


ARTICLE

Effect of visualising and re-expressing evidence of policy effectiveness on perceived effectiveness: a population-based survey experiment

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Abstract

Communicating evidence that a policy is effective can increase public support although the effects are small. In the context of policies to increase healthier eating in out-of-home restaurants, we investigate two ways of presenting evidence for a policy's effectiveness: (i) visualising and (ii) re-expressing evidence into a more interpretable form. We conducted an online experiment in which participants were randomly allocated to one of five groups. We used a 2 (text only vs visualisation) × 2 (no re-expression vs re-expression) design with one control group. Participants ($n = 4500$) representative of the English population were recruited. The primary outcome was perceived effectiveness and the secondary outcome was public support. Evidence of effectiveness increased perceptions of effectiveness ($d = 0.14$, $p < 0.001$). There was no evidence that visualising, or re-expressing, changed perceptions of effectiveness (respectively, $d = 0.02$, $p = 0.605$; $d = -0.02$, $p = 0.507$). Policy support increased with evidence but this was not statistically significant after Bonferroni adjustment ($d = 0.08$, $p = 0.034$, $\alpha = 0.006$). In conclusion, communicating evidence of policy effectiveness increased perceptions that the policy was effective. Neither visualising nor re-expressing evidence increased perceived effectiveness of policies more than merely stating in text that the policy was effective.

Keywords: policies; acceptability; obesity; nudge; communication

Introduction

Unhealthy patterns of food consumption, including excess energy intake, are major contributors to high and rising rates of obesity leading to increasing deaths worldwide (Global Burden of Disease Obesity Collaborators, 2017; Steel *et al.*, 2018; Swinburn

et al., 2019; Lindberg *et al.*, 2020). Increasing rates of obesity are largely attributable to food environments (Swinburn *et al.*, 2011; Tyrrell *et al.*, 2017; Brandkvist *et al.*, 2019). Factors such as the increasing availability of unhealthy foods and the increasing portion size of foods contribute to these unhealthy food environments and are therefore key targets for intervention (Marteau *et al.*, 2012). There is growing evidence that targeting these aspects of the food environment, namely replacing higher calorie foods with lower calorie alternatives and reducing portion sizes, are effective interventions for reducing energy intake (Zlatevska *et al.*, 2014; Hollands *et al.*, 2015, 2019; Pechey *et al.*, 2019; Reynolds *et al.*, 2021). However, relatively low public support for policies that aim to limit the availability and size of less health food products (Petrescu *et al.*, 2016; Reynolds *et al.*, 2019a) limits the likelihood that they will implement (Burstein, 2003; Cullerton *et al.*, 2016, 2018; Sevenans, 2021).

There are many factors that explain why the public support or oppose government policies (e.g. increasing tax on fossil fuels, mandating warning labels on foods high in sugar and fat). These factors include beliefs about the problem that the policy is trying to address (Hilbert *et al.*, 2007; Barry *et al.*, 2009), perceived fairness of the policy (Eriksson *et al.*, 2008), personal outcome expectations (Schade & Schlag, 2003; Schuitema *et al.*, 2010) and – key to the current study – the perceived effectiveness of the policy (Lam, 2014; Storrøll *et al.*, 2015; Huber *et al.*, 2020). One approach to increase support for policies is to communicate evidence that the policy is effective (Reynolds *et al.*, 2020a). This systematic review synthesised results from 35 studies across multiple policies domains including health, environmental and immigration policies and concludes that communicating evidence of policy effectiveness can increase support by approximately four percentage points, e.g. from 50% to 54%. Given that the key mediating variable is the belief that the policy is effective (Reynolds *et al.*, 2018), maximising the degree to which this belief is changed should subsequently lead to greater increases in public support. One study attempted to change this belief by comparing asserted and quantified evidence ('this policy will reduce tobacco use by 10%') against asserted evidence ('this policy will reduce tobacco use'), but this had no detectable impact on beliefs about policy effectiveness (Reynolds *et al.*, 2019a). A second study successfully changed beliefs about policy effectiveness by communicating 'enhanced evidence' against 'basic evidence' but the latter comprised multiple components making it unclear which component(s) was key (Reynolds *et al.*, 2018). Visualisation of evidence – using graphs or infographics – has been shown in other contexts to increase attention and recall of information (Lipkus, 2007; Borkin *et al.*, 2013) and has been shown to change beliefs, yet it is unclear whether these benefits would translate into greater belief and attitude change within the context of healthy eating policies. Many studies that investigate influences on policy support have communicated various types of information in images, visualisations or infographics (Niederdeppe *et al.*, 2016; Young *et al.*, 2016; Zhou & Niederdeppe, 2017; McGlynn & McGlone, 2018; Reynolds *et al.*, 2018, 2020b). However, of these, only one visualised evidence of policy effectiveness (Reynolds *et al.*, 2018) and none tested this against the same information in non-visual (i.e. text-based) form. Despite a large number of studies using visualisations to communicate information within this field, it is still unclear whether visualising evidence would be more effective at changing the perceived effectiveness of policies.

The effectiveness of specific food policies is often described in terms of the reduction in calories that are consumed or purchased (Zlatevska *et al.*, 2014; Hollands *et al.*, 2018; Pechey *et al.*, 2019). Effectively communicating this information requires that the target audience understand calorie content, yet previous research has shown that the public either over- or underestimate the calorie content of food and drink products (Taksler & Elbel, 2014; Horne *et al.*, 2019). Re-expressing calorie content into more familiar terms could increase the impact of providing information about the effectiveness of food policies that reduce energy intake. This is illustrated in PACE (Physical Activity Calorie Equivalent) food labels in which calorie information (e.g. a bag of crisps; 150 Calories) is re-expressed as the amount of physical activity needed to expend the energy (e.g. 47 minutes walking). A recent systematic review suggests that re-expressing calories within PACE labels may be more effective at changing behaviour than calorie labels alone (Daley *et al.*, 2019). The current study builds on this approach by investigating whether re-expressing calorie information in terms of the equivalent energy content of a familiar food (Mars® bars) can change perceived effectiveness of a policy targeting energy intake.

The current study aims to investigate whether communicating evidence of policy effectiveness can change perceptions of intervention effectiveness and support for policies. We first hypothesise that communicating evidence of policy effectiveness will increase perceptions of policy effectiveness. We also hypothesise that visualising evidence and re-expressing evidence of policy effectiveness will both increase perceptions of policy effectiveness. We investigate these hypotheses within the context of two food policies that target out-of-home eating establishments: (i) replacing some higher energy foods with lower energy foods and (ii) reducing the portion size of some higher energy foods.

Methods

The study was preregistered with the Open Science Framework (DOI: <https://doi.org/10.17605/OSF.IO/KMFPG>). There were no deviations from the protocol or statistical analysis plan. All study materials, sample size calculation, data and code can be found in the same OSF folder.

Participants

A research agency (www.onepoll.com) recruited 4500 participants that were representative of the English population based on quotas for age, gender, geographic region and educational attainment. Data collection occurred from October to November 2020. The mean age of the sample was 47.50 (SD = 16.70) and 51% were female. See Table S1 in the Supplementary Material for the full demographic characteristics of the sample. All participants passed the attention check and so none were excluded. Participants took a mean of 4 minutes and 6 seconds (SD = 12 m 22 s) to complete the questionnaire. 335 (7%) of eligible participants dropped out and recruitment continued until the target number of completed surveys was reached.

Sample size calculation

We aimed to recruit 4500 participants (900 per group) to ensure that we would have at least 90% power to test all three primary hypotheses. Testing the first hypothesis required combining all four evidence groups into one, which was then compared

against the control group. To maintain 90% power for detecting effect sizes larger than $d = 0.13$ (Reynolds *et al.*, 2018), with $\alpha = 0.05$, we needed to recruit at least 755 participants into the control group. The second and third hypotheses were to be tested in a 2×2 design using Groups 2–5. To have 90% power for detecting effect sizes larger than $d = 0.13$, with $\alpha = 0.05$, we needed to recruit at least 2924 participants for the four groups that receive evidence (731 in each).

Design

We conducted an online study using a between-participants design, with five groups varying in: their visualisation of evidence (text only vs infographic) as well as their use of re-expression (no re-expression vs re-expression), with one control group given no evidence (see Figure 1). Participants were randomly allocated to one of the five groups, using the research agency’s software.

Interventions

Participants in all five groups received the same background information about obesity and a description of the two policies to encourage healthy eating (see Supplementary Material B for all interventions). Four of the five groups received further information which described the effectiveness of the two interventions at reducing calorie intake. The evidence that was presented in these interventions was obtained from a study (Reynolds *et al.*, 2021) that tested (i) replacing some higher energy foods with lower energy foods (Availability; *product* \times *availability* intervention in the TIPPME typology (Hollands *et al.*, 2017)) and (ii) reducing the portion size of some higher energy foods in cafeterias (Size; *product* \times *size* intervention (Hollands *et al.*, 2017)).

1. *Control group*: Provided with background information on obesity and description of two policies with no information on policy effectiveness.
2. *Assert and Quantify*: Provided with background information on obesity, description of two policies, and an additional sentence that asserted and quantified the effectiveness of the two policies.

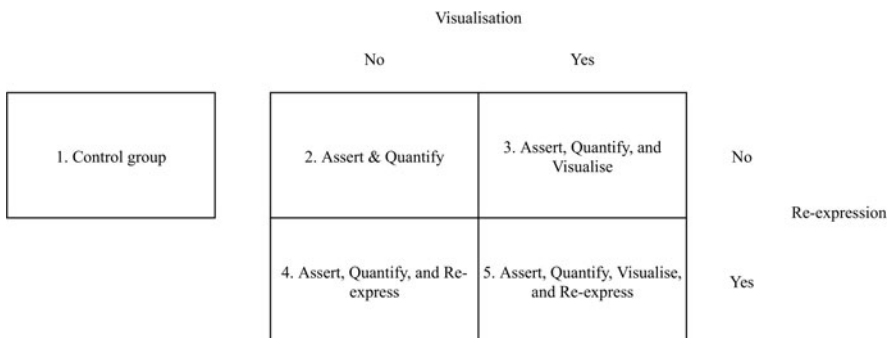


Figure 1. Study design.

3. *Assert, Quantify and Visualise*: Provided with background information on obesity, description of two policies, and the same information as Group 2, however this information was integrated into an infographic and presented visually.
4. *Assert, Quantify and Re-express*: Provided with background information on obesity, description of two policies and the same information as Group 2, however a further sentence was added that converted the number of calories into the equivalent amount of a familiar food (Mars bars).
5. *Assert, Quantify, Visualise and Re-express*: Provided with background information on obesity, description of two policies and the visualised information as Group 3 with the addition of the re-expression used in Group 4 (see Figure 2).

Measures

Primary outcome

Perceived effectiveness of Availability plus Size. This was measured with the mean of two items ($\alpha = 0.88$) on a seven-point scale (1 = Strongly disagree, 7 = Strongly agree) (Adapted from Reynolds *et al.* (2018)): ‘Making these two changes in cafes and restaurants will reduce the number of calories that people eat’; and, ‘England’s problem with people eating too many calories can be helped by making these two changes in cafes and restaurants’. See the OSF folder for the full questionnaire and materials.

Secondary outcomes

Perceived effectiveness of the policies individually. Each variable was measured with two items (Availability: $\alpha = 0.85$ and Size: $\alpha = 0.86$) on a seven-point scale (1 = Strongly disagree, 7 = Strongly agree) (Reynolds *et al.*, 2018): ‘[Replacing some higher calorie

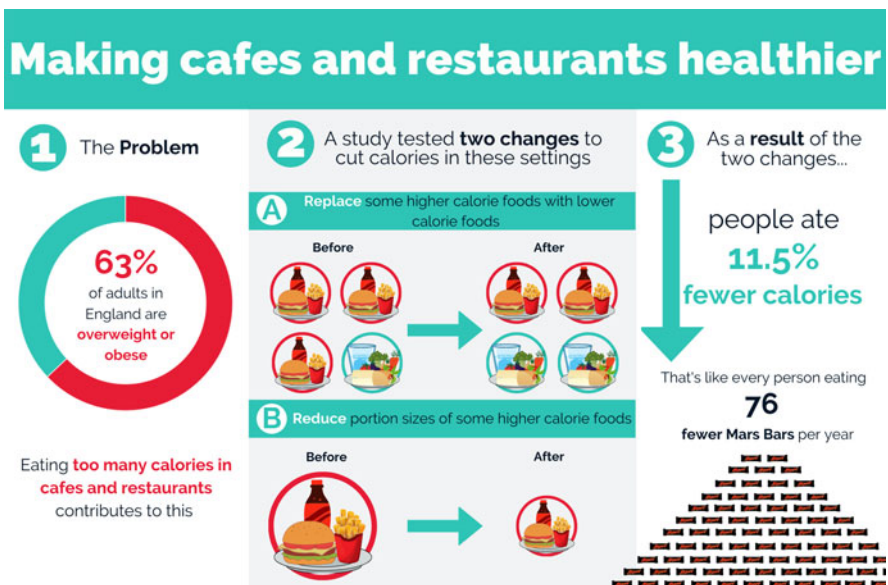


Figure 2. The infographic used in Group 5. See the Supplementary Material for all other infographics.

products with lower calorie products/reducing the portion size of some higher calorie products] in cafés and restaurants will reduce the number of calories that people eat'; and, 'England's problem with people eating too many calories can be helped [replacing some higher calorie products with lower calorie products / reducing the portion size of some higher calorie products] in cafes and restaurants'.

Acceptability of policies. We define acceptability as how people think and feel about the implementation of a policy and consider it synonymous with public support (Sekhon *et al.*, 2017). Acceptability of the Availability plus Size policy, and the two policies individually was assessed using a single item on a seven-point scale (1 = Strongly oppose, 7 = Strongly support) for each (Reynolds *et al.*, 2018): 'Do you support or oppose [making both of these two changes / replacing some higher calorie products with lower calorie alternatives / reducing the portion size of some higher calorie products] in cafes and restaurants?'.

Subjective comprehension of the intervention content. The subjective comprehension of the interventions was measured with two items ($\alpha = 0.89$) on a seven-point scale (1 = Strongly disagree, 7 = Strongly agree) (Reynolds *et al.*, 2018): 'I found the information about these two changes to be clear'; and, 'I found the information about the two healthy eating changes easy to understand'.

Recall of the intervention content. The participants' recall of the information provided in the infographics was assessed with two items that were adapted from a previous study (Reynolds *et al.*, 2018): 'Below are seven changes that could be made in cafes and restaurants. Select two of these to show which were described at the beginning of this survey' and 'What was the effect of the two changes that were described?'. Each item had multiple-choice response options with seven possible options. There was a total of three possible correct answers from the two questions and recall was therefore scored from 0 to 3.

Numeracy. Numeracy was assessed with a single item (Wright *et al.*, 2009). There are three response options of which one is the correct answer. This variable was converted to a dichotomous variable: high numeracy (correct answer) or low numeracy (incorrect answer).

Other outcomes

Demographic data were collected, including: age, gender, geographic region, educational attainment and ethnicity. Body mass index (BMI) was calculated from participants' self-reported height and weight. See Supplementary Material C for the full questionnaire.

Analyses

Quantitative analyses

The main analyses used ordinary least squares regression to test the main effects of the experimental group on the primary and secondary outcomes. The exception was the recall outcome, which was analysed using ordered logistic regression as the recall outcome only has four discrete categories (scored 0–3 correct answers). Model diagnostics (residual plot, Normal p-p plot of residuals) showed that the regression modelling assumptions were satisfied. Continuous variables were

examined to detect the presence of outliers (± 3 SDs from the median), however none were removed for the primary analyses as the 1–7 scales make it unlikely that any outlier is due to error. However, sensitivity analyses reported in Supplementary Material D re-ran the same models after removing outliers to determine if the main results are robust to the presence of outliers.

For any analysis involving the primary outcome we used the standard $\alpha = 0.05$ threshold to determine statistical significance. However, for all analyses involving a secondary outcome we used a Bonferroni adjustment according to the total number of primary and secondary outcomes. With eight total outcomes, the threshold was set at $\alpha = 0.05/8 = 0.00625$. Bayes factors were calculated for analyses involving the primary outcome (Morey & Rouder, 2018).

Qualitative analysis

An inductive thematic analysis was conducted on the responses ($n = 249$) to the open text box which had the instruction: ‘Do you have any further thoughts or comments that you would like to add?’. The analysis was conducted according to the methods laid out by Braun and Clarke (2006). Two authors (AH and MV) generated initial codes and considered potential themes separately for 20% of the dataset. They then collaboratively discussed the codes ideas about potential themes. The purpose of this was to generate discussion about ideas for codes and themes. One researcher (AH) then performed all six steps of Braun and Clarke’s thematic analysis phases in relation to the remaining 80% of the dataset, adapting and updating codes and themes originally discussed between the two authors, as well as generating new codes and themes as necessary.

Results

Communicating evidence of policy effectiveness

Communicating evidence of Availability plus Size effectiveness (four evidence groups combined vs control group) increased perceptions of the effectiveness of Availability plus Size for reducing energy intake, $B = 0.19$, 95% CIs [0.09–0.29], $p < 0.001$, $d = 0.14$ (see Table 1 for descriptive stats). This was supported by the Bayesian analysis, Bayes Factor (BF) = 60.5, which found very strong evidence in favour of the experimental hypothesis.

There was no evidence that communicating evidence of the effectiveness of the two interventions combined increased acceptability of the Availability plus Size policy after a Bonferroni adjustment ($\alpha = 0.006$), $B = 0.12$, 95% CIs [0.01–0.20], $p = 0.034$, $d = 0.08$ (see Table 2 for full models).

Visualising evidence of policy effectiveness

There was no evidence that visualising the information on policy effectiveness changed perceptions of effectiveness for the Availability plus Size policy, $B = 0.02$, 95% CIs [–0.06 to 0.11], $p = 0.605$, $d = 0.02$ (see Table 2 for full models). This was consistent with a Bayesian analysis, BF = 0.04, which found strong evidence in favour of the null hypothesis.

Table 1. Descriptive (mean [SD]) statistics by group

	Control Group	Assert and Quantify	Assert, Quantify and Visualise	Assert, Quantify and Re-express	Assert, Quantify, Re-express and Visualise	Combined
	(<i>n</i> = 894)	(<i>n</i> = 892)	(<i>n</i> = 894)	(<i>n</i> = 927)	(<i>n</i> = 893)	(<i>N</i> = 4500)
Perceived effectiveness: Availability + Size	5.49 (1.42)	5.67 (1.36)	5.72 (1.26)	5.67 (1.28)	5.66 (1.34)	5.64 (1.33)
Perceived effectiveness: Availability	5.61 (1.29)	5.68 (1.24)	5.71 (1.18)	5.72 (1.22)	5.68 (1.28)	5.68 (1.24)
Perceived effectiveness: Size	5.41 (1.43)	5.57 (1.32)	5.65 (1.28)	5.62 (1.29)	5.62 (1.36)	5.57 (1.34)
Acceptability: Availability + Size	5.24 (1.67)	5.30 (1.57)	5.41 (1.53)	5.35 (1.53)	5.40 (1.56)	5.34 (1.57)
Acceptability: Availability	5.46 (1.56)	5.50 (1.46)	5.57 (1.43)	5.50 (1.47)	5.59 (1.46)	5.52 (1.48)
Acceptability: Size	5.32 (1.64)	5.31 (1.60)	5.43 (1.55)	5.34 (1.58)	5.38 (1.61)	5.35 (1.60)
Subjective comprehension	6.20 (0.943)	6.12 (1.01)	6.02 (1.10)	6.15 (0.991)	6.02 (1.10)	6.10 (1.03)
Recall						
None correct	164 (18.3%)	119 (13.3%)	128 (14.3%)	127 (13.7%)	151 (16.9%)	689 (15.3%)
One correct	136 (15.2%)	155 (17.4%)	162 (18.1%)	134 (14.5%)	152 (17.0%)	739 (16.4%)
Two correct	594 (66.4%)	205 (23.0%)	210 (23.5%)	252 (27.2%)	241 (27.0%)	1502 (33.4%)
Three correct	0 (0%)	413 (46.3%)	394 (44.1%)	414 (44.7%)	349 (39.1%)	1570 (34.9%)

Note. The maximum possible recall score for the control group was two correct answers. The recall data represent count (percentage).

Table 2. Regression models depicting the effect of communicating, visualising and re-expressing evidence of policy effectiveness on perceptions of effectiveness and acceptability of the policy

Model	Predictors	Perceived effectiveness of Availability plus Size				Acceptability of Availability plus Size			
		<i>B</i>	95% <i>CI</i>	<i>p</i>	Cohen's <i>d</i>	<i>B</i>	95% <i>CI</i>	<i>p</i>	Cohen's <i>d</i>
1	(Intercept)	5.49	5.40 to 5.58	<0.001	–	5.24	5.14 to 5.34	<0.001	–
	Control	<i>Reference</i>				<i>Reference</i>			
	Evidence group	0.19	0.09 to 0.29	<0.001	0.14	0.12	0.01 to 0.24	0.034	0.08
	Observations	4500				4500			
	<i>R</i> ²	0.003				0.001			
2	(Intercept)	5.68	5.61 to 5.76	<0.001	–	5.31	5.23 to 5.40	<0.001	–
	Text only	<i>Reference</i>				<i>Reference</i>			
	Visualise	0.02	–0.06 to 0.11	0.605	0.02	0.08	–0.02 to 0.18	0.121	0.05
	No re-expression	<i>Reference</i>				<i>Reference</i>			
	Re-expression	–0.03	–0.11 to 0.06	0.507	–0.02	0.02	–0.08 to 0.12	0.674	0.01
	Observations	3606				3606			

Note. The criterion for significance was 0.05 for the Primary outcome (Perceived effectiveness of Availability plus Size) and $\alpha = .006$ for all other outcomes following a Bonferroni adjustment.

There was also no evidence that visualising the information on policy effectiveness changed the acceptability of the Availability plus Size policy, $B = 0.08$, 95% CIs $[-0.02 \text{ to } 0.18]$, $p = 0.121$, $d = 0.05$.

Visualising the evidence did not have a significant effect on recall of the evidence content after Bonferroni adjustment ($\alpha = 0.006$), $OR = 0.85$, 95% CIs $[0.76 \text{ to } 0.95]$, $p = 0.007$, however visualising the evidence reduced the subjective comprehension of the information, $B = -0.11$, 95% CIs $[-0.18 \text{ to } -0.05]$, $p = 0.001$, $d = -0.11$ (see [Table 3](#) for full models).

Re-expressing evidence of policy effectiveness

There was no evidence that re-expressing the information on policy effectiveness changed perceptions of effectiveness for the Availability plus Size policy, $B = -0.03$, 95% CIs $[-0.11 \text{ to } 0.06]$, $p = 0.507$, $d = -0.02$. This was supported by the Bayesian analysis, $BF = 0.04$, which found strong evidence in favour of the null hypothesis.

There was no evidence that re-expressing the information on policy effectiveness changed the acceptability of the Availability plus Size policy, $B = 0.02$, 95% CIs $[-0.08 \text{ to } 0.12]$, $p = 0.674$, $d = 0.01$.

There was no evidence that re-expressing the information on policy effectiveness changed recall of the evidence content, $OR = 0.92$, 95% CIs $[0.83 \text{ to } 1.02]$, $p = 0.168$, or changed the subjective comprehension of the information, $B = 0.01$, 95% CIs $[-0.06 \text{ to } 0.08]$, $p = 0.814$, $d = 0.01$.

Further outcomes

Each of the hypotheses regarding evidence communication, visualising, and re-expressing were also tested using the individual policies and are reported in Supplementary Material E. The results are similar but attenuated compared to the effects on the combined policy of Availability plus Size.

Interactions with numeracy

Further analyses were conducted to determine if visualising or re-expressing improved subjective comprehension and recall for people with lower numeracy. There was no evidence that this was the case as the interaction between numeracy and visualising the evidence did not have a significant association with subjective comprehension, $B = -0.03$, 95% CIs $[-0.17 \text{ to } 0.10]$, $p = 0.622$, or recall, $OR = 1.00$, 95% CIs $[0.89 \text{ to } 1.13]$, $p = 0.981$. There was also no evidence that the interaction between numeracy and re-expressing was related to subjective comprehension, $B = 0.06$, 95% CIs $[-0.08 \text{ to } 0.20]$, $p = 0.379$, or recall, $OR = 0.95$, 95% CIs $[0.84 \text{ to } 1.07]$, $p = 0.687$.

Baseline support

The results also show that a majority support the policies (see [Figure 3](#)). Among the control group, 74% supported reducing the portion size of some higher energy products in cafes and restaurants, 79% supported replacing some higher energy products with lower energy options and 71% supported implementing both policies together.

Table 3. Regression models depicting the effect of visualising and re-expressing evidence of policy effectiveness on recall and comprehension of intervention content

Predictors	Subjective comprehension				Recall		
	<i>B</i>	<i>CI</i>	<i>p</i>	Cohen's <i>d</i>	<i>Odds ratio</i>	<i>CI</i>	<i>p</i>
(Intercept)	6.13	6.07 to 6.19	<0.001	–	–	–	–
Ref = All incorrect One correct	–	–	–	–	0.15	0.13 to 0.17	<0.001
Ref = One correct Two correct	–	–	–	–	0.40	0.36 to 0.45	<0.001
Ref = Two correct Three correct	–	–	–	–	1.15	1.01 to 1.30	0.014
Text only	<i>Reference</i>				<i>Reference</i>		
Visualise	–0.11	–0.18 to –0.05	0.001	–0.11	0.85	0.76 to 0.95	0.007
No re-expression	<i>Reference</i>				<i>Reference</i>		
Re-expression	0.01	–0.06 to 0.08	0.814	0.01	0.92	0.83 to 1.02	0.168
Observations	3606				3606		

Note. The Bonferroni-adjusted criterion for significance was $\alpha = 0.006$.

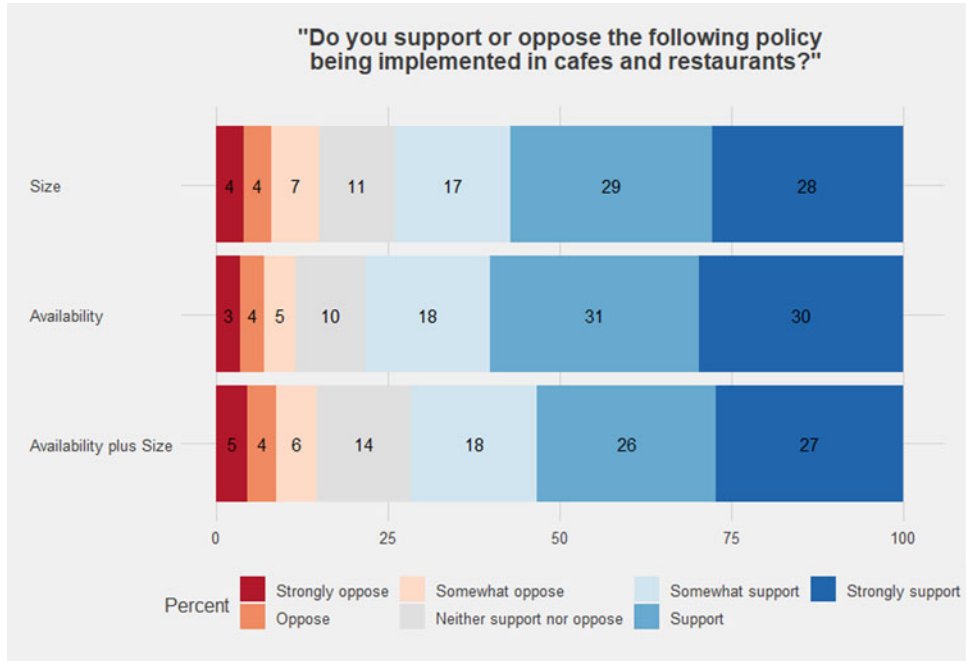


Figure 3. Support and opposition of each policy for the control group only. See Supplementary Material F for the full table containing the estimates and confidence intervals for these data.

Qualitative analysis

Four themes were identified in the qualitative analysis. See [Box 1](#) for a summary of the themes and see Supplementary Material G for further analysis.

Discussion

The current study was a large population-based survey experiment that tested three hypotheses on the role of evidence communication at changing perceived policy effectiveness. The results suggest that asserting and quantifying evidence of policy effectiveness increases perceptions about the effectiveness of the policies. However, Bayesian analyses suggest that visualising and re-expressing the evidence confer no additional effect on perceived effectiveness or support for the policies. Furthermore, there was a decrease in subjective comprehension of the interventions when they were visualised (compared to text-only). The results of this study therefore suggest that while communicating evidence of policy effectiveness can be used to

Box 1. Themes identified from a Thematic Analysis of open text responses. See Supplementary Material G for further analysis.

Four themes were identified:

1. Effectiveness: whether the Size and Availability interventions were perceived capable of reducing levels of obesity, and why.

'These interventions, which are simple to implement, make a significant difference to the total calories that are consumed when eating out. This would lead to a major health gain for obese individuals'. (participant 3469, intervention 5)

'I think encouraging healthier eating is the way forward as surely if portion sizes are reduced then people will just order more, which would be even worse for them'. (participant 535, intervention 5)

2. Acceptability: whether the Size and Availability interventions were supported or opposed, and why.

'I look forward to hopefully seeing these new changes in cafes and restaurants in the future'. (participant 713, intervention 4)

'Hope this proposal is abandoned'. (participant 235, intervention 3)

3. Presentation of information: whether the information presented during the study was accurate and well-presented.

'I think that it is important to judge the equivalent calorie reduction based on hypothetical Mars bar consumption, which provides greater insight on the benefits of eating more responsibly'. (participant 3595; assert, quantify, visualise and re-express)

'I thought the original info and graphics were too complicated, [sic] taking time to read it all and digest it'. (Participant 773; assert, quantify, visualise and re-express)

4. Other solutions for obesity: approaches to reducing obesity levels that participants deemed more effective and/or acceptable.

'I don't believe that people can or should be forced to change their eating habits. The only way to change eating habits so they are "healthier" is by education and information/labelling'. (participant 1395; control group)

'banning the sale of cola and the like to under 18 s would be more effective' (participant 842; assert, quantify and re-express)

increase perceptions of effectiveness, visualising and re-expressing the information may confer no additional benefit.

The effect of evidence on perceived policy effectiveness supports the existing evidence from a range of domains (Reynolds *et al.*, 2018, 2019a) but extends this to a novel and important policy context, namely interventions to reduce out-of-home consumption of food. These results, therefore, suggest that this effect generalises across a wide range of policies, interventions and populations. It also supports the results of a larger literature which demonstrates that some people – but not everyone – update their beliefs when given evidence that conflicts with their existing beliefs (for review, see Chan *et al.*, 2017). In the present study, despite successfully changing the target belief, there was no statistically significant increase in support for the policies. However, there are at least two reasons to think that the result reported here is consistent with the recent systematic review that showed that communicating evidence of policy effectiveness increases policy support (Reynolds *et al.*, 2020a). First, the effect size on support for the Availability plus Size policy in the current study was $d = 0.08$, a small effect that we were not powered to detect. However, this effect size was in the same direction as, and within the confidence intervals of, the meta-analysis: $d = 0.11$ 95% CI [0.07–0.15]. Second, the effect in the current study was significant prior to applying a conservative Bonferroni adjustment. It therefore remains plausible that participants did increase their support for the policies in the current study, but the study was underpowered to detect this relatively small effect. This small and statistically non-significant effect could be partly explained by the relatively small increase in perceived effectiveness ($d = 0.14$) which was insufficient to reliably change attitudes. Changing people's prior beliefs using educational information such as in this study requires both that the participants are motivated for accuracy and believed that the evidence was credible (Druckman & McGrath, 2019). If either of these two requirements were not commonly met in our sample, then this could account for the small degree of belief change, and thus the lack of a statistically significant effect on policy support.

Neither of the two methods of altering the evidence – visualising and re-expressing – improved any primary or secondary outcomes. Although much research in this field has used visuals or infographics in an attempt to influence policy beliefs and attitudes (Niederdeppe *et al.*, 2016; Young *et al.*, 2016; Zhou & Niederdeppe, 2017; McGlynn & McGlone, 2018; Reynolds *et al.*, 2018, 2020b), none have explicitly tested whether visualising evidence improves perceptions of policy effectiveness. The current study is therefore the first to provide evidence that visualising evidence does not change perceptions of effectiveness, at least within the context that the current study was conducted. This also supports some evidence that pie charts are no better than text alone at communicating information about the existence of climate change (van der Linden *et al.*, 2014). While there is considerable evidence that visualisation has other benefits, such as improving attention and comprehension of the information (Lipkus, 2007; Borkin *et al.*, 2013), in this case we found no effect on recall, and it diminished subjective comprehension. While there may be a common tacit expectation that visual images will benefit any communication – indeed, the concept of seeing is commonly conflated with that of knowledge (Jenks, 1995) – these results suggest that this should not be assumed and needs to be tested in any given context. A further consideration is that although

visualisation did not confer any additional belief or attitude change here, in certain settings such as social media using images increases the number of people who will stop and read the content (Dudley, *n.d.*). Therefore by increasing attention, changes to beliefs could still be achieved.

The second method of altering the evidence – re-expressing – is a less common approach to framing evidence. In the current study, we re-expressed the policies' effectiveness (11.5% reduction in calories consumed per day) in relation to a familiar food product that contains the same number of calories (76 Mars bars per year). The Bayesian analyses suggest that this re-expression did not affect perceptions of effectiveness, and there was also no evidence that the re-expression influenced policy support, comprehension or recall. While there is some evidence that similar re-expressions of calorie information – in the form of PACE labels – can change behaviour (Daley *et al.*, 2019), the current study suggests that re-expressing calories into food content is not similarly effective at changing any of the outcomes that were measured in the current study. While there is an open question about whether this approach could improve communication in other contexts, our results are consistent with there being no effect. The null effects of both visualising and re-expressing may in part reflect the high baseline level of perceived effectiveness and policy support that were observed in the control group (ranging from 5.24 to 5.61 on a 7-point scale). Due to these high baseline levels, it may not have been possible to generate detectable increases. It would be prudent for future research to focus on increasing support for policies deemed less effective and acceptable, such as taxes on less healthy foods or any meat reduction policies (Reynolds *et al.*, 2019b; Pechey *et al.*, 2022).

Strength, limitations and future research

The current study recruited a large, nationally representative sample of the English population to investigate the effects of communicating evidence of policy effectiveness. The existing research suggested that evidence of policy effectiveness may increase perceptions of policy effectiveness and the current research confirms these findings and shows that this generalises to new policy domains. We also investigated two methods of improving evidence communication in the form of visualising the evidence and re-expressing the evidence. While the current study provides evidence in favour of a null effect for these two methods, it does so within the specific domain of healthy eating policies, and it is unclear how this would generalise to other policy domains. Furthermore, we used specific approaches of visualising and re-expressing information, and other approaches which could vary in format and content should be tested to confirm whether they are more or less effective. For example, this could include changing the visualisation of the results from a downward arrow to a bar graph that visualises energy consumed before and after the intervention. This could also involve changing the re-expression from Mars bars to a different product.

The infographics used in the current study were developed by the authors in collaboration with a graphic design company. Multiple iterations of the infographics were created, evaluated by the research team, other health researchers, and members of the public, and subsequently improved. Despite this process which aimed to generate a clear and effective means of communicating the policy effectiveness, the results

showed that visualising the evidence lowered subjective comprehension, while not benefiting other key outcomes. The effect size was very small, but detectable. The qualitative analysis of comments did not shed further light on this as only one participant (out of 249 that provided comments) addressed this issue and suggested there was too much information to easily understand. Future research should investigate under what conditions evidence visualisation can be a useful communication tool. Future research could also investigate how to incorporate other messaging strategies to improve the communication of evidence of policy effectiveness. This could include combining evidence with narratives that describe how an intervention can change an individual's behaviour (Niederdeppe *et al.*, 2011), including evidence of multiple benefits of the policy (Mantzari *et al.*, 2022), or altering the wording using linguistic agency assignment (i.e. assigning agency to either the threat or the person) (McGlynn & McGlone, 2018).

Policy implications

There was high support for replacing some high calorie products with lower calorie products in cafes and restaurants (79%), high support for reducing the portion size of some higher calorie products in cafes and restaurants (74%) and high support for implementing both of these policies together (71%). Support was higher than has been previously reported for Availability and Size policies. For example, reducing the portion size of sugar-sweetened beverages was supported by 60% (Petrescu *et al.*, 2016) and reducing the portion size of high calorie snacks was supported by 57% (Reynolds *et al.*, 2019a) of UK samples. Support for restricting sales of high calorie snacks in local shops and reducing meat availability in cafeterias are supported by 33% and 52% of the public, respectively (Reisch *et al.*, 2017; Reynolds *et al.*, 2019a). The current study, therefore, suggests that Size and Availability interventions applied to high energy foods in out-of-home eating settings are particularly acceptable to the English public and therefore may be more politically viable than other applications of these interventions. The current study also suggests that communicating evidence of the effectiveness of these policies can increase perceptions of their effectiveness in the general public which may subsequently increase support for the policies beyond (relatively high) baseline levels. Ensuring that the policies are perceived as effective and maintaining high levels of public support is crucial to the implementation and continued existence of food policies that can meaningfully improve the population's diets (Cullerton *et al.*, 2016, 2018).

Conclusion

The current study finds further evidence that communicating evidence of the effectiveness of a policy can increase perceptions of its effectiveness. While public support for the policies also increased in the predicted direction, the current study was not sufficiently powered to detect the effect. We found no evidence that visualising and re-expressing evidence added to the effect of simply reporting it in text form.

Supplementary material. To view supplementary material for this article, please visit <https://doi.org/10.1017/bpp.2022.32>.

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References

- Barry, C. L., V. L. Brescoll, K. D. Brownell and M. Schlesinger (2009), 'How beliefs about the causes of obesity affect support for public policy', *Milbank Quarterly*, **87**: 7–47.
- Borkin, M. A., A. A. Vo, Z. Bylinskii, P. Isola, S. Sunkavalli, A. Oliva and H. Pfister (2013), 'What makes a visualization memorable?' *IEEE Transactions on Visualization and Computer Graphics*, **19**: 2306–2315. <https://doi.org/10.1109/TVCG.2013.234>.
- Brandkvist, M., J. H. Bjørngaard, R. A. Ødegård, B. O. Åsvold, E. R. Sund and GÅ Vie (2019), 'Quantifying the impact of genes on body mass index during the obesity epidemic: longitudinal findings from the HUNT Study', *BMJ*, **366**: 14067. <https://doi.org/10.1136/bmj.14067>.
- Braun, V. and V. Clarke (2006), 'Using thematic analysis in psychology', *Qualitative research in psychology*, **3**(2): 77–101.
- Burstein, P. (2003), 'The impact of public opinion on public policy: a review and an agenda', *Political Research Quarterly*, **56**: 29–40. <https://doi.org/10.1177/106591290305600103>.
- Chan, M. S., C. R. Jones, K. Hall Jamieson and D. Albarracín (2017), 'Debunking: a meta-analysis of the psychological efficacy of messages countering misinformation', *Psychological Science*, **28**: 1531–1546. <https://doi.org/10.1177/0956797617714579>.
- Cullerton, K., T. Donnet, A. Lee and D. Gallegos (2016), 'Playing the policy game: a review of the barriers to and enablers of nutrition policy change', *Public Health Nutrition*, **19**: 2643–2653. <https://doi.org/10.1017/S1368980016000677>.
- Cullerton, K., T. Donnet, A. Lee and D. Gallegos (2018), 'Effective advocacy strategies for influencing government nutrition policy: a conceptual model', *International Journal of Behavioral Nutrition and Physical Activity*, **15**: 83. <https://doi.org/10.1186/s12966-018-0716-y>.
- Daley, A. J., E. McGee, S. Bayliss, A. Coombe and H. M. Parretti (2019), 'Effects of physical activity calorie equivalent food labelling to reduce food selection and consumption: systematic review and meta-analysis of randomised controlled studies', *Journal of Epidemiology and Community Health*, **74**: 269–275. <https://doi.org/10.1136/jech-2019-213216>.
- Druckman, J. N. and M. C. McGrath (2019), 'The evidence for motivated reasoning in climate change preference formation', *Nature Climate Change*, **9**: 111–119. <https://doi.org/10.1038/s41558-018-0360-1>.
- Dudley, C. (n.d.), How to Increase Twitter followers: a 101 Guide for brands [WWW Document]. Retrieved from: <https://business.twitter.com/en/blog/how-to-increase-twitter-followers.html> (accessed 21 March 2022).
- Eriksson, L., J. Garvill and A. M. Nordlund (2008), 'Acceptability of single and combined transport policy measures: the importance of environmental and policy specific beliefs', *Transportation Research Part A: Policy and Practice*, **42**: 1117–1128. <https://doi.org/10.1016/j.tra.2008.03.006>.
- Global Burden of Disease Obesity Collaborators (2017), 'Health effects of overweight and obesity in 195 countries over 25 years', *The New England Journal of Medicine*, **377**: 13–27. <https://doi.org/10.1056/NEJMoa1614362>.
- Hilbert, A., W. Rief and E. Braehler (2007), 'What determines public support of obesity prevention?' *Journal of Epidemiology and Community Health*, **61**: 585–90. <https://doi.org/10.1136/jech.2006.050906>.
- Hollands, G. J., I. Shemilt, T. M. Marteau, S. A. Jebb, H. B. Lewis, Y. Wei, J. P. T. Higgins and D. Ogilvie (2015), 'Portion, package or tableware size for changing selection and consumption of food, alcohol and tobacco', *Cochrane Database of Systematic Reviews*, **9**: CD011045. <https://doi.org/10.1002/14651858.CD011045.pub2>.
- Hollands, G. J., G. Bignardi, M. Johnston, M. P. Kelly, D. Ogilvie, M. Petticrew, A. Prestwich, I. Shemilt, S. Sutton and T. M. Marteau (2017), 'The TIPPME intervention typology for changing environments to change behaviour', *Nature Human Behaviour*, **1**: 0140. <https://doi.org/10.1038/s41562-017-0140>.
- Hollands, G. J., E. Cartwright, M. Pilling, R. Pechey, M. Vasiljevic, S. A. Jebb and T. M. Marteau (2018), 'Impact of reducing portion sizes in worksite cafeterias: a stepped wedge randomised controlled pilot trial', *International Journal of Behavioral Nutrition and Physical Activity*, **15**: 78–92. <https://doi.org/10.1186/s12966-018-0705-1>.

- Hollands, G. J., P. Carter, S. Anwer, S. E. King, S. A. Jebb, D. Ogilvie, I. Shemilt, J. P. T. Higgins and T. M. Marteau (2019), 'Altering the availability or proximity of food, alcohol, and tobacco products to change their selection and consumption', *Cochrane Database of Systematic Reviews*, **9**: CD012573. <https://doi.org/10.1002/14651858.CD012573.pub2>.
- Horne, D., R. Palermo, M. F. Neumann, R. Housley and J. Bell (2019), 'Can people accurately estimate the calories in food images? An optimised set of low- and high-calorie images from the food-pics database', *Appetite*, **139**: 189–196. <https://doi.org/10.1016/j.appet.2019.04.017>.
- Huber, R. A., M. L. Wicki and T. Bernauer (2020), 'Public support for environmental policy depends on beliefs concerning effectiveness, intrusiveness, and fairness', *Environmental Politics*, **29**: 649–673. <https://doi.org/10.1080/09644016.2019.1629171>.
- Jenks, C. (1995), *Visual Culture*. London, UK: Routledge.
- Lam, S.-P. (2014), 'Predicting support of climate policies by using a protection motivation model', *Climate Policy*, **15**: 321–338. <https://doi.org/10.1080/14693062.2014.916599>.
- Lindberg, L., E. Hagman, P. Danielsson, C. Marcus and M. Persson (2020), 'Anxiety and depression in children and adolescents with obesity: a nationwide study in Sweden', *BMC Medicine*, **18**: 30. <https://doi.org/10.1186/s12916-020-1498-z>.
- Lipkus, I. M. (2007), 'Numeric, verbal, and visual formats of conveying health risks: suggested best practices and future recommendations', *Medical Decision Making*, **27**: 696–713. <https://doi.org/10.1177/0272989X07307271>.
- Mantzari, E., J. P. Reynolds, S. A. Jebb, G. J. Hollands, M. A. Pilling and T. M. Marteau (2022), 'Public support for policies to improve population and planetary health: a population-based online experiment assessing impact of communicating evidence of multiple versus single benefits', *Social Science & Medicine*, **296**: 114726. <https://doi.org/10.1016/j.socscimed.2022.114726>.
- Marteau, T. M., G. J. Hollands and P. C. Fletcher (2012), 'Changing human behavior to prevent disease: the importance of targeting automatic processes', *Science*, **337**: 1492–1495. <https://doi.org/10.1126/science.1226918>.
- McGlynn, J. and M. S. McGlone (2018), 'Desire or disease? Framing obesity to influence attributions of responsibility and policy support', *Health Communication*, **34**: 1–13. <https://doi.org/10.1080/10410236.2018.1431025>.
- Morey, R. and J. Rouder (2018), BayesFactor: Computation of Bayes Factors for Common Designs.
- Niederdeppe, J., M. A. Shapiro and N. Porticella (2011), 'Attributions of responsibility for obesity: narrative communication reduces reactive counterarguing among liberals', *Human Communication Research*, **37**: 295–323. <https://doi.org/10.1111/j.1468-2958.2011.01409.x>.
- Niederdeppe, J., S. Roh and C. Dreisbach (2016), 'How narrative focus and a statistical map shape health policy support among state legislators', *Health Communication*, **31**: 242–55. <https://doi.org/10.1080/10410236.2014.998913>.
- Pechey, R., E. Cartwright, M. Pilling, G. J. Hollands, M. Vasiljevic, S. A. Jebb and T. M. Marteau (2019), 'Impact of increasing the proportion of healthier foods available on energy purchased in worksite cafeterias: a stepped wedge randomized controlled pilot trial', *Appetite*, **133**: 286–296. <https://doi.org/10.1016/j.appet.2018.11.013>.
- Pechey, R., J. P. Reynolds, B. Cook, T. M. Marteau and S. A. Jebb (2022), 'Acceptability of policies to reduce consumption of red and processed meat: a population-based survey experiment', *Journal of Environmental Psychology*, **81**: 101817. <https://doi.org/10.1016/j.jenvp.2022.101817>.
- Petrescu, D. C., G. J. Hollands, D. L. Couturier, Y. L. Ng and T. M. Marteau (2016), 'Public acceptability in the UK and USA of nudging to reduce obesity: the example of reducing sugar-sweetened beverages consumption', *PLoS One*, **11**: e0155995. <https://doi.org/10.1371/journal.pone.0155995>.
- Reisch, L. A., C. R. Sunstein and W. Gwozdz (2017), 'Viewpoint: beyond carrots and sticks: Europeans support health nudges', *Food Policy*, **69**: 1–10. <https://doi.org/10.1016/j.foodpol.2017.01.007>.
- Reynolds, J. P., M. Pilling and T. M. Marteau (2018), 'Communicating quantitative evidence of policy effectiveness and support for the policy: three experimental studies', *Social Science & Medicine*, **218**: 1–12. <https://doi.org/10.1016/j.socscimed.2018.09.037>.
- Reynolds, J. P., S. Archer, M. Pilling, M. Kenny, G. J. Hollands and T. M. Marteau (2019a), 'Public acceptability of nudging and taxing to reduce consumption of alcohol, tobacco, and food: a population-based survey experiment', *Social Science & Medicine*, **236**: 112395. <https://doi.org/10.1016/j.socscimed.2019.112395>.
- Reynolds, J. P., S. Archer, M. Pilling, M. Kenny, G. J. Hollands and T. M. Marteau (2019b), 'Public acceptability of nudging and taxing to reduce consumption of alcohol, tobacco, and food: a population-based survey experiment', *Social Science & Medicine*, **236**: 112395. <https://doi.org/10.1016/j.socscimed.2019.112395>.

- Reynolds, J. P., K. Stautz, M. Pilling, S. van der Linden and T. M. Marteau (2020a), 'Communicating the effectiveness and ineffectiveness of government policies and their impact on public support: a systematic review with meta-analysis', *Royal Society Open Science*, *7*: 190522. <https://doi.org/10.1098/rsos.190522>.
- Reynolds, J. P., M. Vasiljevic, M. Pilling, M. G. Hall, K. M. Ribisl and T. M. Marteau (2020b), 'Communicating evidence about the causes of obesity and support for obesity policies: two population-based survey experiments', *International Journal of Environmental Research and Public Health*, *17*: 6539. <https://doi.org/10.3390/ijerph17186539>.
- Reynolds, J. P., M. Ventsel, D. Kosite, B. Rigby Dames, L. Brocklebank, S. Masterton, E. Pechey, M. Pilling, R. Pechey, G. J. Hollands and T. M. Marteau (2021), 'Impact of decreasing the proportion of higher energy foods and reducing portion sizes on food purchased in worksite cafeterias: a stepped-wedge randomised controlled trial', *PLoS Medicine*, *18*: e1003743. <https://doi.org/10.1371/journal.pmed.1003743>.
- Schade, J. and B. Schlag (2003), 'Acceptability of urban transport pricing strategies', *Transportation Research Part F: Traffic Psychology and Behaviour*, *6*: 45–61. [https://doi.org/10.1016/s1369-8478\(02\)00046-3](https://doi.org/10.1016/s1369-8478(02)00046-3).
- Schuitema, G., L. Steg and J. A. Rothengatter (2010), 'The acceptability, personal outcome expectations, and expected effects of transport pricing policies', *Journal of Environmental Psychology*, *30*: 587–593. <https://doi.org/10.1016/j.jenvp.2010.05.002>.
- Sekhon, M., M. Cartwright and J. J. Francis (2017), 'Acceptability of healthcare interventions: an overview of reviews and development of a theoretical framework', *BMC Health Services Research*, *17*: 88. <https://doi.org/10.1186/s12913-017-2031-8>.
- Sevenans, J. (2021), 'How public opinion information changes politicians' opinions and behavior', *Political Behavior*, *43*: 1801–1823. <https://doi.org/10.1007/s11109-021-09715-9>.
- Steel, N., J. A. Ford, J. N. Newton, A. C. Davis, T. Vos, M. Naghavi, S. Glenn, A. Hughes, A. M. Dalton and D. Stockton (2018), 'Changes in health in the countries of the UK and 150 English Local Authority areas 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016', *The Lancet*, *392*: 1647–1661. [https://doi.org/10.1016/S0140-6736\(18\)32207-4](https://doi.org/10.1016/S0140-6736(18)32207-4).
- Storvold, E. E., I. S. Moan and J. Rise (2015), 'Predicting attitudes toward a restrictive alcohol policy: using a model of distal and proximal predictors', *Psychology of Addictive Behaviors*, *29*: 492–9. <https://doi.org/10.1037/adb0000036>.
- Swinburn, B. A., G. Sacks, K. D. Hall, K. McPherson, D. T. Finegood, M. L. Moodie and S. L. Gortmaker (2011), 'The global obesity pandemic: shaped by global drivers and local environments', *The Lancet*, *378*: 804–814.
- Swinburn, B. A., V. I. Kraak, S. Allender, V. J. Atkins, P. I. Baker, J. R. Bogard, H. Brinsden, A. Calvillo, O. De Schutter and R. Devarajan (2019), 'The global syndemic of obesity, undernutrition, and climate change: The Lancet Commission report', *The Lancet*, *393*: 791–846. [https://doi.org/10.1016/S0140-6736\(18\)32822-8](https://doi.org/10.1016/S0140-6736(18)32822-8).
- Taksler, G. B. and B. Elbel (2014), 'Calorie labeling and consumer estimation of calories purchased', *International Journal of Behavioral Nutrition and Physical Activity*, *11*: 91. <https://doi.org/10.1186/s12966-014-0091-2>.
- Tyrell, J., A. R. Wood, R. M. Ames, H. Yaghootkar, R. N. Beaumont, S. E. Jones, M. A. Tuke, K. S. Ruth, R. M. Freathy and G. Davey Smith (2017), 'Gene–obesogenic environment interactions in the UK Biobank study', *International Journal of Epidemiology*, *46*: 559–575. <https://doi.org/10.1093/ije/dyw337>.
- van der Linden, S. L., A. A. Leiserowitz, G. D. Feinberg and E. W. Maibach (2014), 'How to communicate the scientific consensus on climate change: plain facts, pie charts or metaphors?', *Climatic Change*, *126*: 255–262. <https://doi.org/10.1007/s10584-014-1190-4>.
- Wright, A. J., S. C. L. Whitwell, C. Takeichi, M. Hankins and T. M. Marteau (2009), 'The impact of numeracy on reactions to different graphic risk presentation formats: an experimental analogue study', *British Journal of Health Psychology*, *14*: 107–125. <https://doi.org/10.1348/135910708X304432>.
- Young, R., A. Hinnant and G. Leshner (2016), 'Individual and social determinants of obesity in strategic health messages: interaction with political ideology', *Health Communication*, *31*: 903–910. <https://doi.org/10.1080/10410236.2015.1018699>.
- Zhou, S. and J. Niederdeppe (2017), 'The promises and pitfalls of personalization in narratives to promote social change', *Communication Monographs*, *84*: 319–342. <https://doi.org/10.1080/03637751.2016.1246348>.
- Zlatevska, N., C. Dubelaar and S. S. Holden (2014), 'Sizing up the effect of portion size on consumption: a meta-analytic review', *Journal of Marketing*, *78*: 140–154. <https://doi.org/10.1509/jm.12.0303>.

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Supplement A - Demographics

Table S1. Demographic characteristics of the sample

	Control group	AQ	AQV	AQR	AQVR	Overall
	(N=894)	(N=892)	(N=894)	(N=927)	(N=893)	(N=4500)
Age						
Mean (SD)	47.5 (17.0)	46.9 (16.5)	47.6 (16.6)	47.8 (16.7)	47.8 (16.8)	47.5 (16.7)
Gender						
Female	448 (50.1%)	459 (51.5%)	464 (51.9%)	489 (52.8%)	440 (49.3%)	2300 (51.1%)
Male	446 (49.9%)	433 (48.5%)	430 (48.1%)	438 (47.2%)	453 (50.7%)	2200 (48.9%)
BMI						
Mean (SD)	26.0 (6.04)	26.2 (6.22)	26.4 (6.49)	25.9 (6.27)	25.9 (5.65)	26.1 (6.14)
Missing	17 (1.9%)	25 (2.8%)	31 (3.5%)	39 (4.2%)	30 (3.4%)	142 (3.2%)
Education						
Low	302 (33.8%)	325 (36.4%)	335 (37.5%)	326 (35.2%)	344 (38.5%)	1632 (36.3%)
Medium	201 (22.5%)	200 (22.4%)	195 (21.8%)	202 (21.8%)	189 (21.2%)	987 (21.9%)
High	391 (43.7%)	367 (41.1%)	364 (40.7%)	399 (43.0%)	360 (40.3%)	1881 (41.8%)
Region						
East Anglia	102 (11.4%)	96 (10.8%)	91 (10.2%)	107 (11.5%)	93 (10.4%)	489 (10.9%)
East Midlands	71 (7.9%)	84 (9.4%)	72 (8.1%)	81 (8.7%)	86 (9.6%)	394 (8.8%)
London	133 (14.9%)	135 (15.1%)	147 (16.4%)	148 (16.0%)	143 (16.0%)	706 (15.7%)
North East	44 (4.9%)	43 (4.8%)	47 (5.3%)	35 (3.8%)	53 (5.9%)	222 (4.9%)
North West	121 (13.5%)	112 (12.6%)	113 (12.6%)	120 (12.9%)	117 (13.1%)	583 (13.0%)
South East	162 (18.1%)	134 (15.0%)	150 (16.8%)	150 (16.2%)	129 (14.4%)	725 (16.1%)
South West	90 (10.1%)	92 (10.3%)	100 (11.2%)	94 (10.1%)	89 (10.0%)	465 (10.3%)
West Midlands	90 (10.1%)	92 (10.3%)	95 (10.6%)	109 (11.8%)	87 (9.7%)	473 (10.5%)
Yorkshire and the Humber	81 (9.1%)	104 (11.7%)	79 (8.8%)	83 (9.0%)	96 (10.8%)	443 (9.8%)

Note. A = Assert, Q = Quantify, V = Visualise, R = Re-express

Supplement B - Interventions

Control group

Making Cafes and Restaurants Healthier

The problem:

63% of adults in England are overweight or obese.

Eating too many calories in cafes and restaurants contributes to this.

A study tested two changes to cut calories in these settings:

Change 1: Replace some higher calorie foods with lower calorie foods.

Change 2: Reduce portion sizes of some higher calorie foods.

Assert and Quantify group

Making Cafes and Restaurants Healthier

The problem:

63% of adults in England are overweight or obese.

Eating too many calories in cafes and restaurants contributes to this.

A study tested two changes to cut calories in these settings:

Change 1: Replace some higher calorie foods with lower calorie foods.

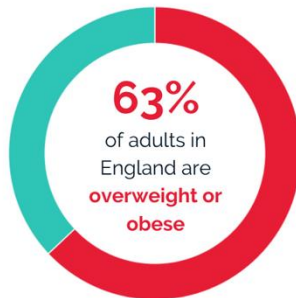
Change 2: Reduce portion sizes of some higher calorie foods.

As a result of the two changes, people ate 11.5% fewer calories.

Assert, Quantify, and Visualise group

Making cafes and restaurants healthier

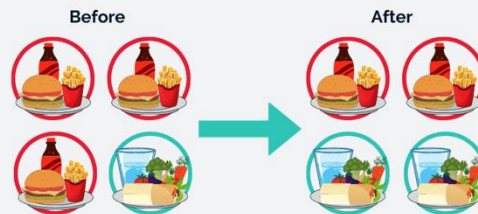
1 The Problem



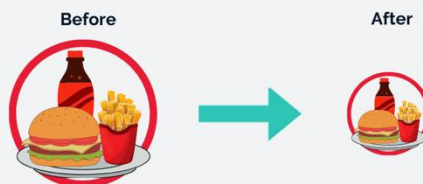
Eating **too many calories in cafes and restaurants** contributes to this

2 A study tested **two changes** to cut calories in these settings

A Replace some higher calorie foods with lower calorie foods



B Reduce portion sizes of some higher calorie foods



3 As a **result** of the two changes...

people ate
11.5%
fewer calories

Assert, Quantify, and Re-express

Making Cafes and Restaurants Healthier

The problem:

63% of adults in England are overweight or obese.

Eating too many calories in cafes and restaurants contributes to this.

A study tested two changes to cut calories in these settings:

Change 1: Replace some higher calorie foods with lower calorie foods.

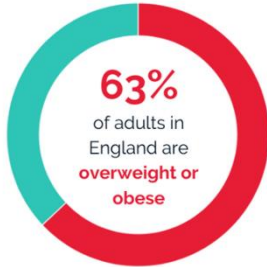
Change 2: Reduce portion sizes of some higher calorie foods.

As a result of the two changes, people ate 11.5% fewer calories.

That's like every person eating 76 fewer Mars Bars per year.

Making cafes and restaurants healthier

1 The Problem



Eating **too many calories in cafes and restaurants** contributes to this

2 A study tested **two changes** to cut calories in these settings

A Replace some higher calorie foods with lower calorie foods



B Reduce portion sizes of some higher calorie foods



3 As a **result** of the two changes...

people ate
11.5%
fewer calories

That's like every person eating
76
fewer Mars Bars per year



Supplement C – Full questionnaire

[All instructions are in square brackets and should not appear in the final questionnaire]

[Perceived effectiveness: both]

The following questions are about your views on the two different changes that have been proposed. Please indicate whether you agree or disagree with each statement

[Randomly order questions 1a and 1b]

	1. Making this change in cafes and restaurants will reduce the number of calories that people eat:						
a) Reducing the portion size of some higher calorie foods	Strongly agree	Agree	Somewhat agree	Neither agree not disagree	Somewhat disagree	Disagree	Strongly disagree
b) Replacing some higher calorie foods with lower calorie foods	Strongly agree	Agree	Somewhat agree	Neither agree not disagree	Somewhat disagree	Disagree	Strongly disagree
c) Making both of these changes	Strongly agree	Agree	Somewhat agree	Neither agree not disagree	Somewhat disagree	Disagree	Strongly disagree

[Randomly order questions 2a and 2b]

	2. England's problem with eating too many calories can be helped by:						
a) Reducing the portion size of some higher calorie foods in cafes and restaurants	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
b) Replacing some higher calorie foods with lower calorie foods in cafés and restaurants	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
c) Making both of these changes	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

[Acceptability]

The next few questions are about your views on implementing the changes in cafes and restaurants. Please indicate whether you support or oppose each change.

[Randomly order questions 3a and 3b]

	3. Do you support or oppose the following changes in cafes and restaurants:						
a) Reducing the portion size of some higher calorie foods	Strongly support	Support	Somewhat support	Neither support nor oppose	Somewhat oppose	oppose	Strongly oppose
b) Replacing some higher calorie foods with lower calorie foods	Strongly support	Support	Somewhat support	Neither support nor oppose	Somewhat oppose	oppose	Strongly oppose
c) Making both of these changes	Strongly support	Support	Somewhat support	Neither support nor oppose	Somewhat oppose	oppose	Strongly oppose

[Subjective comprehension]

The next two questions are about the information that you received about the two changes that were proposed for cafes and restaurants. Please indicate whether you agree or disagree with each statement.

[Randomly order questions 10 and 11]

10. I found the information about the two changes to be clear

- a. Strongly agree
- b. Agree
- c. Agree a little
- d. Neither agree nor disagree
- e. Disagree a little
- f. Disagree
- g. Strongly disagree

11. I found the information about the two changes easy to understand

- a. Strongly agree
- b. Agree
- c. Agree a little
- d. Neither agree nor disagree
- e. Disagree a little
- f. Disagree

- g. Strongly disagree

[Attention check]

12. Please select the number 4 from the list below

- a. 1
- b. 4
- c. 9
- d. 12

[Recall]

The next questions are to test whether you remember the information that you received about the two changes that were proposed in cafes and restaurants

13. Below are seven changes that could be made in cafes and restaurants. Select two of these to show which were described at the beginning of this survey [randomise order of response options]

- a. Placing fruit and vegetables close to customers
- b. Reducing the size of plates
- c. Replacing higher calorie foods with lower calorie foods
- d. Calorie labelling on foods
- e. Reducing the portion size of foods
- f. Health warning labels on foods
- g. Decreasing the price of healthier foods

14. What was the effect of the two changes that were described?

- a. Increased calories purchased 1-10%
- b. Increased calories purchased 10-20%
- c. Increased calories purchased 20-30%
- d. No effect on calories purchased
- e. Decreased calories purchased 1-10%
- f. Decreased calories purchased 10-20%
- g. Decreased calories purchased 20-30%

[Height and weight for BMI]

15. What is your current height?

[drop down menu]

16. What is your current weight?

[drop down menu]

[Numeracy]

17. Which of the following numbers represents the biggest risk of getting a disease? [randomise order of response options]
- a. 1 in 100 risk of getting a disease
 - b. 1 in 1,000 risk of getting a disease
 - c. 1 in 10 risk of getting a disease
18. Do you know what a Mars Bar is?
- a. Yes
 - b. No

Supplement D – Sensitivity analyses

The following section provides the results for the sensitivity analyses to compare whether the main results change following the removal of outliers (defined as any value ± 3 standard deviations from the median). Tables S1-S5 show that all results and conclusions are robust to the presence of outliers.

Table S1. Effect of communicating evidence on perceived effectiveness with and without outliers

Predictors	Perceived effectiveness of Availability + Size			Perceived effectiveness of Availability + Size with outliers removed		
	Estimates	CI	p	Estimates	CI	p
(Intercept)	5.49	5.40 – 5.58	<0.001	5.61	5.53 – 5.69	<0.001
Control group	<i>Reference</i>			<i>Reference</i>		
Evidence group	0.19	0.09 – 0.29	<0.001	0.15	0.06 – 0.23	0.001
Observations	4500			4422		

Note. Both results are significant, in the same direction, and with similar sized estimates.

Table S2. Effect of communicating evidence on acceptability with and without outliers

Predictors	Acceptability of Availability + Size			Acceptability of Availability + Size with outliers removed		
	Estimates	CI	p	Estimates	CI	p
(Intercept)	5.24	5.14 – 5.34	<0.001	5.44	5.35 – 5.53	<0.001
Control group	<i>Reference</i>			<i>Reference</i>		
Evidence group	0.12	0.01 – 0.24	0.034	0.07	-0.04 – 0.17	0.206
Observations	4500			4343		

Note. Both results are non-significant (at adjusted $\alpha = .006$) and with similar sized estimates.

Table S3. Effect of visualising and re-expressing evidence on perceived effectiveness with and without outliers

Predictors	Perceived effectiveness of Availability + Size			Perceived effectiveness of Availability + Size with outliers removed		
	Estimates	CI	p	Estimates	CI	p
(Intercept)	5.68	5.61 – 5.76	<0.001	5.77	5.70 – 5.84	<0.001
Text only	<i>Reference</i>			<i>Reference</i>		
Visualise	0.02	-0.06 – 0.11	0.605	0.01	-0.07 – 0.09	0.797
No re-expression	<i>Reference</i>			<i>Reference</i>		
Re-expression	-0.03	-0.11 – 0.06	0.507	-0.05	-0.13 – 0.03	0.211
Observations	3606			3551		

Note. Both visualisation results are non-significant with similar sized estimates. Both re-expression results are non-significant with similar sized estimates.

Table S4. Effect of visualising and re-expressing evidence on acceptability with and without outliers

Predictors	Acceptability of Availability + Size			Acceptability of Availability + Size with outliers removed		
	Estimates	CI	p	Estimates	CI	p
(Intercept)	5.31	5.23 – 5.40	<0.001	5.49	5.41 – 5.57	<0.001
Text only	<i>Reference</i>			<i>Reference</i>		
Visualise	0.08	-0.02 – 0.18	0.121	0.05	-0.04 – 0.14	0.239
No re-expression	<i>Reference</i>			<i>Reference</i>		
Re-expression	0.02	-0.08 – 0.12	0.674	-0.02	-0.11 – 0.07	0.711
Observations	3606			3490		

Note. Both visualisation results are non-significant with similar sized estimates. Both re-expression results are non-significant with similar sized estimates.

Table S5. Effect of visualising and re-expressing evidence on subjective comprehension with and without outliers

Predictors	Subjective comprehension			Subjective comprehension with and without outliers		
	Estimates	CI	p	Estimates	CI	p
(Intercept)	6.13	6.07 – 6.19	<0.001	6.15	6.09 – 6.20	<0.001
Text only	<i>Reference</i>			<i>Reference</i>		
Visualise	-0.11	-0.18 – -0.05	0.001	-0.09	-0.15 – -0.03	0.006
No re-expression	<i>Reference</i>			<i>Reference</i>		
Re-expression	0.01	-0.06 – 0.08	0.814	0.02	-0.05 – 0.08	0.578
Observations	3606			3578		

Note. Both visualisation results are significant, in the same direction, and with similar sized estimates. Both re-expression results are non-significant with similar sized estimates.

Supplement E – Additional results

The following section provides the results for secondary analysis in which the outcomes including perceived effectiveness and acceptability of the Size and Availability policies individually.

Communicating evidence of policy effectiveness

Communicating evidence of Availability plus Size effectiveness (four evidence groups combined vs control group) increased the belief Size policy alone, $B = 0.20$, 95% CIs [0.11 to 0.30], $p < 0.001$, $d = 0.15$, yet there was no evidence that this changed perceptions of the effectiveness of the Availability policy alone, $B = 0.09$, 95% CIs [-0.01 to 0.18], $p = 0.066$, $d = 0.07$. This was supported by a Bayesian analysis, $BF = 0.23$, which provide moderate evidence in favour in the null hypothesis.

There was no evidence that communicating evidence of the effectiveness of the two interventions combined increased acceptability of the Availability policy, $B = 0.08$, 95% CIs [-0.03 to 0.19], $p = 0.141$, $d = 0.06$, $BF = 0.12$, or Size policy, $B = 0.05$, 95% CIs [-0.07 to 0.16], $p = 0.437$, $d = 0.03$, $BF = 0.07$. Bayes factors suggest there is anecdotal evidence, moderate evidence, and strong evidence for the null hypothesis, respectively.

Visualising evidence of policy effectiveness

There was no evidence that visualising evidence of policy effectiveness changed perceptions of the effectiveness of the Availability policy, $B = 0.00$, 95% CIs [-0.08 to 0.08], $p = 0.995$, $d = 0.00$, $BF = 0.04$ or the Size policy, $B = 0.04$, 95% CIs [-0.04 to 0.13], $p = 0.323$, $d = 0.03$, $BF = 0.06$. The Bayesian analyses suggest there is strong evidence in favour of the null hypothesis for both policies.

There was also no evidence that visualising evidence of policy effectiveness changed acceptability of the Availability policy, $B = 0.08$, 95% CIs [-0.02 to 0.17], $p = 0.119$, $d = 0.05$, $BF = .13$ or the Size policy, $B = 0.08$, 95% CIs [-0.02 to 0.18], $p = 0.135$, $d = 0.05$, $BF = .11$. The Bayesian analyses suggest there is moderate evidence in favour of the null hypothesis for both policies.

Re-expressing evidence of policy effectiveness

There was no evidence that re-expressing the evidence of policy effectiveness changed perceptions of the effectiveness of the Availability policy, $B = 0.01$, 95% CIs [-0.07 to 0.09], $p = 0.846$, $d = 0.01$, $BF = .04$, or Size policy, $B = 0.01$, 95% CIs [-0.08 to 0.09], $p = 0.900$, $d = 0.00$, $BF = .04$. The Bayesian analyses suggest there is strong evidence in favour of the null hypothesis for both policies.

There was also no evidence that re-expressing the evidence of policy effectiveness changed acceptability of the effectiveness of the Availability alone, $B = 0.01$, 95% CIs [-0.09 to 0.10], $p = 0.873$, $d = 0.01$, $BF = .04$, or Size alone, $B = -0.01$, 95% CIs [-0.12 to 0.09], $p = 0.802$, $d = -0.01$, $BF = .04$. The Bayesian analyses suggest there is strong evidence in favour of the null hypothesis for both policies.

Supplement F – Support for policies among the control group

Table S6. Support and opposition of each policy for the control group only.

Variable	Count	Percentage	95% Confidence intervals
Acceptability of Size			
Oppose	135	15%	13%, 18%
Neither support nor oppose	98	11%	9%, 13%
Support	661	74%	71%, 77%
Acceptability of Availability			
Oppose	104	12%	10%, 14%
Neither support nor oppose	90	10%	8%, 12%
Support	700	78%	75%, 81%
Acceptability of Availability plus Size			
Oppose	132	15%	13%, 17%
Neither support nor oppose	122	14%	12%, 16%
Support	640	72%	69%, 74%

Note. These may not match the sum of the sub-categories in Figure 1 due to rounding.

Supplement G – Qualitative analyses

Out of the 4500 participants recruited into the study, 249 (6%) left comments in the open text response box (after removing comments such as “no comment” or “N/A”).

Thematic analysis

Four main themes were identified from manual content analysis of participants’ free-text comments:

- i. Effectiveness (i.e. whether the size and availability interventions were perceived capable of reducing levels of obesity, and why).
- ii. Acceptability (i.e. whether the size and availability interventions were supported or opposed, and why).
- iii. Presentation of information (i.e. whether the information presented during the study was accurate and well-presented).
- iv. Other solutions for obesity (i.e. approaches to reducing obesity levels that participants deemed more effective and/or acceptable).

Additional subthemes were identified for each theme. More information about each theme and subtheme can be found in Table S7.

Valence of comments

An analysis of the comment valence suggested that 14% of comments were positive towards the interventions, 47% were negative, and 38% were neutral/mixed. A breakdown of valence by intervention group can be found in Table S8. This is further broken down by theme in tables S9-S12.

Table S7. Themes identified in free-text comments

Theme	Subtheme	Description	Examples
Theme 1: Effectiveness	The interventions would be effective	Participants believed that the size/ availability interventions would be effective at reducing obesity.	<i>“These interventions, which are simple to implement, make a significant difference to the total calories that are consumed when eating out. This would lead to a major health gain for obese individuals.”</i> (participant 3469, intervention 5)
	The interventions would be ineffective	Participants believed that the size/ availability interventions would be ineffective at reducing obesity, and may even backfire to make the situation worse.	<i>“I think encouraging healthier eating is the way forward as surely if portion sizes are reduced then people will just order more, which would be even worse for them.”</i> (participant 535, intervention 5)
	Additional considerations are necessary for the interventions to be effective	Participants believed that the size/ availability interventions had potential, but that more thought should be put into how they could be implemented effectively in practice.	<i>“reucing [sic] portions is helpful but some people would just buy more regardless of price. A lot of foods have empty calories and people feel the need to fill up more just to gain the required nutrition so it isnt [sic] only about reducing the calories, they must also improve the nutrititional [sic] contents.”</i> (participant 942, intervention 3)
Theme 2: Acceptability	Generally supportive	Participants commented that they would like to see the interventions implemented.	<i>“I look forward to hopefully seeing these new changes in cafes and restaurants in the future”</i> (participant 713, intervention 4)
	Generally opposed	Participants commented that they would not like to see the interventions implemented.	<i>“Hope this proposal is abandoned”</i> (participant 235, intervention 3)
	Acceptability contingent on how the interventions are implemented	Participants were open to the interventions, but only if they would be implemented in particular ways.	<i>“the only way this can happen is if prices drop too”</i> (participant 2873, intervention 1)

	The interventions are not targeted enough	Participants felt that broadly targeting cafes and restaurants for intervention was unnecessary, as not everyone who eats in a café or restaurant needs to reduce their calorie intake.	<i>“why penalise normal weight people because overweight people eat too much”</i> (participant 192; control group)
	The interventions would ruin the treat of eating out	Participants felt that eating out should be a treat, and that the interventions would ruin the enjoyment in eating out.	<i>“you assume that everybody eats out a lot I very rarely do, so eating out for me is a real treat, and\I [sic] don't think about the calories in food just if i [sic] like it or not”</i> (2396; control group)
	Opposed to feeling controlled by the interventions	Participants felt that the interventions removed their agency and individual choice, and treated them as if they could not make decisions for themselves. They disliked this, and felt that individuals should be able to make their own choices about what they eat.	<i>“It is up to the individual to look after his health. I am utterly fed up with the Nanny state we are living in where other people feel the need to think for us. If I want to eat food that is considered less good for, that is my choice and nobody elses [sic].”</i> (participant 3226; assert, quantify, and re-express)
	Belief that interventions would not be implemented fairly	Participants did not trust that the interventions would be implemented fairly. Some believed that companies may use the interventions to exploit customers.	<i>“It's all well and good reducing portion sizes and whilst I agree that it is the right thing to do, having been in the catering trade I know full well that the prices will not reflect the reductions, ie, prices will remain the same or rise. As a person who is fortunate enough to earn a very good living that is not going to affect me, but as usual, those at the lower end of the pay scale or unemployed will be getting less and paying more. I do not think that this is fair, no matter why.”</i> (participant 141; assert, quantify, visualise, and re-express)
Theme 3: Presentation of information	Positive view of information presented: content	Participants commented favourably on the content of the information presented during the study.	<i>“I think that it is important to judge the equivalent calorie reduction based on hypothetical Mars bar consumption, which provides greater insight on the benefits of eating more responsibly.”</i> (participant 3595; assert, quantify, visualise, and re-express)
	Negative view of information presented: form	Participants commented unfavourably on the form of the information presented during the study, particularly the visualisation.	<i>“I thought the original info and graphics were too complicated , [sic] taking time to read it all and digest it”.</i> (Participant 773; assert, quantify, visualise, and re-express)

	Negative view of information presented: content	Participants either disagreed with information that had been given to them in the study materials, or felt that useful information was missing from the study materials.	<i>“very optimistic science and farcical to blame the problems on cafes and restaurants”</i> (Participant 1569; assert, quantify, and visualise)
Theme 4: Other solutions for obesity	Education/ information campaigns	Participants believed that the reduce and replace interventions would not work or were not acceptable, and that a better approach would be to educate and inform people about how to be healthy.	<i>“I don’t believe that people can or should be forced to change their eating habits. The only way to change eating habits so they are “healthier” is by education and information/labelling.”</i> (participant 1395; control group)
	Financial intervention	Participants believed that the reduce and replace interventions would not work or were not acceptable, and that a better approach would be to intervene financially, either to make healthy eating cheaper, or unhealthy eating more expensive.	<i>“I personally consider education or increased taxes (and thus increased prices) on unhealthy food to be a better approach to reducing obesity than reducing portion sizes (people will order more portions / go somewhere with larger portions) or swapping (people will ignore advice to swap).”</i> (participant 4328; assert, quantify, visualise, and re-express)
	Restrict sales	Participant believed that the reduce and replace interventions would not work or were not acceptable, and that a better approach would be to ban the sales of certain products that contribute to overweight and obesity.	<i>“banning the sale of cola and the like to under 18s would be more effective”</i> (participant 842; assert, quantify, and re-express)
	Design environments conducive to better health	Participants believed that the reduce and replace interventions would not work or were not acceptable, and that a better approach would be to prioritise health in urban design and in plans to improve quality of life.	<i>“I don't agree that cutting the amount of calories or portion sizes in cafes etc is the right way to go about it, offering people the chance to have a better quality of life in general would natural ly [sic] increase their motivation to eat healthier, e.g.. help people to reduce stress or improve their income more easily.”</i> (participant 1287; assert and quantify)
	Medical/ scientific intervention	Participants believed that the reduce and replace interventions would not work or were not acceptable, and that a better approach would be to solve the problem through medical interventions.	<i>“If doctors/scientists really want to help obesity they should just come up with a pill that stops you gaining weight, and another to make you lose weight if you're already overweight.”</i> (Participant 1711; assert, quantify, visualise, and re-express)
	Physical activity	Participants believed that the reduce and replace interventions would not work or were not acceptable, and that a better approach would be to focus on physical activity interventions.	<i>“EXERCISE WILL MAKE MORE DIFFERENCE TO naTIONS [sic] HEALTH THAN CHANGES TO FOOD INTAKE”</i> (Participant 4171; assert, quantify, and re-express)

Table S8. Percentage (number) of valence code type by intervention group

	Control group	Assert and quantify	Assert, quantify, and visualise	Assert, quantify, and re-express	Assert, quantify, visualise, and re-express	Total
Positive	13 (7)	20 (9)	7 (4)	12 (6)	22 (10)	14 (36)
Negative	50 (27)	51 (23)	49 (27)	45 (22)	41 (19)	47 (118)
Neutral/mixed	37 (20)	29 (13)	44 (24)	43 (21)	37 (17)	38 (95)

Table S9: Percentage (number) of valence code type by intervention group – Theme 1 (Effectiveness)

	Control group	Assert and quantify	Assert, quantify, and visualise	Assert, quantify, and re-express	Assert, quantify, visualise, and re-express	Total
Positive	4 (1)	18 (4)	0 (0)	6 (1)	5 (1)	9 (7)
Negative	56 (14)	41 (9)	61 (11)	35 (6)	57 (12)	65 (50)
Neutral/mixed	40 (10)	41 (9)	39 (7)	59 (10)	38 (8)	43 (44)

Table S10: Percentage (number) of valence code type by intervention group – Theme 2 (Acceptability)

	Control group	Assert and quantify	Assert, quantify, and visualise	Assert, quantify, and re-express	Assert, quantify, visualise, and re-express	Total
Positive	19 (6)	23 (6)	11 (4)	18 (5)	27 (6)	19 (27)
Negative	58 (18)	54 (14)	50 (19)	43 (12)	32 (7)	48 (70)
Neutral/mixed	23 (7)	23 (6)	39 (15)	39 (11)	41 (9)	33 (48)

Table S11: Percentage (number) of valence code type by intervention group – Theme 3 (Presentation of information)

	Control group	Assert and quantify	Assert, quantify, and visualise	Assert, quantify, and re-express	Assert, quantify, visualise,	Total

					and re-express	
Positive	0 (0)	0 (0)	0 (0)	0 (0)	50 (3)	13 (3)
Negative	33 (1)	75 (3)	33 (2)	100 (4)	33 (2)	52 (12)
Neutral/mixed	66 (2)	25 (1)	66 (4)	0 (0)	17 (1)	35 (8)

Table S12: Percentage (number) of valence code type by intervention group – Theme 4 (Other solutions for obesity)

	Control group	Assert and quantify	Assert, quantify, and visualise	Assert, quantify, and re-express	Assert, quantify, visualise, and re-express	Total
Positive	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Negative	100 (6)	100 (5)	71 (5)	63 (5)	100 (3)	83 (24)
Neutral/mixed	0 (0)	0 (0)	29 (2)	38 (3)	0 (0)	17 (5)