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Look away now! Defensive processing and unrealistic optimism by level of alcohol consumption

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ABSTRACT

Objective: Health risk information is insufficient as a means of reducing alcohol use, particularly when it evokes negative emotional states amongst those for whom it is most personally relevant. Appraisal biases, or 'defensive processing', may be employed to mitigate the psychological discomfort posed by such information. Few studies have evaluated the role of defensive processing in people with different levels of alcohol consumption.

Design: Online participants ($n = 597$) completed measures of defensive processing of a health risk infographic, perceived susceptibility and severity of alcohol use, efficacy for resisting alcohol use, unrealistic optimism, the Alcohol Use Disorder Identification Test – Consumption (AUDIT-C) and demographics.

Results: AUDIT-C scores were positively and linearly associated with all defensive processing measures (Pearson's correlation r from.16 to .36), threat and susceptibility (r = .16) and unrealistic optimism (r = .50). AUDIT-C scores were also negatively associated with efficacy for controlling alcohol use ($r = -0.48$).

Conclusion: People with alcohol use disorder (AUD) engaged in much more defensive processing of alcohol-related messages, offering an explanation for why such messages are limited at eliciting behaviour change. High levels of unrealistic optimism in people with alcohol use disorder may reflect low problem recognition in order to maintain a problem-free drinking identity.

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Alcohol use disorder; defensive processing; health behaviour; addiction; recovery

1. Introduction

Alcohol Use Disorder (AUD) has been defined as regularly drinking above lower risk levels,[1] and is responsible for over 3 million deaths each year (NICE, 2010; WHO, 2018). However, the majority of the health and economic burden of alcohol use results from AUD levels defined as hazardous and harmful (i.e. lower severity AUD), which are not generally considered 'problematic' drinking behaviours by people in these groups (Morris et al., 2023a;

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Smith et al., 2022). As such, most AUD and its associated harms occur amongst people with low or non-clinical levels of alcohol dependence who frame their alcohol use positively, and point to what they perceive as other more extreme forms of 'problem drinking' to contrast against their own 'responsible' drinking practices (Morris, 2020; Orford et al., 2002; Room, 2005). This practice of *othering* has been identified across multiple drinking groups (E. Davies et al., 2022; Gough et al., 2019; Melia et al., 2021). For instance, regular home-based drinkers may point to the 'hedonistic excesses' of binge drinkers (Larsen et al., 2022; Parke et al., 2018; Wilson et al., 2013), whilst many AUD groups point to the *alcoholic other*, drawing on extreme stereotypes of dysfunction and 'rock bottom' (Khadjesari et al., 2018; Morris, 2020; Schomerus et al., 2011; Wallhed Finn et al., 2014).

To promote individual level behaviour change amongst lower severity AUD groups, non-treatment[2] interventions need to engage them in ways that not only highlight the health risks of their consumption but also motivate change processes (E. L. Davies et al., 2017; Ferri et al., 2019; Larimer & Cronce, 2002; Morris et al., 2021a; Wakefield et al., 2017). For instance, simply making people aware of lower risk drinking guidelines has little sustainable effect on drinking behaviours amongst lower severity AUD groups (Ferri et al., 2019; Holmes et al., 2020). Some work has even reported potential iatrogenic effects of increased, rather than decreased, consumption following exposure to alcohol-related health messages (Jessop & Wade, 2008; Moss et al., 2015).

In isolation, health-related information may be largely ineffective at facilitating sustainable changes in alcohol-related behaviour for several reasons (Hollands et al., 2016; Larimer & Cronce, 2002; Tannenbaum et al., 2015; Wakefield et al., 2010). Notably, qualitative accounts consistently point to how various AUD groups dismiss information such as recommended drinking guidelines because they view their drinking levels as 'normal', 'know their own limits', and are not actual 'problem' drinkers (Burgess et al., 2019; E. L. Davies et al., 2022; Gallage et al., 2020; Garnett et al., 2015; Khadjesari et al., 2018; Larsen et al., 2022; Lovatt et al., 2015; Lyons et al., 2014; O'Donnell et al., 2020; Orford et al., 2002). These accounts suggest how lower severity AUD groups actively resist the personal relevance of alcohol-related risk information when asked to reflect on the potential risks associated with their alcohol consumption.

However, limited attention has been given as to how personally relevant alcohol-related information may be treated in real world contexts, particularly where more automated thinking processes typically predominate over more reflective ones (Evans & Stanovich, 2013; Hollands et al., 2016; Zerhouni et al., 2018). For instance, lower severity AUD groups may be frequently exposed to a range of informational cues that could indicate risks associated with their level of alcohol use, yet may employ a range of automatic mental processes to avoid, manage or dismiss such information (Brown & Locker, 2009; Morris et al., 2021a; Moss & Albery, 2009; Zhou & Shapiro, 2017). Accordingly, *defensive processing* has been identified as a set of cognitive-affective processes in which such information is managed (e.g. deemed invalid or personally irrelevant) or avoided (e.g. averting attentional enagement) at a level below conscious awareness (Kessels et al., 2014; Liberman & Chaiken, 1992).

These cognitively biased evaluations have been examined largely in the context of *fear appeal* messages designed to evoke changes in health behaviours (Maloney et al., 2011; Tannenbaum et al., 2015), including for AUD (Brown & Locker, 2009; Pechey et al., 2020; Stead et al., 2019). Fear is an unpleasant affective state that

people are motivated to eliminate by employing a variety of defensive processing mechanisms such as *avoidance*, *minimisation* or *denial*[3] (Maloney et al., 2011; Yzer et al., 2012), thus attenuating the intended effect of the message. It has also been suggested that in the process of judging oneself (e.g. the chances of developing an alcohol problem), people spontaneously evaluate themselves against a prototypical *other* in a social comparative way (Goffin & Olson, 2011; Zell et al., 2020). Individuals are motivated to use this comparative approach to resist acknowledging that they are vulnerable or susceptible to future negative health events as a self-serving mechanism to protect themselves against feelings evoked by external threats to one's self-esteem (MKenna & Albery, 2001; Harris, Griffin & Murray, 2008), including from the threat of a problem drinking identity (Morris et al., 2021b; van Lettow et al., 2013).

Whilst reflective 'conscious' and more 'unsconscious' automatic processes are not completely separate processes (Melnikoff & Bargh, 2018), defensive processing may be associated with more explicit phenomena indicative of low problem recognition in AUD groups (Morris et al., 2021a; Smith et al., 2022). For instance, individuals commonly state their chances of experiencing negative health outcomes relative to other people to be less for negative events and greater for positive events - labelled *unrealistic optimism* or *optimistic bias* (Weinstein, 1980; Shepperd, Klein, Waters & Weinstein, 2013). Similarly, *neutralizations* are explicit justifications for behaviours that contravene a social norm (Peretti-Watel & Moatti, 2006) and have also been identified amongst AUD groups (Piacentini et al., 2012).

Given that many AUD groups appear heavily invested in their drinking identities as positive and non-problematic, it follows they may be particularly motivated to defensively process (including unconscious avoidance of) personally relevant information about alcohol risks (Morris et al., 2021a; So et al., 2017; Zhou & Shapiro, 2017), and relatedly, demonstrate higher levels of unrealistic optimism. However, whilst defensive processing has been observed towards alcohol-related information, we are not aware of any studies that have examined whether and how such processes are related to AUD severity. Perceptions of severity and self-efficacy towards a risk behaviour are known to predict levels of defensive processing (Peters et al., 2013), whilst AUD severity is important for identifying appropriate interventions across the AUD continuum (Morris et al., 2023b). The present study therefore sought to examine key defensive processing related variables via an exploratory analysis of self-efficacy, levels of unrealistic optimism, and defensive processing of a health risk infographic in a sample of drinkers with varying levels of alcohol use disorder. We hypothesised that people with higher alcohol use disorder (as indexed by AUDIT-C) would report decreased self-efficacy and increased unrealistic optimism, and would engage in greater defensive processing of an alcohol health-risk infographic.

2. Methods

2.1. Participants

Participants were invited to complete an online study using Qualtrics software via Facebook advertisements targeting people in England over the age of 18 and via the lead author's Twitter account. In total, 703 participants accessed the link, 614 of whom

completed the questionnaire. Fifteen cases were removed where participants clicked through the manipulation page in less time than required to complete its viewing (detailed in 2.2). Two cases were removed where participants had identified both the *no addiction experience* and *one addiction experience* options. A total of 597 participants completed the study and were included in the analyses.

Participants provided demographic information that identified the sample as 52.9% ($n = 316$) men, 46.4% ($n = 277$) women and <1% other ($n = 4$). The participant mean age was 37.21 (SD = 13.58). Eighty-nine per cent ($n = 532$) self-identified as British, 2.5% as American ($n = 15$), 2.3% as Irish ($n = 14$), with the remaining responses ($n = 36$) indicating other nationalities.

2.2. Design and procedure

The study was an anonymous cross-sectional online questionnaire that included an experimental procedure testing problem framing factors, as reported in Morris et al. (2021a). For the present study, we are not reporting on effects of problem framing which were not associated with significant differences in defensive processing across the experimental groups (Morris, 2020). After accessing the study link, participants were directed to an information page and asked to provide informed consent. Optional demographic information was collected followed by AUD measures (see 2.3.1). Participants were primed to watch a short video and then randomised by the survey platform to one of three manipulation conditions (continuum, Binary Disease Model or control; Morris et al. 2021a) which contained a fictionalised first-person vignette in audio-visual format. Following the video vignette participants were required to correctly answer two questions about its content before being able to continue. Eight participants answered both questions incorrectly and were excluded. Next, beliefs about alcohol problems were assessed via the Problem Drinking Belief Scale (Morris et al., 2021b), followed by presentation of a health risk infographic (Appendix A). Participants could not click through the infographic page until 30 s or more had elapsed. Participants were then required to correctly identify three problems shown in the infographic before being able to continue. Answering incorrectly resulted in participants being asked to view the infographic again. Eleven participants answered incorrectly on the second attempt and were excluded from the study. Participants then completed measures relating to defensive processing of the health risk infographic, past drinking changes, self-relevance, self-efficacy and unrealistic optimism. Addiction experience was assessed before participants were directed to the debriefing page and invited to leave optional contact details to be eligible to win one of two £50 Amazon vouchers. The study design was given ethics approval by London South Bank Univerisity's School of Applied Sciences Ethics Committee (ethics application number SAS1724).

2.3. Measures and stimulus

2.3.1. Demographic questionnaire and alcohol consumption

Participants completed demographic items including age, gender, nationality and employment status and the AUDIT-C (Alcohol Use Disorder Identification Test—Consmption) to quantify alcohol consumption. AUDIT-C items include 'How often do

you have a drink containing alcohol?', 'How many units of alcohol do you drink on a typical day when you are drinking?' and 'How often have you had 6 or more units if female, or 8 or more if male, on a single occasion in the last year?', with a possible score range of 0–12. AUDIT-C has been found to be of comparable utility to the full AUDIT (Babor et al., 2001) in detecting alcohol use disorders (Dawson et al., 2012) and to distinguish between levels of AUD at different cut-offs (Meneses-Gaya et al., 2010). Harmful drinking has been found to be suitably captured by the UK-adapted version of the AUDIT-C amongst a largely UK-based population (Khadjesari et al., 2017). Thus AUDIT-C scores of ≥8 for women or ≥9 for men were operationalised as harmful drinking. In the present study, AUDIT-C was found to have internal reliability of α = .72.

2.3.2. Health risk infographic stimulus

The health risk infographic (see Appendix A) was taken from the World Health Organization resource manual for the AUDIT (Babor et al., 2001) and depicts a simple human body animation diagram indicating the 'effects of high-risk drinking', including physical and mental health conditions, and behavioural problems. The infographic was selected as a simple depiction of alcohol consumption related risks which prior studies have used to assess alcohol-related defensive processing elements (Armitage et al., 2011).

2.3.3. Outcomes: self-efficacy

Self-efficacy: Alcohol-related self-efficacy was assessed using the Alcohol Resistance Self-Efficacy Scale (Schwarzer & Renner, 2009). The scale presents participants with the stem, 'I am certain that I can control myself to…', followed by three items: '… reduce my alcohol consumption', '…not to drink any alcohol at all', and '…drink only at special occasions'. Participants responded on a 4-point Likert scale, rating each item from 1 (*Very uncertain*) to 4 (*Very certain*). Their self-efficacy score was calculated as the mean score across the three items. Schwarzer and Renner (2009) found that the scale was correlated with self-reported alcohol drinking six months on (r (810) = −0.284) p = .012); current study α = .82.

2.3.4. Outcomes: unrealistic optimism

Unrealistic optimism: Participants rated their perceived risk of developing an alcohol problem by responding to the question, 'How likely do you think it is that you will develop a drinking-related problem at some time in your life?'. Next, participants reported the perceived risk for an average person by responding to the item, 'How likely do you think it is that the average person will develop a drinking related problem at some time in their life?'. Participants responded on a 7-point Likert scale, rating each item from 1 (*Extremely likely*) to 7 (*Extremely unlikely*). Items were adapted from studies assessing unrealistic optimism amongst student drinkers (Dillard et al., 2009; Kim & Niederdeppe, 2016). To assess unrealistic optimism, a difference score between self-appraised risk and that attributed to the average person was calculated by subtracting responses to average person's risk from own risk judgements (M = .34,

SD = 1.92) (Kim & Niederdeppe, 2016) (positive values were indicative of perceived decreased risk for the *self* compared to *other* - i.e. an optimistic bias).

2.3.5. Outcomes: defensive processing of health risk infographic

Message derogation: Participants were asked to rate the perceived credibility of the alcohol-related health risk infographic by responding to four items following the question stem text, 'What do you think about the alcohol health risk information you saw (Figure 1: right)? Did you think it was…', with a reduced scale version of the health risk infographic presented to the right of the question text. Participants then responded to the items 'Overblown', 'Exaggerated', 'Trying to manipulate my feelings', and 'Trying to stretch the truth' on a 7-point Likert scale, rating each item from 1 (*strongly disagree*) to 7 (*strongly agree*), with higher scores indicating a higher degree of message derogation. The scale was adapted from a previous study (Jessop et al., 2009). The present study showed a high internal consistency for the four-item message derogation scale (α = .86).

Defensive avoidance: Participants rated their perceived reaction to the alcohol-related health risk infographic by responding to the question stem, 'When I read the alcohol health risk information (Figure 1: right) my first reaction was that I did not want to think about it', with a reduced scale version of the health risk infographic presented to the right of the question text. Participants responded on a 7-point Likert scale, rating each item from 1 (*Strongly disagree*) to 7 (*Strongly agree*). The item was adapted from a similar item used by Armitage et al. (2011).

Fear posed by a health risk infographic: Participants rated the perceived fear of the alcohol-related health risk infographic by responding to the question stem, 'The alcohol health risk information made me feel' on a 7-point Likert scale, ranging from 1 (*Not at all frightened*) to 7 (*Extremely frightened*). The item was adopted from a similar item used by Armitage et al. (2011).

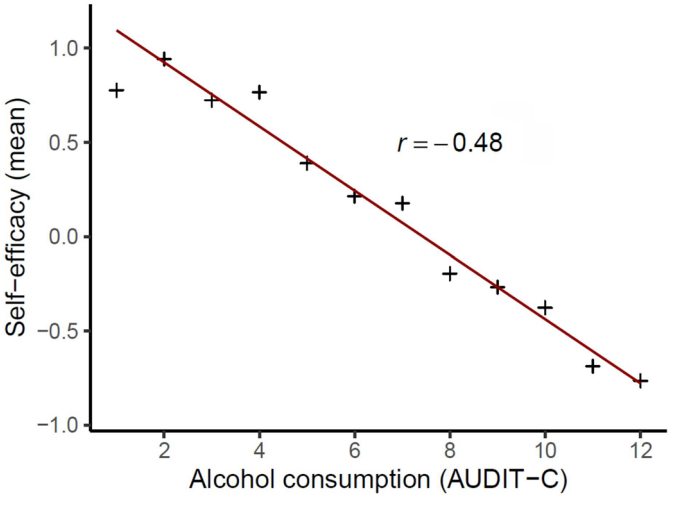

Figure 1. Self-efficacy across levels of alcohol consumption (AUDIT-C). Points (+) represent mean standardised self-efficacy score at each level of AUDIT-C. The line represents the fitted values from a linear regression. *r* is the Pearson's correlation coefficient.

2.3.6. Outcomes: threat and susceptibility ratings for a health risk infographic

Threat and susceptibility: Participants rated perceived threat and susceptibility to the consequences of risky drinking by responding to three items adapted from a study exploring defensive processing relating to advice about vegetable and fruit consumption (Napper et al., 2014). For perceived threat, participants responded to the question stem, 'How serious are the health consequences of regularly exceeding the recommended drinking guidelines of 14 units per week?' by responding on a 7-point Likert scale (1 = *Not at all serious* to 7 = *Extremely serious*). For a measure of susceptibility participants responded to the question stem, 'My chances of experiencing alcohol-related health problems such as liver damage or some cancers in the future if I regularly drink above the recommended drinking guidelines are…', responding on a 7-point Likert scale, ranging from 1 (*Extremely low*) to 7 (*Extremely high*). Next, participants responded to the question stem, 'How likely is it that you will experience poor health in the future if you regularly drink above the recommended drinking guidelines?', responding on a 7-point Likert scale 1 (*Extremely unlikely*) to 7 (*Extremely likely*); present study Cronbach's α = .85. alpha. A mean score of the three items was calculated for the threat and susceptibility measure ($M = 5.31$, $SD = 1.22$) as per Napper et al (2014). This measure was inverse coded prior to analysis as higher perceived threat and susceptability indicate lower defensive processing.

2.4. Analysis plan

The *mice* package in *R version 4.2* was used for multiple imputation of missing covariate data, using five iterations (van Buuren & Groothuis-Oudshoorn, 2011). For interpretability, all outcomes were standardised into z-scores (subtracting the mean and then dividing by standard deviation). Using linear regression, we estimated the association of alcohol consumption, as measured by AUDIT-C score, with (1) self-efficacy, (2) unrealistic optimism, and (3) each of the four defensive processing outcomes: message derogation, defensive avoidance, fear, and threat/susceptibility. Regression models were performed with and without adjustment for sex and occupation as categorical covariates and age as a linear continuous covariate. Regression coefficients for the association of AUDIT-C with each outcomes were reported alongside 95% confidence intervals (95% CIs) and Pearson's correlation coefficient. We hypothesised that, on average, people who consumed more alcohol (i.e. have higher AUDIT-C scores) would have lower self-efficacy but higher unrealistic optimism and defensive processing.

Using the unadjusted regression models described above, we estimated the mean value of each outcome across the full range of AUDIT-C scores from 1 to 12.

3. Results

3.1. Self-efficacy

Self-efficacy declined linearly as alcohol consumption increases, such that self-efficacy is −1.54 standard deviations (SDs) lower among those with the highest versus the lowest AUDIT-C scores (Figure 1). Unadjusted regression results show that for every unit increase in AUDIT-C, self-efficacy falls by −0.17 SDs (95%CI, −0.20 to −0.14;

$r = -0.48$). After covariate adjustment, the association was estimated at −0.18 SDs (95%CI, −0.20 to −0.15; r = .46). Table 1 shows adjusted and unadjusted regression results alongside correlation coefficients.

3.2. Unrealistic optimism

Conversely, unrealistic optimism increases linearly with alcohol consumption such that unrealistic optimism is 2.03 SDs higher among those with the highest versus the lowest AUDIT-C scores (Figure 2). Unadjusted regression results show that for every unit increase in AUDIT-C, unrealistic optimism increases by 0.18 SDs (95%CI, 0.16 to 0.21; r = .50). After covariate adjustment, the association remained unchanged at 0.19 SDs (95%CI, 0.16 to 0.21; r = .50). Adjusted and unadjusted regression results are presented alongside correlation coefficients in Table 1.

Table 1. Associations of alcohol consumption (AUDIT-C) with self-efficacy, unrealistic optimism, and defensive processing outcomes.

	Unadjusted association with AUDIT-C*			**Adjusted association with AUDIT-C***		
Outcome	*B*	95%CI	*r*	*B*	95%CI	*r*
Self-efficacy	−0.18	−0.20 to −0.15	−0.48	−0.17	−0.20 to −0.14	−0.46
Unrealistic optimism	0.18	0.16 to 0.21	.50	0.19	0.16 to 0.21	.50
Defensive processing						
Message derogation	0.06	0.03 to 0.09	.15	0.07	0.05 to 0.10	.20
Defensive avoidance	0.13	0.10 to 0.16	.36	0.13	0.10 to 0.16	.36
Fear	0.08	0.04 to 0.11	.20	0.06	0.03 to 0.09	.15
Threat/susceptibility (inv)	0.06	0.03 to 0.09	.16	0.09	0.06 to 0.12	.24

B = Standardised mean difference in outcome per unit of AUDIT-C. 95% CI = 95% confidence interval. r = Pearson's correlation coefficient.
*From regression models with AUDIT-C as a linear predictor, before and after adjustment for demographic covariates (age, sex, and occupation). Data came from 597 participants.

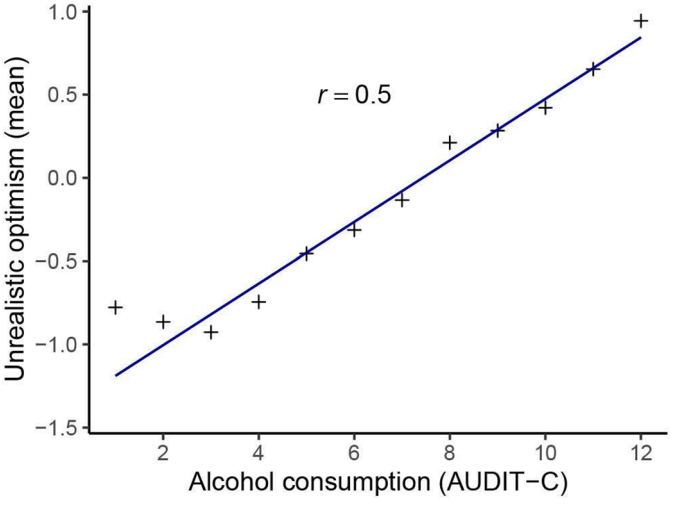

Figure 2. Unrealistic optimism across levels of alcohol consumption (AUDIT-C). Points (+) represent mean standardised unrealistic optimism score at each level of AUDIT-C. The line represents the fitted values from a linear regression. r is the Pearson's correlation coefficient.

3.3. Defensive processing

People with higher alcohol consumption showed greater levels of defensive processing across all four measures: message derogation, defensive avoidance, fear, and inverse-coded threat/susceptibility (Figure 3). Linear regression results showed that the size of associations between alcohol consumption and defensive processing spanned from 0.06 SDs per unit of AUDIT-C (correlation of r = .15) for message derogation to 0.13 SDs (r = .36) for defensive avoidance. All associations remained after covariate adjustment, as shown in Table 1.

3.4. Threat and susceptibility

People with higher alcohol consumption showed greater levels of inverse-coded threat/susceptibility (Figure 4). Unadjusted regression results show that for every unit increase in AUDIT-C, threat/susceptibility rises by 0.06 SDs (95%CI, −0.03 to −0.09;

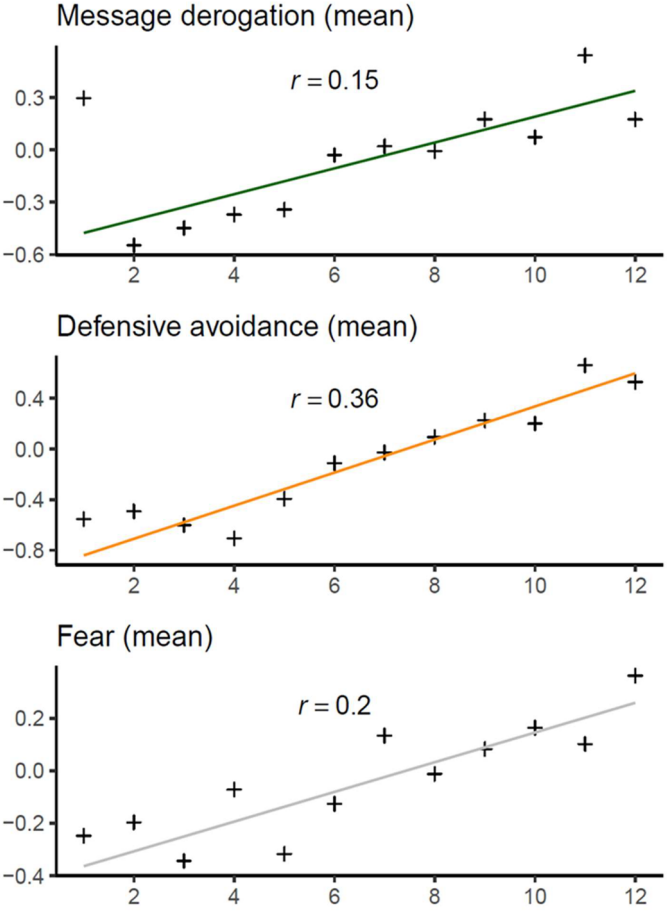

Figure 3. Defensive processing across levels of alcohol consumption (AUDIT-C). Points (+) represent mean standardised outcome score at each level of AUDIT-C. The lines represents the fitted values from a linear regression. r is the Pearson's correlation coefficient.

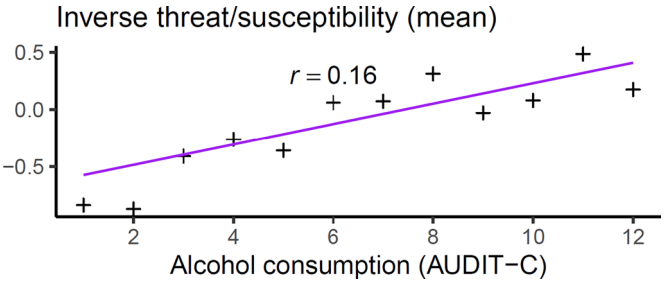

Figure 4. Threat/susceptibility across levels of alcohol consumption (AUDIT-C). Points (+) represent mean standardised outcome score at each level of AUDIT-C. The lines represents the fitted values from a linear regression. *r* is the Pearson's correlation coefficient.

r = −0.16). After covariate adjustment, the association was estimated at 0.09 SDs (95%CI, 0.06 to 0.12; *r* = .24). All associations remained after covariate adjustment, as shown in Table 1.

4. Discussion

The higher an individual's alcohol consumption, the more they engaged in defensive processing when exposed to an infographic highlighting the harms of high-risk drinking. Participants with higher alcohol consumption derogated the infographic's message more harshly, tried to avoid thinking about its content, expressed more fear, and judged themselves to be less susceptible to consequences of drinking at harmful levels. In addition, the higher a person's alcohol consumption, the lower their self-efficacy, which indicates that those with higher consumption felt less confident to control their drinking behaviour. Higher levels of alcohol consumption were also strongly associated with greater unrealistic optimism about personally experiencing alcohol-related harm relative to the average drinker. Taken together, these results show that the heavier a person's alcohol consumption, the less confident they are in their ability to control their drinking, the more they avoid engaging with personally relevant messages, and the less likely they are to accurately appraise the negative consequences of their alcohol consumption. Thus, these findings highlight the importance of AUD severity in understanding defensive processing responses to personally relevant but threatening alcohol-related information, and similarly the association with self-efficacy and unrealistic optimism by AUD severity (as measured by AUDIT-C in the present study).

These findings are particularly important in terms of highlighting the limitations of promoting alcohol-related health risk information owing to the paradox that the more personally relevant (i.e. the higher the level of consumption), the more defensive processing is utilised to avoid contemplating the message content. These results are consistent with models such as the Extended Parallel Process Model (EPPM; Witte, 1992) which emphasise efficacy as central in determining whether defensive processing or behavioural responses are engaged. Namely, low self-efficacy represents beliefs that the drinking behaviour cannot be controlled, and thus defensive processing is employed to remove the state of fear or anxiety invoked by personally relevant

information (So et al., 2016). The strong negative association between self-efficacy and consumption likely reflects the degree to which beliefs about 'loss of control' are part of perceptions and experiences of alcohol problems (Morris et al., 2023a; Spada & Wells, 2010). As such, low self-efficacy amongst heavier drinkers may mediate the effect of defensive processing to control fear or anxiety invoked by personally relevant information which should be addressed by future experimental studies.[4]

The large effect size found for unrealistic optimism may represent the well-documented phenomenon of othering amongst people with lower severity AUD (Morris et al., 2021b). When asked to rate their own risk of alcohol harms versus the average person, the higher the AUDIT-C score, the more unrealistic optimism participants showed. Notably, assessing unrealistic optimism requires a more conscious reflection of the individual's risk (versus the average person's risk) than the more implicit processes captured via defensive processing measures. Thus, people with harmful levels of drinking (who do not currently identify as having an alcohol problem) appear strongly motivated to emphasise their own alcohol use as non-problematic compared to others. As such, drawing on more extreme characterizations of alcohol problems (i.e. othering) serves as a rationalisation to maintain unrealistic optimism about personal susceptibility. In the context of AUD, othering has also been attributed to the heavy stigma associated with a problem drinking identity, with people drawing on extreme stereotypes of the 'alcoholic other' to distinguish their own 'responsible' drinking (Morris et al., 2021b; Morris & Schomerus, 2023). As such, in addition to health consequences of heavy drinking, stigma may be an additional driver of fear or anxiety (Speerforck et al., 2017) and, in turn, defensive processing and unrealistic optimism biases.

These findings have particular significance for policy makers and stakeholders seeking to influence drinking behaviours via communicating alcohol-related risk messages. For example, many public health groups call for mandatory labelling of alcohol products to include health warnings, nutritional information and unit content, which is currently voluntary in the UK. Whilst important to provide consumers with adequate and easy to access information, such messages are unlikely to change behaviour, particularly as AUD severity increases. Our findings suggest this is at least partially due to defensive processing and unrealistic optimism biases evident amongst AUD groups which hinder problem recognition processes (Morris et al., 2021a). This supports broader evidence for modifying environmental factors, particularly price, availability and marketing, as the most effective approaches to reducing alcohol consumption (Burton et al., 2017; Morris et al., 2023c; Williams et al., 2018).

Attempts to modify alcohol-related behaviours via health risk information must take account of the importance of various factors, particularly self-efficacy, that can affect how such information is appraised and its consequences for behaviour, including potential unintended consequences (Jessop & Wade, 2008; Moss et al., 2015). A conceptual framework for enhancing problem recognition amongst harmful drinkers identifies potential key factors for further empirical testing (Morris et al., 2021a). This model has some support concerning the potential value of promoting continuum beliefs in enhancing problem recognition amongst harmful drinkers (Morris et al., 2020). Indeed, continuum beliefs likely function to reduce perceived differences between 'problem' and 'non-problem' drinkers, thus increasing personal relevance and

acceptability of non-abstinent recovery, and reducing stigma-related threats (Morris et al., 2023b). Findings in the present study also support a continuum model of alcohol use and harms since there were no 'cut-off' points at which defensive processing and related factors occurred, rather than clear linear associations with AUD severity. Continuum beliefs are likely to be best enhanced via exposure to narratives that relay the viability of drinking reduction reduction goals and challenge stereotypes associated with the alcoholic other (Morris et al., 2022; van Lettow et al., 2013).

A number of limitations to this study are important to consider. Notably, these analyses were exploratory and cannot provide evidence of the directional role of the associations found. Participants recruited via social media may not be representative of the general population, thus generalisability may be limited. Respondents to online questionnaires also inevitably vary in the level of effort and engagement with the survey (Huang et al., 2012), though the survey included attention checks which resulted in eight responses being removed for failing the attention check question twice.

We recommend expanding this work, including confirmatory examination of the present findings. Additionally, further work should examine anxiety, which has been proposed as a significantly over-looked affective driver of defensive processing (So et al., 2016), and may be particularly important in the context of alcohol-related risk information. This work should include development of a robust theoretical model that accounts for the specific mediating or moderating roles of these variables. For instance, Morris et al. (2021a) have proposed a theoretical model for identifying problem recognition factors amongst AUD groups which builds on existing parallel processing models to predict how defensive processes may undermine problem recognition, including for example, when self-efficacy is low.

5. Conclusion

This study points to a strong linear association between higher alcohol consumption and higher defensive processing of personally relevant health-risk information. Higher alcohol consumption was also strongly associated with lower self-efficacy and higher unrealistic optimism. These findings highlight the importance of recognising the limitations of messages that seek to change alcohol-related behaviour, and the extent to which people with AUD apply optimism biases—particularly as AUD severity increases—to avoid acknowledging their personal susceptibility to alcohol-related harms. Relevant models indicate the importance of enhancing self-efficacy and continuum beliefs as possible responses to maximise the potential for problem recognition and behaviour change responses. These should be conveyed via relatable narratives that address the absence of relatable drinking prototypes that include the viability drinking reduction goals.

Notes

1. Except within the DSM-5 approach to AUD, which focuses more on a dependence-orientated model of alcohol problems.
2. Treatment interventions are those which typically target people with higher severity AUD/alcohol dependence and include comprehensive assessment and structured support.

3. Here the term 'denial' is used as per the relevant defensive processing literature, i.e. as a more automatic process, not as per its common but stereotyped understanding in addiction contexts (Morris, 2020; Pickard, 2016).
4. Supplementary Figure 1 indicates no strong moderating effect of self-efficacy on the observed effects. However owing to the study design and exploratory nature of the analysis we suggestion caution in interpreting these results.

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No potential conflict of interest was reported by the author(s).

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Data availability statement

The data that support the findings of this study are openly available at https://doi.org/10.17605/OSF.IO/TY26A [Assessing alcohol health risks and problem drinking n597].

References

Armitage, C. J., Harris, P. R., & Arden, M. A. (2011). Evidence that self-affirmation reduces alcohol consumption: Randomized exploratory trial with a new, brief means of self-affirming. *Health Psychology: Official Journal of the Division of Health Psychology, American Psychological Association*, *30*(5), 633–641. https://doi.org/10.1037/a0023738

Babor, T. F., Higgins-Biddle, J. C., Saunders, J. B., & Monteiro, M. G. (2001). AUDIT - The Alcohol Use Disorders Identification Test: Guidelines for Use in Primary Care (second edition), 2001. In *WHO*. World Health Organization. https://www.who.int/publications/i/item/WHO-MSD-MSB-01.6a

Brown, S. L., & Locker, E. (2009). Defensive responses to an emotive anti-alcohol message. *Psychology & Health*, *24*(5), 517–528. https://doi.org/10.1080/08870440801911130

Burgess, M., Cooke, R., & Davies, E. L. (2019). My own personal hell : Approaching and exceeding thresholds of too much alcohol. *Psychology & Health*, *34*(12), 1451–1469. https://doi.org/10.1080/08870446.2019.1616087

Burton, R., Henn, C., Lavoie, D., O'Connor, R., Perkins, C., Sweeney, K., Greaves, F., Ferguson, B., Beynon, C., Belloni, A., Musto, V., Marsden, J., & Sheron, N. (2017). A rapid evidence review of the effectiveness and cost-effectiveness of alcohol control policies: An English perspective. *Lancet (London, England)*, *389*(10078), 1558–1580. https://doi.org/10.1016/S0140-6736(16)32420-5

Davies, E. L., Conroy, D., Winstock, A. R., & Ferris, J. (2017). Motivations for reducing alcohol consumption: An international survey exploring experiences that may lead to a change in drinking habits. *Addictive Behaviors*, *75*, 40–46. https://doi.org/10.1016/j.addbeh.2017.06.019

Davies, E. L., Cooke, R., Visser, R. O. D., & Conroy, D. (2022). Calling time on responsible drinking: A qualitative study of perceptions of information on alcohol product labels. *British Journal of Health Psychology*, *28*(2), 320–337. https://doi.org/10.1111/BJHP.12627

Davies, E., Lewin, J., & Field, M. (2022). Am I a responsible drinker? The impact of message frame and drinker prototypes on perceptions of alcohol product information labels. *Psychology & Health*, 1–18. https://doi.org/10.1080/08870446.2022.2129055/SUPPL_FILE/GPSH_A_2129055_SM4769.DOCX

Dawson, D. A., Smith, S. M., Saha, T. D., Rubinsky, A. D., & Grant, B. F. (2012). Comparative performance of the AUDIT-C in screening for DSM-IV and DSM-5 alcohol use disorders. *Drug and Alcohol Dependence*, *126*(3), 384–388. https://doi.org/10.1016/j.drugalcdep.2012.05.029

Dillard, A. J., Midboe, A. M., & Klein, W. M. P. (2009). The dark side of optimism: Unrealistic optimism about problems with alcohol predicts subsequent negative event experiences. *Personality & Social Psychology Bulletin*, *35*(11), 1540–1550. https://doi.org/10.1177/0146167209343124

Evans, J. S. B. T., & Stanovich, K. E. (2013). Dual-process theories of higher cognition: Advancing the debate. *Perspectives on Psychological Science: A Journal of the Association for Psychological Science*, *8*(3), 223–241. https://doi.org/10.1177/1745691612460685/ASSET/IMAGES/LARGE/10.1177_1745691612460685-FIG2.JPEG

Ferri, M., Mouteney, J., & Griffiths, P. (2019). Low-risk drinking guidelines: A pragmatic approach to health promotion? *Addiction (Abingdon, England)*, *114*(4), 605–607. https://doi.org/10.1111/ADD.14532

Gallage, H. P. P. S., Heath, T., & Tynan, C. (2020). Adopting and sustaining responsible drinking: Reconciling selves amidst conflicting messages. *Journal of Marketing Management*, *36*(17-18), 1635–1657. https://doi.org/10.1080/0267257X.2020.1857819

Garnett, C., Crane, D., West, R., Michie, S., Brown, J., & Winstock, A. (2015). Normative misperceptions about alcohol use in the general population of drinkers: A cross-sectional survey. *Addictive Behaviors*, *42*, 203–206. https://doi.org/10.1016/j.addbeh.2014.11.010

Goffin, R. D., & Olson, J. M. (2011). Is it all relative? *Perspectives on Psychological Science: A Journal of the Association for Psychological Science*, *6*(1), 48–60. https://doi.org/10.1177/1745691610393521

Gough, B., Madden, M., Morris, S., Atkin, K., & McCambridge, J. (2019). How do older people normalise their drinking?: An analysis of interviewee accounts. *Appetite*, *146*, 104513. https://doi.org/10.1016/J.APPET.2019.104513

Harris, P. R., Griffin, D. W., & Murray, S. (2008). Testing the limits of optimistic bias: Event and person moderators in a multilevel framework. *Journal of Personality and Social Psychology*, *95*(5), 1225–1237. https://doi.org/10.1037/a0013315

Hollands, G. J., Marteau, T. M., & Fletcher, P. C. (2016). Non-conscious processes in changing health-related behaviour: A conceptual analysis and framework. *Health Psychology Review*, *10*(4), 381–394. https://doi.org/10.1080/17437199.2015.1138093

Holmes, J., Beard, E., Brown, J., Brennan, A., Meier, P. S., Michie, S., Stevely, A. K., Webster, L., & Buykx, P. F. (2020). Effects on alcohol consumption of announcing and implementing revised UK low-risk drinking guidelines: Findings from an interrupted time series analysis. *Journal of Epidemiology and Community Health*, *74*(11), 942–949. https://doi.org/10.1136/JECH-2020-213820

Huang, J. L., Curran, P. G., Keeney, J., Poposki, E. M., & DeShon, R. P. (2012). Detecting and deterring insufficient effort responding to surveys. *Journal of Business and Psychology*, *27*(1), 99–114. https://doi.org/10.1007/s10869-011-9231-8

Jessop, D. C., & Wade, J. (2008). Fear appeals and binge drinking: A terror management theory perspective. *British Journal of Health Psychology*, *13*(Pt 4), 773–788. https://doi.org/10.1348/135910707X272790

Jessop, D. C., Simmonds, L. V., & Sparks, P. (2009). Motivational and behavioural consequences of self-affirmation interventions: A study of sunscreen use among women. *Psychology & Health*, *24*(5), 529–544. https://doi.org/10.1080/08870440801930320

Kessels, L. T. E., Ruiter, R. A. C., Wouters, L., & Jansma, B. M. (2014). Neuroscientific evidence for defensive avoidance of fear appeals. *International Journal of Psychology: Journal International de Psychologie*, *49*(2), 80–88. https://doi.org/10.1002/ijop.12036

Khadjesari, Z., Stevenson, F., Toner, P., Linke, S., Milward, J., & Murray, E. (2018). 'I'm not a real boozer': A qualitative study of primary care patients' views on drinking and its consequences. *Journal of Public Health (Oxford, England)*, *41*(2), e185–e191. https://doi.org/10.1093/pubmed/fdy067

Khadjesari, Z., White, I. R., McCambridge, J., Marston, L., Wallace, P., Godfrey, C., & Murray, E. (2017). Validation of the AUDIT-C in adults seeking help with their drinking online. *Addiction Science & Clinical Practice*, *12*(1), 2. https://doi.org/10.1186/s13722-016-0066-5

Kim, H. K., & Niederdeppe, J. (2016). Effects of self-affirmation, narratives, and informational messages in reducing unrealistic optimism about alcohol-related problems among college students. *Human Communication Research*, *42*(2), 246–268. https://doi.org/10.1111/hcre.12073

Larimer, M. E., & Cronce, J. M. (2002). Identification, prevention and treatment: A review of individual-focused strategies to reduce problematic alcohol consumption by college students. *Journal of Studies on Alcohol. Supplement*, *63*(14), 148–163. https://doi.org/10.15288/jsas.2002.s14.148

Larsen, J., Christmas, S., & Souter, A. (2022). Perceptions of alcohol health harm among midlife men in England: A qualitative interview study. *Health, Risk & Society*, *25*(5-6), 216–233. https://doi.org/10.1080/13698575.2022.2138833

Liberman, A., & Chaiken, S. (1992). Defensive processing of personally relevant health messages. *Personality and Social Psychology Bulletin*, *18*(6), 669–679. https://doi.org/10.1177/0146167292186002

Lovatt, M., Eadie, D., Meier, P. S., Li, J., Bauld, L., Hastings, G., & Holmes, J. (2015). Lay epidemiology and the interpretation of low-risk drinking guidelines by adults in the United Kingdom. *Addiction (Abingdon, England)*, *110*(12), 1912–1919. https://doi.org/10.1111/add.13072

Lyons, A. C., Emslie, C., & Hunt, K. (2014). Staying "in the zone" but not passing the "point of no return": Embodiment, gender and drinking in mid-Life. In *From health behaviours to health practices: Critical perspectives* (Vol. 36, Issue 2, pp.106–119). Wiley/Blackwell. (10.1111). https://doi.org/10.1002/9781118898345.ch10

Maloney, E. K., Lapinski, M. K., & Witte, K. (2011). Fear appeals and persuasion: A review and update of the extended parallel process model. *Social and Personality Psychology Compass*, *5*(4), 206–219. https://doi.org/10.1111/j.1751-9004.2011.00341.x

Melia, C., Kent, A., Meredith, J., & Lamont, A. (2021). Constructing and negotiating boundaries of morally acceptable alcohol use: A discursive psychology of justifying alcohol consumption. *Addictive Behaviors*, *123*, 107057. https://doi.org/10.1016/J.ADDBEH.2021.107057

Melnikoff, D. E., & Bargh, J. A. (2018). The mythical number two. *Trends in Cognitive Sciences*, *22*(4), 280–293. https://doi.org/10.1016/J.TICS.2018.02.001

Meneses-Gaya, C., Zuardi, A. W., Loureiro, S. R., Hallak, J. E. C., Trzesniak, C., De Azevedo Marques, J. M., MacHado-De-Sousa, J. P., Chagas, M. H. N., Souza, R. M., & Crippa, J. A. S. (2010). Is the full version of the AUDIT really necessary? Study of the validity and internal construct of its abbreviated versions. *Alcoholism, Clinical and Experimental Research*, *34*(8), 1417–1424. https://doi.org/10.1111/j.1530-0277.2010.01225.x

Mkenna, F. P. and Albery, I. P. (2001). Does Unrealistic Optimism Change Following a Negative Experience?. *Journal of Applied Social Psychology*, *31*, 1146–1157. https://doi.org/10.1111/j.1559-1816.2001.tb02667.x

Morris, J. (2020). Effects of continuum versus binary beliefs about alcohol problems on problem recognition, defensive processing and stigma among harmful drinkers [OSF]. https://doi.org/10.17605/OSF.IO/7HQGN

Morris, J., & Schomerus, G. (2023). Why stigma matters in addressing alcohol harm. *Drug and Alcohol Review*, *42*(5), 1264–1268. https://doi.org/10.1111/dar.13660

Morris, J., Albery, I. P., Heather, N., & Moss, A. C. (2020). Continuum beliefs are associated with higher problem recognition than binary beliefs among harmful drinkers without addiction experience. *Addictive Behaviors*, *105*, 106292. https://doi.org/10.1016/j.addbeh.2020.106292

Morris, J., Albery, I. P., Moss, A. C., & Heather, N. (2021a). Promoting problem recognition amongst harmful drinkers: A conceptual model for problem framing factors. In D. Frings & I. P. Albery (Eds.), *The handbook of alcohol use* (pp. 221–236). Elsevier. https://doi.org/10.1016/b978-0-12-816720-5.00026-8

Morris, J., Boness, C. L., & Burton, R. (2023a). (Mis)understanding alcohol use disorder: Making the case for a public health first approach. *Drug and Alcohol Dependence*, *253*, 111019. https://doi.org/10.1016/j.drugalcdep.2023.111019

Morris, J., Boness, C. L., & Witkiewitz, K. (2023b). Should we promote alcohol problems as a continuum? Implications for policy and practice. *Drugs: Education, Prevention and Policy*, 1–11. https://doi.org/10.1080/09687637.2023.2187681

Morris, J., Cox, S., Moss, A. C., & Reavey, P. (2022). Drinkers like us? The availability of relatable drinking reduction narratives for people with alcohol use disorders. *Addiction Research & Theory*, *31*(1), 1–8. https://doi.org/10.1080/16066359.2022.2099544

Morris, J., Heather, N., Field, M., Moss, A. C., & Satel, S. (2022). Before 'Rock Bottom'? Problem framing effects on stigma and change among harmful drinkers. In N. Heather, M. Field, A. C. Moss, & S. Satel (Eds.), *Evaluating the Brain Disease Model of Addiction* (pp. 187–195). Routledge. https://doi.org/10.4324/9781003032762-21

Morris, J., Moss, A. C., Albery, I. P., & Heather, N. (2021b). The "alcoholic other": Harmful drinkers resist problem recognition to manage identity threat. *Addictive Behaviors*, *124*, 107093. https://doi.org/10.1016/j.addbeh.2021.107093

Morris, J., Rose, A. K., Cox, S., & Jones, A. (2023c). Clinical alcohol guidelines are welcome—but upstream action is paramount. *Addiction (Abingdon, England)*, *119*(3), 593–594. https://doi.org/10.1111/ADD.16408

Moss, A. C., & Albery, I. P. (2009). A dual-process model of the alcohol-behavior link for social drinking. *Psychological Bulletin*, *135*(4), 516–530. https://doi.org/10.1037/A0015991

Moss, A. C., Albery, I. P., Dyer, K. R., Frings, D., Humphreys, K., Inkelaar, T., Harding, E., & Speller, A. (2015). The effects of responsible drinking messages on attentional allocation and drinking behaviour. *Addictive Behaviors*, *44*, 94–101. https://doi.org/10.1016/j.addbeh.2014.11.035

Napper, L. E., Harris, P. R., & Klein, W. M. P. (2014). Combining self-affirmation with the extended parallel process model: The consequences for motivation to eat more fruit and vegetables. *Health Communication*, *29*(6), 610–618. https://doi.org/10.1080/10410236.2013.791962

NICE. (2010). *Alcohol-use disorders: prevention* [*PH24]*. https://www.nice.org.uk/guidance/ph24/chapter/Introduction

O'Donnell, A., Hanratty, B., Schulte, B., & Kaner, E. (2020). Patients' experiences of alcohol screening and advice in primary care: A qualitative study. *BMC Family Practice*, *21*(1), 68. https://doi.org/10.1186/s12875-020-01142-9

Orford, J., Dalton, S., Hartney, E., Ferrins-Brown, M., Kerr, C., & Maslin, J. (2002). How is excessive drinking maintained? Untreated heavy drinkers' experiences of the personal benefits and drawbacks of their drinking. *Addiction Research & Theory*, *10*(4), 347–372. https://doi.org/10.1080/1606635021000010270

Parke, H., Michalska, M., Russell, A., Moss, A. C., Holdsworth, C., Ling, J., & Larsen, J. (2018). Understanding drinking among midlife men in the United Kingdom: A systematic review of qualitative studies. *Addictive Behaviors Reports*, *8*, 85–94. https://doi.org/10.1016/J.ABREP.2018.08.001

Pechey, E., Clarke, N., Mantzari, E., Blackwell, A. K. M., De-Loyde, K., Morris, R. W., Marteau, T. M., & Hollands, G. J. (2020). Image-and-text health warning labels on alcohol and food: Potential effectiveness and acceptability. *BMC Public Health*, *20*(1), 376. https://doi.org/10.1186/s12889-020-8403-8

Peretti-Watel, P., & Moatti, J. P. (2006). Understanding risk behaviours: How the sociology of deviance may contribute? The case of drug-taking. *Social Science & Medicine (1982)*, *63*(3), 675–679. https://doi.org/10.1016/J.SOCSCIMED.2006.01.029

Peters, G. J. Y., Ruiter, R. A. C., & Kok, G. (2013). Threatening communication: A critical re-analysis and a revised meta-analytic test of fear appeal theory. *Health Psychology Review*, *7*(Suppl 1), S8–S31. https://doi.org/10.1080/17437199.2012.703527

Piacentini, M. G., Chatzidakis, A., & Banister, E. N. (2012). Making sense of drinking: The role of techniques of neutralisation and counter-neutralisation in negotiating alcohol consumption. *Sociology of Health & Illness*, *34*(6), 841–857. https://doi.org/10.1111/j.1467-9566.2011.01432.x

Pickard, H. (2016). Denial in addiction. *Mind & Language*, *31*(3), 277–299. https://doi.org/10.1111/mila.12106

Room, R. (2005). Stigma, social inequality and alcohol and drug use. *Drug and Alcohol Review*, *24*(2), 143–155. https://doi.org/10.1080/09595230500102434

Schomerus, G., Corrigan, P. W., Klauer, T., Kuwert, P., Freyberger, H. J., & Lucht, M. (2011). Self-stigma in alcohol dependence: Consequences for drinking-refusal self-efficacy. *Drug and Alcohol Dependence*, *114*(1), 12–17. https://doi.org/10.1016/j.drugalcdep.2010.08.013

Schwarzer, R., & Renner, B. (2009). Health-specific self-efficacy scales. *Freie Universität Berlin. Retrieved March*. https://www.researchgate.net/profile/Ralf_Schwarzer/publication/251801350_Health-Specific_Self-Efficacy_Scales/links/00b4952a9e98058340000000.pdf

Shepperd, J. A., Klein, W. M. P., Waters, E. A., & Weinstein, N. D. (2013). Taking Stock of Unrealistic Optimism. *Perspectives on Psychological Science*, *8*(4), 395–411. https://doi.org/10.1177/1745691613485247

Smith, J. J., Spanakis, P., Gribble, R., Stevelink, S. A. M., Rona, R. J., Fear, N. T., & Goodwin, L. (2022). Prevalence of at-risk drinking recognition: A systematic review and meta-analysis. *Drug and Alcohol Dependence*, *235*, 109449. https://doi.org/10.1016/J.DRUGALCDEP.2022.109449

So, J., Jeong, S. H., & Hwang, Y. (2017). Which type of risk information to use for whom? Moderating role of outcome-relevant involvement in the effects of statistical and exemplified risk information on risk perceptions. *Journal of Health Communication*, *22*(4), 304–311. https://doi.org/10.1080/10810730.2016.1252819

So, J., Kuang, K., & Cho, H. (2016). Reexamining fear appeal models from cognitive appraisal theory and functional emotion theory perspectives. *Communication Monographs*, *83*(1), 120–144. https://doi.org/10.1080/03637751.2015.1044257

Spada, M. M., & Wells, A. (2010). Metacognitions across the continuum of drinking behaviour. *Personality and Individual Differences*, *49*(5), 425–429. https://doi.org/10.1016/j.paid.2010.04.011

Speerforck, S., Schomerus, G., Matschinger, H., & Angermeyer, M. C. (2017). Treatment recommendations for schizophrenia, major depression and alcohol dependence and stigmatizing attitudes of the public: Results from a German population survey. *European Archives of Psychiatry and Clinical Neuroscience*, *267*(4), 341–350. https://doi.org/10.1007/s00406-016-0755-9

Stead, M., Angus, K., Langley, T., Katikireddi, S. V., Hinds, K., Hilton, S., Lewis, S., Thomas, J., Campbell, M., Young, B., & Bauld, L. (2019). Mass media to communicate public health messages in six health topic areas: A systematic review and other reviews of the evidence. *Public Health Research*, *7*(8), 1–206. https://doi.org/10.3310/phr07080

Tannenbaum, M. B., Hepler, J., Zimmerman, R. S., Saul, L., Jacobs, S., Wilson, K., & Albarracín, D. (2015). Appealing to fear: A meta-analysis of fear appeal effectiveness and theories. *Psychological Bulletin*, *141*(6), 1178–1204. https://doi.org/10.1037/a0039729

van Buuren, S., & Groothuis-Oudshoorn, K. (2011). Mice: Multivariate imputation by chained equations in R. *Journal of Statistical Software*, *45*(3), 1–67. https://doi.org/10.18637/jss.v045.i03

van Lettow, B., de Vries, H., Burdorf, A., Norman, P., & van Empelen, P. (2013). Associations between abstainer, moderate and heavy drinker prototypes and drinking behaviour in young adults. *Psychology & Health*, *28*(12), 1407–1423. https://doi.org/10.1080/08870446.2013.821473

Wakefield, M. A., Brennan, E., Dunstone, K., Durkin, S. J., Dixon, H. G., Pettigrew, S., & Slater, M. D. (2017). Features of alcohol harm reduction advertisements that most motivate reduced drinking among adults: An advertisement response study. *BMJ Open*, *7*(4), e014193. https://doi.org/10.1136/bmjopen-2016-014193

Wakefield, M. A., Loken, B., & Hornik, R. C. (2010). Use of mass media campaigns to change health behaviour. *Lancet (London, England)*, *376*(9748), 1261–1271. https://doi.org/10.1016/s0140-6736(10)60809-4

Wallhed Finn, S., Bakshi, A.-S., & Andréasson, S. (2014). Alcohol consumption, dependence, and treatment barriers: Perceptions among nontreatment seekers with alcohol dependence. *Substance Use & Misuse*, *49*(6), 762–769. https://doi.org/10.3109/10826084.2014.891616

WHO. (2018). International Classification of Diseases, 11th Revision (ICD-11). In *WHO*. World Health Organization. https://www.who.int/classifications/icd/en/

Weinstein, N. D. (1980). Unrealistic optimism about future life events. *Journal of Personality and Social Psychology*, *39*(5), 806–820. https://doi.org/10.1037/0022-3514.39.5.806

Williams, R., Alexander, G., Aspinall, R., Batterham, R., Bhala, N., Bosanquet, N., Severi, K., Burton, A., Burton, R., Cramp, M. E., Day, N., Dhawan, A., Dillon, J., Drummond, C., Dyson, J., Ferguson, J., Foster, G. R., Gilmore, I., Greenberg, J., … Yeoman, A. (2018). Gathering momentum for the way ahead: Fifth report of the lancet standing commission on liver disease in the UK. *Lancet (London, England)*, *392*(10162), 2398–2412. https://doi.org/10.1016/S0140-6736(18)32561-3

Wilson, G. B., Kaner, E. F. S., Crosland, A., Ling, J., McCabe, K., & Haighton, C. A. (2013). A qualitative study of alcohol, health and identities among UK adults in later life. *PloS One*, *8*(8), e71792. https://doi.org/10.1371/journal.pone.0071792

Witte, K. (1992). Putting the fear back into fear appeals: The extended parallel process model, *Communication Monographs*, *59*(4), 329–349. https://doi.org/10.1080/03637759209376276

Yzer, M., Southwell, B. G., & Stephenson, M. T. (2012). *Inducing fear as a public communication campaign strategy*. https://www.semanticscholar.org/paper/Inducing-fear-as-a-public-communication-campaign-Yzer-Southwell/02fc68d2cdd5c9fd8ac0b4d3b6c6a36ee707fb5b

Zell, E., Strickhouser, J. E., Sedikides, C., & Alicke, M. D. (2020). The better-than-average effect in comparative self-evaluation: A comprehensive review and meta-analysis. *Psychological Bulletin*, *146*(2), 118–149. https://doi.org/10.1037/BUL0000218

Zerhouni, O., Bègue, L., Comiran, F., & Wiers, R. W. (2018). Controlled and implicit processes in evaluative conditioning on implicit and explicit attitudes toward alcohol and intentions to drink. *Addictive Behaviors*, *76*, 335–342. https://doi.org/10.1016/j.addbeh.2017.08.026

Zhou, S., & Shapiro, M. A. (2017). Reducing resistance to narrative persuasion about binge drinking: The role of self-activation and habitual drinking behavior. *Health Communication*, *32*(10), 1297–1309. https://doi.org/10.1080/10410236.2016.1219931

Appendix A: Health risk infographic