NIHR | Policy Research Unit in Obesity

OPRU Briefing Paper: Assessing the impact of alcohol calorie and unit labelling on consumer behaviours: findings from a systematic review

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Executive Summary

Question

Does the inclusion of energy (calorie), unit or alcohol by volume (ABV%)/strength descriptor labelling on alcohol products impact purchase and consumption behaviours?

Background

As part of the public health strategy to reduce obesity, the UK government announced an intention to consult on whether to introduce mandatory calorie labelling on prepacked alcoholic drinks and alcoholic drinks sold in on-trade businesses. Alcohol labels are currently not required to include calorie or unit information but are required to include alcohol by volume (ABV%) if more than 1.2%. For regular drinkers, energy intake from alcohol provides a substantial portion of daily calories (7-8%), which could potentially contribute to gaining excess weight.

Methods

We conducted a systematic review to synthesise the relevant evidence on the impact of alcohol energy (including calories) and unit labels on consumer purchasing or consumption behaviours. We searched 11 databases, three relevant grey literature sites and conducted hand searches of pre-prints. We included studies with calorie, unit or ABV%/strength descriptor labelling (front or back of pack) on pre-packaged alcohol products with any purchasing or consumption behaviours (including intentions). We included experimental, quantitative, real-world, and qualitative studies, conducted in any country or language.

Findings

We identified 23 studies from 22 articles, most of which assessed the impact of calorie labelling on subjective behavioural outcomes (e.g., consumption or purchase intention, intention to drink less, drink choice).

Overall, there was mixed evidence as to the effectiveness of energy, unit or ABV% labels at influencing consumer behaviour.

Energy (calorie) labels

- There was early but limited evidence from quantitative and qualitative research to suggest that calorie labels reduce intended consumption and encourage choice of lower calorie drinks
- Evidence on purchasing behaviours was also mixed. One online randomised controlled trial (RCT) found that calorie labels on alcoholic drinks reduced calories purchased. Otherwise, there was very limited evidence that calorie labels reduce intended purchasing, and counter evidence that calorie labels increased purchasing. These findings could be confounded by increased preference for products with calorie labels, rather than indicating increased purchasing of alcohol.

Unit labels

- There was limited evidence from quantitative and qualitative research to suggests that unit labels reduce motivation to drink (intention to consume), but no evidence that unit labels affected drink choice.
- Evidence from one real-world study showed that unit labelling may lead to a decrease in purchasing of labelled products.

ABV% or strength descriptor labels

- Evidence from quantitative and qualitative research examining the impact of ABV% or strength descriptor labels (related to unit information) showed mixed results. There was limited evidence to suggest that as ABV% decreased, actual consumption increased, while there were mixed findings on whether appeal or preference decreased as ABV% increased or decreased.

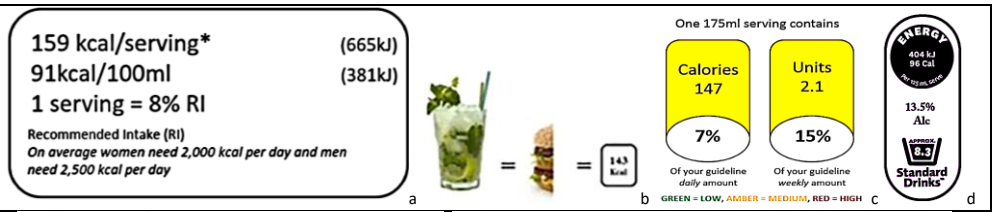
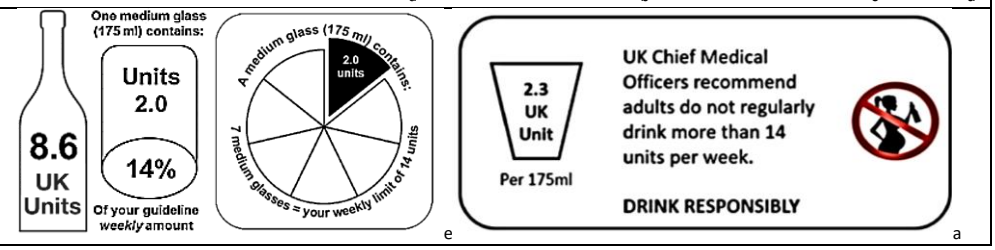
This review shows that there is a lack of research in this area and that existing evidence is mixed. However, there was some limited evidence that calorie labels reduce consumption intentions, calories purchased, purchasing intentions (results potentially confounded by preference), and that unit labels could be effective at reducing motivations to drink and purchasing of alcoholic beverages, especially those of higher strength. Further research is needed in the form of appropriately powered experimental studies and estimation of the likely impacts of introducing calorie labelling on alcoholic drinks.

Background

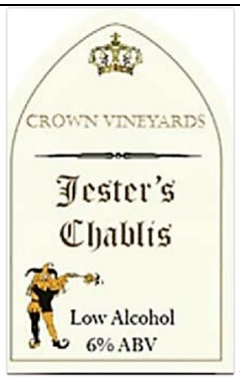
The addition of calorie and unit information to alcohol labels (see Figure 1 for examples) has been suggested by the Royal Society for Public Health to allow consumers to make more informed drinking choices.[1] The majority of alcohol sales in the UK occur in off-trade premises, such as supermarkets and shops (≈70%).[2,3] Current regulations for prepacked alcohol labelling in the UK do not include calorie or unit information specifications, just the inclusion of alcoholic strength if above 1.2%.[4] Alcohol is high in energy and research shows that for those that drink regularly, energy from alcohol accounts for 7-8% of overall energy intake and that for heavier drinkers this intake could contribute to having excess weight.[5,6]

Evidence from a recent meta-analysis suggests that most people do not have a good understanding of the calorie content in alcoholic drinks (pooled estimate =74%) but that there is public support for calorie labelling of alcoholic drinks (pooled estimate = 64%).[7] A UK survey of alcohol products in 2020, found that calorie information was provided on 44% of sampled products (187/424),[8] a substantial increase from 2014 where a previous UK study found calorie labelling was only present on 1.3% of products (2/156).[9] These data suggest that calorie labelling on alcoholic drinks could provide easy to understand information to consumers that may result in reduced intake of calories from alcoholic drinks for some drinkers. The addition of calorie labels to alcoholic drink could be useful for tackling both obesity and harmful alcohol consumption.

Figure 1. Examples of calorie, unit and ABV% labels

Calorie	
Unit	

[1] Royal Society for Public Health. (2022) Alcohol calorie labelling. Accessed 15/09/2022 https://www.rsph.org.uk/our-work/policy/drugs/alcohol-calorie-labelling-.html
[2] Richardson et al. (2021) The impact of COVID-19 and related restrictions on population-level alcohol sales in Scotland and England &Wales, March–July 2020.
[3] NHS Health Scotland (2017) MESAS monitoring report 2017 http://www.healthscotland.scot/publications/mesas-monitoring-report-2017
[4] Regulation (EU) No 1169/2011 https://www.legislation.gov.uk/eur/2011/1169/chapter/IV/section/2
[5] PHE. National Diet and Nutrition Survey (2018) Results from Years 7 and 8 (combined) of the Rolling Programme (2014/2015 to 2015/2016).
[6] Traversy & Chaput (2015) Alcohol Consumption and Obesity: An Update. Current obesity reports, 4(1), 122–130. https://doi.org/10.1007/s13679-014-0129-4
[7] Robinson et al. (2021) Alcohol, calories, and obesity: A rapid systematic review and meta-analysis of consumer knowledge, support, and behavioral effects of energy labeling on alcoholic drinks. Obes. Rev. 22, e13198
[8] Alcohol Health Alliance UK (2020) Drinking in the dark: How alcohol labelling fails consumers. https://ahauk.org/wp-content/uploads/2020/08/DRINKING-IN-THE-DARK.pdf
[9] Petticrew et al. (2017) Provision of information to consumers about the calorie content of alcoholic drinks: did the Responsibility Deal pledge by alcohol retailers and producers increase the availability of calorie information? Public Health. https://doi.org/10.1016/j.puhe.2017.04.020

ABV% or strength descriptor	e  f

Images from: [a] Robinson, 2021, [b] Piper, 2021, [c]Maynard, 2018, [d] Walker, 2019b, [e]Blackwell, 2018, [f] Vasiljevic, 2018 ABV% = Alcohol by volume

Research assessing the effectiveness of calorie labelling to reduce consumption or related behaviour is limited. A recent review[7] found six studies that assessed the impact of calorie labelling on purchasing and consumption behaviours and found no likely effect of calorie labelling. Most of the included studies had subjective behavioural outcomes, including purchase intention, with only one study that tested actual consumption.[10] Although it was an objective measure, it was designed as a bogus taste test conducted in a laboratory, where the participants did not choose the beverages or how many drinks to order or consume; therefore, the real-world impact is uncertain. The lack of data on potential impacts on consumer behaviour may reflect a lack of real-world implementation, as alcohol calorie labelling is not mandatory in any country.

Research on the effectiveness of unit labelling on consumer behaviours is also limited. One rapid review including four studies found that unit/standard drink information improved the accuracy of alcohol content estimates compared to ABV% information but concluded there was limited research on behavioural impact.[11]

A recent non-systematic integrative review (a review that includes diverse study types) examined the energy labelling of alcoholic drinks as a public health policy to reduce obesity.[12] The study has yet to be peer-reviewed but concluded that there was no convincing evidence that energy labels would lead to undesirable effects on health or well-being and that there is a need for energy labelling on alcoholic drink products. However, unintended negative consequences of calorie and unit labelling have been identified elsewhere in the literature, showing some consumers could potentially use calorie and unit labelling information to make unhealthy choices, rather than healthy choices (research on this has primarily been conducted in university students).[7,12] These unhealthy choices include using unit information to buy the strongest drink at the lowest price and to reduce food intake/skip meals based on energy information or increase intake if energy was less than they thought.

Quantitative work was recently undertaken by the UCL Department of Behavioural Science and Health who added a series of questions to the Ipsos Mori Omnibus Survey (*n* = 4,963) to assess participants' opinions, likely impacts and potential behaviour changes of calories labelling. Findings suggested that

[10] Maynard et al. (2018a) No Impact of Calorie or Unit Information on Ad Libitum Alcohol Consumption. Alcohol. 53, 12–19
[11] Dimova & Mitchell (2021) Rapid literature review on the impact of health messaging and product information on alcohol labelling, Drugs: Education, Prevention and Policy, doi:10.1080/09687637.2021.1932754
[12] Robinson et al. (2021) Energy labelling of alcoholic drinks as a public health policy to reduce obesity: An integrative review https://psyarxiv.com/du9sm/

support for calorie labels was strong, that such information would be useful to participants, that one-third of moderate drinkers would reduce the amount they drank in response to calorie labels, and that other positive changes could result, including choosing lower calorie beverages or smaller servings.

Policy relevance

In 2020, the UK government announced an intention to consult on whether to introduce mandatory calorie labelling on prepacked alcoholic drinks and alcoholic drinks sold in on-trade businesses as part of their public health strategy to reduce obesity.[13] To support the consultation, this review, alongside quantitative work conducted by the UCL Department of Behavioural Science and Health, aimed to provide evidence to inform policymaker thinking around the likely effectiveness of alcohol calorie labelling. This review was requested to inform active research, given there has not been a comprehensive systematic review on consumer behaviours in relation to alcohol calorie labelling.

Aim

The aims of this review were to understand how the provision of A) calorie or B) unit information on alcohol products could influence behaviour change (purchase and consumption). We specifically looked at off-trade premises and included both objective (e.g., actual consumption) and subjective outcomes (e.g., intentions). The strength of the evidence base for these interventions and programmes was assessed to identify potential gaps and weaknesses in the research.

Methods

We conducted a systematic review of studies that have assessed the impact of alcohol energy (including calories) or unit labelling on consumer behaviours. Working with colleagues from the UCL Institute of Education (IoE) we created a search strategy. From initial scoping, we found limited literature on this topic. We included studies from any time point, focusing on pre-packed drinks from off-trade premises (i.e., not at a pub). We searched 11 databases, three grey literature sites and conducted hand searches of pre-prints (see Appendix 1 for details and Appendix 2 for search history) and included all studies which met the following criteria:

> *Participants*: No restrictions (did not exclude based on age in case some studies included underage drinkers).
>
> *Exposure:* Any energy content/calorie or unit labelling on pre-packaged alcoholic products (products sold in off-trade premises).
>
> *Study type:* Intervention studies or RCTs; observational studies with a before and after implementation or programme evaluation studies; Qualitative studies.
>
> *Outcome:* Purchasing and consumption behaviours, including intentions.

All studies were double screened. Descriptive data extraction was carried out by one author with a subset (50%) checked by another, including study details, label types and key findings. Bias assessment was completed by two authors using appropriate methods, dependent on study type (RoB 2.0 for

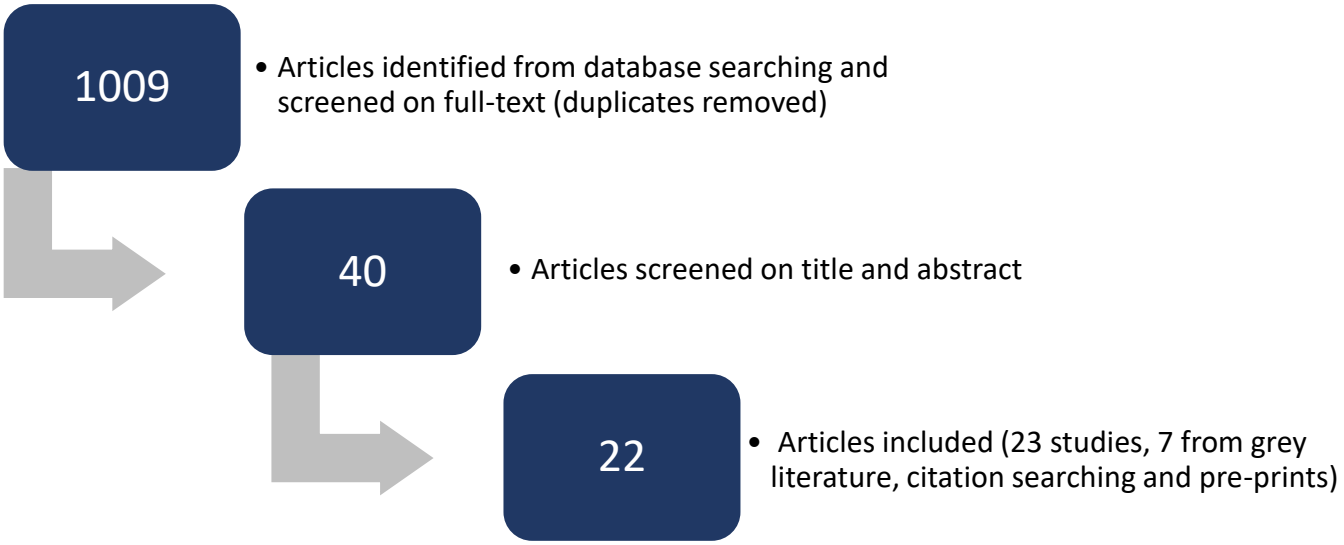
[13] Department of Health and Social Care (2020) New obesity strategy unveiled as country urged to lose weight to beat coronavirus (COVID-19) and protect the NHS. https://www.gov.uk/government/news/new-obesity-strategy-unveiled-as-country-urged-to-lose-weight-to-beat-coronavirus-covid-19-and-protect-the-nhs

randomised controlled trials,[14] ROBINS-I for non-randomised interventions,[15] CASP Qualitative Checklist[16] for qualitative studies and critical appraisal tool for quantitative sales data).[17] For the narrative synthesis, we present results by label type: calorie (energy), unit or ABV%/strength descriptor.

Findings

The flowchart of the studies through the review are shown in Figure 2 (see Appendix 3 for a detailed flowchart). The database searches yielded 1,759 articles, resulting in 1,009 after removing duplicates. Following title and abstract screening, 969 articles were excluded, and 40 were included to be screened on full text. An additional 17 studies were identified from grey literature, citation searching and pre-prints, of which seven were included. Following full text screening, the final inclusion was 22 articles (23 studies).

Figure 2. Flow chart



[14] Sterne et al. (2019) RoB 2: a revised tool for assessing risk of bias in randomised trials. doi:10.1136/bmj.l4898
[15] Sterne et al. (2016) ROBINS-I: a tool for assessing risk of bias in non-randomized studies of interventions. http://www.riskofbias.info
[16] Critical Appraisal Skills Programme (2018). CASP Qualitative Checklist online. https://casp-uk.net/casp-tools-checklists/
[17] O'Mara-Eves & Kneale (2019). A critical appraisal tool for assessing research on purchasing (point of sales) data. EPPI-Centre, UCL Institute of Education

Description of studies

A summary of the studies is provided in Table 1. We identified a total of 23 studies (from 22 articles). The studies were from a range of countries; ten in the UK,[10,18,19,20,21,22,23,24,25,26] four in the US,[27,28,29] three in Italy,[30,31,32] two in New Zealand,[33,34] one each in Germany,[35] Australia,[36] Canada[37] and one study in multiple countries (Australia, Germany and Italy).[38]

The study designs were primarily experimental with quantitative outcomes (n = 18), experimental with qualitative outcomes (n = 4), or real-world interrupted time series (ITS) (n = 1). The behavioural outcome measures varied between objective, subjective or qualitative. For objective outcomes, two studies measured alcohol consumption during a bogus taste test conducted in a laboratory;[10,25] two measured actual purchases, made before and during unit labelling being applied to alcoholic drinks,[37] or following an online RCT testing calories labels, where selections were emailed to participants and purchases were counted if completed within 48 hours.[26] The quantitative subjective measures included consumption intention (n = 6);[10,27,29,24,34] intention or motivation to drink less (n = 3);[19,20,21] purchase intention (n = 7);[23,24,26, 28,30,31,34] hypothetical purchase or drink choice (n= 3);[18,38,32] and monetary auction bidding task (n = 1).[31] The qualitative outcomes included open-ended/free-text responses to prompts such as comments about calorie/unit labelling;[10] impact of energy labelling on likely purchase and consumption

[18] Blackwell et al. (2018) Informing drinkers: Can current UK alcohol labels be improved? doi:10.1016/j.drugalcdep.2018.07.032
[19] Gold et al. (2021) Effect of alcohol label designs with different pictorial representations of alcohol content and health warnings on knowledge and understanding of low-risk drinking guidelines: a randomized controlled trial. doi:10.1111/add.15327
[20] Maynard et al. (2018b) Know your limits: Labelling interventions to reduce alcohol consumption. https://s3.eu-west-2.amazonaws.com/files.alcoholchange.org.uk/documents/FinalReport_0150.pdf
[21] Robinson et al. (2021) The effect of calorie and physical activity equivalent labelling of alcoholic drinks on drinking intentions in participants of higher and lower socioeconomic position: An experimental study. doi:10.1111/bjhp.12527
[22] Roderique-Davies, et al. (2020) Investigating the impact of changing health messages on alcohol products. doi:10.1080/14659891.2020.1749948
[23] Royal Society for Public Health (2018) Labelling the Point: towards better alcohol health information. https://www.rsph.org.uk/static/uploaded/4ae31b49-c4d7-4355-ad94a660aba36108.pdf
[24] Vasiljevic et al. (2018a) Impact on product appeal of labeling wine and beer with (a) lower strength alcohol verbal descriptors and (b) percent alcohol by volume (ABV%): An experimental study. doi:10.1037/adb0000376
[25] Vasiljevic et al. (2018b) Impact of lower strength alcohol labeling on consumption: A randomized controlled trial. Health Psychol. doi:10.1037/hea0000622
[26] Clarke et al. (2022) Impact of health warning labels and calorie labels on selection and purchasing of alcoholic and non-alcoholic drinks: a randomised controlled trial. doi:10.1101/2022.07.22.22277929
[27] Bui et al. (2008) What am I drinking? The effects of serving facts information on alcohol beverage containers. doi:10.1111/j.1745-6606.2007.00095.x
[28] Kelley et al.(2015) U.S. wine consumer preferences for bottle characteristics, back label extrinsic cues and wine composition A conjoint analysis. doi:10.1108/APJML-09-2014-0140
[29] Martinez et al. (2015) The impact of standard nutrition labels on alcoholic beverages. https://www.jstor.org/stable/48506439
[30] Piper et al. (2021) Pictorial warning labels as deterrents of alcohol abuse. doi:10.1108/BFJ-02-2021-0187
[31] Vecchio et al. (2018) Is More Better? Insights on Consumers' Preferences for Nutritional Information on Wine Labelling. doi:10.3390/nu10111667
[32] Bazzani et al. (2020) Nutritional Knowledge and Health Consciousness: Do They Affect Consumer Wine Choices? Evidence from a Survey in Italy. doi:10.3390/nu12010084
[33] Walker et al. (2019a) Energy labelling for alcoholic beverages in New Zealand: Consumer perceptions: Phase 1 report: Focus groups. https://www.hpa.org.nz/sites/default/files/documents/Energy_labelling_for_alcoholic_beverages_in_New_Zealand_Phase_2_research_report_March_2019.pdf
[34] Walker et al. (2019b) Energy labelling for alcoholic beverages in New Zealand: Impact on consumer purchase and consumption: Phase 2 report: randomised trial. https://apo.org.au/node/230391
[35] Pabst et al. (2019) The effects of mandatory ingredient and nutrition labelling for wine consumers – A qualitative study. doi:10.1016/j.wep.2019.02.001
[36] Thomson et al. (2012) An exploratory study of drinkers views of health information and warning labels on alcohol containers. doi:10.1111/j.1465-3362.2011.00343.x
[37] Zhao et al. (2020) The Effects of Alcohol Warning Labels on Population Alcohol Consumption: An Interrupted Time Series Analysis of Alcohol Sales in Yukon, Canada. doi:10.15288/jsad.2020.81.225
[38] Pabst et al. (2021) Consumers' reactions to nutrition and ingredient labelling for wine – A cross-country discrete choice experiment.doi:10.1016/j.appet.2020.104843

of alcoholic beverages;[33] main decision factors and drink choice;[35] views on prototype labels (including how they would be used);[36] and strength and weaknesses of labels.[22]

Label types included in the studies were: energy labels (n = 12),[21,23,26,28,29, 30,31,33,34, 35,38] unit labels (n = 3),[18,19,37] energy and unit labels (n = 5),[10,20,22,27,36] or ABV% and strength descriptor labels (n = 3).[24,25,32] Energy labels included simple calorie labels, calorie labels with additional nutritional information provided (e.g., food label equivalent with information on carbohydrates etc.), or calorie information with an interpretative element, such as Guidelines Daily Amount, Traffic Lights, physical activity calorie equivalent (PACE) (e.g., figure or stopwatch icon with information about physical activity required to burn-off the shown energy), or a pictorial warning of food product equivalent (e.g., a burger). The images of the label used in the included studies were extracted where possible and are shown in Appendix 4.

All but one study[27] required participants to purchase or consume alcohol regularly (e.g., weekly or monthly) or have previously consumed alcohol (n = 21). Two studies included underage participants, one in the US (where 18 years is underage)[29] and the other in Australia (where 16 years is underage).[36] For recruitment of participants, the majority of studies used online panel or market research companies (n = 12),[18,19,21,24,25,26,28,32,33,34,38] followed by university-wide recruitment (n = 3),[10,22,31] university students (n = 2),[27,29] a mall (n = 1),[29] natural consumption locations (e.g., bars, n = 1),[30] various non-wine-related private and professional networks (n = 1),[35] and a combination of a sampling panel, the Tobacco and Alcohol Research Group and public areas (n = 1).[20]

Quantitative experimental studies were assessed using Cochrane risk of bias tools (see Appendix 5 for all bias assessments). Eleven studies were assessed as having a low risk of bias[10,18,19,21,24,25,26,28,32,34,38] and seven were assessed as having some concerns,[20,23,27,29,30,31] most commonly due to lack of detail around the randomisation process or concerns with controlling for potential confounding factors. Four studies were assessed using the CASP qualitative tool and found to be mostly of moderate quality.[22,33,35,36] The ITS study was assessed using a sales data appraisal tool and found to be of low concern overall.[37]

Narrative synthesis – calorie (energy) labels

Objective findings

Two studies provided objective data on calorie labels. The first found no significant differences in consumption between a calorie label condition (provided on a piece of paper next to the beer), compared to the no calorie label control, during a bogus taste test.[10] The second study was an online RCT, where participants were emailed the drink selections they had made within the study and then their actual purchases completed within 48 hours were collected; they found that calorie labels compared to no calories labels led to significantly fewer calories purchased.[26]

Subjective findings

Purchasing outcomes. Three studies found that alcoholic beverages with energy labelling led to lower purchase intention outcomes.[23,28,30] One tested significance and found the pictorial representation of calorie content led to significantly lower purchase intentions compared to no label control.[30] Two studies did not test significance but found: 40-50% of participants reported that calorie labelling would change their purchase intention to a low calorie wine, compared to standard label control (without energy information);[28] lastly, with calorie information added to labels in one study, high-range ABV%

choices went down by 11% and low-range ABV% choices up by 8% (down 21% and up 19% respectively among young drinkers).[23]

Conversely, three studies showed that energy labels significantly positively impacted on purchasing outcomes compared to no label control conditions (including greater purchase intentions,[34] increased likelihood of hypothetical purchase choice[38] and higher value bid in monetary auction bidding task[31]). Note that higher purchase intention of a labelled product might reflect participant preference for the information rather than indicating that their overall purchasing of alcoholic beverages (and then consumption) would increase based on this information. The hypothetical purchase choice study concluded that consumers valued and had positive utility for nutritional information.[38] A purchase intention study found that overall, only the nutrition information panel (NIP) significantly increased the reported likely purchase of alcoholic beverages, compared to the no label control, but there was no difference for the other two energy label conditions (calories, or calories with interpretive physical activity). They additionally found for Māori participants only, that the energy label with interpretative physical activity information also significantly increased the reported likely purchase of alcoholic beverages, compared to the no label control group.[34] A further RCT study tested intention to purchase through drink selection, measured in alcohol units and calories selected. Comparing the 'calorie label only' group to the 'no label' group, there was no overall difference found for the number of alcohol units or calories selected.[26]

Consumption intentions. One study found drinking intentions were significantly lower with energy label conditions (kilocalorie (kcal) or kcal + PACE) compared to the standard label control (without energy information).[21] Another study did not test significance but found labels with calorie information led to 20% of participants reporting their drinking intention would be lower, compared to 15% who said their intention would be higher with a label with no calorie information (exposed to all labels).[20] Three studies found that there was no significant difference in future consumption intentions between no label control conditions and conditions with energy information.[10,29] Conversely, one study showed that consumption intentions, were significantly greater when an alcoholic beverage displayed energy information on the product, compared to no label control condition (for wine and distilled spirits only, no significant difference for regular or light beer).[27] This study was conducted in college students and may relate only to products that have lower calorie content than anticipated; therefore, leading to greater consumption intentions.

An additional outcome from one study found that, based on calorie information, 38% of participants reported they would not change their behaviour, 36% would exercise more, 30% would switch to low calorie or diet mixer, and 16% would drink less.[20] A subset of participants from a different study also reported that they believed calorie labelling would be likely to positively change their eating and exercise behaviour.[21]

Qualitative findings

Four studies assessed qualitative outcomes relating to energy labels and found mixed results. Two studies found that participants thought energy labelling would make them think more carefully about their consumption (especially females or those concerned about their weight/on a diet);[10] and energy information was seen as the information most likely to influence drinking behaviour.[33] Whereas, two of the studies found that participants did not think energy labelling would effectively impact drinking behaviours.[22,35]

Narrative synthesis – unit labels

Objective

One study was a real-world ITS study, where alcohol containers in a Canadian region (Whitehorse) were labelled with unit/standard drinks information (SD) and low-risk drinking guidelines (LRDG) for a 4-month period (applied to 98% of products).[37] They found that during the LRDG/SD labelling period, total alcohol sales significantly decreased by 11.35%, sales of the labelled products significantly decreased by 11.79%, sales of the unlabelled products significantly increased, compared to the 28-months period before.

Subjective

Two studies assessed the impact of unit information on subjectively measured behaviour. The first study found that motivation to drink was lower when unit information was shown in the style of a food label or graphically (pictograph or gradient), compared to industry standard control label.[19] The second study found no evidence of any difference in participants choosing a higher strength drink in a hypothetical choice task between any of the label conditions with unit information or the control condition.[18]

Qualitative

Only one study measured qualitative outcomes in response to unit labelling and found that: "Some of the younger participants reported using the number of standard drinks and ABV% information to purchase beverages with the maximum alcohol content; to enable them to get drunk as cheaply as possible. The parent groups were more likely to use this information to select low alcohol products and/or manage their consumption when driving."[36]

Narrative synthesis – ABV% and strength descriptor labels

Objective findings

One study provided objective data on ABV% and strength descriptor labels during a bogus taste test.[25] The total amount of beer or wine consumed increased as the ABV%/strength indicated on the label decreased (drink type varied based on participant preference). The amount consumed in the 'Super Low' condition (4% for wine/1% for beer) was significantly greater than the amount consumed in the 'Regular' condition (12.9% for wine and 4.2% for beer) but there were no significant differences in consumption between 'Low' (8% for wine/3% ABV% for beer) or 'Regular'.

Subjective

Two studies assessed subjective outcomes in response to ABV% information including hypothetical purchase choice[32] or product appeal (purchase and consumption intention)[24] and found mixed results. The first study examined hypothetical purchase choice with latent class analysis and found one group (described as 'health-conscious wine consumer') had significantly decreased utility of choosing a bottle of wine as alcohol content increased. The other study found that appeal (purchase and consumption intention combined) decreased significantly as ABV% decreased, with lowest appeal for the lowest ABV% options (0% or 4% for wine, 1% or 2% for beer) compared to regular ABV% (12.9% for wine, 4.2% for beer). This could indicate lower preference for this product rather than indicating consumption or purchase behaviour would decrease.

Impact of label format

The impact and preference of different label formats was also of interest and addressed in six studies. A survey with four label options found that the majority of participants (63%) preferred the Guideline

Daily Amounts with Traffic Lights label (compared to healthier choice tick, Guideline Daily Amounts or Traffic Lights), showing the support for Traffic Light style labels which are currently used for front of pack food labels in the UK.[20] Of the experimental studies, one found that the label with food image representing caloric content (e.g., a burger), was the only condition that significantly reduced purchase intention compared to calorie text warning;[30] no difference between kcal or kcal + PACE labels in purchase intentions;[21] all experimental labels decreased motivation to drink, but labels with enhanced pictorial representation improved knowledge/understanding outcomes.[19]

A qualitative focus group study concluded that energy labelling should be simple, primarily on the front, visually engaging, not require calculations and allow easy comparison between drink options. Follow-up experimental research by the same group showed that NIP increased purchase intention of alcohol beverages but the other conditions that did not significantly change purchase intention, compared to no label control.[34] Lastly, qualitative research conducted alongside a quantitative survey found participants thought calorie and alcohol unit information 'per container' was most useful and followed by 'per serving' (seen as most relatable to people's real life drinking behaviours –rather than variable serving sizes or 'per 100ml').[23]

Discussion

This is the first comprehensive systematic review to assess the impact of alcohol calorie, unit or ABV%/strength descriptor labelling on consumer behaviours. Across these 23 studies, we found that there was mixed evidence of alcohol calorie or unit labelling impacting on consumer purchase or consumption behaviours. For calorie labelling, we found limited evidence from quantitative and qualitative studies that labels reduced intentions to consume. The evidence on purchasing behaviours was mixed and there is complexity in understanding the direct impact of the label. Evidence from objectively measured purchases completed following selections in a randomised controlled trial, suggest that calorie labels on alcoholic drinks may reduce calories purchased. Higher purchase intentions for products with calorie labels may be confounded by preference for products with calorie labels (i.e., preferring and therefore purchasing more of that type of product), rather than overall alcohol consumption.

For unit labelling, we found there was limited evidence from quantitative and qualitative studies that unit labels could reduce motivation to drink (consumption intention) but other studies found no change in drink preference/choice. Evidence from the only real-world study showed that unit labelling can lead to a decrease in consumer purchasing behaviours. Preference for products with calorie, unit or ABV%/strength descriptor labels (i.e., preferring and therefore purchasing more of that type of product), may be related to motivation to consume less calories, less alcohol or both. Further behaviour may be influenced by liking or disliking for the label itself.

The limitations of this review include the inability to conduct meta-analyses, due to differences in the studies (design, label types, outcomes) and lack of available data. Some of the outcomes also have limitations, such as the objective taste test studies which are not truly representative of real alcohol purchasing or consumption environments; and intentions outcomes which are predictive of behaviour but there remains a gap between intentions and actual behaviours. We acknowledge that intentions to consume may differ from actual behaviour, but intentions to consume have been shown to be a useful

indicator of intake and strongly correlate to actual consumption.[39] However, one study that considered both found no significant difference in intention to purchase but a significant difference in actual purchasing behaviours.[26] A general challenge in this area is the lack of implemented policies in the UK or elsewhere and making likely impacts on consumer behaviours broadly speculative.

Further research is required to develop understanding of whether labels are impacting consumer behaviours (i.e., using the information on the label to make a healthier choice) or if people are impacted by their liking for labels (i.e., switching products because they do not like the label). The ongoing mixed methods work that the UCL Department of Behavioural Science and Health are undertaking will develop understanding on this issue. Together with this review, these projects provide a platform from which further work could be developed. An appropriately powered experimental study could provide important evidence as to the likely impacts of calorie labels on intentions to purchase and consume; the Alcohol Toolkit Study[40] could be further developed to explore how adults might use ACLs; and, effect sizes from such an experimental study could be used to estimate how ACLs might influence alcohol and obesity related disease over a longer term.

[39] Cooke, R., Dahdah, M., Norman, P., & French, D. P. (2016). How well does the theory of planned behaviour predict alcohol consumption? A systematic review and meta-analysis. Health psychology review, 10(2), 148-167.

[40] NIHR - School for Public Health Research (2022) The Alcohol Toolkit Study (ATS) Accessed 15/09/2022 (https://sphr.nihr.ac.uk/members/the-alcohol-toolkit-study-ats/

Table 1. Descriptive characteristics

Author, Country, Year	Participant details	Setting, allocation	Label Type	Label details	Outcome measures	Findings
Bazzani, Italy, 2020[32]	*n* = 278, aged 18+; red wine consumers recruited from online panel provider	Online, order randomized	ABV%	4 ABV% conditions: 11%, 12%, 13%, 14% Shown on mock-up version of red wine bottle	12 purchase choice tasks – choice between 2 bottles or 'neither of these' option (for home consumption)	Latent class analysis- found that class 1 'health-conscious wine consumer' were the only segment where alcohol content was a significant parameter, increase in alcohol content decreased respondents' utility from choosing a bottle of wine. Class 2 'opponents' and class 3 'new clean trend lovers' content was not significant
Blackwell, UK, 2018 – S1[18]	*n* = 1884, mean age = 35 (SD 12), alcohol consumers recruited from online platform Prolific Academic	Online, pseudo-randomized	UNIT	4 label conditions: Basic ABV%; Responsibility Deal (UK units); Food Label Equivalent (units and guideline %); Pie Chart (unit) Shown on three unfamiliar beer brand bottles with randomised ABV% (4, 5, 6%)	Subjective: Drink choice – choice of one out of three options	No evidence from ordinal logistic regression that any of the four conditions increased the ordered log odds of choosing a higher strength beverage.
Bui, US, 2008[27]	*n* = 230, mean age = 25, age range = 20-36, undergraduate students, no drinking information	Location and allocation not stated, assume university in person	UNIT + CAL	2 label conditions: Servings Facts label including information on alcohol content, calories carbohydrates, fat, and serving size; Standard labelling with no unit information Shown on mock-up versions of bottles of beer, light beer, wine and distilled liquor	Subjective: Intended alcohol consumption (beer, light beer, wine, distilled liquor)	Intended consumption (across drink types) was significantly higher ($p < .05$) when serving facts labels were provided vs. standard labelling. Exposure to the Facts information significantly increased consumption intention levels for wine ($p<0.001$), and distilled spirits ($p<0.05$), but not light or regular beer.
Clarke, UK, 2022[26]*	*n* = 205, mean age = 35.5 (SD 10.8), regular beer or wine consumers or online purchasers recruited	Online, randomised	CAL	2 relevant label conditions: Calorie labels: present vs absent Shown a range of 64 options, including on beers, ciders, alcohol-free beer and cider alternatives, a range of wines, alcohol-free wine alternatives and soft drinks	Subjective: number of alcohol units and calories selected (with intention to purchase) Objective: Alcohol units and calories purchased (actual)	There was no evidence of an overall difference for calorie labels on the number of alcohol units selected [calorie labels = 0.002, p = .961]. There was also no evidence of an overall difference on any secondary outcomes, including the number of alcohol units purchased [calorie labels = 0.193, p = .661]. In pre-specified subgroup analyses comparing the 'calorie label only' group (n = 101) to the 'no label' group (n = 104) there was no evidence that calorie labels reduced the number of calories selected [unadjusted means: 1913 calories vs 2203 calories, p =

	from research panel					.643]. Amongst the 75% of participants who went on to purchase drinks, those in the 'calorie label only' group (n = 74) purchased fewer calories from alcoholic drinks than those in the 'no label' group (n = 79 [p = .0229, a reduction of 22% (95%CI: -37.18%, -3.41%)].
Gold, England, 2021[19]	*n* = 7516, mean age = 44.15 (SD 16.45), age range = 18-99, alcohol consumers recruited from third-party panel providers	Online, randomized	UNIT	7 unit label conditions: Industry standard; Food serving; Food serving and container; Pictographs servings; Pictographs containers; Pie charts servings; Risk gradients Shown on pictures of nine drinks (bottle of wine, spirits or beer)	Subjective: Motivation to drink less	All experimental label conditions decreased the stated motivation to drink compared to the control, albeit by a very small amount (0.1 - 0.3 points on a five-point scale).
Kelley, US, 2015[28]	*n* = 910 age range = 21-64, wine consumers randomly selected from a Survey Sampling managed panel	Online, randomly selected from an online panel	CAL	4 relevant label conditions: 750 ml bottle of wine with 10-14% alcohol content at 80-112 calories per 5 oz. serving (standard); Less than 10% alcohol content; 15% or greater alcohol content; Fewer than 80 calories per 5 oz. serving Shown on images of mock-up back of wine bottle labels	Subjective: Likelihood/intention to purchase (to serve to family and/or friends)	Approximately 1/3 of each segment indicated that these proposed changes would encourage them to change their wine consumption in the following way(s): decrease in calorie content to 80 calories per 5 oz. serving (40-50%). Both a lower and higher ABV% tended to appeal more to those who purchased "at least once a week".
Martinez, US, 2015 - S1[29]	*n* = 80, mean age = 18.56 (SD 0.9), undergraduate students with previous alcohol consumption	Lab, randomized	CAL	2 label conditions: Nutrition information provided; Nutrition information absent Shown on images of a beer bottle	Subjective: Future drinking intentions (frequency of heavy drinking sessions and number of drinks in a typical drinking day planned over next 30 days)	No significant difference in future drinking intentions between conditions (p > .05).
Martinez, US, 2015 - S2[29]	*n* = 98, mean age= 26.5 (SD 13.3), recruited from a mall with previous alcohol consumption	Online, randomized	CAL	4 label conditions: accurate nutrition label; no label; label with greatly enhanced vitamin C; label with greatly decreased calories Shown on image of beer bottle	Subjective: Future drinking intentions (frequency of heavy drinking sessions and number of drinks in a typical drinking day planned over next 30 days)	No significant difference in future drinking intentions between conditions (p > .05).

Maynard, UK, 2018a[10]	*n* = 264 (58% responded to qualitative question, n= 153); aged 18+, regular alcohol drinkers from UK university database	Laboratory, randomised	UNIT + CAL	4 conditions: calorie content (present/absent) and unit information (present/absent) of beer provided alongside other product information on a piece of paper or removed	Objective**:** Laboratory measured alcohol consumption (beer) using bogus taste-test Subjective: Future intentions to consume beverage ("How many half pints of would you consume?") Qualitative: 'Do you have any other comments about calorie or unit labelling?'	No significant difference in beer consumption between two conditions (3% more consumed in calorie label condition, p = .35, p < 0.01). No significant difference in future intended consumption of beverage between two conditions (4% increase in intentions in calorie labelling condition, p = .39). Qualitative findings showed a general opinion, especially from female participants, that calorie information might make alcohol consumers think more carefully about their consumption. View that calorie information would only affect those who were worried about their weight or who already restricted their calorie intake from food.
Maynard, UK, 2018b S1 Online survey[20]	*n* = 450, aged 18+, alcohol consumers recruited from Prolific Academic, Tobacco and Alcohol Research Group (TARG) and public areas (e.g., libraries)	Online, all exposed to the same four images	UNIT + CAL	4 conditions: Healthier choice tick; Guideline amounts (calorie and % guideline daily amounts); Traffic lights (low/medium/high with calorie and unit information); Guideline amounts with traffic lights	Subjective: Intention to drink less Impact of the labels on drinking behaviour (number of drinks, use of diet mixer, selection of lower strength drink, negative consequences)	Proportion of participant responses were reported, and significance was not tested. Approximately 20% of participants reported that their intention to drink would be lower if exposed to the labels with calorie information. For Healthier choice tick (no calorie information) 5% said it would lower intention and 15% said it would increase. Based on calorie information the following proportion of participants said it would impact their drinking behaviour by: taking no action (38%), reducing the number of drinks (16%), using a diet or low-calorie mixer (30%) or doing more exercise (36%). The proportion of potential negative behavioural consequences from calorie information: would probably (or definitely) reduce the amount of food they eat based on information about calories in alcohol (15%), think diet is important when thinking about how much they drink (37%), reduce the number of drinks based on calorie information (19% female, 13% male).
Pabst, Australia, Germany, Italy, 2021[38]	Australia, *n* = 745; Germany, *n* = 716; Italy, *n* = 715; all aged 18+, wine drinkers recruited by professional panel agency	Online, (random allocation not relevant to labels)	CAL	3 conditions: no nutrition information; short nutrition table with energy value; long nutrition table with nutrients mandatory for other foods (energy, fats, saturated fatty acids, carbohydrates, sugar, protein and salt)	Subjective: Discrete choice experiment - choice of one out of three wine options they would purchase in 12 choice scenarios	Significant positive utility for detailed nutrition information across all three countries. Nutritional information significantly affected wine choice (proxy for purchase intention), and more information received a significantly higher utility than short or no information.
Pabst, Germany, 2019[35]	*n* = 21 age details not stated,	Qualitative, three focus groups,	CAL	3 conditions: current standard; standard plus detailed nutrition information (instead of tasting	Qualitative: Main decision factors Wine bottle choice between the 3 conditions	All participants agreed that energy labelling on wine would not result in lower consumption. This was mainly because wine was considered a special treat rather than a staple or

	wine consumers recruited from various non-wine related private and professional networks	private setting, approximately 90 minutes		notes); standard plus detailed nutrition information and list of ingredients Shown on white wine bottle		basic food. Actual energy values of alcoholic beverages were lower than some participants expected, which some said might lead to greater consumption. Purchase intention based on label conditions, majority said they would not exclude any of the wines due to the nutrition information or ingredients listed. Overall, participants did not intend or want to decrease their wine consumption because of the new labelling law. Context such as occasion and recommendations were important factors when choosing wine, not ingredients.
Piper, Italy, 2021[30]	*n* = 480, aged 18+, recruited from natural consumption places (e.g. lounge bar in the city centre)	Randomly selected, natural consumption	CAL	4 label conditions: Control = no label; Textual warning label = numeric value of the caloric content of the product; Pictorial warning label = food product equivalent in caloric terms; Claim = 'Drink responsibly' Shown besides images of either "Mojito" or "Piña Colada" cocktails. Also shown in different combinations (claim + pictorial; textual warning + pictorial etc.)	Subjective: Purchase intention (strength of their intention to buy the product and their likelihood of buying the product)	Only the presence of an image representing the calorie content of an alcoholic beverage led to a significant reduction in consumers' purchase intentions.
Robinson, UK, 2021[21]	*n* = 1084, mean age = 36 (SD 14), alcohol consumers recruited from online platform Prolific	Online, randomized	CAL	3 label conditions: Control (standard alcohol labelling with unit); kcal (standard plus drink kilocalorie information); kcal + PACE labelling (standard, kilocalorie information, plus information on physical activity needed to compensate for drink calories)	Subjective: Intentions to drink less Perceived behavioural effects of energy labelling on alcoholic drinks	Both kcal labelling and kcal + PACE labelling conditions had significantly lower drinking intentions compared to the control condition ($p < .001$). A subset of participants also reported that they believed calorie labelling would be likely to positively change their eating and exercise behaviour.
Roderique-Davies & John, UK, 2018[22]	*n* = 10, alcohol consumers recruited through UK University internal marketing	Qualitative	UNIT + CAL	Presented with two variants of alcohol products, the first comprising 'real world' labels and the second with bespoke, re-designed labels giving alcohol unit information much greater prominence (on the front label) and also including health-related information.	Qualitative: Asked to consider the positive and negative aspects of current alcohol labels, as well as the strengths and weaknesses of the new re-designed labels	When considering existing labels, aside from unit information, participants viewed the label design as unhelpful in providing health-related information, noting poor placement, the small font size of the text, and contrast issues. Whilst the alternative labels were seen as a positive improvement, with key unit and health information placed on the front label being well-received, the participants were of the view that point of sale changes and pricing would be a more effective way of influencing purchasing behaviour.

RSPH, UK, 2018[23]	*n* = 1783, alcohol consumers recruited by Populus Data Solutions	Online, all exposed to the same three images	CAL + ABV%	3 label conditions: ABV%; Calorie content; Combined ABV% and calorie content Shown on three drink ABV% value categories (low-range, midrange, high-range), either wine, spirits or beer (depending on the participants' preference)	Subjective: Hypothetical purchase choice	On average across the three drink categories, high-range ABV% choices went down by 11% and low-range ABV% choices up by 8% when calorie information was added to the labels (down 21% and up 19% respectively among young drinkers). This equates to a 9.5% swing from high to low (20% among young drinkers).
Thomson, Australia, 2012[36]	*n* = 45, recruited by market research company (adults = regular drinkers, teenagers = previous alcohol consumption)	Qualitative (6 focus groups, segmented by life stage)	UNIT + CAL	12 conditions: different alcoholic drinks (beer, wine, spirits etc.), each with a different health advisory message and image All shown with NIP and unit information	Qualitative: Focus group participants were asked to give their views on the 12 prototype labels	Some of the younger participants reported using the number of standard drinks and ABV% information to purchase beverages with the maximum alcohol content; to enable them to get drunk as cheaply as possible. The parent groups were more likely to use this information to select low alcohol products and/or manage their consumption when driving.
Vasiljevic, UK, 2018a[24]	*n* = 3390, age range = 18-99; alcohol consumers recruited by market research agency	Online, randomised	ABV% + VSD	18 label combinations: 3 x verbal descriptor (Low vs. Super Low vs. No verbal descriptor-control); 6 x ABV% (5 levels varying for wine and beer (wine: 0%, 4%, 6%, 8%, 10%; beer: 0%, 1%, 2%, 3%, 4%), and no level given-control). Shown on beer or wine.	Subjective: Product appeal (purchase and consumption intention)	Products with verbal descriptors denoting lower strength (Low and Super Low) had lower appeal than Regular strength products. Appeal decreased significantly as ABV% decreased with lowest appeal for wine with 0% ABV% and 4% ABV%, and for beer with 1% ABV% and 2% ABV% ($p<.001$, for the comparison with Regular). Appeal increased with ABV% and was highest for products without a verbal descriptor or ABV%. Appeal was lowest for Low verbal descriptors + No ABV%, and Super Low verbal + 0% ABV%.
Vasiljevic, UK, 2018b[25]	*n* = 264, age range = 18-70; alcohol consumers recruited by market research agency	Laboratory (bar), random	ABV% +VSD	3 conditions: verbal descriptor 'Super Low' combined with 4% ABV% for wine/1% ABV% for beer; verbal descriptor 'Low' combined with 8% ABV% for wine/3% ABV% for beer; no verbal descriptors of strength (Regular) Shown on mock-up beer or wine bottle labels	Objective: Laboratory measured alcohol consumption (beer/wine) using bogus taste-test	The total amount of drink consumed increased as the label on the drink denoted successively lower alcohol strength. Group contrasts showed significant differences between those offered drinks labelled as Super Low (M=213.77) compared with Regular (M=176.85), p= 0.019. There was no significant difference in amount consumed between those offered drinks labelled as Low compared with Regular.
Vecchio, Italy, 2018[31]	*n* = 103, mean age = 29.1 (SD 7.1), regular	University campus, presentatio	CAL	4 label conditions: kcal content for a glass of wine; nutrition information for 100ml; nutritional information for	Subjective: Hypothetical monetary auction bidding task	Nutrition labels resulted in increased value of wine. Compared to the no nutrition information (€3.92) label condition, all nutrition label conditions (kcal per glass =

	wine consumers recruited at university campus	n randomised		a glass of wine relative to guideline daily amounts; no nutrition information		€4.27; Nutritional information = €4.97; Relative to daily guidelines (€4.71) were associated with an increase in hypothetical monetary bid.
Walker, NZ, 2019a[33]	*n* = 35, aged 18+, regular alcohol consumers recruited via third party (Prime Research)	Qualitative, 7 focus groups, segmented by age and drinking status, plus a Māori only group (90 minutes)	CAL	4 labels (participants saw all): Beer with a nutrition information panel (NIP) placed on the back; Round energy icon (kJ or cal) on front; Round energy icon + % daily intake per serve; Combined label with standard drinks icon, ABV%, round energy icon + % daily intake per serve.	Qualitative: Impact of energy labelling on likely purchase and consumption of alcoholic beverages. Created their own alcohol labels they felt may be effective in changing attitudes and lowering purchase intention	Energy and cal/kJ were the most common responses to what information would most likely influence their behaviour (buy/consume alcoholic drinks). The combined label was most preferred, and energy + % daily intake was least preferred (additional % daily intake was not seen as useful). NIP was seen as not useful and overwhelming. The round energy icon was seen as eye catching and simple. For all labels, beyond taste and price, participants stated they would look at the standard drinks or % alcohol content labels first, rather than the energy content, indicating that the energy content labels would have little influence. Some felt energy content was only "*for health freaks"* or people who are *"concerned about their weight,"* and did not find the information personally relevant.
Walker, NZ, 2019b[34]	*n* = 615, mean age = 41.2 (SD 15.1), regular alcohol consumers recruited via third party online panel (Research Now SSI)	Online, randomised	CAL	4 conditions: Unlabelled control; Nutritional information panel (back-of-bottle); Combined energy content (kJ or cal), ABV% and standard drinks (front-of-bottle); Interpretive energy content/PACE (kJ or cal) with an orange stopwatch icon demonstrating the amount of exercise required to burn-off the shown energy (front-of-bottle) Shown on mock-up beer, wine or spirit bottle.	Subjective: Purchase intention Number of drinks likely to purchase Consumption intention	The nutrition information panel label condition had a significantly higher likelihood of purchasing the displayed alcoholic beverage compared to no label control (5.6/11 vs. 4.8/11, p=.04). Compared to no label, there were no other differences for the other conditions for purchase intention. No differences observed for number of drinks likely to purchase or consumption intentions, between each condition and no label condition. The NIP and interpretive energy labels significantly increased the reported likely purchase of alcoholic beverages by Māori participants.
Zhao, Canada, 2020[37]	Whitehorse Yukon monthly alcohol sales from July 2015-December 2018	Interrupted Time Series	UNIT	Unit/standard drinks label shown in Whitehorse, Yukon between May 28–Jul. 31, 2018. Placed on Wine 750 ml, spirit 750 ml, beer 355 ml, cooler 2 L. *Not presented here, also 3 other label types	Objective: Actual alcohol purchase	(iii) a 4-month period during which most alcohol containers sold in Whitehorse were labelled with either a standard drink or LRDG label (approximately 200,000 containers). Gradually increasing reductions in total and labelled alcohol sales were observed over time, with the smallest during the initial 1-month period (i) (--11.35% during the LRDG/standard drinks labelling and post-intervention periods

LRDG = low-risk drinking guideline; ABV% = Alcohol by volume; VSD = verbal strength descriptor; kJ = kilojoule; cal = calorie; ml = millilitre; L = litre; physical activity calorie equivalent = PACE. *Clarke et al (2022) *n* = 608 for the whole study, also Health warning labels conditions, which are not presented, and included soft-drinks which we were not interested in.

Appendices

Appendix 1. Details of search

Databases:

- MEDLINE
- Cochrane Library Web
- EMBASE
- SCOPUS
- PsycINFO
- Web of Science – SSCI, SCI, ESCI
- ASSIA and Sociological Abstracts (ProQuest)
- ABI Inform Global (ProQuest)
- HMIC
- Social Policy and Practice
- TRoPHI
- Google Scholar (focussed search around alcohol calorie labelling/labelling)
- Alcohol change https://alcoholchange.org.uk/research-hub/research
- NICE evidence search

Inclusion criteria:

Participants	Any age
Exposure (intervention)	Energy/calorie or unit labelling on alcohol products Applied to pre-packaged foods only. Purchasing for individual/ family, not food supply
Comparison	Randomised or quasi-randomised controlled trials (RCTs/Q-RCTs) Controlled before-and-after studies Interrupted time series (ITS) studies Compared a labelled product (with information on nutrients or energy) with the same product without a nutritional label Assessed objectively measured purchasing or consumption of foods or non-alcoholic drinks in real-world or laboratory settings. Studies where both groups were exposed to FOPL, and an intervention group was exposed to additional info, were excluded
Outcome measure	Objective Purchasing behaviour (individual/ family) Dietary intake (individual) Sales data (higher level) Subjective Purchasing intentions (individual/ family) Dietary intake intentions
Study designs	Experimental; intervention (with a control group); observational; Qualitative
Other Geography Languages Time	 All All All

Appendix 2. Search history

Cochrane Library Web - 20/12/2021

ID	Search	Hits
#1	MeSH descriptor: [Alcoholic Beverages] explode all trees	
#2	MeSH descriptor: [Ethanol] this term only	
#3	MeSH descriptor: [Alcohol Drinking] explode all trees	
#4	MeSH descriptor: [Beer] this term only	
#5	MeSH descriptor: [Wine] this term only	
#6	MeSH descriptor: [Absinthe] this term only	
#7	(alcohol* or ethanol or beer or lager or wine or cider or alcopop or alco-pop or spirit or liquor or liquer or liqueur or whisky or whiskey or whiskies or whiskeys or schnapp or brandy or brandies or gin or rum or tequila or vodka or cocktail or ale or bitter or soju or sake):ti,ab,kw (Word variations have been searched)	
#8	#1 or #2 or #3 or #4 or #5 or #6 or #7	
#9	MeSH descriptor: [Nutritive Value] this term only	
#10	(Calorific or calorie* or caloric or kilojoule* or kilocalorie* or kcal* or kJ* or energy or unit):ti,ab,kw (Word variations have been searched)	
#11	MeSH descriptor: [Product Packaging] this term only	
#12	MeSH descriptor: [Product Labeling] this term only	
#13	MeSH descriptor: [Food Labeling] explode all trees	
#14	MeSH descriptor: [Food Packaging] this term only	
#15	#11 or #12 or #13 or #14	
#16	(#9 or #10) AND #15	
#17	(((calorie adj2 label*) or (nutrition* adj2 label*) or (energy adj2 label*) or (unit adj2 label) or (nutrit* adj2 information) or (nutrit* adj2 panel) or "nutrition facts" or (((Calorific or calorie* or caloric or kilojoule* or kilocalorie* or kcal* or kJ* or energy or unit) adj5 (label* or content* or information or vignette* or symbol* or sign or sticker*)) and (label* or packaging or package* or pack or packs or prepack*))))):ti,ab,kw (Word variations have been searched)	
#18	#16 or #17	
#19	#18 AND #8	

EMBASE - 20/12/2021

#	Query
1	exp alcoholic beverages/ or beer/ or liquor/ or wine/ or exp alcohol drinking/ or binge drinking/ or social drinking/
2	(alcohol* or ethanol or beer or lager or wine or cider or alcopop or alco-pop or spirit or liquor or liquer or liqueur or whisky or whiskey or whiskies or whiskeys or schnapp or brandy or brandies or gin or rum or tequila or vodka or cocktail or ale or bitter or soju or sake).ti,ab,kw.
3	1 or 2
4	nutritive value/
5	(Calorific or calorie* or caloric or kilojoule* or kilocalorie* or kcal* or kJ* or energy or unit).ti,ab,kw.
6	4 or 5
7	product packaging/ or product labeling/ or exp food labeling/ or food packaging/
8	6 and 7
9	((calorie adj2 label*) or (nutrition* adj2 label*) or (energy adj2 label*) or (unit adj2 label) or (nutrit* adj2 information) or (nutrit* adj2 panel) or "nutrition facts" or (((Calorific or calorie* or caloric or kilojoule* or kilocalorie* or kcal* or kJ* or energy or unit) adj5 (label* or content* or information or vignette* or symbol* or sign or sticker*)) and (label* or packaging or package* or pack or packs or prepack*))).ab,ti,kw.
10	8 or 9
11	3 and 10

SCOPUS - 20/12/2021

1 TITLE-ABS-KEY (alcohol* OR ethanol OR beer OR lager OR wine OR cider OR alcopop OR alco-pop OR spirit OR liquor OR liquer OR liqueur OR whisky OR whiskey OR whiskies OR whiskeys OR schnapp OR brandy OR brandies OR gin OR rum OR tequila OR vodka OR cocktail OR ale OR bitter OR soju OR sake)

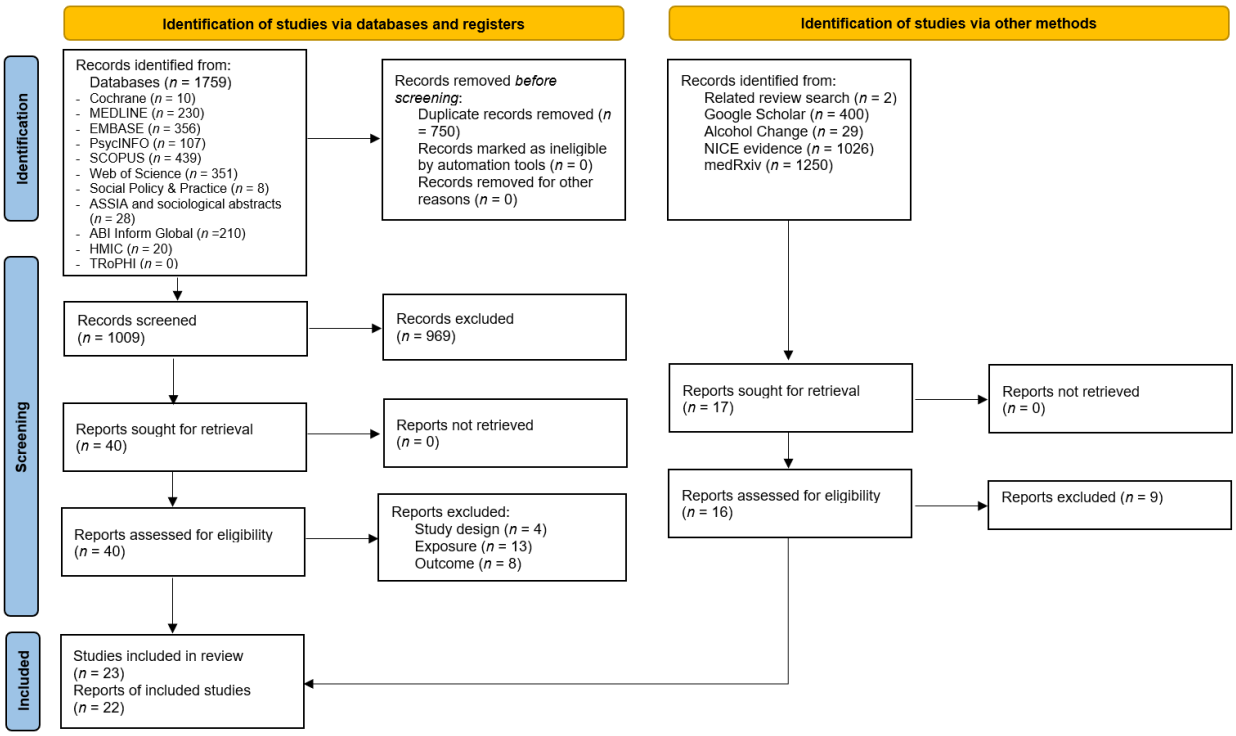
2 TITLE-ABS-KEY (((calorie W/2 label*) OR (nutrition* W/2 label*) OR (energy W/2 label*) OR (unit W/2 label) OR (nutrit* W/2 information) OR (nutrit* W/2 panel) OR "nutrition facts") OR (((calorific OR calorie* OR caloric OR kilojoule* OR kilocalorie* OR kcal* OR kj* OR energy OR unit) W/5 (label* OR content* OR information OR vignette* OR symbol* OR sign OR sticker*)) AND (label* OR packaging OR package* OR pack OR packs OR prepack*))))

3 TITLE-ABS-KEY ((alcohol* OR ethanol OR beer OR lager OR wine OR cider OR alcopop OR alco-pop OR spirit OR liquor OR liquer OR liqueur OR whisky OR whiskey OR whiskies OR whiskeys OR schnapp OR brandy OR brandies OR gin OR rum OR tequila OR vodka OR cocktail OR ale OR bitter OR soju OR sake) AND ((calorie W/2 label*) OR (nutrition* W/2 label*) OR (energy W/2 label*) OR (unit W/2 label) OR (nutrit* W/2 information) OR (nutrit* W/2 panel) OR "nutrition facts") OR ((

((calorific OR calorie* OR caloric OR kilojoule* OR kilocalorie* OR kcal* OR kj* OR energy OR unit) W/5 (label* OR content* OR information OR vignette* OR symbol* OR sign OR sticker*)) AND (label* OR packaging OR package* OR pack OR packs OR prepack*))))
Web of Science – SSCI, SCI, ESCI - 20/12/2021 Query #1 TS=(alcohol* OR ethanol OR beer OR lager OR wine OR cider OR alcopop OR alco-pop OR spirit OR liquor OR liquer OR liqueur OR whisky OR whiskey OR whiskies OR whiskeys OR schnapp OR brandy OR brandies OR gin OR rum OR tequila OR vodka OR cocktail OR ale OR bitter OR soju OR sake) Indexes=SSCI, ESCI, SCI-EXPANDED Query #2 TS=(((calorie NEAR/2 label*) or (nutrition* NEAR/2 label*) or (energy NEAR/2 label*) or (unit NEAR/2 label) or (nutrit* NEAR/2 information) or (nutrit* NEAR/2 panel) or "nutrition facts" or (((Calorific or calorie* or caloric or kilojoule* or kilocalorie* or kcal* or kJ or energy or unit) NEAR/5 (label* or content* or information or vignette* or symbol* or sign or sticker*)) and (label* or packaging or package* or pack or packs or prepack*)))) Indexes=SSCI, ESCI, SCI-EXPANDED Query #3 (#1) AND #2 Indexes=SSCI, ESCI, SCI-EXPANDED
ASSIA and Sociological Abstracts (Proquest) - 20/12/2021 (TI,AB ((alcohol* OR ethanol OR beer OR lager OR wine OR cider OR alcopop OR alco-pop OR spirit OR liquor OR liquer OR liqueur OR whisky OR whiskey OR whiskies OR whiskeys OR schnapp OR brandy OR brandies OR gin OR rum OR tequila OR vodka OR cocktail OR ale OR bitter OR soju OR sake) AND ((calorie W/2 label*) OR (nutrition* W/2 label*) OR (energy W/2 label*) OR (unit W/2 label) OR (nutrit* W/2 information) OR (nutrit* W/2 panel) OR "nutrition facts") OR ((((calorific OR calorie* OR caloric OR kilojoule* OR kilocalorie* OR kcal* OR kj* OR energy OR unit) W/5 (label* OR content* OR information OR vignette* OR symbol* OR sign OR sticker*)) AND (label* OR packaging OR package* OR pack OR packs OR prepack*)))))
ABI Inform Global (Proquest) - 20/12/2021 S1 MAINSUBJECT.EXACT("Alcoholic beverages") OR MAINSUBJECT.EXACT("Beer") OR MAINSUBJECT.EXACT("Wines") OR MAINSUBJECT.EXACT("Liquor") S2 ((TI,AB (alcohol* or ethanol or beer or lager or wine or cider or alcopop or alco-pop or spirit or liquor or liquer or liqueur or whisky or whiskey or whiskies or whiskeys or schnapp or brandy or brandies or gin or rum or tequila or vodka or cocktail or ale or bitter or soju or sake))) S3 S1 OR S2 S4 MAINSUBJECT.EXACT("Calories") S5 ((TI,AB (Calorific or calorie* or caloric or kilojoule* or kilocalorie* or kcal* or kJ* or energy or unit))) S6 S4 OR S5 S7 MAINSUBJECT.EXACT("Food packaging") OR MAINSUBJECT.EXACT("Descriptive Labeling") S8 S6 AND S7 S9 ((TI,AB ((calorie N/2 label*) or (nutrition* N/2 label*) or (energy N/2 label*) or (unit N/2 label) or (nutrit* N/2 information) or (nutrit* N/2 panel) or "nutrition facts" or (((Calorific or calorie* or caloric or kilojoule* or kilocalorie* or kcal* or kJ* or energy or unit) N/5 (label* or content* or information or vignette* or symbol* or sign or sticker*)) and (label* or packaging or package* or pack or packs or prepack*))))) S10 S8 OR S9 S11 S10 AND S3 S12 S11 NOT (Newspapers AND Trade Journals AND Magazines AND Dissertations)
HMIC - 20/12/2021 1 alcoholic beverages/ or beer/ or liquor/ or wine/ 2 exp Alcohol consumption/ 3 (alcohol* or ethanol or beer or lager or wine or cider or alcopop or alco-pop or spirit or liquor or liquer or liqueur or whisky or whiskey or whiskies or whiskeys or schnapp or brandy or brandies or gin or rum or tequila or vodka or cocktail or ale or bitter or soju or sake).ab,ti,nt. 4 1 or 2 or 3 5 nutritional value/ 6 (Calorific or calorie* or caloric or kilojoule* or kilocalorie* or kcal* or kJ* or energy or unit).ab,ti,nt. 7 food packaging/ or product labelling/ 8 5 or 6 9 7 and 8 10 ((calorie adj2 label*) or (nutrition* adj2 label*) or (energy adj2 label*) or (unit adj2 label) or (nutrit* adj2 information) or (nutrit* adj2 panel) or "nutrition facts" or (((Calorific or calorie* or caloric or kilojoule* or kilocalorie* or kcal* or kJ* or energy or unit) adj5 (label* or content* or information or vignette* or symbol* or sign or sticker*)) and (label* or packaging or package* or pack or packs or prepack*))).ab,ti,nt. 11 9 or 10 12 4 and 11
Social Policy and Practice - 20/12/2021

1 (alcohol* OR ethanol OR beer OR lager OR wine OR cider OR alcopop OR alco-pop OR spirit OR liquor OR liquer OR liqueur OR whisky OR whiskey OR whiskies OR whiskeys OR schnapp OR brandy OR brandies OR gin OR rum OR tequila OR vodka OR cocktail OR ale OR bitter OR soju OR sake).ti,ab,nt,de,hw. 2 ((calorie adj2 label*) or (nutrition* adj2 label*) or (energy adj2 label*) or (unit adj2 label) or (nutrit* adj2 information) or (nutrit* adj2 panel) or "nutrition facts" or (((Calorific or calorie* or caloric or kilojoule* or kilocalorie* or kcal* or kJ* or energy or unit) adj5 (label* or content* or information or vignette* or symbol* or sign or sticker*)) and (label* or packaging or package* or pack or packs or prepack*))).ti,ab,nt,de,hw. 3 1 and 2
TRoPHI 17/11/2021 (EPPI-Reviewer 4, IE interface) 2465 "alcohol* or ethanol or beer or lager or wine or cider or alcopop or alco-pop or spirit or liquor or liquer or liqueur or whisky or whiskey or whiskies or whiskeys or schnapp or brandy or brandies or gin or rum or tequila or vodka or cocktail or ale or bitter or soju or sake" (in Title and Abstract) 2466 "Calorific or calorie* or caloric or kilojoule* or kilocalorie* or kcal* or kJ* or energy or nutrit*" (in Title and Abstract) 2467 "label* or packaging or package* or pack or packs or prepack*" (in Title and Abstract) 2468 2467 AND 2466 AND 2465 2469 "panel* or information* or facts" (in Title and Abstract) 2470 "nutriti*" (in Title and Abstract) 2471 2470 AND 2469 AND 2465 2472 2471 OR 2468 2473 Coded with: alcohol 2474 2473 AND 2467 AND 2466 2475 2474 OR 2472 2476 2473 AND 2470 AND 2469
Google Scholar (screened first 5 pages, sorted by relevance) - 20/12/2021 Searched: alcohol calorie labelling consume alcohol calorie labelling purchase alcohol unit labelling consume alcohol unit labelling purchase
Alcohol change https://alcoholchange.org.uk/research-hub/research -20/12/2022 29 results, 12 publications – searched 'alcohol label'
NICE evidence search - 20/12/2021 1026 results for alcohol label with filters Evidence Summaries; Primary Research
Medrxiv (pre-prints) - 12/09/2022 1,205 results for 'calorie label AND alcohol', sorted by most relevant

Appendix 3. PRISMA flowchart



Appendix 4. Images of the labels extracted from the included studies

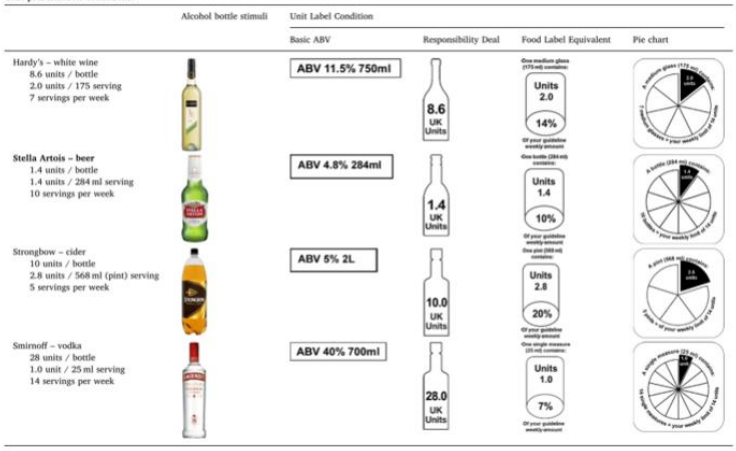
Clarke, 2022

Calorie label	HWL type		
	Image-and-text HWL	Text-only HWL	No HWL
Present	Group 1* Alcohol causes liver cancer 300 CALORIES Per bottle	Group 2* Alcohol causes bowel cancer 300 CALORIES Per bottle	Group 3* 300 CALORIES Per bottle
Absent	Group 4 Alcohol causes liver cancer	Group 5 Alcohol causes bowel cancer	Group 6 No HWL No calorie label

*In these groups, calorie labelling was also added to non-alcoholic drinks

Blackwell, 2018 – S1

Table 1
Unit presentation conditions.



Note that alcohol bottle stimuli were presented to participants in color.

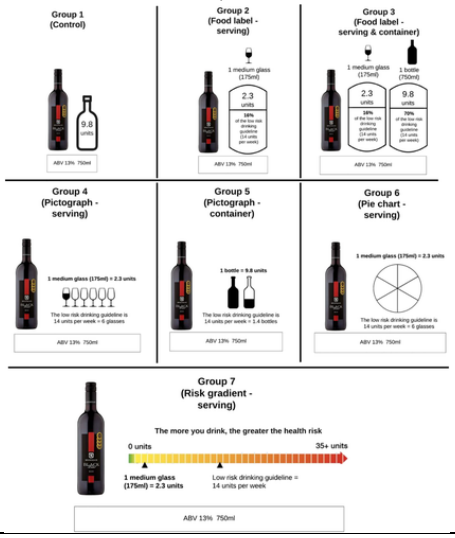
Bui, 2008

APPENDIX 1
Examples of Stimuli

Control condition: Light Beer

Manipulated condition: Wine

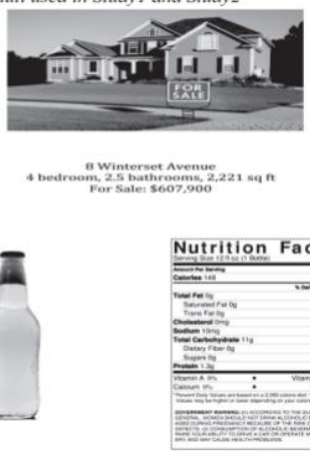
Gold, 2021



Martinez, 2015 - S1 + 2

FIGURE 1

Example stimuli used in Study1 and Study2



Maynard, 2018b S1 Online survey

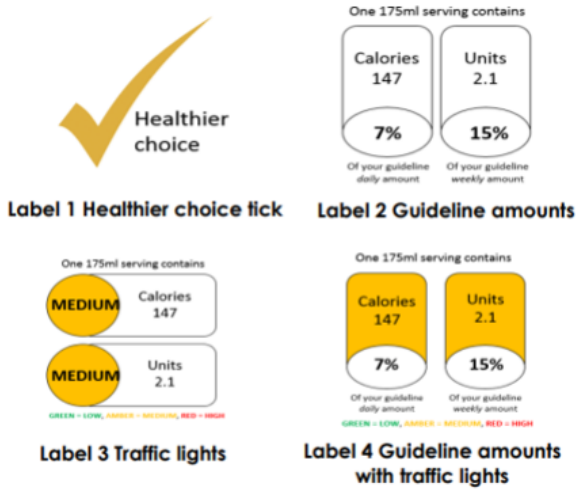
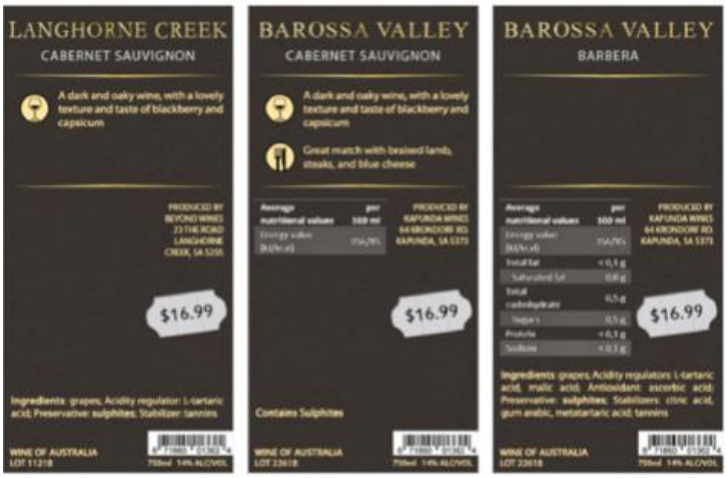


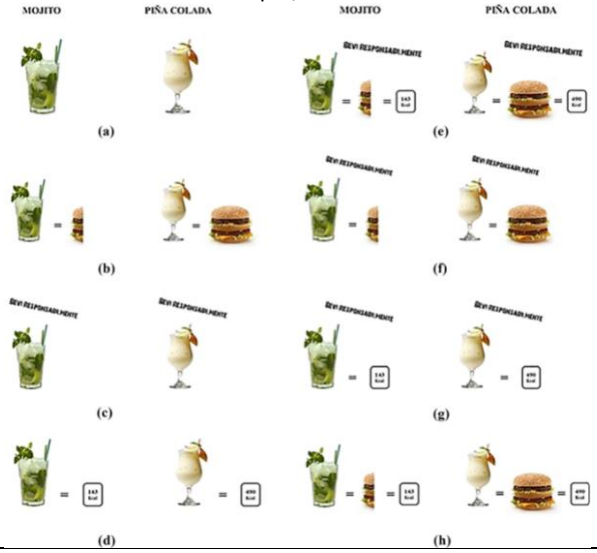
Figure 1 Example labels displaying calorie and / or unit information

Pabst, 2021



Pabst, 2019

Piper, 2021



Robinson, 2021

Roderique-Davies & John, 2018 (figure 1)

Roderique-Davies & John, 2018 (figure 2)

RSPH, 2018

Thomson, 2012

Vasiljevic, 2018a

Vasiljevic, 2018b

Vecchio, 2018

Walker, 2019a

Walker, 2019b

Zhao, 2020

CHART 1. Point-of-sale warning labels placed on alcohol containers in different alcohol monopoly liquor stores in Yukon and Northwest Territories (NWT) at different times between July 2015 and December 2018

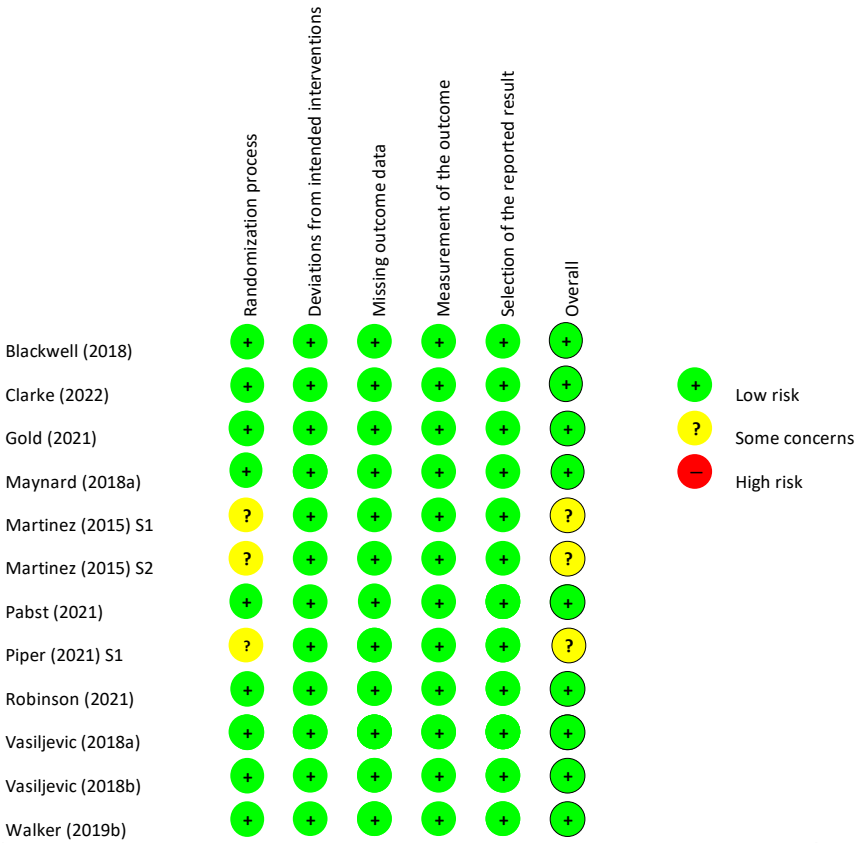
Label content				
Whitehorse, Yukon (n = 1)	• Jul. 2015–Nov. 19, 2017 • Aug.–Dec. 2018	• Nov. 20–Dec. 19, 2017	• Nov. 20–Dec. 19, 2017 • Apr. 11–Jul. 31, 2018	• May 28–Jul. 31, 2018
Rural areas in Yukon (n = 5)	• Jul. 2015–Dec. 2018	None	None	None
NWT (n = 1)	• Jul. 2015–Dec. 2018	None	None	None

*Studies not included in this table did not provide images within the paper or supplementary files

Appendix 5. Bias assessments

ROBINS-I

RoB 2.0



CASP qualitative assessment

Author (year)	Was there a clear statement of the aims of the research?	Is a qualitative methodology appropriate?	Was the research design appropriate to address the aims of the research?	Was the recruitment strategy appropriate to the aims of the research?	Was the data collected in a way that addressed the research issue?	Has the relationship between researcher and participants been adequately considered?	Have ethical issues been taken into consideration?	Was the data analysis sufficiently rigorous?	Is there a clear statement of findings?	How valuable is the research?	Overall Quality Assessment
Walker (2019a)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	M
Pabst (2019)	Y	Y	Y	Y	Y	C	C	Y	Y	N	M
Thomson (2012)	Y	Y	Y	C	Y	C	Y	Y	Y	Y	M
Roderique-Davies & Jones (2018)	Y	Y	Y	C	Y	C	C	Y	Y	Y	L

Y= Yes, C= Can´t tell, N=No, N/A= Not applicable, M = Moderate overall quality, L = Low overall quality.

Quantitative sales data bias and quality assessment

	Zhao et al, 2018
AIMS	
Was there a clear statement of the aims of the study?	Yes
DATA	
Was a commercial data set used?	No
What was the data collection method?	Other (sales data)
Was the dataset complete?	Yes
Were there apparent, unintended restrictions in the dataset in terms of tobacco products or sales points?	No
Was the sampling method appropriate to the question/ inference being made?	Yes
Was the data sample representative of intended population?	Yes
Did the study report a priori power calculations (where appropriate)?	No
Was the timing of the data collection appropriate for the aims of the study?	Yes
Duration of study: Were the data collected over a sufficient time period for the intended analysis?	Yes
Were all plausible variables of interest measured in the dataset?	Yes
Are the measures/ variables adequately described?	Yes
Overall, are there concerns about the soundness of the data for the purposes of the study?	No
ANALYSIS	
Were the analyses appropriate given the stated aims?	Yes
Was the size of the dataset sufficient for the analyses being conducted?	Yes
Have the data been analysed appropriately?	Yes
Overall, are there concerns about the analyses?	No
INFERENCES AND CONCLUSIONS	
Are the inferences drawn from analyses appropriate given the sample relative to population?	Yes
Are the inferences drawn appropriate given the analyses and results?	Yes
Is there an over-emphasis on statistical significance rather than magnitude/ direction of effect?	No
Is there an appropriate emphasis of the real-world importance of the statistical results?	Yes
OVERALL	
Are there concerns about the soundness of the study?	No concerns