ALCOHOL RESEARCH UK

Know your limits: Labelling interventions to reduce alcohol consumption

Dr Olivia Maynard, Dr Anna Blackwell, Professor Marcus Munafò and Dr Angela Attwood

April 2018

AUTHOR DETAILS

Dr Olivia Maynard, Dr Anna Blackwell, Professor Marcus Munafò and Dr Angela Attwood

UK Centre for Tobacco and Alcohol Studies, School of Experimental Psychology, University of Bristol

MRC Integrative Epidemiology Unit at the University of Bristol.

Contact: olivia.maynard@bristol.ac.uk

This report was funded by Alcohol Research UK. Alcohol Research UK is an independent charity working to reduce levels of alcohol-related harm by ensuring that policy and practice can always be developed on the basis of research-based evidence.

Read more reports at: www.alcoholresearchuk.org

Opinions and recommendations expressed in this report are those of the authors.

CONTENTS

EXECUTIVE SUMMARY

Alcohol labelling provides a relatively low-cost, population-level approach to providing consumers with information about the content and harms related to alcohol consumption. Alcohol consumers need to know how much they are drinking and how this relates to potential health risks in order to make informed decisions about their behaviour.

Across two online studies, we examined the impact of calorie, unit and health warning labelling on knowledge, attitudes, beliefs, intentions and behaviours related to alcohol. We found that knowledge of the calorific and alcohol content of alcoholic beverages is low and that by using labels which clearly present this information, knowledge can be increased. We suggest that these labels should put both calorie and unit information in the context of guideline amounts and give consumers information about the content of a single serving, rather than an entire bottle.

We found evidence that unit information may be used to facilitate greater alcohol consumption among some users. We suggest that the potential for misuse of information is not an adequate reason to withhold it from the public, but that this issue presents a strong case for the inclusion of health messages about the alcohol-related health risks alongside unit information.

We found that health warnings which describe the negative consequences of drinking, focusing on the risk of cancer, may be an effective communication tool. Increased support for health labelling policies was related to more positive responses to health warnings. Opportunities to involve the public in the development of public health policies to ensure they are clearly communicated may facilitate public support.

Our research suggests that a comprehensive alcohol labelling policy could benefit from a broad range of message content and formatting to maximise reach. Future research should identify how to effectively communicate information about alcohol content and harms to at-risk groups.

INTRODUCTION

A review of the alcohol trade press has shown that alcohol packaging has been used for decades by the industry as a promotional tool, and is important in influencing drinking behaviour, brand awareness and even taste (Stead et al., 2014). To minimise alcohol harms, we can use the same features instead to reduce consumption. Labelling interventions which change these features are described as 'choice architecture' interventions (CAIs), as they work by changing the environments in which decisions are made, and influence population health through their aggregate effect on behaviour (Hollands et al., 2013).

The importance of alcohol labelling interventions is recognised by policy-makers and in 2015, the European Parliament and the UK House of Lords European Union (EU) Committee called on the EU to "*make it mandatory for labelling on alcoholic beverages to include information on the strength, the ingredients, nutrition, and the dangers of drinking during pregnancy*" (European Union Committee, 2015, European Parliament, 2015). In 2011, the alcohol industry pledged to place clear labelling on at least 80% of products. However, a recent report has found that the industry has fallen short of this target both in terms of the extent and quality of this voluntary labelling (Institute of Alcohol Studies, 2015). Statutory regulation may be the only feasible method of ensuring alcohol labelling is '*clear, concise and effective*' (Institute of Alcohol Studies, 2015).

There is a lack of research on the effectiveness of alcohol labelling interventions (i.e. unit, calorie and health warning information) for reducing alcohol consumption (Hollands et al., 2013). Australian research has shown that 'standard drink' labelling (similar to UK 'unit' labelling) is effective in educating drinkers about the alcoholic content of beverages (Osiowy et al., 2015, Stockwell, 1994, Stockwell et al., 1991a, Stockwell et al., 1991b), but focus groups have suggested that unit information may paradoxically facilitate choice of high alcohol content beverages (Jones and Gregory, 2009). Despite the high calorie content of alcoholic beverages (Tujague and Kerr, 2009) and extensive research on calorie labelling for food and soft drinks (Yeomans et al., 2001, Yamamoto et al., 2005, Dumanovsky et al., 2011), little research has examined the impact of calorie information on drinking behaviour. Furthermore, it is possible that calorie information may have unintended consequences of discouraging eating while drinking, another concern which has not been examined (Kerr and Stockwell, 2012). Finally, although there is some evidence that alcohol warning labels increase awareness of the risks of drinking (MacKinnon et al., 1993, Greenfield and Kaskutas, 1993, Greenfield et al., 1993), there is less research on how best to present this information.

In the two studies reported here, we examine how alcohol labels influence attitudes and beliefs towards drinking, behavioural intentions and alcohol choice behaviours and examine whether there are any unintended consequences of presenting this information.

STUDY 1: ONLINE SURVEY

Introduction

This is an online public survey, investigating what information should be provided on alcohol labels, including the optimal presentation of health warnings, calories and units, and how to deliver this information to maximise the effectiveness for changing the attitudes, intentions and behaviour of consumers of alcohol.

The primary research questions are:

1. What is the public's current knowledge regarding the strength (i.e., alcoholic unit content), calorie content and health risks of alcohol?
2. What impact does viewing calorie, unit and health warning information have on knowledge, attitudes, beliefs, intentions and behaviours?
3. What are the unintended consequences of this information?
4. To what extent are calorie, unit and warning labelling interventions supported by the public?

Methods

Study Design

We conducted an online survey of social alcohol consumers. Information on a number of key demographics was also collected to enable analysis of how knowledge, attitudes and behaviour may differ between key groups.

Participants

We recruited alcohol consumers from the current sample of participants on Prolific Academic (https://www.prolific.ac/) and more widely from the general public, utilising the existing networks of the Tobacco and Alcohol Research Group (TARG) and public areas (e.g., libraries). Participants were required to be at least 18 years of age, live in the UK and report drinking alcohol. The study was approved by the Faculty of Science Research Ethics Committee at the University of Bristol (ethics approval code: 41541).

Measures and Materials

***Demographics*:** Participants reported their age, gender, ethnicity (ONS, 2015), marital status (ONS, 2016), height, weight, parental status (any children under 18), occupation and level of education.

***Patterns of drinking*:** The Alcohol Use Disorders Identification Test (AUDIT) (Bohn et al., 1995a) questions addressed actual drinking behaviour. Participants were asked how much they normally drink and their patterns of use. Participants were asked their beliefs about how much they currently drink relative to the UK Chief Medical Officers' drinking guidelines.

Support for labelling interventions: Participants indicated their support ('agree' vs 'disagree') for a range of statements related to health warnings and calorie and unit labelling (see Table 2 for a list of statements).

Knowledge of harms: Participants were asked "If you decided to reduce the amount of alcohol that you drink in the next six months, how sure are you that you would succeed?" and "The UK Chief Medical Officers' recommended weekly alcohol limit is 14 units for men and women. How easy do you think it would be for you to drink within these guidelines?" Responses were on a 1-5 point Likert scale from 'not at all' to 'extremely'. To assess response efficacy, participants were asked: "To what extent do you think that reducing your current alcohol intake would improve your health and well-being?" based on a 1-5 point Likert scale from 'not at all' to 'a great deal'.

Participants were asked about their perceptions of their own risk and the perceived severity of the 10 conditions outlined in the knowledge of harm question. The order in which conditions are presented was randomised. Severity and susceptibility questions were based on the scale proposed by Weinstein (2000).

Participants were also asked the extent to which they thought alcohol played a role in a list of 10 health conditions based on the Chief Medical Officers' (CMO) guidelines (Department of Health, 2016) and suggestions in European reports of alcohol harms and labelling (Eurocare, 2012, 2014). Arthritis was included as a red herring. Responses were given on a scale of 1 (not at all) to 10 (extremely).

Impact of health warnings on knowledge, attitudes, beliefs and behaviour: Participants were shown eight text-only health-related messages that depict different risks of alcohol consumption. These were based on Australian examples (AER Foundation, 2011) and suggestions in European reports (Eurocare, 2012, Eurocare, 2014), representing the wide-ranging health impacts of alcohol.

Participants were shown eight health related messages:

1. ALCOHOL INCREASES THE RISK OF LIVER DISEASE
2. ALCOHOL CAN REDUCE FERTILITY
3. ALCOHOL CAN CAUSE DEPENDENCE
4. ALCOHOL INCREASES THE RISK OF DRIVING ACCIDENTS
5. ALCOHOL INCREASES THE RISK OF CANCER
6. ALCOHOL INCREASES THE RISK OF MENTAL HEALTH PROBLEMS
7. ALCOHOL CAN HARM YOUR UNBORN CHILD
8. ALCOHOL INCREASES THE RISK OF INJURY

The presentation order of the health warnings was randomised. For each message, participants were asked the extent to which they agree that the message provides new information (novelty), is true (validity), or would make themselves or others drink less (impact). The impact questions are based on previous surveys of health warnings on alcohol products (Miller et al., 2016, Wigg and Stafford, 2016).

Participants were then asked the extent to which they agree that these kinds of labels are acceptable (acceptance) or annoying (reactance), whether they would try to

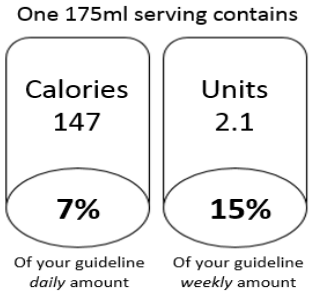
avoid them (avoidance), whether the government should put them on alcohol products (reactance), or whether they are used as a means of control (reactance). Agreement for these five factors was assessed on a 1-5 scale using the anchors 'strongly disagree' to 'strongly agree'. The reactance questions were based on the 27-item scale developed by Hall et al. (2016) for reactance to tobacco health warnings by smokers and non-smokers. The three items that were used in the current survey all have high factor loadings on three of the nine factors in the scale: anger, government and manipulation, which were found to reduce the perceived effectiveness of warnings, these factors were all also related to message avoidance. The avoidance questions were based on the ones used in the PATH study of smoking (Population Assessment of Tobacco and Health Study, 2015) selected to broadly cover the range of questions in the PATH study.

***Knowledge of calories and units*:** Participants were asked to estimate the number of calories and units in a selection of alcoholic drinks (volume and alcohol strength by volume were provided). Actual values were calculated using www.drinkaware.co.uk.

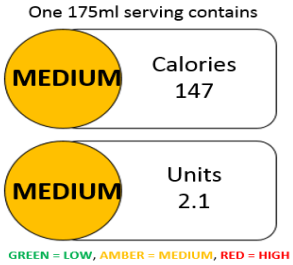
Participants were also asked to report the UK Chief Medical Officers' (CMO) recommended weekly drinking guidelines for men and women. The correct answer for both men and women is 14 units.

Impact of unit and calorie information on knowledge, attitudes, beliefs and behaviour: Participants were shown four examples of calorie and unit labels with different presentation formats and levels of information. As shown in Figure 1, the labels reflect existing nutritional labels used on food and soft drinks packaging (Borgmeier and Westenhoefer, 2009).

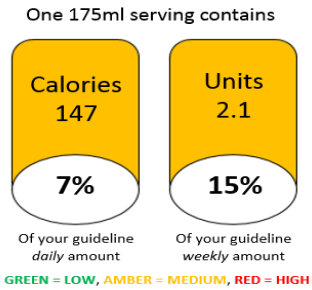
Label 1 Healthier choice tick



Label 2 Guideline amounts



Label 3 Traffic lights



Label 4 Guideline amounts with traffic lights

Figure 1 Example labels displaying calorie and / or unit information

Questions assessed whether participants believe that the information would help them to understand the calories and units of an alcohol drink. Participants were asked about the potential impact of the labels on their drinking behaviour, as well as which label they would most like to see of the alcohol products that they drink.

Participants were asked which of four drinks (beer/cider, wine, spirits, alcopops) they would normally drink and how many of these drinks they would normally have on one occasion. Based on this information they were shown the number of calories and units this would be equal to, to provide an example of more personalised feedback about alcohol content. Across a series of questions, participants were then asked the extent to which they think the provision of unit and calorie information would influence their own drinking behaviour.

Procedure

Once survey participants were recruited, as outlined above, they followed a link to the survey on the Qualtrics platform. The first screen provided participants with background information about the study, details on what would be involved in taking part. Participants were asked to confirm that they consent to their involvement. The survey took approximately 25-30 minutes to complete.

Results

Characteristics of participants

In total, 480 responses were received and 450 were analysed for this report. Thirty responses were excluded for the following reasons: not an alcohol drinker (n=26), not a UK resident (n=3) and user error (n=1). The majority of valid responses were collected through the Prolific Academic online crowdsourcing platform (n=304), and 146 valid responses were received through use of a direct link to the online survey (15 invalid responses were collected through each route and were excluded from analysis). Table 1 shows the demographic characteristics of the survey sample.

Table 1 Characteristics of participants

Characteristic	*Number and / or %*
Gender	
Female	242 (54%)
Male	205 (46%)
Other	3 (1%)
Age	**Mean (38), median (34), range (18-83)**
18-24	95 (21%)
25-34	141 (31%)
35-44	66 (15%)
45-54	59 (13%)
55-64	59 (13%)
65+	30 (7%)
Education level	**Mean (2), median (2)**
1 Post-graduate	107 (24%)
2 Graduate	184 (41%)
3 Post-school	106 (24%)
4 Secondary school or less	50 (11%)
AUDIT score	**Mean (8), median (7), range (1-36)**
Zone I (0-7: low risk)	239 (53%)
Zone II (8-15: excess of low risk)	163 (36%)
Zone III/IV (16+: harmful and hazardous/possible dependence)	48 (11%)
BMI	**Mean (25), median (24), range (15-59)**
Underweight (<18.5)	16 (4%)
Normal (18.5-24.9)	240 (53%)
Pre-obesity (25-29.9)	118 (26%)
Obesity I (30-34.9)	50 (11%)
Obesity II (35-39.9)	15 (3%)
Obesity III (≥40)	11 (2%)
Ethnicity	
White British or Irish	86%
Black or minority ethnic	14%
Marital status	

Single	42%
Cohabiting	20%
Married or civil partnered	32%
Divorced	4%
Widowed	1%
Religion (actively practicing faith)	12%
Children under 18	21%
Pregnant or breastfeeding	1% (added later - missing 199 responses)
Full time student	18%

Separate analyses were run for all participants who scored 16+ (n=48) on the AUDIT, suggesting harmful levels of drinking; 14 participants in this group (29%) scored 20+ suggesting possible alcohol dependence. The mean age of the harmful drinking group was 32 years old and two thirds (65%) of these participants were male. The mean BMI was the same as the whole sample (25.0, see Table 1). The majority (90%) of participants were from white British or Irish backgrounds. A higher proportion of this sample were single (77%) compared to the whole survey sample (42%). Similar proportions said they were actively practising a religion (15%) or had children under 18 (25%) compared to the whole sample. Over a quarter (29%) were full-time students, which was higher than the whole sample (18%).

Support for labelling interventions: There were high levels of public support for increased information on alcohol products, the majority of people agreed that unit and calorie information as well as health warnings were a good idea (Table 2). While most people believed that both the UK government and alcohol industry should inform people about the harms of alcohol consumption, there was less support for increased control from government over industry.

Support for calorie (83%) and unit (92%) labelling as well as health warnings (83%) was high among the harmful drinking group. However, almost half (46%) of this group said they would try and avoid health warnings. Students (36%) and people who consumed alcohol more than once a week (33%) or 7+ units in one session (37%) from the whole sample were also most likely to say that they would try to avoid health warnings on alcohol products.

Table 2 Support for labelling interventions

	Agree	*Disagree*
Alcohol unit information on drinks is a good idea	91%	4%
The UK government should inform people about alcohol-related harms	91%	3%
The alcohol industry should inform people about alcohol-related harms	88%	4%
Calorie information on alcoholic drinks is a good idea	81%	7%
Health warnings on alcoholic drinks are a good idea	77%	8%

The UK government should have more control over the alcohol industry	49%	24%

Knowledge of harms: Approximately two thirds of participants believed that it would be easy for them to drink within the CMO weekly guidelines (65%). The proportion of harmful drinkers who were sure that they would be able to reduce the amount of alcohol they consumed in the next six months if they chose to (23%) was half the proportion in the whole sample (51%). However, harmful drinkers were more likely to believe that reducing their consumption would improve their health (38%) compared to the whole survey sample (15%).

Participants generally believed that alcohol played a large role in a range of health conditions that have been previously covered in public health campaigns, such as drink driving injuries and harm to an unborn child when pregnant (Figure 2). On average, alcohol was only thought to play a moderate role in cancer. Arthritis was included as a red herring and this condition had the lowest mean score.

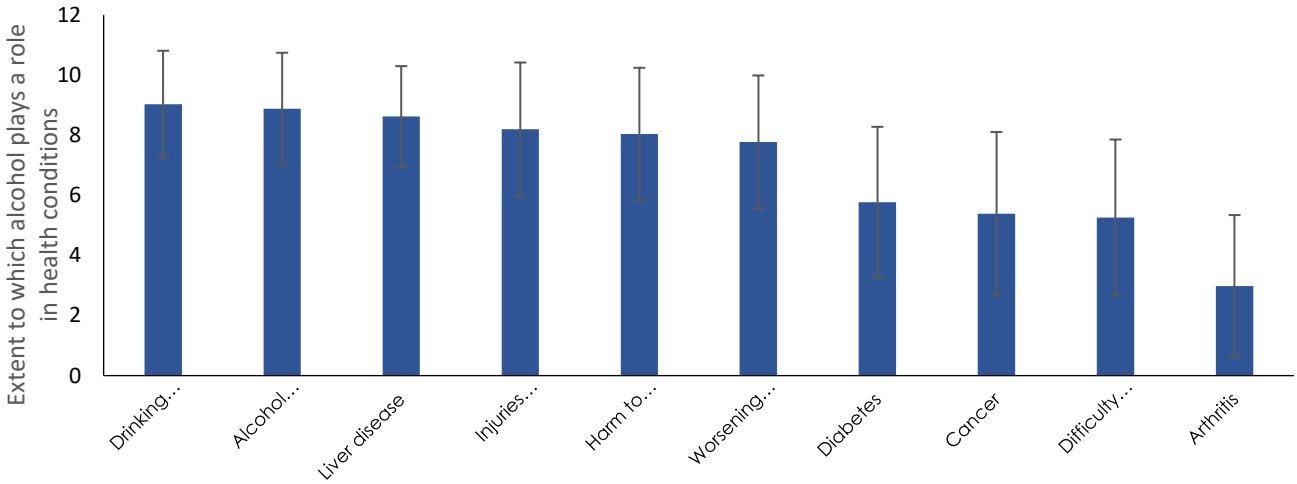


Figure 2 Mean scores for the role of alcohol in health conditions (scale 1 'not at all' to 10 'extremely'). Error bars represent standard deviation.

Participants in the harmful drinking group consistently rated the likelihood of alcohol impacting them across a range of health conditions as higher compared to the whole survey sample (Figure 3). The harmful drinking group rated liver disease and alcohol dependence as the most likely to impact, closely followed by injury and worsening depression.

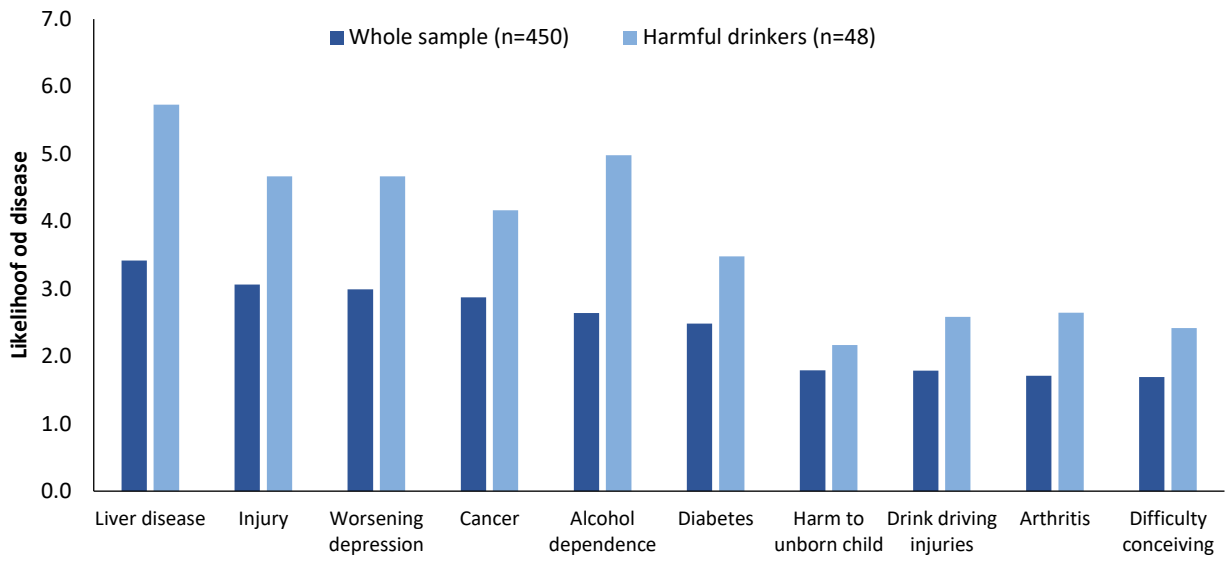


Figure 3 Likelihood ratings for the impact of drinking on personal health

Impact of health warnings on knowledge: Approximately one in five said that the liver disease, driving accidents and harm to unborn child messages provided new information (18%, 17%, 20%, respectively). In comparison a larger proportion said that the cancer, mental health and fertility messages provided new information (36%, 36% and 37% respectively).

Impact of health warnings on attitudes and beliefs: The majority of participants believed that the liver disease, driving accidents and harm to unborn child messages were true (95%, 95%, 91%, respectively). A slightly smaller majority believed that the cancer, mental health and fertility messages were true (72%, 77% and 76% respectively).

After reviewing the health warning examples, the majority of participants (86%) agreed that they would find it acceptable to see these messages on alcohol products, which was slightly higher than the proportion who thought health warnings were a good idea at the start of the study (77%, see Table 2).

Despite these levels of acceptance, over a quarter (28%) of respondents said they would try and avoid health warnings, one in five (20%) said they found them annoying and two in five (38%) said they would be used to try and control what people drink. A smaller but notable proportion (14%) felt that the government should not put warnings on alcohol products.

Impact of health warnings on intentions and behaviours: Participants were most likely to say that health messages about the risk of liver disease (39%), driving accidents (38%) and harm to an unborn child when pregnant (37%) would make them drink less (Figure 4). Over a third of participants (36%) also said that the cancer message would make them drink less. People were least likely to say that the mental health and fertility messages would make them drink less (21% and 26% respectively).

The harmful drinkers were most likely to agree that cancer (42%), pregnancy (40%) or driving (38%) warnings would encourage them to drink less. Information about the risks of cancer (31%), fertility problems (46%) and mental health (29%) related to alcohol consumption were most often recorded as providing new information and had lower ratings for validity (69%, 69% and 67% respectively).

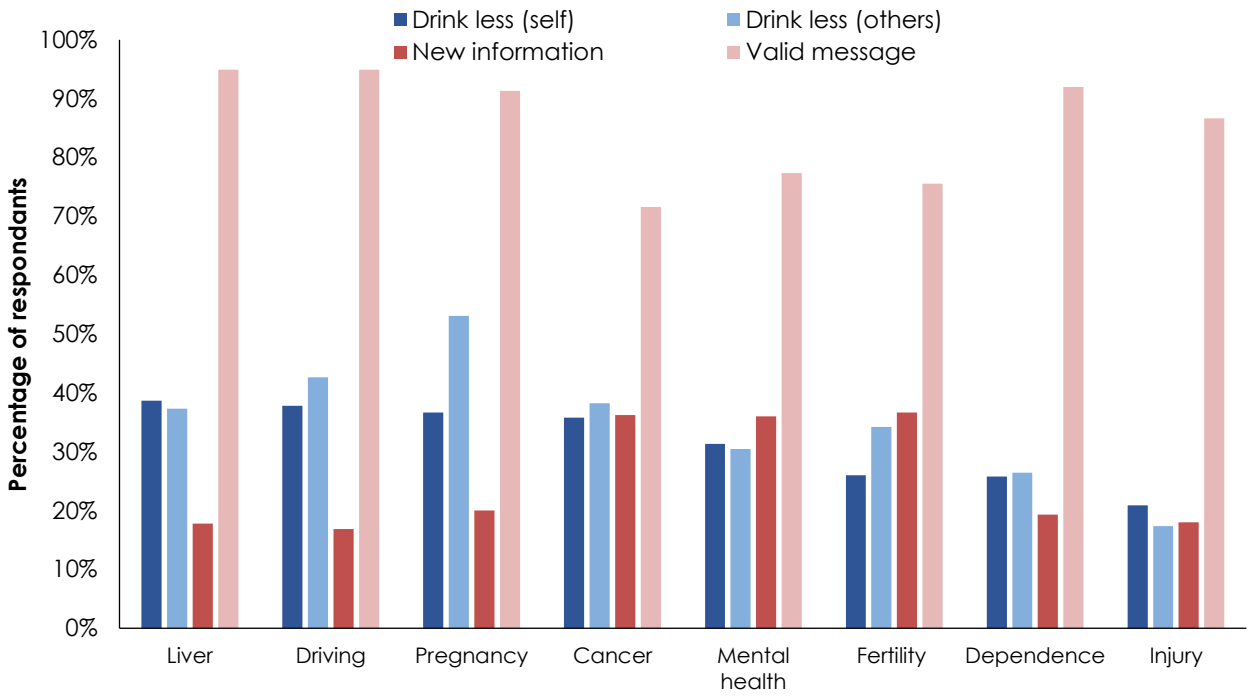


Figure 4 Responses to health-related messages

Calories and units

Knowledge of calories: Calories in alcoholic drinks were consistently over-estimated (Figure 5).

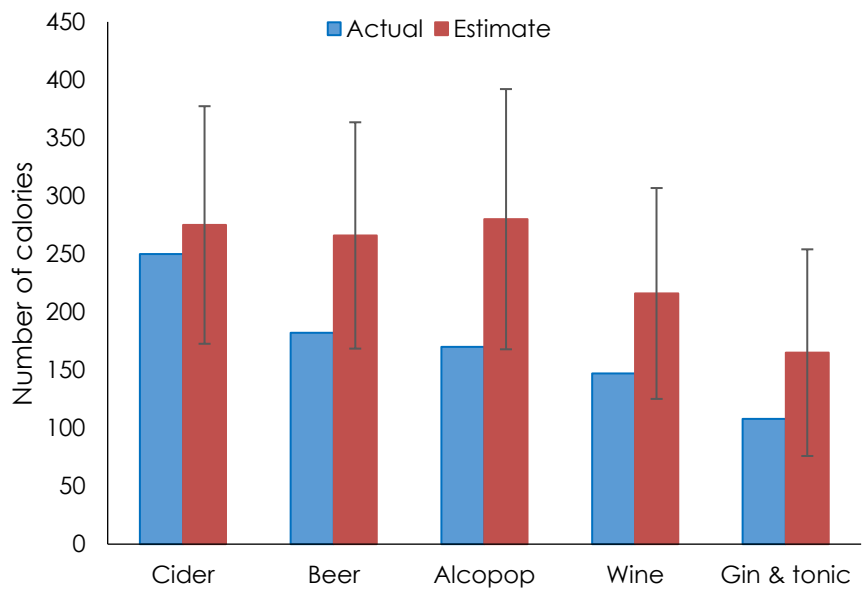


Figure 5 Mean calorie estimates of common alcoholic drinks. Error bars represent standard deviation

Knowledge of units: Participants reported that the CMO recommended weekly drinking guideline for men was 14 (SD = 6.6) and for women was 11 (SD = 5.3) – the correct answer is 14 for both men and women.

The accuracy of unit estimates varied across different drinks (volumes and alcohol strength by volume were provided). Mean estimates for a bottle of wine and pint of beer were consistent with the actual number of units (Figure 6). In contrast, estimates for the whisky (M=4.9) and vodka (M=2.6) were both two and a half times greater than the actual number (2.0 and 1.0 units, respectively). The large bottle of cider was the only drink for which people under-estimated (M=7.7) the actual number (10.0) of units.

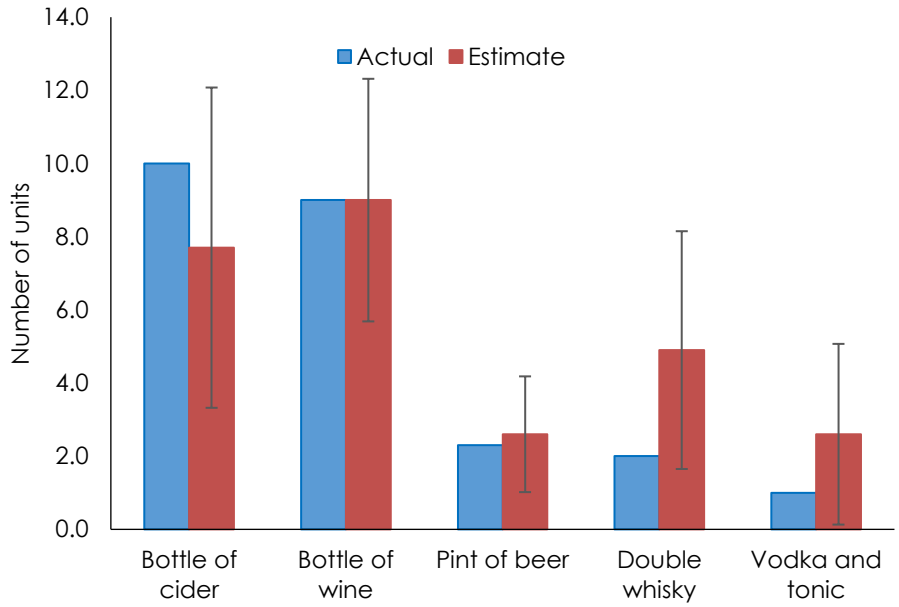


Figure 6 Mean estimates of units in common alcoholic drinks. Error bars represent standard deviation

Impact of calorie and unit labelling on knowledge: After being told the number of units and calories in their preferred drinks, beer/cider and wine drinkers frequently under-reported the number of units they were consuming (Table 3). Less than one in 10 participants under-reported the number of units in the spirits they drink, which was consistent with the tendency to over-estimate units in spirits.

Table 3 Proportion of participants stating the calories or units in their selected drinks were higher than expected

Drink	*Calories*	*Units*
Pint of beer or cider (n=177)	18%	37%
Glass of wine (n=189)	23%	34%
Single measure of spirits (before mixer) (n=75)	21%	8%
Alcopop (n=9)	0%	11%

The majority (85-90%) of people said that Labels 2-4 (Figure 1) helped them to understand the number of units and calories in a single drink. Less than a quarter of people said that Label 1 helped them understand the units (14%) or calories (22%) in a drink.

Approximately one in five (22%) respondents said that Label 4 would make them drink less. Similar proportions said Label 2 (19%) and Label 3 (17%) would make them drink less. Only 5% of participants said that Label 1 would make them drink less, and 15% said it would make them drink more (small proportions (5-7%) of people said that Labels 2-4 would make them drink more).

Impact of unit and calorie labelling on attitudes and beliefs: The majority of participants preferred Label 2 (26%) or Label 4 (63%) out of the four options, highlighting support for the use of a traffic light coloured system for alcoholic products, which is already being used on many food and soft drink products.

After receiving personalised calorie and unit information and rating example labels, agreement that this information should be included on alcoholic products was high (83% and 95%, respectively), maintaining the levels of support provided at the start of the survey (see Table 2).

***Impact of unit and calorie labelling on intentions and behaviour*:** Approximately a third of respondents said that they would take no action based on either the calorie or unit information (38% and 33% respectively). A small proportion of participants said that they would reduce the number of drinks they have based on the calorie (16%) and unit (14%) information. Based on the calorie information, approximately a third of people said that they would[1] use diet or low-calorie mixers (30%) or do more exercise (36%).

Approximately one in six people (16%) said that they would select a lower strength drink to avoid getting drunk, based on the personalised unit information, and 40% said they would select a lower strength drink to stay within safe driving limits. However, it is also possible that people could choose to drink even more of certain drinks if they realise they had been under-estimating their intake.

There was some evidence for negative unintended consequences of unit and calorie information. A small proportion (15%) of participants said that they would probably (or definitely) reduce the amount of food they eat based on information about calories in alcohol. Over a third (37%) of these people said that their diet was important when thinking about how much they drink. The proportions of people saying they would eat less were similar for male and female participants; however, a slightly larger proportion of female participants (19%) said they would reduce the number of drinks they have based on calorie information compared to male participants (13%).

In response to individualised unit information, male participants or people who drank 7+ units on one occasion were more likely to say they would select a high strength drink to get value for money (18% and 29%), good quality (16% and 23%) or to get drunk (12% and 30%) compared to female participants or people who typically drink 1-4 units on one occasion (≤11%). Students were also more likely to say they would select a high strength drink, to either get good value for money (31%) or get drunk

[1] Based on 'definitely' and 'probably' answers on a 1-5 Likert scale of likelihood

(28%). Overall, 12% of people said they would select high strength drinks to get drunk, based on the personalised unit information.

Discussion

In our large online survey of alcohol consumers, we examined knowledge, attitudes, intentions and behaviours resulting from viewing calorie, unit and health warning labels for alcoholic beverages.

Over a third of participants said that warnings about the risk of liver disease, driving accidents, harm to an unborn child when pregnant and cancer would make them drink less. In comparison, warnings about dependence and injury were less likely to be rated as effective. Interestingly, when asked about the role alcohol plays in certain health conditions, there was more awareness of those conditions which have been the subject of previous campaigns (i.e., drink driving injuries and risks when pregnant), compared to others that have not, (i.e., cancer, mental health and fertility problems). Given that a majority of participants reported that the cancer warning would encourage them to drink less, and we observed low levels of awareness of the link between alcohol and cancer, this could be a target for a new campaign. We observed some evidence of avoidance and reactance to health warning labels and this was particularly evident among the harmful drinkers. Evidence from the tobacco field suggests that avoidance and reactance are markers of engagement with health warnings (Thrasher et al., 2016, Cho et al., 2016). Future research should examine the extent to which avoidance and reactance of alcohol health warnings is related to drinking behaviour.

The inconsistencies and limited accuracy of calorie and unit estimation we observed demonstrates a need to increase public understanding of these measures. Our data suggest that the traffic light coloured calorie and unit labelling was preferred by the majority of participants. In addition, approximately one in five participants said that this information would make them drink less. However, separate interviews we have held with public health experts have cautioned against the use of 'traffic light' labelling, as these may give the false impression that those beverages labelled green are healthy. It has been suggested that only alcohol-free beverages should be labelled green. As we have found previously (Maynard et al., 2017), there was some evidence of negative unintended consequences of unit information, such that individuals reported that they would use this information to select high strength drinks, get good value for money and get drunk. Generally, calorie information was well received and the majority of participants reported that it would have a positive influence on their drinking behaviour.

Importantly, however, we found high levels of public support for increased information on alcohol products, including health warnings. We suggest that accurate calorie and unit labelling might be an effective intervention to encourage responsible drinking.

STUDY 2: ONLINE EXPERIMENT

Introduction

In Study 1, we found evidence that both cancer and mental health related warnings provide new information to a large minority of alcohol consumers. Here we develop these two warnings and investigate the optimal method of presenting this information to consumers. There are numerous variations regarding the formatting and content of alcohol health messages, which may impact on their effectiveness (Martin-Moreno et al., 2013, Farke, 2011). Research with Australian drinkers found that specific rather than general messages (e.g., '1 in 5 breast cancers are caused by alcohol' vs. 'Alcohol causes cancer') were rated as more believable and effective (Miller et al, 2016). The way messages are framed can also impact on responses; however, both positively (e.g., 'Reduce your drinking to reduce your risk of cancer') and negatively (e.g., 'Warning: alcohol increases your risk of cancer') framed messages may play a useful role and could appeal to different types of drinkers (Jarvis & Pettigrew, 2013).

In Study 1 we used a survey methodology to examine alcohol consumers' attitudes to unit and calorie labelling. There was wide support for calorie labelling with the majority of participants reporting that it would at least make them consider their alcohol consumption. Consumers were less knowledgeable about units and there was evidence that this information could have unintended consequences among some individuals. In Study 2 we therefore use an experimental design to examine the impact of unit information on alcohol choice and knowledge in relation to the current low-risk weekly drinking guidelines. We compare four unit labels: 1) the basic alcohol by volume (ABV) percentage, which is required on all alcoholic drinks; 2) total units per bottle, which are used in the alcohol industry Responsibility Deal; 3) units per serving alongside percentage of the weekly low-risk guideline amount, following the example of voluntary food labelling schemes; and 4) a novel pie chart design that displays units as a proportion of the weekly low-risk guideline amount.

The primary research questions are:

1. What is the best method of presenting unit information?
2. What is the best method of presenting health warning information?

Methods

Study Design

We conducted an online between-subjects experiment with two tasks. Participants were randomised to one of four unit conditions in the first task (see Table 4) where accuracy in assessing conceptual understanding of units was the primary outcome measure. In the second task, participants were randomised to one of eight health warning label conditions (where the health warnings varied in their specificity, framing and health message – see Table 5) and participants completed a series of questions regarding this warning, where motivation to drink less was the primary outcome measure. Support for alcohol labelling policies before and after the

experiments was also assessed. The study protocol was published on the Open Science Framework prior to starting testing, where more details about the methods are described (Drax et al., 2017, May 26).

Participants

We recruited alcohol consumers from the current sample of participants on Prolific Academic (https://www.prolific.ac/). A sample size calculation indicated that 1900 participants were required. Participants read an information statement before giving their consent to participate. Equal numbers of males and females were recruited, achieved by creating identical, but separate online experiments for male and female participants. Participants were required to be at least 18 years of age, live in the UK and report drinking alcohol. We used the pre-screening feature on Prolific Academic to confirm age and location, while alcohol consumption was assessed in the first question in the experiment. The study was approved by the Faculty of Science Research Ethics Committee at the University of Bristol (ethics approval code: 23051753685).

Measures and Materials

Demographic questions. Participants were first asked 'Do you drink alcohol?', with the options 'Yes' and 'No'. Those participants answering 'No' were taken to the end of the experiment and were not reimbursed. Participants also provided demographic information including age, gender, and where they currently live in the UK and their highest qualification attained. Participants were asked whether they are currently a university student and students stated what type of course they study. Level of problematic alcohol use was assessed using the Alcohol Use Disorders Identification Test (AUDIT) (Bohn et al., 1995a).

Support for alcohol labelling. Participants were asked to what extent they agree with the following statements: 1) 'Alcoholic beverages should include more information about alcohol strength (i.e., unit information)', 2) 'Alcoholic beverages should have information about the health impact of drinking (i.e., health warning labels)', and 3) 'Alcoholic beverages should include more nutritional information (i.e. calorie information)'. These three questions were answered using a 100-point visual analogue scale with the anchors 'STRONGLY DISAGREE' and 'STRONGLY AGREE'.

Unit information task and stimuli. Participants were randomly assigned to one of four unit label conditions (see Table 4 for images of these labels): 1) Basic ABV, 2) Responsibility Deal, 3) Food Label Equivalent and 4) Pie Chart. The 'Basic ABV' label is the minimum legal requirement for alcohol labels and this information was also included in the other conditions (ABV = 'alcohol by volume' and refers to the strength of the drink). The 'Responsibility Deal' label is the one typically used to meet the Responsibility Deal requirements, which call for 'labels with clear unit content'. The 'Food Label Equivalent' label is similar to the labels typically seen on food products in the UK and is therefore a plausible suggestion for unit labels in the UK. The 'Pie Chart' label is a novel label designed by the research team which presents the proportion of one's weekly units taken by a single alcoholic beverage.

Conceptual understanding of units. To examine if unit labelling can improve conceptual understanding of units and weekly drinking guidelines, participants were shown four alcoholic beverages (presented in a line on a single page which the participant had to scroll down) alongside the unit label according to their condition (see Table 1). The four beverages reflected the most popular drink types and brands in the UK and the presentation order of the four beverages was randomised. Participants were asked: 'How many [serving name (XX ml)] of this [wine / cider / vodka / beer] could you have in a week before reaching the recommended limit of 14 units per week?' The accuracy of this estimate was the primary outcome measure for the unit information task. Time taken to make the response was also measured (participants were asked to 'answer as quickly and as accurately as you can', and told that they must not use a calculator).

Drink choice. To examine the impact of unit labelling on drink choice, participants were presented with three bottles of non-UK (i.e., relatively unfamiliar) beer bottles brands, simultaneously on screen, each alongside the unit label as per their randomly assigned condition (see Figure 2). The three beers were labelled with different alcohol strengths (ABVs): 4%, 5% and 6% and between participants this strength information was randomised between the three beer brands to control for any systematic brand preferences. Participants were asked 'Which beer would you choose to drink?' Participants were required to click on one of the beers.

Table 4 Unit presentation conditions

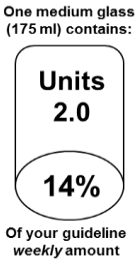
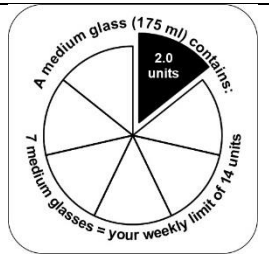
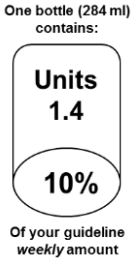
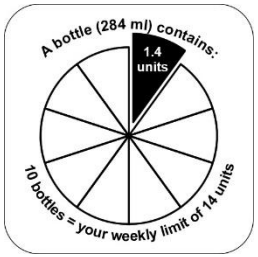
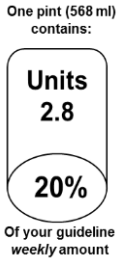
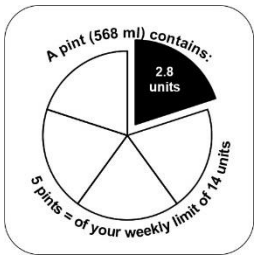
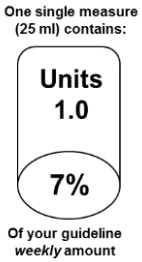
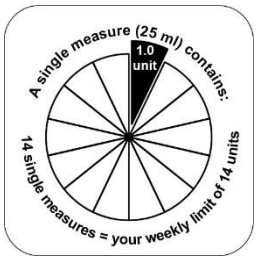
	Alcohol bottle stimuli	Basic ABV	Unit Label Condition			
			Responsibility Deal	Reference Intake		Pie chart
Hardy's – white wine 8.6 units / bottle 2.0 units / 175 serving 7 servings per week		ABV 11.5% 750ml				
Stella Artois – beer 1.4 units / bottle 1.4 units / 284ml serving 10 servings per week		ABV 4.8%				
Strongbow – cider 10 units / bottle 2.8 units / 568ml (pint) serving 5 servings per week		ABV 5% 2L				
Smirnoff – vodka 28 units / bottle 1.0 unit / 25ml serving 14 servings per week		ABV 40% 700ml				

Figure 7 Example beer and Responsibility Deal labels for drink choice task

Health warning task and stimuli. Table 5 presents the eight different health warnings used, categorised according to message specificity (general vs specific), message framing (positive vs negative) and message content (cancer vs mental health). Participants were randomly assigned to view one of these warnings towards the bottom of a bottle of unfamiliar beer in black text on a white background.

Table 5 Health warning messages

	General		Specific	
	Negatively framed	Positively framed	Negatively framed	Positively framed
Cancer	Alcohol increases your risk of cancer	Drinking less reduces your risk of cancer	Alcohol increases your risk of bowel cancer	Drinking less reduces your risk of bowel cancer
Mental health	Alcohol increases your risk of mental illness	Drinking less reduces your risk of mental illness	Alcohol increases your risk of depression	Drinking less reduces your risk of depression

Motivation to drink less: To measure motivation to drink less, participants were asked 'Does this health warning make you feel motivated to drink less?' This question was answered on a five-point-scale from 'STRONGLY DISAGREE' (coded as 1) to 'STRONGLY AGREE' (coded as 5) (adapted from (Wakefield et al., 2017)). This was our primary outcome measure as recent research has used this measure to assess responses to anti-alcohol advertisements (Wakefield et al., 2017).

Reactance: To measure reactance to the warning, the Brief Reactance to Health Warnings Scale (BRHWS) was administered (Hall et al., 2017). Participants rated the extent to which they agree that 'This warning is trying to manipulate me', 'The health effect on this health warning is overblown' and 'This warning annoys me'. Agreement with reactance statements was scored on a five-point scale from 'STRONGLY DISAGREE' (coded as 1) to 'STRONGLY AGREE' (coded as 5).

Avoidance: Avoidance of the warning was measured with three items, preceded by the text 'Imagine that all alcohol containers had this warning' 1) 'How likely is it that you would try to avoid thinking about the warning?' 2) 'How likely is it that you would try to avoid looking at the warning on your drink?', and 3) 'How likely is it that you would keep the drink out of sight to avoid looking at the warning?' Questions were answered on a five-point scale from 'NOT AT ALL LIKELY' (coded as 1) to 'EXTREMELY LIKELY' (coded as 5).

Believability: To assess the believability of the warning, participants were asked 'How believable is this health warning?' This question was answered on a five-point scale from 'NOT AT ALL BELIEVABLE' (coded as 1) to 'EXTREMELY BELIEVABLE' (coded as 5).

Other measures: To assess self-efficacy, participants were asked 'For me cutting down on the number of alcohol units that I drink in the next week would be…'VERY DIFFICULT' (coded as 1) to 'VERY EASY' (coded as 5). To assess response-efficacy, participants were asked, 'To what extent do you think that cutting down on your drinking would reduce your risk of alcohol-related disease?' Questions were answered on a five-point scale from 'NOT AT ALL LIKELY' (coded as 1) to 'EXTREMELY LIKELY' (coded as 5). To assess alcohol craving, participants competed the Alcohol Urges Questionnaire (AUQ). The AUQ is an 8-item measure of drinking urges, answered on a 7-point Likert-type scale (Bohn et al., 1995b).

Procedure

The study was designed and hosted on the Qualtrics online survey platform (http://www.qualtrics.com/). Participants were recruited using Prolific Academic, which provides participants with a link to the study on the Qualtrics platform. The experiment was only compatible with desktop and laptop devices to ensure the stimuli were readable. Participants were first shown an information statement explaining the experiment and what they were required to do and the completed a tick-box consent page.

Participants then completed the screening demographic questions and reported their support for alcohol labelling policies. Qualtrics was used to pseudo-randomise participants into the different experimental conditions (i.e., one of four unit information conditions and one of eight health warning conditions) such that an equal number of participants were in each condition. They then completed the unit information and health warning tasks in that order.

Participants completed the questions regarding self-efficacy, response efficacy and the AUQ. This section included one attention check question, which asked participants to select a particular option ('This is an attention check question, please

select the 'extremely likely' option'). Finally, participants again reported their support for alcohol labelling policies, completed the AUDIT, and provided their educational attainment and student status. At the end of the survey, participants were presented with a debriefing screen including information about how they can find more information if they wished to. The experiment took approximately 10 minutes to complete and participants were reimbursed £1 on completion.

Statistical Analysis

Estimates of how many servings of each of the four drinks an individual could have in a week before reaching the limit of 14 units were subtracted from the correct answer for each of the four different beverages. These four scores were then averaged to create an overall accuracy variable. The full data analysis plan is presented in the study protocol (Drax et al., 2017, May 26).

Results

Characteristics of participants

Data were collected for 1908 participants. Of these, 24 participants (13 females) were excluded from all analyses based on giving an incorrect response for the attention check question. Remaining participants (n=1884) were 50% female, had a mean age of 35 (SD=11.9) and 83% lived in England, 10% in Scotland, 5% in Wales and 2% in Ireland. 58% of participants' highest level of education was from a higher education institution and 13% were currently students. Of these 71% were studying for undergraduate degrees.

Unit information

Primary outcome - accuracy of number of servings estimates: As shown in Table 6, the mean accuracy scores for all labelling conditions were below zero, indicating that on average, participants underestimated the number of servings of each drink they could have before reaching the weekly recommended maximum. One way ANOVA with unit condition (Basic ABV, Responsibility Deal, Food Label Equivalent or Pie Chart) as the four variables provided evidence for a main effect of unit label condition ($F_{(3,1880)}=22.16$ $p<0.001$, $\eta^2=0.03$). Bonferroni corrected post-hoc t-tests indicated that those in the Food Label Equivalent and Pie Chart conditions were more accurate than those in the Basic ABV and Responsibility Deal conditions (i.e. Responsibility Deal vs Food Label Equivalent: $t_{(1880)}=4.61$, $p<0.001$). There were no differences between the estimates for the Basic ABV and Responsibility Deal conditions and between the Food Label Equivalent and Pie Chart conditions. Figure 8 displays the accuracy estimates for participants in the four conditions for each of the four beverages indicating that participants were particularly inaccurate in estimating the number of servings for vodka.

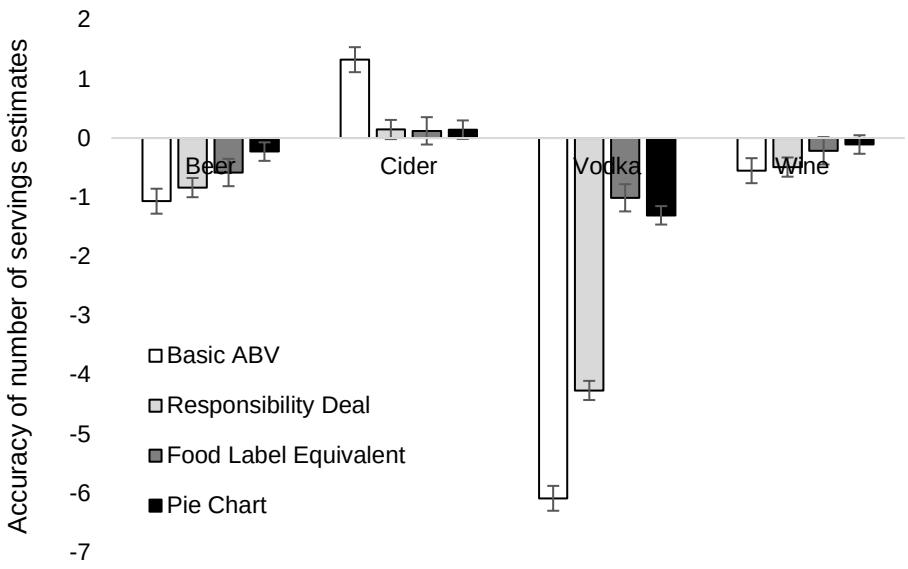


Figure 8 Accuracy of number of servings estimates for the unit information task. Error bars represent standard error of the mean

Secondary outcome measures. A series of one-way ANOVAs were conducted with unit condition (Basic ABV, Responsibility Deal, Food Label Equivalent or Pie Chart) on each of the secondary outcome measures (time taken to complete the number of servings question for all four drinks, self-efficacy to drink less, response-efficacy and the AUQ). All means are presented in Table 6.

Table 6 Summary of all outcome measures for the unit information task

	Basic ABV (n=470)	Responsibility Deal (n=470)	Food Label Equivalent (n=475)	Pie Chart (n=469)
Accuracy	-1.60 (3.71)	-1.36 (2.77)	-0.42 (1.98)	-0.38 (2.93)
Time taken	71.12 (54.12)	115.24 (90.59)	83.44 (72.54)	77.01 (46.03)
Self-efficacy	4.21 (0.96)	4.26 (0.94)	4.15 (1.04)	4.17 (1.04)
Response-efficacy	3.73 (1.15)	3.68 (1.18)	3.56 (1.19)	3.55 (1.21)
AUQ	19.16 (7.61)	19.22 (8.19)	20.07 (8.98)	20.23 (9.03)

Figures represent means (standard deviations)

Time taken: A main effect was observed for the time taken to complete the task ($F_{(3, 1880)}$=39.30 p<0.001, η^2=0.06). Participants in the Basic ABV condition completed the unit task in the shortest number of seconds followed by the Pie Chart condition and Food Label Equivalent condition. Participants in the Responsibility Deal condition completed the unit task in the slowest time and post-hoc Bonferroni corrected t-tests indicated that the only meaningful difference was between the time taken for those in the Responsibility Deal condition and the other three conditions (e.g. Responsibility Deal vs Food Label Equivalent: $t_{(1880)}$=6.93, p<0.001).

Self-efficacy: Overall there was relatively high self-efficacy across participants (M=4.2; SD=1.0). One way ANOVA with unit condition (Basic ABV, Responsibility Deal, Food Label Equivalent or Pie Chart) on self-efficacy to drink less indicated no evidence of a difference between those in the four conditions ($F_{(3, 1880)}$=1.15 p=0.33, η^2=0.002).

Response efficacy: Overall there was relatively high response-efficacy across participants (M=3.63; SD=1.2). One way ANOVA with unit condition (Basic ABV, Responsibility Deal, Food Label Equivalent or Pie Chart) on response-efficacy indicated weak evidence of a difference between those in the four conditions ($F_{(3, 1880)}$=2.73 p=0.04, η^2=0.004) with the highest response-efficacy among those in the Basic ABV condition.

Alcohol Urges Questionnaire (AUQ): One way ANOVA with unit condition (Basic ABV, Responsibility Deal, Food Label Equivalent or Pie Chart) on the AUQ indicated weak evidence of a difference between those in the four conditions ($F_{(3, 1880)}$=2.14 p=0.09, η^2=0.003).

Drink choice: An ordinal logistic regression was conducted to examine the impact of unit condition on alcohol choice (4%, 5% or 6%). There was no evidence for a difference in choice between the four conditions (see Figure 9).

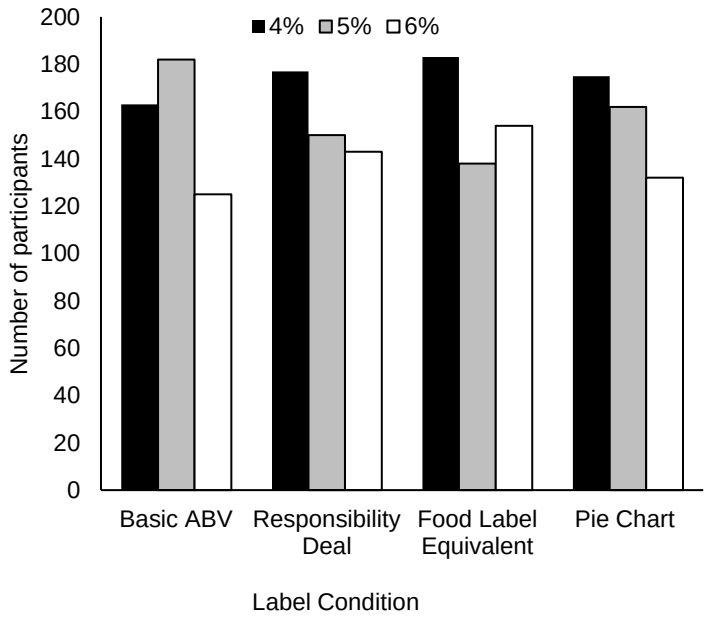


Figure 9 Drink choice for participants in the four unit label conditions for the unit information task

Health warning

A series of 2 (message specificity) × 2 (message content) × 2 (message framing) factorial ANOVA were conducted on each of the outcome measures: motivation to drink less, reactance, avoidance, self-efficacy, response-efficacy and AUQ. Motivation, reactance and avoidance were all asked of participants in direct relation to the health warnings, while self-efficacy, response-efficacy and the AUQ

were asked at the end of the experiment. Motivation to drink less was our primary outcome measure and our analyses were powered to detect only main effects rather than interactions. Means are reported in Table 7.

Health message - cancer versus mental health warnings. There was evidence that motivation to drink less ($F_{(1, 1876)}$=6.45, p=0.01, η^2=0.003) was higher among those participants randomised to the cancer versus mental health warning. Avoidance was also higher for those in the cancer condition# ($F_{(1, 1876)}$=21.93, p<0.001, η^2=0.012)

Specificity - general versus specific warnings. There was evidence that those randomised to view the specific warning reported lower levels of reactance ($F_{(1, 1876)}$=7.04, p=0.008, η^2=0.004), found the warning more believable ($F_{(1, 1876)}$=16.75, p<0.001, η^2=0.009) and had higher response-efficacy ($F_{(1, 1876)}$=6.94, p=0.008, η^2=0.004) versus those who viewed a general warning.

Framing - negative versus positive warnings. The negatively framed warnings received higher scores for motivation to drink less ($F_{(1, 1876)}$=7.01, p=0.008, η^2=0.004), reactance ($F_{(1, 1876)}$=5.87, p=0.015, η^2=0.003) and avoidance ($F_{(1, 1876)}$=6.10, p=0.014, η^2=0.003) than the positively framed warnings.

Table 7 Summary of outcomes for the health warning information task

	Health warning message			Health warning specificity			Health warning framing		
	Cancer	Mental health	P value	General	Specific	P value	Negative	Positive	P value
Motivation to drink less	2.77 (1.20)	2.63 (1.21)	0.01	2.74 (1.20)	2.67 (1.20)	0.24	2.77 (1.14)	2.63 (1.17)	0.01
Reactance	2.91 (1.08)	2.91 (1.08)	0.91	2.97 (1.08)	2.85 (1.07)	0.01	2.97 (1.08)	2.84 (1.06)	0.02
Avoidance	2.98 (1.17)	2.72 (1.10)	<0.001	2.90 (1.12)	2.81 (1.15)	0.10	2.92 (1.12)	2.79 (1.15)	0.01
Believability	3.48 (1.09)	3.41 (1.08)	0.18	3.34 (1.08)	3.55 (1.07)	<0.001	3.46 (1.10)	3.43 (1.06)	0.53
Self-efficacy	4.16 (1.02)	4.23 (0.98)	0.11	4.17 (1.10)	4.22 (0.98)	0.35	4.19 (1.02)	4.20 (0.98)	0.76
Response efficacy	3.59 (1.19)	3.67 (1.18)	0.17	3.56 (1.19)	3.70 (1.18)	0.01	3.61 (1.20)	3.64 (1.17)	0.59
Alcohol urges	19.60 (8.35)	19.73 (8.21)	0.73	19.69 (8.16)	19.65 (8.40)	0.92	19.53 (7.88)	19.81 (8.67)	0.47

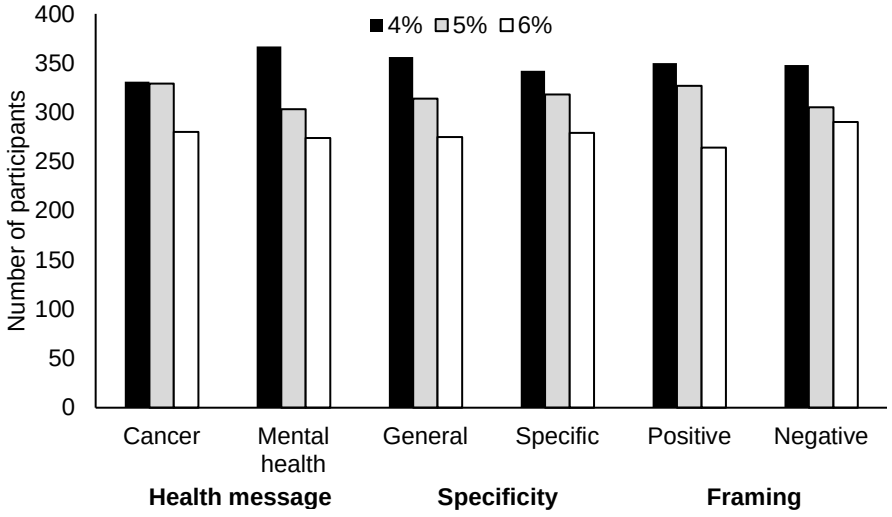


Figure 10 Drink choice for participants viewing the different warnings for the health

An ordinal logistic regression was run to examine the impact of the health warning information on drink choice (4%, 5% or 6%). The model included three independent variables (message specificity, content and framing), each with two levels as described above. There was no evidence that any of the variables increased the ordered log odds of choosing the lower strength drink (see Figure 10).

Support for labelling policies

A 2 (pre-study vs post-study) x 3 (information type: strength information, health warning, calorie information) ANOVA was conducted to examine change in support for labelling policies (scored out of 100) over the course of the experiment. This revealed an interaction ($F_{(2,3764)}$=15.07, p<0.001, η^2=0.008) characterised by an increase in support for strength information (pre: M=66.80, SD=26.80, post: M=69.67, SD=26.25; $t_{3766)}$=8.52, p<0.001) and calorie information (pre: M=66.01, SD=28.05, post: M=67.19, SD=27.96; ($t_{3766)}$=4.43 p<0.001) after the experiment, but not health warning information (pre: M=61.31, SD=27.90, post: M=61.67, SD=28.87; $t_{3766)}$=0.91, p=0.36). A main effect of label type ($F_{(2,3766)}$=56.74 p<0.001, η^2=0.029) indicated that support for strength information was marginally greater than for the calorie information ($t_{(3766)}$=1.89 p=0.06), which in turn was greater than for the health warning information ($t_{(3766)}$=7.21, p<0.001), which had the lowest levels of support.

A series of linear regressions examining the relationship between support for health warning labelling policies (at the beginning of the experiment) and responses to the health warnings indicated that those with higher levels of support reported lower levels of reactance (-0.13, 95% Confidence Interval (CI) = -0.15 to -0.12, p<0.001) and avoidance (-0.003,95% CI = -0.005 to -0.001, p=0.001) and higher levels of warning believability (0.009, 95% CI = 0.007 to 0.010, p<0.001), motivation to drink less (0.016, 95% CI = 0.015 to 0.018, p<0.001), self-efficacy (0.004, 95% CI = 0.003 to 0.06, p<0.001) and response efficacy (0.010, 95% CI = 0.008 to 0.012, p<0.001). Support scores for each of the labelling types (strength, calorie and health warnings) at the end of the experiment were subtracted from those at the beginning to create a change in

support score for each type. A 2 (message specificity) × 2 (message content) × 2 (message framing) factorial ANOVA observed no evidence for a difference in the change score for support for health warning information between participants in different health warning conditions. A one-way ANOVA with unit condition (Basic ABV, Responsibility Deal, Food Label Equivalent or Pie Chart) observed no evidence of a difference between those in the four different unit label conditions regarding support for strength information.

Discussion

We find that the presentation and format of health information can impact on the effectiveness of labels to communicate accurate information and encourage healthier behaviour. Overall, participants under-estimated the number of drink servings they could have within the low-risk weekly guideline amount of 14 units, which demonstrates the difficulty drinkers have estimating alcohol consumption in units and across multiple drinks. Inaccurate estimates were particularly evident for vodka, which was consistent with the findings from Study 1, which found that people overestimate the number of units in spirits to a greater extent than wine and beer. The absence of a difference in accuracy between the Basic ABV and Responsibility Deal conditions, and the increased accuracy shown in the Food Label Equivalent and Pie Chart conditions, clearly demonstrates that current unit labels could be improved. In addition, participants in the Responsibility Deal condition took the longest time to complete the unit estimates. It is important that consumers have a clear understanding of how many drinks are equivalent to the weekly guidelines to consider the extent to which their own consumption varies from this amount.

The type of unit label had little to no impact on the measures of participants' cognition related to behaviour change, in terms of their ability to reduce consumption, the impact it would have on their health or their choice of drink. These findings are consistent with the results from Study 1, in which only a small proportion of respondents suggested that they would drink less in response to unit information that related to their personal level of consumption. However, it is also possible that if consumers were previously under-estimating how many drinks constituted 14 units then they could feel encouraged to increase their drinking.

Martin-Moreno and colleagues (2013) considered the issue of unintended consequences previously in a review of the labelling literature. They concluded that the potential for misuse of information was not an adequate reason to withhold it from the public, but that this issue presents a strong case for the inclusion of messages about the alcohol-related health risks alongside unit information (Martin-Moreno et al., 2013). Unit labelling alone may not present a sufficient strategy for improving public health, and policy-makers should consider the valuable addition of health warnings, which, aside from warnings about drinking when pregnant, are currently missing from voluntary industry labelling approaches.

Along with Study 1, this study provides some guidance on the type of health messages that could be included on alcohol labels. Participants' reported higher motivation to drink less when viewing both cancer messages and negatively framed messages. The latter is consistent with previous research that found negatively

framed messages could support reduction in alcohol consumption; however, the research also found that positively framed messages could have a beneficial role in promoting healthier decision making (Jarvis and Pettigrew, 2013). The present study found that reactance was greater in response to negatively framed messages and avoidance was higher for both negatively framed and cancer messages. There is some evidence from the tobacco literature that avoidance and reactance are markers of engagement with health warnings (Thrasher et al., 2016, Cho et al., 2016). It is important to conduct further research to examine the relationship between these measures of actual drinking behaviour.

CONCLUSIONS

Alcohol labelling provides a relatively low-cost, population-level approach to providing consumers with information about the content and harms related to alcohol consumption. In both Studies 1 and 2, we found relatively high levels of support for alcohol labelling interventions, although support for health warnings was lowest. Increased support for health labelling policies was related to more positive responses to health warnings. Opportunities to involve the public in the development of public health policies to ensure they are clearly communicated may facilitate public support.

Our research suggests that a comprehensive alcohol labelling policy could benefit from a broad range of message content and formatting to maximise reach. We have developed and tested a range of novel designs for presenting unit and calorie information.

Future research should identify how to most effectively communicate information about alcohol content and harms to at-risk groups. Hospital admissions related to alcohol disproportionately occur among people from lower socioeconomic backgrounds and awareness of the low-risk guidelines are also lower among this demographic of drinkers. This highlights the need to target improvements in health literacy to address health inequalities increased through alcohol use (Rosenberg et al., 2017).

Public engagement

We ran a public engagement event at the Bristol science museum At-Bristol (now 'We the Curious') at an adult-only event. We created a 'Bar to the Future' and developed labels for four fictitious beer brands which differed in their unit, calorie and health warning information. These used the unit and calorie labels we developed for Study 1. Attendees rated the taste of each beer and then had small group discussions with researchers about what information should be placed on alcohol products.

Figure 11 Bar to the Future' event at At-Bristol

The event was a valuable opportunity to hear the public's perspective on what they would, and would not, like to see on labels. We collected a huge number of suggestions about ways to help people understand the strength of different alcoholic drinks and encourage people to think about how much they're drinking, as well as reactions to the type of health messages that have previously been used on tobacco packaging.

There was a lot of support for improving unit labelling and putting this information into the context of low risk drinking guidelines. People recognised the potential for serious health messages, such as the link between alcohol and bowel cancer, to have a strong impact, and thought it was important to know this information, but some thought that labelling of this kind on alcohol products might be going too far. Discussions also raised questions about how relevant people would find long-term health conditions when making everyday drinking decisions and whether the more immediate consequences of drinking, such as hangover, would be more appropriate. This public involvement provided valuable insight which aided the development of stimuli and research questions for Study 2.

REFERENCES

AER FOUNDATION 2011. ALCOHOL PRODUCT LABELLING: Health Warning Labels and Consumer Information. Australia.

BOHN, M. J., BABOR, T. F. & KRANZLER, H. R. 1995a. The Alcohol Use Disorders Identification Test (AUDIT): validation of a screening instrument for use in medical settings. *Journal of studies on alcohol,* 56, 423-432.

BOHN, M. J., KRAHN, D. D. & STAEHLER, B. A. 1995b. Development and initial validation of a measure of drinking urges in abstinent alcoholics. *Alcoholism: Clinical and Experimental Research,* 19, 600-606.

BORGMEIER, I. & WESTENHOEFER, J. 2009. Impact of different food label formats on healthiness evaluation and food choice of consumers: a randomized-controlled study. *BMC Public Health,* 9, 184.

CHO, Y. J., THRASHER, J. F., SWAYAMPAKALA, K., YONG, H.-H., MCKEEVER, R., HAMMOND, D., ANSHARI, D., CUMMINGS, K. M. & BORLAND, R. 2016. Does Reactance against Cigarette Warning Labels Matter? Warning Label Responses and Downstream Smoking Cessation amongst Adult Smokers in Australia, Canada, Mexico and the United States. *PloS one,* 11, e0159245.

DEPARTMENT OF HEALTH 2016. Alcohol Guidelines Review – Report from the Guidelines development group to the UK Chief Medical Officers. London, UK.

DRAX, K., ATTWOOD, A. S., MUNAFO, M. R., BLACKWELL, A. & MAYNARD, O. M. 2017, May 26. Know Your Limits: How does alcohol labelling influence knowledge, attitudes and behaviour?

DUMANOVSKY, T., HUANG, C. Y., NONAS, C. A., MATTE, T. D., BASSETT, M. T. & SILVER, L. D. 2011. Changes in energy content of lunchtime purchases from fast food restaurants after introduction of calorie labelling: cross sectional customer surveys. *bmj,* 343.

EUROCARE 2012. Eurocare library of health warning labels. Brussels, Belgium.

EUROCARE 2014. What's not on the Bottle? Eurocare reflections on alcohol labelling. Brussels, Belgium.

EUROPEAN PARLIAMENT 2015. European Parliament resolution of 29 April 2015 on Alcohol Strategy (2015/2543(RSP)). *In:* PARLIAMENT, E. (ed.).

EUROPEAN UNION COMMITTEE 2015. A new EU Alcohol Strategy? *In:* COMMITTEE, E. U. (ed.).

FARKE, W. V., P. 2011. Factsheet—Health warning labels on alcoholic beverages. .
GREENFIELD, T. K., GRAVES, K. L. & KASKUTAS, L. A. 1993. Alcohol warning labels for prevention: National survey findings. *Alcohol Health & Research World*.

GREENFIELD, T. K. & KASKUTAS, L. A. 1993. Early impacts of alcoholic beverage warning labels: national study findings relevant to drinking and driving behavior. *Safety Science,* 16, 689-707.

HALL, M. G., SHEERAN, P., NOAR, S. M., RIBISL, K. M., BACH, L. E. & BREWER, N. T. 2016. Reactance to Health Warnings Scale: Development and Validation. *Ann Behav Med*.

HALL, M. G., SHEERAN, P., NOAR, S. M., RIBISL, K. M., BOYNTON, M. H. & BREWER, N. T. 2017. A brief measure of reactance to health warnings. *Journal of Behavioral Medicine*, 1-10.

HOLLANDS, G. J., SHEMILT, I., MARTEAU, T. M., JEBB, S. A., KELLY, M. P., NAKAMURA, R., SUHRCKE, M. & OGILVIE, D. 2013. Altering micro-environments to change population health behaviour: towards an evidence base for choice architecture interventions. *BMC public health,* 13, 1218.

INSTITUTE OF ALCOHOL STUDIES 2015. Dead on Arrival? Evaluating the Public Health Responsibility Deal for Alcohol.

JARVIS, W. & PETTIGREW, S. 2013. The relative influence of alcohol warning statement type on young drinkers' stated choices. *Food Quality and Preference,* 28, 244-252.

JONES, S. C. & GREGORY, P. 2009. The impact of more visible standard drink labelling on youth alcohol consumption: helping young people drink (ir)responsibly? *Drug Alcohol Rev,* 28, 230-4.

KERR, W. C. & STOCKWELL, T. 2012. Understanding standard drinks and drinking guidelines. *Drug and alcohol review,* 31, 200-205.

MACKINNON, D. P., PENTZ, M. A. & STACY, A. W. 1993. The alcohol warning label and adolescents: the first year. *American Journal of Public Health,* 83, 585-587.

MARTIN-MORENO, J. M., E HARRIS, M., BREDA, J., MØLLER, L., ALFONSO, J. & GORGOJO, L. 2013. *Enhanced labelling on alcoholic drinks: Reviewing the evidence to guide alcohol policy*.

MAYNARD, O. M., LANGFIELD, T., ATTWOOD, A. S., ALLEN, E., DREW, I., VOTIER, A. & MUNAFÒ, M. R. 2017. No Impact of Calorie or Unit Information on Ad Libitum Alcohol Consumption. *Alcohol and Alcoholism*, 1-8.

MILLER, E. R., RAMSEY, I. J., BARATINY, G. Y. & OLVER, I. N. 2016. Message on a bottle: are alcohol warning labels about cancer appropriate? *BMC Public Health,* 16, 1-10.
ONS 2015. Harmonised Concepts and Questions for Social Data Sources: Primary principles. Ethic Group. (Version 3.3). . Office for National Statistics.

ONS. 2016. *Statistical bulletin: Population estimates by marital status and living arrangements, England and Wales: 2002 to 2015* [Online]. Office for National Statistics. Available:

http://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/bulletins/populationestimatesbymaritalstatusandlivingarrangements/2002to2015 [Accessed 27 October 2016].

OSIOWY, M., STOCKWELL, T., ZHAO, J., THOMPSON, K. & MOORE, S. 2015. How much did you actually drink last night? An evaluation of standard drink labels as an aid to monitoring personal consumption. *Addiction Research & Theory,* 23, 163-169.

POPULATION ASSESSMENT OF TOBACCO AND HEALTH STUDY 2015. PATH: Population Assessment of Tobacco and Health. . United States.

ROSENBERG, G., BAULD, L., HOOPER, L., BUYKX, P., HOLMES, J. & VOHRA, J. 2017. New national alcohol guidelines in the UK: public awareness, understanding and behavioural intentions. *Journal of Public Health*, 1-8.

STEAD, M., ANGUS, K., MACDONALD, L. & BAULD, L. 2014. Looking into the glass: Glassware as an alcohol marketing tool, and the implications for policy. *Alcohol and alcoholism,* 49, 317-320.

STOCKWELL, T. 1994. Would standard drink labelling result in more accurate self‐reports of alcohol consumption? *Addiction,* 89, 1703-1704.

STOCKWELL, T., BLAZE-TEMPLE, D. & WALKER, C. 1991a. A test of the proposal to label containers of alcoholic drink with alcohol content in standard drinks. *Health Promotion International,* 6, 207-215.

STOCKWELL, T., BLAZE‐TEMPLE, D. & WALKER, C. 1991b. The effect of 'standard drink'labelling on the ability of drinkers to pour a 'standard drink'. *Australian journal of public health,* 15, 56-63.

THRASHER, J. F., SWAYAMPAKALA, K., BORLAND, R., NAGELHOUT, G., YONG, H.-H., HAMMOND, D., BANSAL-TRAVERS, M., THOMPSON, M. & HARDIN, J. 2016. Influences of Self-Efficacy, Response Efficacy, and Reactance on Responses to Cigarette Health Warnings: A Longitudinal Study of Adult Smokers in Australia and Canada. *Health communication*, 1-10.

TUJAGUE, J. & KERR, W. C. 2009. Energy intake estimates of respondent-measured alcoholic beverages. *Alcohol and alcoholism,* 44, 34-41.

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, e014193.

WEINSTEIN, N. D. 2000. Perceived probability, perceived severity, and health-protective behavior. *Health Psychol,* 19, 65-74.

WIGG, S. & STAFFORD, L. D. 2016. Health Warnings on Alcoholic Beverages: Perceptions of the Health Risks and Intentions towards Alcohol Consumption. *PLoS ONE,* 11 e0153027.

YAMAMOTO, J. A., YAMAMOTO, J. B., YAMAMOTO, B. E. & YAMAMOTO, L. G. 2005. Adolescent fast food and restaurant ordering behavior with and without calorie and fat content menu information. *Journal of Adolescent Health,* 37**,** 397-402.

YEOMANS, M. R., LARTAMO, S., PROCTER, E. L., LEE, M. D. & GRAY, R. W. 2001. The actual, but not labelled, fat content of a soup preload alters short-term appetite in healthy men. *Physiology & behavior,* 73**,** 533-540.