of opposing information (Harris and Napper, 2005). These defensive strategies likely undermine the effects of public-health messages when these threaten 'the self.' Indeed, interventions aiming to modify alcohol risk-appraisals through threatening messages are ineffective at changing drinking-related intentions and behaviours (Sheeran et al., 2013).

Although alcohol abuse occurs across the lifespan, high-risk drinking is especially prevalent in adolescents and college students. Curbing excessive drinking among college students is a public health priority in a number of Western countries (O'Malley and Johnston, 2002). One approach involves making the negative consequences of excessive drinking more salient using brief feedback-based interventions (Miller et al., 2013). The efficacy of these interventions might be improved by integrating procedures that counteract the defensive processes outlined above.

Strategies involving recall of, and reflection upon personally-meaningful values can 'affirm' the self as capable, adaptive and moral. These strategies appear to counteract defensiveness, enabling appropriate processing of self-threatening information (Cohen and

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Sherman, 2014). Effects of *self-affirmation* have been examined in studies of alcohol-related

threatening health information (Armitage et al., 2011, Armitage et al., 2014, Meier et al.,

2015, Harris and Napper, 2005, Klein and Harris, 2009, Klein et al., 2011). These studies

tend to support self-affirmation theory, showing for example, increased subjective fear and

intention to reduce consumption following threatening health information in self-affirmed

participants, although these effects may depend on participants' habitual level of drinking

(Scott et al., 2013, Harris and Napper, 2005, Klein and Harris, 2009).

Other boundary conditions may determine the effectiveness of self-affirmation

(Critcher et al., 2010) although these are currently poorly understood. For example, given that

pro-social feelings mediate the effects of self-affirmation, and such feelings are proposed to

be more easily aroused in women (Crocker et al., 2008), gender might moderate the effects of

self-affirmation on threat-processing. Clarification of gender-effects is especially important

given the differential risks/harms men and women experience from alcohol (Nolen-

Hoeksema, 2004).

Furthermore, establishing the effects of self-affirmation using web-based methods is

important because of their potential application in eHealth and mHealth (Webb et al., 2010),

which are likely to benefit from theoretically-informed intervention-components (Epton et al.,

2013). We are not aware of any previous studies that have specifically examined self-

affirmation using web-based procedures in hazardous/harmful-drinkers.

In the current randomised-controlled experiment, we examine the effects of an online

self-affirmation task on drinking behaviour and intention (primary outcomes), and on

processing of threatening alcohol-related health-information (secondary outcomes) in at-risk

drinkers. Our aim was to determine whether effects typically observed in laboratory studies -

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which tend to support self-affirmation theory - are also seen in a less tightly-controlled online experiment.

In addition, given the role of prosocial feelings outlined above, and the proposal that because of these, self-affirmation effects may be moderated by gender (Crocker et al., 2008), the influence of gender was examined across all outcomes. A number of previous relevant studies included only women (Harris and Napper, 2005, Klein and Harris, 2009, Klein et al., 2011), while those that included both men and women did not examine gender-effects (Meier et al., 2015, Armitage et al., 2011, Scott et al., 2013).

METHOD

A randomised controlled, between-subjects, repeated-measures experimental design was used. All procedures were conducted during three online experimental 'sessions' (session-one; one-week; one-month follow-up). The study was approved by the Research Ethics Committee of University College London.

Participants

Participants were recruited via online social media sites used by university students from across the UK. Inclusion criteria were assessed during an online screening. These were: current UK university student; regular harmful- or hazardous-drinking defined as ≥ 4 or ≥ 5 alcohol 'units'/ day (1 unit=8 grams of ethanol) at least four times/week for women and men respectively - in other words, drinking more than the UK government-recommended daily maximum of 3 and 4 units for women and men respectively on more days than not; consumed alcohol in the past week; age 18-35; fluency in English. Participants were also required to

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supply a verifiable UK university email address (ending '.ac.uk'), which could only be submitted once during online screening. Individual participants' responses were also required to be linked to a unique IP address. Those completing one-month follow-up were rewarded with a £7 shopping voucher.

Procedure

Eligible participants were emailed a link to the online experiment. Informed consent was provided online. The survey programme Qualitrics (Provo, Utah, USA) was used to randomise participants, and administer all tests. Blocked randomisation was not used. All participants completed the same sequence of tasks/measures, differing only in the instructions provided for self-affirmation/control tasks.

Demographics, baseline-drinking and drinking-history were assessed first. Additional exploratory measures followed, typically requiring no more than 2 min to complete (e.g. relating to affective response to alcohol images and stages of change), but will not be discussed further here. For the experimental manipulation we used commonly-employed self-affirmation and control tasks (McQueen and Klein, 2006): participants selected one of 11 values that they judged to be the most personally-important (self-affirmation), or least personally-important, but important to another student (control), and wrote about these in a free-text box. Participants then rated how much love, joyfulness, connectedness and affection they felt (Crocker et al., 2008).

Generic threatening information was followed by rating of perceived threat; personalised threatening information was then presented, and another threat rating completed. Ratings of message derogation, avoidance and intention to reduce alcohol-use were then obtained. At the end of session-one, participants were given the opportunity to click on a link

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to a UK National Health Service (*NHS)* site containing information about alcohol and drinking in moderation.

Participants were reminded by email to complete the one-week and one-month assessment of alcohol consumption (TLFB) and intention to reduce consumption.

Materials and Measures

Alcohol Use and History

The Timeline-Followback (TLFB, 7-day; (Sobell and Sobell, 1992), a reliable and valid measure of alcohol consumption, which has been validated in an online student sample (Pedersen et al., 2012), was used. An infographic illustrating the alcohol content of various beverages was provided to guide participants' estimates. The TLFB was completed before the self-affirmation/control task during session-one and repeated at one-week and one-month.

The Alcohol Use Disorders Identification Test (AUDIT) (Babor et al., 2001), a reliable online instrument in young adults (Thomas and McCambridge, 2008) gauged harmful-drinking. Participants additionally indicated age of first drink ('more than just a sip'), age of regular drinking and family history of 'alcohol-difficulties,' as defined by a list of indices of alcohol-use disorder.

Self-Affirmation and control writing tasks

The self-affirmation task involved writing about one of 11 personally-important values (Sherman et al., 2000). Participants wrote about how the value influenced past behaviour/attitudes, and how it guided everyday behaviour. Participants in the control condition identified the value of *least* personal importance and wrote about why this value would be important to another student.

Participants rated feelings of 'love,' 'connectedness,' 'affection,' and 'joy' on a 0 (not at all) to 100 (extremely) sliding scale (Cronbach's α: 0.897). Since prosocial feelings are expected to be higher in self-affirmed individuals, these ratings were used as a manipulation-check. Compliance with task instructions and task-engagement were indirectly assessed using a word-count on the writing tasks.

Threatening information

Two types of information comprised the generic threat: prose and infomercial. The prose was a 203-word outline of the link between alcohol-consumption and oral/pharyngeal cancers based on information from the UK *NHS* website on health conditions (http://www.nhs.uk/Conditions; see supplementary information). This was followed by a 30 second infomercial graphically depicting the role of alcohol in cancer (www.reducemyrisk.tv). After this, participants provided a rating of how personally-threatening they found the generic information (prose plus infomercial).

Personalised threatening information took the form of a *percentage increase* in the risk of oral/pharyngeal cancers (Turati et al., 2013), determined from participants' gender and alcohol-consumption (session-one TLFB): "Based on the information you provided about your gender and alcohol consumption ….at your current level of alcohol consumption your risk of mouth and/or throat cancer is increased by at least [....] %." Participants again rated how personally-threatening they found this information. Given that epidemiological data (Turati et al., 2013) was only available for those drinking ≥10.5 drinks (UK alcohol-units), participants indicating lower consumption in the previous week (n=47) did not receive personalised feedback.

Intention to reduce consumption

Participants rated the statement, "I will cut down on the amount of alcohol I drink in the next 7 days:" 1=strongly disagree; 9=strongly agree (Harris and Napper, 2005).

Message derogation, avoidance and acceptance

Message derogation was assessed using items from a previous study (Jessop et al., 2009). Participants were asked to respond in relation to the *entirety of the information* that they received (personalised and generic) on a nine-point scale. That is, they responded to the question: "Now, thinking about all of the information you have been provided with (the written information, the video and your personal risk of mouth and/or throat cancer), please rate each of the following statements from 1=strongly disagree to 9=strongly agree. Participants first rated the statement "The information about the link between alcohol and cancer was overblown;" then "The message tried to manipulate my feelings." Message avoidance was assessed via rating of the statement: "My initial reaction was to try and not think about the information" (Jessop et al., 2009). Message engagement was assessed indirectly via page dwell-times for prose, video and personalised threatening information, equivalent to the reading-time measure used in previous self-affirmation studies (Reed and Aspinwall, 1998, Klein and Harris, 2009).

Perceived threat

The level of threat experienced after generic and personalised threatening information was assessed on seven-point scales (1=not at all threatening; 7=very threatening) in response

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respectively, to the questions: "Thinking about the written information and informational video about the link between alcohol and cancer, how personally threatening did you find the information?" and "Thinking about the information about your personal risk of mouth and/or throat cancer due to your alcohol consumption, how personally threatening did you find that information?"

'Accuracy' of responses

At the end of the one-month follow-up, participants were asked to indicate how 'accurately' they responded to questions across the experiment. The instructions acknowledged that tiredness and distractions from other tasks may have affected the accuracy of their responses. This was rated on a 0='not at all accurate' to 100='very accurate' scale and examined in relation social desirability, as assessed using the short-form (13-item) Marlowe-Crowne scale (Reynolds, 1982). A strong correlation between accuracy ratings and Marlowe-Crowne scores might suggest socially desirable responding whereas weak associations would increase confidence in the accuracy ratings.

Data analysis

Data were examined for outliers, defined as values ≥3 SD from the mean. Such values were replaced with one plus the largest non-outlying value, except for page dwell-times of ≥100s which were considered spurious and removed. Such adjustments are reflected in the degrees of freedom reported in the statistical analyses.

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Between-group differences in baseline characteristics were assessed using independent samples t-tests. Group and Gender effects on message avoidance, derogation, and threat processing were examined using univariate ANOVA. Repeated measures ANOVA was used to analyse the effects of Group and Gender on behaviour (TLFB) and intention. The α value was 0.05. Significant interactions were followed up with post-hoc, pair-wise, Bonferroni-corrected tests. Categorical data were analysed using Chi square. Two-tailed test were used, and where appropriate, corrected p values are reported. Tests were checked for sphericity and inequality of variance. Adjusted statistical values (including degrees of freedom) are reported where appropriate.

In common with most internet-based 'intervention' studies (Eysenbach, 2005), there was a substantial drop-off in participation between the first session (n=528; see sample characteristics in Table 1) and one-week (remaining sample=69.7%: control, n=190; Self-Affirmation, n=178) and one-month follow-up (remaining=59.3%: control, n=158; Self-Affirmation, n=155). There were also occasional failures to record responses, although few variables were affected . On balance, given the amount of missing data resulting from attrition by one-month, list-wise analysis of the existing data was considered preferable to replacement strategies.

Total word-count and number of personal pronouns used in the self-affirmation and control tasks were determined using the Linguistic Inquiry and Word Count programme (Pennebaker et al, 2007).

Data are reported as Mean $\pm$ Standard Deviation except where indicated. All statistical analyses were conducted using SPSS (Version 22) for Windows.

RESULTS

Demographics and alcohol consumption

Participant characteristics are presented in Table 1[1]. Randomisation achieved equivalence in the full range of baseline alcohol measures. As expected, men consumed more alcohol in the preceding week than women [$t(526)=5.84$, $p<0.001$]. There were no other significant differences between groups or gender.

Self-affirmation manipulation check.

Self-affirmed participants wrote more (91.50 ± 82.77 words) than non-affirmed controls (74.24 ± 53.76 words) [$t(419.50)=2.81$, $p=0.005$, $d=0.25$] and used a greater number of first-person pronouns (15.02 ± 8.45) than non-affirmed participants (9.08 ± 6.57) [$t(468.87)=8.95$, $p<0.001$, $d=0.78$].

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[1] The characteristics of participants who only completed session one (n=215) were compared to those who completed the entire experiment (n=313). Those completing one month follow-up were slightly older (20.97 ± 2.70 years) than session one completers (20.11 ± 2.39 years; [$t(514.45)=3.265$, $p=0.001$]). No other baseline difference would survive Bonferroni correction.

As expected, self-affirmation was associated with higher levels of prosocial/positive

feelings (love, connectedness, affection, joy; (Crocker et al., 2008). Since the effect of Group

was the same for these four feelings (all were significantly higher in the self-affirmation

group, p<0.001), a single composite value was calculated (self-affirmation group: 49.80$\pm$

25.22; controls: 27.80 $\pm$ 25.82) [t(525)[2]=9.88, p<0.001, d=0.86][3].

Behavioural outcomes

Alcohol consumption

Men consumed more alcohol [session-one TLFB: $F(1,309)=25.572$, $\eta_p^2=0.076$,

p<0.001], and both groups (control and self-affirmation) showed reduced consumption over

time (session-one, one-week, one-month; [$F(2,618)=37.951$,p<0.001, $\eta_p^2=0.109$]; Figure 1).

However, there was no main effect of Group [$F(1,309)=2.181$, p=0.141], and no significant

interactions involving Gender or Group [F values ≤0.572, p values ≥0.565].

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[2] There was a failure to record 'connectedness' and 'affection' for one participant (self-affirmation group).
[3] There was no difference in prosocial feelings between men (38.53 $\pm$ 28.29) and women (37.92 $\pm$ 27.41) [t(525)=0.249, p>0.8)].

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Information-seeking

Overall, 21.21% of participants clicked on the link to immediately receive information about alcohol's health effects at the end of the experiment. Among women, 26.14% in control group, and 18.71% in the self-affirmation group clicked on the link [$\chi^2(1)$=2.304, p=0.161]. Among men, 21.6% in the control group and 26.12% in the self-affirmation group clicked on the link [$\chi^2(1)$=0.665, p=0.446].

Intention to reduce alcohol consumption

There were no main effects of Time [F(2,616)[4]=0.63, p=0.531], Group [F(1, 308)=0.27,p=0.606] or Gender [F(1,308)=2.00, p=0.159]. There were however, significant two-way Time x Group [F(2, 616)=3.19, p=0.042, η_p^2=0.010] and Time x Gender interactions [F(2, 616)= 5.51, p=0.004, η_p^2=0.018] as well as a three-way Time x Gender x Group interaction [F(2, 616)=5.711, p=0.003, η_p^2=0.018). Post-hoc Bonferroni-corrected tests compared self-affirmed with control participants at each level of Gender and Time, and effects at session-one, one-week and one-month at each level of Group and Gender, in a pair-wise manner. Somewhat unexpectedly, this showed a trend toward *lower* intention to reduce consumption in self-affirmed compared to non-affirmed men at session-one [t(140)=1.87, p=0.051]. However, considering change across time, while men in the control group showed a non-significant decrease between session-one and one-week, self-affirmed men showed an increase in intention to reduce consumption during the same interval [t(66)=3.08, p=0.002], an effect that was sustained (at trend-level) at one-month (compared to session-one; t(66)=1.91, p=0.075; Figure 2).

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[4] There was a failure to record intention for one participant (control at one-week).

Among women there was no significant difference between self-affirmed and non-affirmed controls in intention at any time-point. However, unlike the increase seen in men, self-affirmed women, but not controls, showed a *decrease* in intention, at one-month compared to session-one [t(87)=3.56, p=0.002] and one-week [t(87)=3.125, p=0.039] (Figure 2).

Defensiveness and perceived threat

For the first message-derogation measure (link was overblown), there was a main effect of Gender [F(1,524)=8.09, p=0.005, η_p^2=0.015], such that men's derogation ratings in the control (4.95 $\pm$ 1.69) and self-affirmation (4.89 $\pm$ 1.66) groups were higher than women's (control: 4.41 $\pm$ 1.71; self-affirmation: 4.60 $\pm$ 1.64). However, there was no effect of Group [F(1,524)=0.18, p=0.670] and no Group x Gender interaction [F(1,524)=0.70, p=0.404].

The second measure of message-derogation (manipulated feelings) showed no main effects of Gender [F(1,524)=1.78, p=0.183] or Group [F(1, 524)=0.31, p=0.577] but did show a significant Gender x Group interaction [F(1,524)=4.75, p=0.030, η_p^2=0.009] (Figure 3). Post-hoc Bonferroni-corrected comparisons suggested that underlying this effect was a trend towards lower message derogation in self-affirmed *versus* non-affirmed men [t(234)=1.85, p=0.065].

For perceived threat, there was a main effect of Threat-type (generic versus personalised), with higher perceived threat in response to personalised information [F(1,477)[5]=15.28, p=0.001, η_p^2=0.031]. There was also a trend-level interaction between Threat-type and Gender [F(1,477)=3.74, p=0.054, η_p^2=0.008], with men rating personalised

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[5] Personalised threatening information was only provided to participants who consumed ≥10.5 units in the past week (control group: n=257; self-affirmed : n=224). There were two spurious page dwell-time values (i.e. >100s) for personalised threatening information.

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information as more threatening than generic information [t(223)=4.03; p<0.001]. However,

there was no main or interaction effect involving Group [F values ≤ 2.95, p values ≥0.1].

Message engagement: dwell-times on threatening information pages

Men and women spent similar amounts of time on the prose threat page [F(1,

513)[6]=0. 80, p=0.371] and there was no effect of Group [F(1, 513)=0.23, p=0.634]. However,

there was a Gender x Group interaction [F(1,513)=4.89, p=0.027], which, as depicted in

Figure 4, appeared to be driven by longer page dwell-times among self-affirmed, compared to

non-affirmed men. Post-hoc Bonferroni-corrected comparison confirmed this, although the

effect was at trend level [t(230)=1.73, p=0.085]. There appeared to be an opposite pattern in

women, although there was no statistical difference between the groups (p=0.196).

For the personalised threatening information, there was a main effect of Gender on

page dwell-times [F(1, 472)[4]=6.10, p=0.014], such that men remained on the personalised

information page for longer (10.63 $\pm$ 7.64 s) than women (8.97 $\pm$ 6.52 s). However, there was

no effect of Group [F(1,472)=0.39, p=0.531] and no Group x Gender interaction

[F(1,472)=1.03, p=0.310].

The infomercial was 'viewed' for an average of 36.66 s $\pm$ 20.57[7]. There was no effect

of Group [F(1, 502)[8]=0.00, p=0.969] or Gender[F(1,506)=0.43, p=0.512] and no Group x

Gender interaction [F(1,506)=0.00, p=0.977].

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[6] There were 11 spurious prose page dwell-time values (n=7, control; n=4, self-affirmation group).
[7] 73% of participants viewed the infomercial for ≥30s.
[8] There were 22 spurious infomercial page dwell-time values (n=15 control; n=7 self-affirmation).

Accuracy of responses

Participants rated the 'accuracy' of their responses at 80.62 ± 15.86 (first session),

79.96 ± 14.88 (one-week) and 82.52 ± 15.04 (one-month). These were only weakly

correlated with social desirability (Marlow-Crowne scale scores; 6.10 ± 2.69): r values

≤ 0.143 (p values ≥ 0.024). There was no effect of Gender or Group on Marlow-Crowne

scores (F values ≤ 0.275, p values > 0.5). A trend-level interaction between Gender and Group

was found [$F(1,524)=2.97$, p=0.086), although post-hoc test were not significant (p values

≥ 0.132).

DISCUSSION

This study examined the effects of self-affirmation on drinking behaviour, intention

and health-threat processing in high-risk university students. It builds on related work in three

significant ways. Firstly, we purposively sampled high-risk drinkers. Secondly, we examine

moderation by gender, a neglected area in self-affirmation research. Finally, the experiment

was conducted entirely online. Our primary findings were that self-affirmation had no effect

on behaviour and that effects on intention were moderated by gender. Secondarily, we found

gender-moderated effects of self-affirmation on threat processing, with suggestive (small,

trend-level) effects in men. Although the latter are in line with self-affirmation theory, the

absence of (or paradoxical) effects in women was not expected. However, it should be noted

that the modest retention rate complicates the interpretation of follow-up data on intention

and behaviour. Accordingly, threat processing effects found on session-one are likely to be

more reliable than effects on intention and behaviour.

Our study specifically recruited high-risk drinkers. In line with this goal, previous

week drinking-levels were high (~33.5 and ~24.5 units/week for men and women

respectively) and substantially higher than previous studies examining self-affirmation in relation to alcohol-outcomes. On the basis of previous studies, showing that theory-consistent effects of self-affirmation were only evident among students drinking the equivalent ≥14 units/week, irrespective of gender (Scott et al., 2013, Harris and Napper, 2005), similar effects might have been expected here. However, other studies have found that moderate-, as opposed to high-risk student drinkers show positive effects of self-affirmation (Klein and Harris, 2009) or have found positive effects in *low-risk* (non-student) drinkers (Armitage et al., 2011). Vast differences in participant characteristics between studies therefore contribute to continued uncertainty about the conditions under which self-affirmation is effective (i.e. produces desirable effects on behaviour, intention and threat processing). Students are a particularly high-risk group, and the current study consisted of particularly high average AUDIT scores/TLFB-drinking level. As such our findings may reflect sample characteristics, and indicate an upper limit of risky-drinking beyond which self-affirmation becomes less effective (or even counter-productive, at least in women).

The apparently selective (albeit small) positive effect on message engagement (dwell-time on the prose page) and on one of the derogation measures in men was not expected. Crocker and colleagues (see also Armitage and Rowe, 2011) showed that prosocial feelings, such as love, explained the relationship between self-affirmation and acceptance of threat (Crocker et al., 2008). They suggested that this relationship may be stronger in women, potentially driving stronger self-affirmation effects among women. However, we found no evidence for this: like Crocker et al (2008), we found large differences between groups in prosocial feelings, but no difference between men and women.

Effects on intention were complex. Men in the self-affirmation group initially (immediately after self-affirmation) had *lower* intention to reduce alcohol compared to non-affirmed men. However, self-affirmed men also showed an (almost statistically-significant)

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increase in intention to reduce consumption from session-one to one-week. Since there was

no pre-task assessment of intention it is impossible to determine whether men in the self-

affirmation group had lower baseline intention or suffered an acute paradoxical effect of self-

affirmation, recovering at one week. Similar effects of self-affirmation on intention (i.e.

lower intention levels shortly after self-affirmation compared to control task) have been

reported previously, although as in the current study, these did not adversely affect behaviour

(Reed and Aspinwall, 1998). Temporal effects on intention in women seem clearer, but, in

the opposite-to-expected direction. While this was reflected neither in *group differences* in

intention at any time-point, nor in drinking behaviour, this finding did conform to a pattern of

seemingly opposing effects in men and women. These appeared, at least partially, to drive the

Gender x Group interactions on message derogation and prose-threat page dwell-times.

Perhaps the most significant difference between this and previous alcohol-self-

affirmation studies, is the use of web-based experimentation. Whilst this approach can

generate concerns about participant-engagement and reliability of responses various

indicators suggest that overall, participants in the current study provided genuine responses

and engaged seriously with the experiment. Firstly, the pattern of responses on ratings of

prosocial emotions (Crocker et al., 2008), our primary manipulation check, were in line with

predictions, indicating that the procedure was acutely effective and responses were similar to

previously published studies of lab-based procedures. Secondly, page dwell-times for

different types of threatening information showed the expected pattern of engagement given

the amount of information presented: infomercial>prose>personalised threat. For example,

the mean dwell-time for the infomercial (>36s), given its duration (30s) suggests that on

average, participants viewed it in its entirety before moving to the next page. In addition

since university students read up to ~8 words/sec during skim reading (Hewitt and Brett,

2007), the average dwell-time for the prose-threat (17 s), is consistent with at least low-level

processing of an average of ~65% of the text. Finally, participants' self-judged accuracy of responses were high and did not correlate strongly with social desirability. Since there are no particular demand characteristics associated with the anonymous online responding in this study, participants should have felt free to respond truthfully to the accuracy questions. Overall, these findings suggest that self-affirmation procedures can feasibly be tested online, although effects may be constrained by sample characteristics (Bernstein et al., 2016) or technical features of the self-affirmation procedure.

Our experiment contained potentially therapeutically-active components (e.g. monitoring of alcohol-use, education about consequences) and the findings indicate that self-affirmation may produce some limited incremental efficacy in certain brief interventions, at least among men. For example, self-affirmation may increase engagement in and reduce defensive responding to alcohol-related information or feedback. Improvement in the efficacy of feedback-based intervention is important given that effect sizes are typically small, and often difficult to detect in comparison to control procedures which also contain therapeutic elements (Bernstein et al., 2010). However, the factors implicated in the widely observed improvements in drinking-outcomes in control groups (e.g. regression to the mean) may have been particularly evident in a sample of heavy drinkers - such as our participants - and contributed to an obscuring of subtle effects of self-affirmation.

In summary, our study provided some limited support for self-affirmation theory and the potential application of self-affirmation procedures in heavy student drinkers. Since theory-consistent effects were only seen in men, it is suggested that future research should more routinely examine gender effects to determine the conditions under which gender moderation emerges.

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Conflicts of interest

The authors disclosed no proprietary or commercial interest in any product mentioned or

concept discussed in this article.

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REFERENCES

Armitage C J, Harris PR, Arden MA. (2011) Evidence that self-affirmation reduces alcohol consumption: randomized exploratory trial with a new, brief means of self-affirming. *Health Psychol* **30:** 633-41.

Armitage C J, Rowe R, Arden MA, Harris PR. (2014) A brief psychological intervention that reduces adolescent alcohol consumption. *J Consult Clin Psych* **82:** 546-50.

Babor TF, Higgins-BiddleJC, Saunders JB, Monteiro MG (2001). The alcohol use disorders identification test. Guidelines for Use in Primary Care. Geneva: World Health Organization

Bernstein JA, BernsteinE, Heeren TC. (2010) Mechanisms of change in control group drinking in clinical trials of brief alcohol intervention: implications for bias toward the null. *Drug Alcohol Rev* **29:** 498-507.

BernsteinMH, Wood MD, Erickson LR. (2016) The effectiveness of message framing and temporal context on college student alcohol use and problems: a selective e-mail intervention. *Alcohol Alcohol* **51:** 106-16.

Chaiken S. (1992) Defensive processing of personally relevant health messages. *Pers Soc Psychol Bull* **18:** 669-679.

Cohen GL, Sherman DK. (2014) The psychology of change: Self-affirmation and social psychological intervention. *Ann Rev Psychol* **65:** 333-371.

Critcher CR, Dunning D, Armor DA. (2010) When self-affirmations reduce defensiveness: timing is key. *Pers Soc Psychol Bull* **36:** 947-59.

Crocker J, Niiya Y, Mischkowski D. (2008) Why does writing about important values reduce defensiveness? Self-affirmation and the role of positive other-directed feelings. *Psychol Sci* **19:** 740-747.

Epton T, Norman P, Sheeran P, et al. (2013) A theory-based online health behavior intervention for new university students: study protocol. *BMC Public Health* **13:** 107.

Eysenbach G. (2005) The law of attrition. *J Medical Internet Res* 7: e11.

Harris PR, Napper L. (2005) Self-affirmation and the biased processing of threatening health-risk information. *Pers Soc Psychol Bull* **31:** 1250-63.

Hewitt J, Brett C. (2007) The relationship between class size and online activity patterns in asynchronous computer conferencing environments. *Comput Educ* **49:** 1258-71.

Jessop D, Simmonds L, Sparks P. (2009) Motivational and behavioural consequences of self-affirmation interventions: A study of sunscreen use among women. *Psychol Health* **24:** 529-44.

Klein WM, Harris PR. (2009) Self-affirmation enhances attentional bias toward threatening components of a persuasive message. *Psychol Sci* **20:** 1463-67.

Klein WM, Harris PR, Ferrer RA, Zajac LE. (2011) Feelings of vulnerability in response to threatening messages: Effects of self-affirmation. *J Exp Soc Psychol* **47:** 1237-42.

McQueen A, Klein WM. (2006) Experimental manipulations of self-affirmation: A systematic review. *Self Identity* **5:** 289-354.

Meier E, Miller MB, Lechner WV, Lombardi N, Claborn KR, Leffingwell TR. (2015) The Inability of Self-affirmations to Decrease Defensive Bias Towards an Alcohol-Related Risk Message Among High-Risk College Students. *J Am Coll Health* **63**: 324-29.

Miller MB, Leffingwell T, Claborn K, Meier E, Walters S, Neighbors C. (2013) Personalized feedback interventions for college alcohol misuse: An update of Walters & Neighbors (2005). *Psychol Addic Behav* **27:** 909-20.

Nolen-Hoeksema S. (2004) Gender differences in risk factors and consequences for alcohol use and problems. *Clin Psychol Rev* **24:** 981-1010.

O'Malley PM, Johnston LD. (2002) Epidemiology of alcohol and other drug use among American college students. *J Stud Alcohol Supp* **14**:23-39.

Pedersen ER, Grow J, Duncan S,Neighbors C, Larimer ME. (2012) Concurrent validity of an online version of the Timeline Followback assessment. *Psychol Addict Behav* **26:** 672-77.

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Reed MB, Aspinwall LG. (1998) Self-affirmation reduces biased processing of health-risk information. *Motiv Emot* **22:** 99-132.

Reynolds WM. (1982) Development of reliable and valid short forms of the Marlowe-Crowne Social Desirability Scale. *J Clin Psychol* **38:** 119-125.

Scott JL, Brown AC, Phair JK, Westland JN, Schuz B. (2013) Self-affirmation, intentions and alcohol consumption in students: a randomized exploratory trial. *Alcohol Alcohol* **48:** 458-63.

Sheeran P, Harris PR, Epton T. (2013) Does heightening risk appraisals change people's intentions and behavior? A meta-analysis of experimental studies. *Psychol Bull* **140**: 511-43

Sherman DA, NelsonLD, Steele CM. (2000). Do messages about health risks threaten the self? Increasing the acceptance of threatening health messages via self-affirmation. *Pers Soc Psychol Bull* **26:** 1046-58.

Sobell LC, Sobell MB. (1992) Timeline follow-back. *In Allen J, Litten RZ (eds). Measuring Alcohol Consumption: Psychosocial and Biological Methods. Totowa, NJ: Humana Press, 41–72.*

Steele CM. (1988) The psychology of self-affirmation: Sustaining the integrity of the self. *Advances Exp Soc Psychol* **21:** 261-302.

Thomas BA, McCambridge J. (2008) Comparative psychometric study of a range of hazardous drinking measures administered online in a youth population. *Drug Alcohol Depen* **96:** 121-27.

Turati F, Garavello W, Tramacere I, et al. (2013) A meta-analysis of alcohol drinking and oral and pharyngeal cancers: results from subgroup analyses. *Alcohol Alcohol* **48:** 107-18.

Webb T, Joseph J, Yardley L, Michie S (2010) Using the internet to promote health behavior change: a systematic review and meta-analysis of the impact of theoretical basis, use of behavior change techniques, and mode of delivery on efficacy. *J Medical Internet Res,* 12**,** e4.

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Table 1. Demographic and alcohol-relevant variables by Gender and Group. Except 'family history,' values are *Mean ± SD*

	Control		Self-affirmation	
	Men (n=125)	Women (n=153)	Men (n=111)	Women (n=139)
Age	20.34 (2.87)	20.69 (2.94)	20.68 (3.61)	20.74 (3.24)
AUDIT	17.39 (5.00)	17.48 (5.52)	17.39 (5.25)	17.61 (6.24)
Alcohol (units)	32.24 (17.87)	24.82 (15.18)	35.40 (24.19)	24.32 (14.47)
Age first drink	14.58 (1.94)	14.57 (1.88)	14.41 (1.87)	14.25 (2.38)
Regular drinking*	17.89 (2.04)	17.84 (2.04)	17.83 (1.77)	17.80 (2.57)
Family history**	15.20%	22.22%	12.61%	18.71%

*Age at which starting drinking regularly at current level

** First degree relative with "difficulties with alcohol"

Fig.1. Past week alcohol consumption (TLFB) in units per week (Mean + SEM). Men's responses are displayed in the left panel with black diamonds linked by a black dashed line indicating the control group over time, and the grey open diamonds linked by grey dashed line, the self-affirmation group at three time-points (Session one assessment of consumption occurred *before* self-affirmation/ presentation of threatening health information; one-week; one-month). Women's responses for the two groups: control=solid square/solid line; self-affirmation=open grey square/ sold grey line.
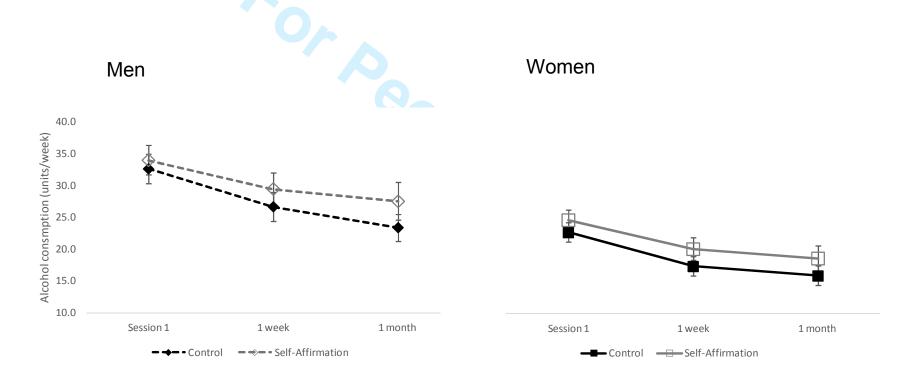
Fig. 2. Ratings of intention (to reduce drinking in the next seven days) at three time-points (the Session one assessment of intention occurred *after* the presentation of threatening health information; one-week; one-month). Symbols are Means $\pm$ SEMs.
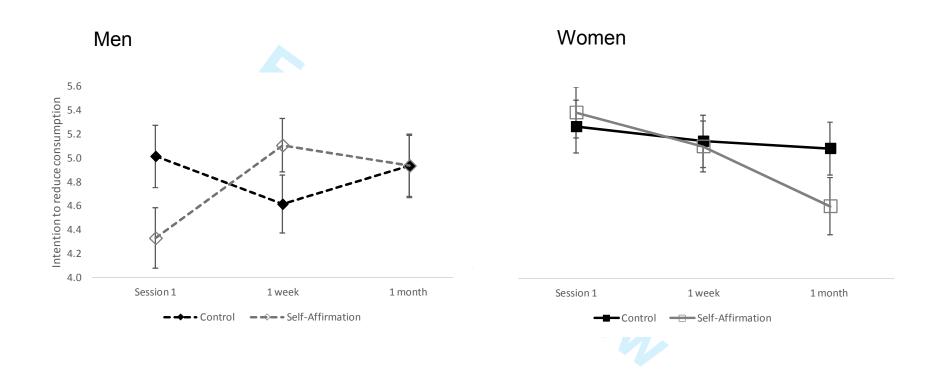
Fig. 3. Ratings of the message derogation item "the message tried to manipulate my feelings" in the control and self-affirmation groups by gender. The filled diamonds/ dashed line indicate the responses of men (Mean + SEM); solid squares/solid line, those of women.
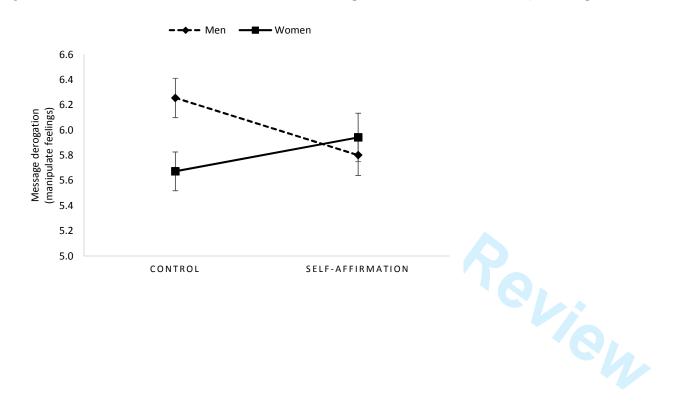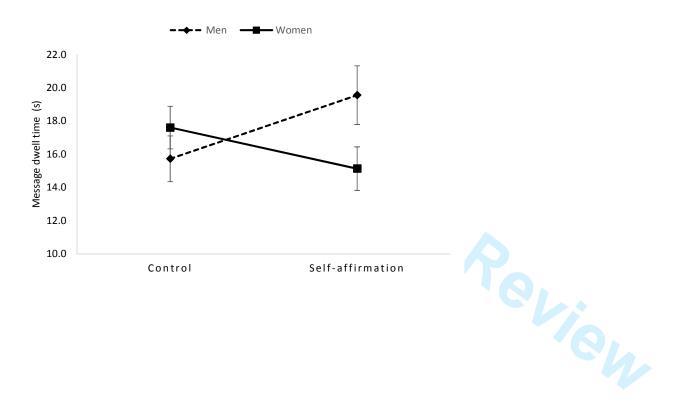
Fig. 4. Page dwell-times (seconds) for prose threat. Solid diamonds/dashed line are men's responses (Mean $\pm$ SEM); solid squares/sold line are women's.

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Supplementary information

S1

"*Alcohol and mouth and throat cancer risk:* Research suggests that there is a clear link between alcohol-consumption and cancer. Indeed, alcohol is in the highest risk category of carcinogens (cancer causing agents). One type of cancer that can be caused by alcohol consumption is oral cancer (cancer of the mouth). Alcohol can act as an irritant and cause damage to cells in this area.   Cells that are damaged may try to repair themselves, which could lead to DNA changes in the cells. A DNA change can cause cells to reproduce in an uncontrollable manner, producing many more abnormal cells which themselves then reproduce uncontrollably. This causes a group of abnormal cells to form, called a tumour. Oral cancer tumours develop on the surface of the tongue, mouth, lips or gums. They can also occur in the salivary glands, tonsils or the part of the throat that connects the nose and mouth to your throat (the pharynx). Cancer originating in the oral cavity can spread away from this region of origin, to surrounding tissues or to another area of the body completely. The more you drink, the greater your risk of mouth and throat cancer. Drinking and smoking together make the risk even higher."