



Prompting food safety responsibility: Does it influence consumers' choices of food safety campaigns?

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ABSTRACT

Communicating food safety and risk information to consumers is essential to reducing the incidence of foodborne illness. However, despite widespread public health campaigns, behaviour change remains limited. This study investigates whether framing individual responsibility in campaign messages influences consumers' stated preferences for food safety campaigns. Using a web-based discrete choice experiment with 2343 Scottish adults, participants were randomly assigned to one of three groups: a control group (no prompt), a treatment with a statement-based responsibility prompt or a treatment with a question-based prompt. Respondents completed a series of choice tasks evaluating hypothetical campaigns that varied by delivery channel, timing and message style, alongside an opt-out option ("no campaign"). Results show that question-framed prompts significantly increase the likelihood of choosing a campaign over the opt-out, relative to both the control and statement conditions. While the overall effects are modest in magnitude, they are consistent with prior evidence on the cognitive and motivational impact of question-based framing. These findings suggest that simple, low-cost message framing strategies, particularly those encouraging reflection and self-persuasion, can enhance the perceived effectiveness of public health campaigns and may support improved food safety communication design.

1. Introduction

Foodborne illness remains a persistent global public health issue, with over 600 million cases reported annually worldwide (WHO, 2020). In the UK, foodborne diseases are estimated to cause over 2.4 million cases annually, leading to substantial health and economic costs (Daniel et al., 2020). To reduce these illnesses and their associated health consequences, it is crucial to improve the effectiveness of food safety and risk communication strategies. Despite widespread efforts by governments and food agencies across Europe and other regions, including public food safety campaigns, rates of foodborne disease have remained high over the past two decades (EFSA and ECDC, 2023). This raises concerns about the effectiveness of communication strategies alone in changing consumer behaviour.

It is well established that foodborne illness arises from multiple points across the food supply chain, including primary production, processing, retail, and home preparation (FSA, 2022). While some incidents are attributable to sources beyond individual control (e.g., contamination in manufacturing or distribution), a substantial portion of foodborne illness cases is linked to consumer practices such as undercooking, improper food storage, cross-contamination and inadequate

hand hygiene (Hoffmann et al., 2017; Redmond & Griffith, 2009). As such, engaging consumers in safe food practices remains a critical component of risk prevention strategies.

Risk communication strategies, such as food safety awareness and information campaigns, are most effective when they enable individuals to reflect on and reconsider their (in)actions in light of communicated risks (Ippolito & Mathios, 1991; Pechmann & Reibling, 2000; Rucker & Petty, 2006; Thrasher et al., 2004). Effectiveness is often undermined by inconsistent messages or information overload, which can reduce trust in the message source and increase confusion (Ding et al., 2012; McCarthy & Brennan, 2009; McCluskey & Swinnen, 2004; Powell & Chapman, 2016; Regan et al., 2014; Verbeke, 2005; Verbeke et al., 2007). However, consumer behaviour in this context is not only shaped by knowledge, but also by motivation, habits and cognitive framing. Recent work in behavioural science suggests that small changes in how information is presented (known as "nudges") can significantly influence decision-making (Loewenstein & Chater, 2017). In particular, responsibility framing has been shown to enhance motivation and personal accountability in domains such as energy use, environmental behaviour and health compliance (Brownell et al., 2010; Evans et al., 2017; Wells et al., 2011).

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Within the broader public health literature, it is recognized that responsibility-driven communication must be carefully framed to avoid perceptions of blame and to create an enabling environment for individual action (Brownell et al., 2010; Forde & Raine, 2008; Niederdeppe et al., 2014). In food safety, only a few studies have directly examined how perceived personal responsibility influences engagement. For example, Kastner (1995) and Unklesbay et al. (1998) showed that while many consumers acknowledge their role in food safety, those who held neutral attitudes about personal responsibility were less likely to adopt safe food handling practices.

Crucially, how responsibility is communicated may be just as important as whether it is communicated. Traditional campaigns rely heavily on statements or direct forms of persuasion, which can trigger psychological reactance and reduce message effectiveness (Agostinelli & Grube, 2003; Müller et al., 2009). Indirect persuasion, including techniques such as metaphorical framing (McQuarrie & Phillips, 2005) and question-based messaging, can reduce defensiveness and promote reflective thinking (Fransen et al., 2015; Rothman et al., 2001). A growing body of literature on self-persuasion shows that asking individuals questions, rather than telling them what to do can increase cognitive engagement, internalization, and behavioural change (Bernritter et al., 2017; Briñol et al., 2012). In the health domain, warning labels framed as questions were found to improve smoking-related risk perceptions (Glock et al., 2013), while question prompts have been shown to enhance self-regulation in behaviour change interventions (Loman et al., 2019; Müller et al., 2016).

In stated preference research, the way information is delivered has long been shown to influence individuals’ choices. The quantity, complexity and framing of information can affect how respondents process attributes, leading to variation in consistency, scale heterogeneity and cognitive effort (Balcombe et al., 2015; DeShazo & Fermo, 2002). Beyond the volume of information, the format in which information is communicated also matters. Recent work by Welling et al. (2023) provides evidence that asking respondents to engage with questions – rather than simply presenting them with statements – can improve both attention and recall in stated preference surveys. These findings support the idea that question-based communication prompts activate more deliberate cognitive processing, which can influence how individuals assess and respond to alternatives. Our study builds on this emerging body of research by testing how responsibility-framed prompts, delivered as either statements or questions, influence stated preferences for food safety campaigns. In particular, we examine whether prompting individuals to reflect on their role in ensuring food safety changes their campaign choices and whether the framing of these prompts affects the salience and influence of the message.

Although responsibility framing has been successfully applied in areas such as energy use, sustainability, and smoking cessation, its application to food safety remains underexplored. This study addresses that gap by investigating whether responsibility prompts influence consumers’ engagement with food safety campaigns—and whether framing these prompts as reflective questions yields greater impact than declarative statements. Understanding how message framing interacts with campaign content is critical for designing low-cost, high-impact interventions that encourage safer food practices.

Despite increased access to information, studies continue to document widespread consumer gaps in food-safety awareness and handling behaviour (Brennan et al., 2007; Cope et al., 2010; Medeiros et al., 2004). While most food safety campaigns focus on content and delivery channel (Fein et al., 2011; Redmond & Griffith, 2004), framing effects may significantly influence how messages are interpreted and acted upon. Recent studies in behavioural and health psychology show that framing can influence affect, attention, and decision-making (Flusberg et al., 2024; Guo et al., 2024; Zhang et al., 2025). These findings support the notion that subtle differences in message format, such as the use of questions may yield measurable differences in consumer engagement and behaviour.

Table 1
Food safety campaign attributes and levels.

Attributes	Levels
How the campaign is delivered	It can appear on TV (TV);
	It can be aired on radio (AO);
	It can be paper based (PB);
	It can be web based (WB);
When the campaign runs	It runs during specific occasions, Such as Christmas, BBQ and summer
	Seasons with seasonal food safety messages (SO);
	It runs all year around with general
	Food safety messages (AY);
The campaign style	It uses facts and figures (FF);
	It uses someone else’s experience (EE);
	It uses humorous cartoons or fictional characters (HC);
	It uses snappy slogans (SS).

While one objective of an information campaign is to close the awareness and knowledge gap, new and targeted risk-communication strategies are needed to better influence consumer behaviours and decrease their food-poisoning risk (Flynn et al., 2018; Murray et al., 2017). From a behavioural standpoint, prompts framed as questions may be especially persuasive, as they invoke the self-generation of arguments (the so-called “question-behavior effect”) and activate deliberative thinking, leading to greater campaign engagement than statements (Aronson, 1999).

This has important implications for food safety policy, where scalable and cost-effective strategies are needed to shift consumer behaviour. By testing the impact of responsibility framing and campaign design, this study offers evidence to inform the development of more effective public communication strategies.

Given the increasing emphasis on consumer agency in food safety, this paper examines how individual responsibility prompts influence consumer engagement. We focus on whether framing personal responsibility as a question – as opposed to a statement – enhances preference for food safety campaigns. We define individual responsibility prompts as short textual messages designed to encourage consumers to reflect on their own role in preventing foodborne illness. In our study, these prompts were delivered in two formats: a statement or an agree/disagree question. Both prompts emphasized that food risks can only be reduced if individuals adopt the safe handling practices promoted by food safety campaigns. These were presented before each choice task in the survey and serve as a framing mechanism for the choice experiment.

Framing individual responsibility has been shown to influence health-related decision-making by increasing perceptions of personal agency and accountability (Brownell et al., 2010; Niederdeppe et al., 2014). In food safety, where consumer behaviours directly influence risk, such prompts may be particularly salient. Prior studies have shown a disconnect between self-perceived responsibility and actual behaviour (Unklesbay et al., 1998), suggesting a role for subtle framing cues in improving behavioural alignment. Based on this evidence, we hypothesize that:

H1. *Exposure to responsibility prompts increases the likelihood that consumers choose a food safety campaign over the opt-out alternative.*

Recent literature also suggests that how responsibility is framed matters. Compared to statements, questions may promote reflection, reduce defensiveness and increase message receptivity (Glock et al., 2013; Loman et al., 2019; Rothman et al., 2001). These mechanisms are well suited for contexts where individuals may be prone to disengagement or minimization of personal risk. Accordingly, we hypothesize that:

H2. *Question-based responsibility prompts have a stronger effect on campaign choice than statement-based prompts.*

To test these hypotheses, we conducted a discrete choice experiment (DCE) with a representative sample of 2343 Scottish adults. Participants were randomly assigned to one of three conditions: the Control group (no prompt), the Treatment Statement (TS) group, and the Treatment

Imagine a food authority is planning to run one of the food safety campaigns below.

We want you to tell us which one of these campaigns you feel is **most likely** to influence the way **you** handle, store and cook your food.

If you feel that neither campaign will work for you, that's fine. Just tick the "No campaign" option.

Campaign 1	Campaign 2	No campaign
Appears on TV	Paper-based	Neither campaign would influence the way I handle, store and cook my food
Runs during specific occasions with seasonal food safety messages	Runs all year around with general food safety messages	
Uses someone else's experience	Uses facts and figures	
Choose one	Choose one	Choose one

Fig. 1. A choice task example.

Question (TQ) group. Following exposure to their assigned prompt, participants completed eight repeated choice tasks involving two hypothetical food safety campaigns and a status quo (No Campaign) option. Each campaign varied along three attributes. These attributes were selected based on literature, stakeholder consultation, and extensive pretesting (see Section 2.1). We estimated a Random Parameter Logit (RPL) model with treatment-specific shifters and full correlation among utility coefficients to examine both average treatment effects and preference heterogeneity. This experimental design enables us to identify whether responsibility prompts affect engagement and whether the framing of such prompts influences their effectiveness.

2. Methods

2.1. Study design

Respondents considered two food-safety campaigns, and a status quo option, and selected the one that they thought would most influence change in their food-handling behaviour. Campaigns were described by three attributes: 'how the campaign was delivered,' 'when it was delivered,' and 'its style'. These attributes and their levels are presented in Table 1.

Attributes and their levels were determined following a review of relevant literature (e.g., Brewer & Rojas, 2008; Feng et al., 2016; Frewer et al., 2016; Kher et al., 2013), consultation with national policymakers in Scotland, and series of focus-group discussions with respondents from different socio-demographic backgrounds.

The stated-choice experiment comprised eight choice tasks, each presenting respondents with two hypothetical food safety campaigns labelled as "Campaign 1" and "Campaign 2", and a "No campaign" option (i.e., status-quo) to reflect real-world decision-making scenarios where respondents are free to choose none of the presented campaigns (Swait & Adamowicz, 2001). Fig. 1 presents a choice task example. Before responding to the choice tasks, respondents were given a detailed description of the food safety campaign attributes.

The discrete choice experiment (DCE) was developed to evaluate how different attributes of food safety campaigns influence consumers' preferences. The design consisted of 10 blocks (versions), each containing eight choice tasks. Each task presented respondents with two hypothetical campaigns and one opt-out option ("no campaign"), and respondents were asked to choose the campaign they believed would most likely influence their food-handling behaviour.

The experimental design was generated in Sawtooth Software using the Balanced Overlap method. The design included three attributes and was structured to achieve strong one-way attribute-level balance and

near-orthogonality across attribute level combinations. Sawtooth design diagnostics confirmed that attribute levels appeared approximately an equal number of times across tasks: each campaign delivery channel level (TV, radio, paper-based, web-based) appeared exactly 40 times; each timing level (seasonal, year-round) appeared exactly 80 times; and the four campaign style levels appeared 40, 40, 41, and 39 times, respectively. Two-way frequency tables also showed approximately symmetric co-occurrence patterns across attribute levels, confirming near-orthogonality without severe confounding. Minor deviations from perfect balance – such as 39 versus 41 appearances for two campaign-style levels – are expected under Balanced Overlap designs and do not prevent identification of main effects (Johnson et al., 2013; Software, 2007).

We selected the Balanced Overlap design because the study was exploratory and reliable prior parameter estimates were unavailable. Unlike fully efficient Bayesian or D-efficient designs, Balanced Overlap designs do not require strong priors and are appropriate in exploratory stated preference research (Johnson et al., 2013). The Balanced Overlap method allows a limited degree of within-task overlap, which can reduce the incidence of overly dominant choice tasks and improve respondent engagement while maintaining good estimation properties for main effects. Consistent with this approach, we assumed no interaction effects in the experimental design and focused on estimating main effects of campaign attributes, which is an assumption common in exploratory discrete choice studies. Importantly, no alternatives were manually removed or screened after the design was generated. The statistical properties of the design, therefore, remained unchanged throughout the study. After generation, the order of tasks within each block was randomized to mitigate potential order effects. Overall, the resulting near-balanced, near-orthogonal design allowed estimation of interpretable trade-offs between food safety campaign attributes while minimizing problematic multicollinearity.

2.2. Responsibility prompts and experimental treatments

Effective risk communication strategies aim not only to raise awareness of specific hazards but also to prompt individuals to adjust their (in)actions in line with recommended behaviours (Ippolito & Mathios, 1991; Pechmann & Reibling, 2000; Rucker & Petty, 2006). However, inconsistent messaging, ambiguous information and communication overload can reduce the effectiveness of these strategies, leading to confusion and a decline in message credibility and engagement (Ding et al., 2012; McCarthy & Brennan, 2009; McCluskey & Swinnen, 2004; Powell & Chapman, 2016; Regan et al., 2014; Verbeke, 2005; Verbeke et al., 2007).

One promising avenue to enhance consumer engagement with food safety campaigns is to increase the salience of individual responsibility. For instance, public health campaigns in 1920s America significantly reduced child mortality from home accidents by explicitly emphasizing parental responsibility (Roberts et al., 1993). In health economics, Mital et al. (2014) found that people are more likely to adopt preventive behaviours when made aware of the personal financial implications of unhealthy lifestyles. However, as Brownell et al. (2010) argue, such strategies must be implemented in a way that empowers individuals rather than shifting blame. Framing responsibility in a supportive context can improve message acceptance and behavioural follow-through. For example, Niederdeppe et al. (2014) showed that messages highlighting both personal and shared responsibility for health led to higher perceived fairness and greater support for public health policies.

Similar effects have been observed in sustainability and environmental policy communication. Promoting individual responsibility has been shown to foster pro-environmental behaviour (Wells et al., 2011), though it may also diffuse into shared or collective responsibility frameworks, depending on context (Evans et al., 2017). Moreover, when public health interventions are perceived as taxpayer-funded, individuals' willingness to comply often depends on the degree to which they are seen as personally responsible for outcomes (Le Clairche & Wittwer, 2015; Pinho & Borges, 2019).

Although these behavioural mechanisms have been documented across domains, they remain underexplored in food safety communication. Individual behaviours such as cross-contamination, undercooking and poor hand hygiene contribute substantially to foodborne illnesses (Hoffmann et al., 2017; Redmond & Griffith, 2009), yet the use of responsibility framing to target these behaviours in communication campaigns has received little empirical attention. We extend existing behavioural insights to this context by explicitly testing whether responsibility-framed messages influence food safety campaign engagement and how the framing format affects this relationship.

In our study, the responsibility prompts were designed to emphasize the individual's role in reducing food safety risks by adopting safe food handling behaviours. This framing draws from established findings in health and sustainability communication, where activating personal responsibility has been linked to increased behavioural intention and compliance (e.g., Brownell et al., 2010; Niederdeppe et al., 2014; Roberts et al., 1993; Wells et al., 2011). While similar strategies have been applied in health and sustainability contexts, their use in food safety campaign design remains limited.

Building on this literature, we designed two responsibility prompts aimed at reinforcing the individual's role in food safety. These prompts were included immediately before each choice task and were randomly assigned at the respondent level, resulting in three experimental groups:

- **Control group (C):** No responsibility prompt shown.
- **Treatment Statement (TS):** A responsibility prompt presented as a declarative statement.
- **Treatment Question (TQ):** The same responsibility prompt, but presented as a question, followed by a Likert-scale agreement task.

The exact wording of the prompts was as follows:

- **TS:** "While campaigns provide information about how to prevent risks of getting food poisoning, these risks are only reduced by adopting safe practices promoted in the campaigns."
- **TQ:** "While campaigns provide information about how to prevent risks of getting food poisoning, do you agree that these risks are only reduced by adopting safe practices promoted in the campaigns?" Respondents in this group then selected their level of agreement on a six-point scale (from "Strongly disagree" to "Strongly agree").

These prompts were displayed before each choice task. For the question-framed group (TQ), the Likert-scale agreement question served both as the framing intervention and as an embedded manipulation check, enabling us to assess respondents' engagement with the responsibility message. The results from this manipulation check are reported in the results section and show strong agreement with the message, especially in the TQ group, thus validating the manipulation.

The treatments and survey instrument were developed using an iterative testing process. We first conducted nine think-aloud interviews¹ to evaluate participant comprehension and emotional reactions to the prompts. This method helped refine the language and ensure the message framing (statement vs. question) was clear and distinguishable. Subsequently, the survey was piloted with a small sample to confirm the flow, timing and randomization process before fielding it to the full sample.

2.3. Data collection and sample

Choice data were collected through a web-based survey administered to a random sample of 2343 individuals drawn from the Scottish adult (aged 18+ years) population in 2018. Respondents recruited using an ESOMAR Regulations compliant survey research company were randomly assigned to one of a control (C, 807 individuals), Treatment Statement (TS, 787 individuals), or Treatment Question (TQ, 749 individuals) group. The control group serves as the baseline and does not include a responsibility prompt, while TS and TQ incorporate responsibility prompts framed differently—TS presents it as a statement, whereas TQ frames it as an agree/disagree question.

Table 2 presents a breakdown of sample characteristics across the three groups. The distributions suggest that the randomization process was effective, as key demographic attributes (e.g., gender, age, education) are broadly comparable across groups. The overall sample had an approximately equal gender distribution, with 52% identifying as female. Additionally, around 20% of respondents were aged 18–34, and 44% were aged 55 or older; almost 50% of individuals had a tertiary qualification (Bachelors or higher), and 5% had no tertiary qualification.

While the sample is broadly balanced across key characteristics, we observe a somewhat higher proportion of older respondents (aged 55+) in the TQ group (51%) compared to the Control (40%) and TS (41%) groups. We investigated two potential sources of this imbalance.

First, we examined survey dropout rates across treatment conditions. The TQ condition required participants to complete an additional Likert-scale agreement task before each of the eight choice sets, which, in principle, could increase respondent fatigue and differential attrition. Dropout rates were 8.6% (69/807) in the Control group, 11.9% (94/787) in the TS group, and 14.0% (105/749) in the TQ group ($\chi^2 = 9.4$, $p = 0.009$), indicating a borderline-significant difference. The key question is whether older respondents were disproportionately more likely to drop out under TQ, which would explain the higher proportion of 55+ completers in that group. To investigate this, we estimated a logistic regression model of dropout (dependent variable: 1 = dropped out, 0 = completed) with treatment condition, age categories (18–34, 35–54, 55+), and treatment-by-age interaction terms as predictors. The treatment-by-age interaction terms were not statistically significant, meaning that older respondents were not disproportionately likely to drop out under the TQ condition compared with younger respondents. This directly rules out age-selective attrition as the explanation for the demographic imbalance. The observed pattern, a higher share of 55+ completers in TQ, is therefore not an artefact of differential attrition. We also note that 694 respondents did not provide age information,

¹ The Think Aloud protocol is a qualitative research method in which respondents verbalize their thoughts while performing a task, offering insights into cognitive processes and instrument clarity (Hagen et al., 2008).

Table 2
Percentage breakdown of individual characteristics by treatment group.

Characteristic	C	TS	TQ	Overall
Female (%)	55	53	49	52
Young adults (18–34) (%)	20	21	19	20
Over 55 adults (%)	40	41	51	44
High qualification (%)	43	46	45	45
No qualification (%)	4	5	5	5
Food poisoning experience - yes (%)	60	66	67	64
Very knowledgeable about cooking food safely (%)	47	49	47	48
Not knowledgeable about cooking food safely (%)	2	2	3	2
Feel that food safety messages are not informative (%)	20	21	15	19
Feel that food safety messages are informative (%)	44	48	54	49
Total N (respondents)	807	787	749	2343

which reduces the precision of these interaction estimates; however, the direction and magnitude of the available evidence do not support selective attrition as an explanation. Second, despite the ESOMAR-compliant survey company providing a sample representative of the UK population in terms of age and gender, the imbalance may be attributable to natural variation in self-selection into survey groups, amplified by the well-documented over-representation of older adults in opt-in online panel surveys (Baker et al., 2010).

More than 50% of respondents had experienced a food-borne incident; nearly half of them regarded their knowledge of how to safely cook their food to be very good, and about the same felt that food safety messages were informative. A low percentage of individuals considered that they lacked knowledge about how to safely cook their food, and 19% of them regarded food safety messages to be uninformative (Table 2). Everyone completed eight choice tasks, producing 18,744 observations for choice analysis.

2.4. Analysing choices

The data is analysed using probabilistic choice models (McFadden et al., 1973). The choice model assumes that the factors influencing an individual's selection of a food safety campaign are not directly observable. Instead, we infer preferences based on observed choices and campaign attributes while incorporating a stochastic component:

$$U_{nit} = V_{nit} + \varepsilon_{nit}, \quad (1a)$$

$$V_{nit} = \beta x_{k_{nit}} \quad (1b)$$

where U_{nit} is the utility individual n associates with campaign i at choice task t ; β is a vector of preference parameters corresponding to the campaign attributes in matrix X_{nit} ; and ε_{nit} is a stochastic term assumed to be independently and identically distributed (i.i.d.) across alternatives.

The specification presented in Eq. (1) assumes homogeneous preferences across all respondents. However, individual preferences may vary due to differences in risk perception, prior experience, or engagement with food safety messages. To account for preference heterogeneity, we estimate a Random Parameter Logit (RPL) model (Train, 2009).

2.4.1. Random parameter logit model

In the RPL framework, preference parameters β_n vary across individuals rather than being fixed, accommodating heterogeneity in respondents' decision-making processes. The random coefficients are assumed to follow a normal distribution $\beta_n \sim \mathcal{N}(\mu, \Sigma)$, where μ represents the mean vector of preferences, and Σ denotes the covariance matrix that captures correlations between random parameters.

A common simplification in RPL models is to assume that random parameters are uncorrelated, leading to a diagonal covariance structure $\Gamma = \text{diag}(\gamma_{11}, \gamma_{22}, \dots, \gamma_{kk})$.

However, this assumption can be restrictive, as it prevents correlation between individual-specific preferences. In our specification, we

allow for correlated random parameters, such that the full variance-covariance matrix is:

$$\text{Var}(\beta_n) = \Gamma \Sigma \Gamma'. \quad (2)$$

2.4.2. Heterogeneity in preferences by treatment condition

To further capture systematic heterogeneity, we introduce treatment specific variations in preferences. Specifically, we test whether individuals assigned to the responsibility prompt conditions (TS—treatment statement, TQ—treatment question) exhibit systematic differences in their campaign choices. The mean and standard deviation of the random parameters are specified as:

$$\mu_k = \mu + \zeta_{k_{\mu TS}} \delta_{TS} + \zeta_{k_{\mu TQ}} \delta_{TQ}, \quad (3a)$$

$$\sigma_k = \sigma + \zeta_{k_{\sigma TS}} \delta_{TS} + \zeta_{k_{\sigma TQ}} \delta_{TQ}. \quad (3b)$$

Here, μ_k and σ_k denote the mean and standard deviation of the distribution for the control setting (i.e., no responsibility prompt). The terms $\zeta_{k_{\mu TS}}$, $\zeta_{k_{\mu TQ}}$, $\zeta_{k_{\sigma TS}}$, and $\zeta_{k_{\sigma TQ}}$ capture the treatment effects for the TS and TQ groups, while δ_{TS} and δ_{TQ} are binary indicators equal to 1 for individuals assigned to the respective treatment group.

The observed utility function in Eq. (1b) is updated to:

$$V_{nit} = \sum_{k=1}^K [(\mu + \zeta_{k_{\mu TS}} \delta_{TS} + \zeta_{k_{\mu TQ}} \delta_{TQ}) + (\sigma + \zeta_{k_{\sigma TS}} \delta_{TS} + \zeta_{k_{\sigma TQ}} \delta_{TQ}) v_{k_n} + \sigma_{k,k-1} v_{(k-1)_n}] X_{k_{nit}}. \quad (4)$$

2.4.3. Choice probabilities and estimation

The probability that individual n selects campaign i among the J available options in choice task t is given by the standard logit expression:

$$\Pr(i_n | X_n, \beta_n) = \frac{\exp(V_{nit})}{\sum_{j=1}^J \exp(V_{njt})}. \quad (5)$$

The likelihood of observing a sequence of choices $y_n = [j_{n1}, j_{n2}, \dots, j_{nT}]$ over T choice tasks is:

$$\Pr(y_n | X_n, \theta) = \int \left(\prod_{t=1}^{T=8} \frac{\exp(V_{nit})}{\sum_{j=1}^J \exp(V_{njt})} \right) f(\beta | \theta) d\beta, \quad (6)$$

where $f(\beta | \theta)$ is the normal density function with θ representing the distribution parameters (mean and variance).

The model parameters are estimated using simulated maximum likelihood estimation. The log-likelihood function is:

$$LL_\theta = \sum_{n=1}^N \ln \Pr(y_n | X_n, \theta). \quad (7)$$

We maximize Eq. (7) using 1000 Halton draws, which improve the accuracy of numerical integration compared to purely random draws. The analysis is conducted in R (R Core Team, 2017) using the Apollo package (Hess & Palma, 2019).

3. Results

3.1. Descriptives of observed choices and consideration sets

We begin by examining the observed choices and consideration sets across experimental groups, as presented in Table 3. The breakdown by choices reports the share of selections for each campaign alternative, while the breakdown by consideration sets captures the proportion of individuals who followed specific choice patterns throughout the survey. Our primary aim is to identify how the different experimental treatments influenced individuals' campaign selections.

We find that participants in both treatment groups were less likely to choose the “no-campaign” option compared to those in the control group. Specifically, across all tasks, the proportion of “no-campaign”

Table 3

Observed shares for control and experimental treatments.

	C	TS	TQ
Number of choices	6456	6296	5992
Number of respondents	807	787	749
<i>Breakdown by choices</i>			
No-campaign	1846 (29%)	1688 (27%)	1403 (23%)
Alternative 1	2286 (35%)	2310 (37%)	2378 (40%)
Alternative 2	2324 (36%)	2298 (36%)	2211 (37%)
<i>Breakdown by respondents' consideration sets</i>			
Exclusive “no-campaign” choosers	111 (14%)	102 (13%)	70 (9%)
Exclusive campaign choosers	345 (43%)	366 (47%)	372 (50%)
Mixed choosers	351 (43%)	319 (41%)	307 (41%)

choices decreased from **29%** in the control group (C) to **27%** in the treatment statement group (TS), and further to **23%** in the treatment question group (TQ). This 6 percentage point decrease between C and TQ suggests a potentially meaningful reduction in campaign opt-outs. The share of “Campaign 1” and “Campaign 2” choices correspondingly increased, with TQ participants most likely to select a campaign option.

To test the statistical significance of these differences, we conducted a chi-square (χ^2) test comparing the proportion of “no-campaign” choices across treatments. Results indicate that these differences are statistically significant at the 1% level ($p < 0.01$). While this confirms a treatment effect, it is important to also evaluate the magnitude of the change. The 6 percentage point drop in campaign rejection from 29% (C) to 23% (TQ) represents a relative decline of approximately **21%**, which we consider a moderate and policy-relevant effect.

Next, we explore whether the treatment effects hold when analysing respondents' consideration sets, which classify participants based on their overall choice behaviour across all eight choice tasks. We define three mutually exclusive consideration set categories:

- **Exclusive “no-campaign” choosers:** respondents who selected the “no-campaign” option in all eight choice tasks.
- **Exclusive campaign choosers:** respondents who always selected one of the two hypothetical campaign alternatives (“Campaign 1” or “Campaign 2”) in all eight tasks.
- **Mixed choosers:** respondents who selected a combination of “no-campaign” and campaign alternatives across the eight tasks.

As shown in Table 3, the proportion of exclusive “no-campaign” choosers was **14%** in the control group, compared to **13%** in TS and only **9%** in TQ. This reflects a **35% reduction** in exclusive “no-campaign” choices for TQ relative to the control. These differences were statistically significant overall at the 5% level, and the contrast between C and TQ was significant at the 1% level.

Differences in consideration set membership across experimental groups were first assessed using Pearson chi-square (χ^2) tests of independence, comparing the proportions of respondents classified as exclusive “no-campaign” choosers, exclusive campaign choosers, and mixed choosers. While these tests indicate statistically significant differences across treatments, we acknowledge that χ^2 tests do not allow for the inclusion of covariates and may be sensitive to sample imbalances. To address this limitation, we further estimated a logistic regression model focusing on exclusive “no-campaign” choice as the dependent variable. As reported in Table 4, the results confirm that the observed reduction in exclusive campaign rejection is driven by the question-framed treatment (TQ), thereby reinforcing the robustness of the consideration set findings.

Table 4

Logistic regression results: Exclusive “no-campaign” choice.

	Coefficient	Std. error	z-statistic
Intercept (Control group)	-1.836***	0.102	-17.93
Treatment Statement (TS)	-0.069	0.147	-0.54
Treatment Question (TQ)	-0.436***	0.164	-3.03
Observations		2343	
Pseudo R^2		0.048	

Notes: Dependent variable equals 1 if the respondent exclusively chose the “no-campaign” option across all choice tasks, and 0 otherwise. The control group is the reference category. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

To validate the robustness of the treatment effects on the likelihood of respondents always choosing the “no-campaign” alternative, we conducted a logistic regression model using a binary variable indicating whether each participant exclusively chose the “no-campaign” option across all eight tasks. Results, reported in Table 4, confirm that the TQ group had significantly lower odds of exclusive “no-campaign” selections compared to the control group ($p = 0.007$), while the TS group did not significantly differ from the control ($p = 0.641$). Deriving from the logistic regression coefficients, the results showed that participants in the TQ group were 6.2 percentage points less likely to exclusively opt out across all eight choice tasks compared to the control group ($p = 0.007$). This indicates a strong treatment effect at the respondent level, independent of campaign attributes. These findings corroborate the descriptive and χ^2 results and demonstrate that the effect of question framing is both statistically and practically meaningful. Taken together, our results provide compelling evidence that responsibility prompts, especially those framed as questions, promote engagement with food safety campaigns. While both treatments reduce campaign rejection rates, the effect is substantially larger for question-framed prompts (TQ). These findings support the hypothesis that question-based responsibility framing can activate personal accountability and reflection more effectively than declarative statements, offering a promising direction for improving the impact of public health communications.

3.2. Model estimation results

While Random Parameter Logit (RPL) models allow for unobserved taste heterogeneity, the commonly imposed assumption that random parameters are uncorrelated can be restrictive (Hess & Train, 2017). To relax this assumption and capture potential interdependencies across campaign attributes, we estimate an RPL model with treatment shifters and full correlation among utility coefficients. This specification constitutes our preferred model. Relative to the uncorrelated RPL with shifters, it provides a substantially better fit to the data, as reflected by an improvement of approximately 300 log-likelihood units and lower AIC and BIC values, even after accounting for the increased number of parameters. These improvements indicate superior explanatory power and support the inclusion of correlated random coefficients. Moreover, the presence of statistically significant standard deviations and correlations confirms that preferences for different campaign attributes are interrelated, underscoring the importance of modelling correlation structures explicitly (Mariel & Meyerhoff, 2018).

Accordingly, to examine how responsibility prompts and their framing influence consumers' choices of food safety campaigns, we base our analysis on the RPL model with shifters and full correlation. The model pools observations from the Control (C), Treatment Statement (TS), and Treatment Question (TQ) groups and incorporates treatment effects through shifters (μ_{TS} – responsibility framed as a statement, and μ_{TQ} – responsibility framed as an agree/disagree question) that interact with campaign attributes. These shifters allow treatment assignment to affect both the mean and, where relevant, the dispersion of random preference parameters. Specifically, responsibility framed as a statement

(TS) and as an agree/disagree question (TQ) is modelled as shifting the distribution of utility coefficients, thereby capturing treatment-induced changes in average preferences as well as in inter-individual preference heterogeneity. All substantive interpretation and policy discussion in this section is therefore based on this preferred specification, while results from simpler models are used solely as robustness checks.

Before analysing the pooled dataset, we tested whether scale variations between the three groups were significantly different from zero.²

To conduct this test, we used the Swait–Louviere procedure (Swait & Louviere, 1993), which distinguishes between differences in scale (error variance) and differences in preferences (utility coefficients) across groups. First, we estimated separate models for each treatment group (Control, TS, TQ) to obtain the unrestricted log-likelihoods. Next, we estimated a pooled model that assumed equal utility parameters across groups but allowed relative scale parameters to vary. This was implemented by normalizing the scale of the control group to one and performing a grid search to identify the optimal scale factors for TS and TQ that maximized the pooled log-likelihood. We then computed the likelihood ratio (LR) statistic to test whether the improvement in fit from allowing group-specific parameters was statistically significant. Our results indicated that the null hypothesis of equal preference structures across groups could be rejected at conventional levels, confirming that our treatments induced both scale and preference heterogeneity. These results validate our modelling strategy using pooled data with treatment-specific shifters. While alternative approaches such as heteroscedastic logit models can account for scale differences, they are less flexible in modelling complex random taste variation and treatment-induced shifts in both the mean and variance of preferences, which our RPL specification captures explicitly.

This step ensures that differences in estimated coefficients are not merely due to scale variations but reflect genuine differences in preference structures. Results from this test allowed us to reject the joint null hypothesis that preference structures are equivalent across all three groups. This provides strong statistical evidence that our treatments influence consumers' campaign choices, validating the inclusion of responsibility prompts as a key explanatory factor in the choice model.

We present the estimation results of the RPL with shifters and full correlation in Table 5 to examine the effects of responsibility prompts on consumers' campaign choices and to explore sources of preference heterogeneity and the RPL with shifters for robustness checks. The simulated log-likelihood was maximized using 1000 Halton draws, ensuring robust model estimation.

Estimation results from the RPL with shifters and full correlation model in Table 5 show that, all else equal, on average, consumers strongly prefer food safety campaigns delivered via television rather than other channels ($\hat{\mu}_{TV} > 0$); year-round instead of seasonally ($\hat{\mu}_{WB} > 0$) and using storytelling elements (i.e., someone else's experience) rather than fact-based messaging. These effects are not only statistically significant but also substantively large, highlighting the central role of message content and delivery format—findings that are of equal or greater substantive relevance than the responsibility prompt treatments themselves. In addition, the estimated coefficient

² In discrete choice models, the scale parameter – representing the inverse of the error variance – is typically unidentifiable within a single dataset and must be normalized (e.g., to $\pi^2/6$ for the standard logit). However, when comparing models across multiple groups, it is possible to test for differences in scale by estimating relative scale factors between datasets. We applied the Swait–Louviere procedure (Swait & Louviere, 1993) to assess whether observed differences in estimated parameters across treatment groups were due to differences in scale (error variance) or true preference heterogeneity. This involved estimating separate models for each group, pooling models with relative scale factors, and using a likelihood ratio test to evaluate scale-adjusted pooling validity. For a full explanation, see Swait and Louviere (1993) and Train (2009).

on the status-quo ($\hat{\mu}_{SQ}$, where SQ refers to the status quo or opt-out alternative), representing the opt-out or “No Campaign” option is negative and statistically significant, indicating that consumers also exhibit a strong aversion to the opt-out alternative and their general preference for having some form of food safety campaign rather than none.

The responsibility prompt treatments (TS and TQ) influence consumer choices differently. TQ further decreases the likelihood of choosing the “No Campaign” option, suggesting that framing responsibility as a question increases consumer engagement with food safety campaigns. In contrast, the TS (Treatment Statement) treatment does not significantly alter the utility of the opt-out alternative (SQ), indicating that statement framing does not robustly reduce the probability of opting out across all campaign configurations.

This finding is consistent with the descriptive results reported in Section 3.1, where TS was associated with a small reduction in overall “no-campaign” selections (from 29% to 27%)³

Turning to heterogeneity, the results indicate that the TQ treatment significantly reduces the standard deviations of several key attribute coefficients, particularly for campaigns delivered year-round and those using humorous cartoons or fictional characters. These reductions should be interpreted as a decrease in inter-individual preference heterogeneity: respondents exposed to question-framed responsibility prompts exhibit more similar evaluations of these campaign characteristics. In other words, TQ leads to a convergence of preferences across individuals with respect to specific campaign features.

Importantly, this reduction in heterogeneity should not be interpreted as increased choice certainty, reduced randomness, or lower error variance at the individual level. Preference heterogeneity reflects differences between respondents, whereas choice certainty and scale relate to within-individual decision noise. Our scale tests explicitly address error variance separately and do not imply that treatments reduce stochastic choice behaviour.

In contrast, the TS treatment does not significantly affect the dispersion of random parameters, indicating that statement-based responsibility prompts do not meaningfully alter the degree of preference heterogeneity across respondents. Thus, framing responsibility as a question influences both the average utility and the degree of agreement among consumers regarding key campaign attributes.

These insights have important implications for food safety campaign design. The results suggest that TV-based, year-round campaigns using storytelling elements are the most effective in engaging consumers. Furthermore, question-based responsibility prompts (TQ) are more effective than statement-based prompts (TS) in increasing campaigns' engagement. These findings highlight the importance of both the type

³ To further strengthen the consistency of the results across Sections 3.1 and 3.2, we estimated a constrained null-attribute multinomial logit (MNL) model containing only group-specific constants for the opt-out alternative and no attribute parameters. In this specification, the constants are, by construction, direct functions of the raw opt-out choice frequencies. The results show that the opt-out constant for the TS group ($ASC_{TS} = -0.089$, $t = -1.008$) is not statistically significant, while the TQ constant ($ASC_{TQ} = -0.270$, $t = -2.994$) is significant at the 1% level (see Table A.7 in Appendix). This confirms that the 29% to 27% descriptive reduction for TS does not reach statistical significance even in the simplest model specification. We also note a conceptual distinction for transparency. In a standard MNL estimated on balanced data, the ASC for the opt-out alternative is algebraically determined by the raw opt-out frequency, because attribute effects and the ASC are orthogonal by construction (Train, 2009). In our RPL specification, the treatment-specific opt-out shifter is conditioned on the full covariance matrix of all correlated random parameters and captures treatment-induced changes in the mean of the opt-out random parameter distribution, which is a richer quantity than a simple MNL ASC. The constrained null-attribute MNL with group-specific opt-out constants also confirms that the RPL results are not anomalous and shows that the TS effect on opt-out is non-significant in the simplest possible specification.

and framing of responsibility messages in influencing consumer engagement. By incorporating question-based responsibility prompts, campaign designers can not only increase engagement with food safety initiatives but also enhance the consistency of consumer choices, ultimately leading to more effective public health interventions.

For example, a food safety campaign poster could include a question-framed prompt such as: *“Do you agree that the risk of food poisoning can only be reduced if you follow safe food handling practices at home?”* This prompt encourages self-reflection and signals individual accountability without using technical language. Integrating such prompts into public campaigns – whether via television, social media, or in-store materials – offers a low-cost and easily scalable strategy to enhance consumer engagement and reinforce behavioural change.

The effects of responsibility prompts (TS and TQ) remain consistent with previous findings but are further refined in this model. TS significantly influences only campaign style preferences, increasing consumer preference for humorous/cartoon-based campaigns over fact-based messaging, while TQ significantly reduces the likelihood of selecting “No Campaign”, reinforcing that question framing increases consumer engagement with food safety campaigns. Regarding heterogeneity in consumer choices, the results indicate that both TS and TQ reduce variation in campaign choices compared to the control group, suggesting more stable consumer preferences in the treatment groups. The only exception is campaigns using snappy slogans, where variation increases under treatment conditions, possibly indicating polarized consumer perceptions of this messaging style. Further, TQ significantly reduces variability in consumer choices, particularly for year-round campaigns ($\hat{\sigma}_{WB}$ decreases), humorous cartoons-based campaigns ($\hat{\sigma}_{HC}$ decreases), confirming that question-based responsibility prompts contribute to improved consistency in consumers’ campaign preferences. By allowing for full correlation among utility coefficients, the model provides a more accurate representation of consumer behaviour. Importantly, in addition to the treatment effects, these results provide strong and consistent evidence on the relative importance of campaign attributes themselves. Across both the RPL with shifters and the RPL with full correlation models, we find that campaigns delivered on TV are significantly preferred over other channels. Year-round campaigns are also valued more highly than those that are seasonal or intermittent. In terms of style, consumers consistently prefer messaging that draws on storytelling or personal experience over fact-based, numerical information. These attribute effects are not only statistically significant at the 1% level, but their estimated coefficients are also larger in magnitude than many of the treatment shifters. These findings highlight the importance of message delivery format and narrative framing in shaping consumer responses and they offer actionable guidance for practitioners designing food safety campaigns.

Overall, the results have important policy implications for the design of food safety campaigns. The mean shifter estimates indicate that incorporating responsibility prompts, particularly when framed as a question (TQ), significantly reduces the likelihood of consumers selecting the “No Campaign” option. This suggests that question-based framing enhances engagement with food safety messaging. In contrast, statement-based prompts (TS) primarily influence campaign style preferences, as respondents in the TS group show a greater preference for humorous cartoons or fictional characters over fact-based approaches. Turning to the standard deviation estimates, the findings reveal that TQ significantly reduces variability in consumer choices, particularly for year-round campaigns and those utilizing humour-based messaging. This suggests that question-based prompts contribute to more stable and consistent decision-making. While TS does not significantly impact variation in choices, both treatments generally lead to lower standard deviations compared to the control group, indicating greater certainty in consumer preferences when responsibility prompts are introduced. These findings highlight the importance of both the type and framing of responsibility messages in influencing consumer engagement. By incorporating question-based responsibility prompts, campaign designers can not only increase engagement with food safety initiatives but also enhance the consistency of consumer choices, ultimately leading to more effective public health interventions.

3.2.1. Marginal impacts of responsibility prompts on opting out

Beyond statistical significance, it is essential to assess the magnitude of treatment effects to determine their relevance for policy. While earlier descriptive results (Section 3.1) suggested that the TQ treatment reduces exclusive opt-out behaviour by approximately 6.2 percentage points at the respondent level (based on logistic regression estimates), we complement this finding here by reporting marginal effects from the RPL models. These allow us to quantify the impact of treatment conditions on the probability of choosing the opt-out alternative (SQ) at the individual task level, accounting for repeated choices and preference heterogeneity.

Table 6 presents the estimated marginal effects of the two responsibility prompt treatments on the probability of choosing the opt-out alternative (SQ) at the choice-task level. These values represent the average change in the predicted probability of opting out when moving from the control group to either TS or TQ, holding other campaign attributes constant.

Under the RPL model with shifters and full correlation, the TQ treatment reduces the predicted probability of choosing the opt-out by 5.2 percentage points ($p < 0.01$), while the TS treatment has a smaller and statistically insignificant marginal effect of approximately 0.7 percentage points. These effects align closely with the observed differences in Table 3, where “No Campaign” choices dropped from 29% in the control group to 23% under TQ. The RPL-based marginal effects thus confirm that question-framed responsibility prompts significantly lower the probability of opting out. These findings corroborate our earlier interpretation that question framing has a stronger behavioural impact than declarative statements.

From a policy perspective, the size of the TQ effect is meaningful. A reduction of around 5% in opt-out likelihood per choice task, achieved through a simple low-cost framing change, can generate substantial improvements in campaign reach and behavioural engagement. This has important implications for the design and delivery of food safety interventions—particularly in large-scale public health settings where cumulative modest shifts in consumer engagement can translate into meaningful public health outcomes.

4. Discussion

This study investigated the effects of responsibility prompts and their framing on consumers’ preferences for food safety campaigns using a discrete choice experiment. Our analysis, based on a Random Parameter Logit (RPL) model with treatment-specific shifters and fully correlated utility coefficients, reveals several important findings concerning both the influence of responsibility prompt framing and the relative importance of campaign attributes in shaping consumer choices.

First, we find strong evidence that campaign design features, such as delivery channel, timing and message style, have a substantial and statistically significant influence on consumer preferences. Specifically, consumers are significantly more likely to choose campaigns that are delivered on television, run year-round and incorporate storytelling elements such as personal experiences. These results are consistent across all model specifications and exhibit larger effect sizes than many of the treatment-specific estimates. This highlights the importance of message content and delivery format, providing direct guidance for public health practitioners designing communication campaigns aimed at behavioural change.

Second, we find that responsibility prompts – particularly when framed as a question – can meaningfully shape engagement with food safety campaigns. The question-framed treatment (TQ) significantly reduces the likelihood of opting out of a campaign, indicating increased willingness to engage with campaign messaging. This effect is visible both in raw choice frequencies and in the estimated marginal effects derived from the choice model. These findings are consistent

Table 5
Estimation results.

	RPL with shifters Estimate	RPL with shifters and correlation Estimate		RPL with shifters Estimate	RPL with shifters and correlation Estimate
<i>Mean</i>			<i>Std. dev</i>		
$\hat{\mu}_{SQ}$	−1.17***	−1.49***	$\hat{\sigma}_{SQ}$	−5.12***	−5.31***
$\hat{\mu}_{TV}$	2.22***	2.38***	$\hat{\sigma}_{TV}$	2.10***	2.54***
$\hat{\mu}_{AO}$	−0.81***	−1.19***	$\hat{\sigma}_{AO}$	−1.83***	−2.09***
$\hat{\mu}_{WB}$	−0.18*	−0.39***	$\hat{\sigma}_{WB}$	1.82***	1.72***
$\hat{\mu}_{SO}$	−0.10**	−0.10**	$\hat{\sigma}_{SO}$	−0.43***	−0.46***
$\hat{\mu}_{EE}$	0.12*	0.11	$\hat{\sigma}_{EE}$	−0.50***	−0.93***
$\hat{\mu}_{HC}$	−0.08	−0.09	$\hat{\sigma}_{HC}$	−0.85***	−0.82***
$\hat{\mu}_{SS}$	−0.15**	−0.14**	$\hat{\sigma}_{SS}$	0.53***	−0.54***
<i>Mean shifters</i>			<i>Std. dev shifters</i>		
$\hat{\zeta}_{SQ_{PTS}}$	−0.37	−0.14	$\hat{\zeta}_{SQ_{PTS}}$	−0.06	−0.24
$\hat{\zeta}_{TV_{PTS}}$	−0.13	−0.20	$\hat{\zeta}_{TV_{PTS}}$	−0.20	−0.20
$\hat{\zeta}_{AO_{PTS}}$	0.14	0.17	$\hat{\zeta}_{AO_{PTS}}$	−0.06	−0.04
$\hat{\zeta}_{WB_{PTS}}$	0.16	0.22	$\hat{\zeta}_{WB_{PTS}}$	0.04	−0.10
$\hat{\zeta}_{SO_{PTS}}$	0.00	0.02	$\hat{\zeta}_{SO_{PTS}}$	−0.11	−0.12
$\hat{\zeta}_{EE_{PTS}}$	−0.14	−0.15	$\hat{\zeta}_{EE_{PTS}}$	−0.10	−0.01
$\hat{\zeta}_{HC_{PTS}}$	0.21**	0.22**	$\hat{\zeta}_{HC_{PTS}}$	−0.01	−0.05
$\hat{\zeta}_{SS_{PTS}}$	−0.01	−0.01	$\hat{\zeta}_{SS_{PTS}}$	−0.06	1.21***
$\hat{\zeta}_{SQ_{PTQ}}$	−0.78**	−1.31	$\hat{\zeta}_{SQ_{PTQ}}$	0.65*	0.37
$\hat{\zeta}_{TV_{PTQ}}$	−0.10	−0.55	$\hat{\zeta}_{TV_{PTQ}}$	−0.30*	−0.19
$\hat{\zeta}_{AO_{PTQ}}$	0.06	0.76	$\hat{\zeta}_{AO_{PTQ}}$	0.15	0.10
$\hat{\zeta}_{WB_{PTQ}}$	0.14	0.96	$\hat{\zeta}_{WB_{PTQ}}$	−0.05	−0.01
$\hat{\zeta}_{SO_{PTQ}}$	0.03	0.29	$\hat{\zeta}_{SO_{PTQ}}$	−0.21**	−0.22**
$\hat{\zeta}_{EE_{PTQ}}$	0.00	−0.34	$\hat{\zeta}_{EE_{PTQ}}$	0.39	0.27
$\hat{\zeta}_{HC_{PTQ}}$	−0.06	−0.48	$\hat{\zeta}_{HC_{PTQ}}$	0.15	0.48
$\hat{\zeta}_{SS_{PTQ}}$	−0.03	−0.40	$\hat{\zeta}_{SS_{PTQ}}$	0.11	1.21***
<i>LL</i>	−13 910.05	−13 588.58			
$\bar{p}^2$	0.3245	0.3401			
AIC	27 916.1	27 329.16			
BIC	28 292.36	27 924.9			
<i>N</i> (obs.)	18 744	18 744.00			
<i>N</i> (param.)	48	81			

Note: Due to rounding, some of the coefficients appear to be zero. ** Parameter is significantly different from zero at the 5% level. *** Parameter is significantly different from zero at the 1% level.

Table 6
Estimated marginal effects of responsibility prompts on opting out.

Model	Treatment	$\Delta \Pr(SQ \mid \text{Treatment})$	Standard error
RPL with shifters	TS	−0.012	0.009
	TQ	−0.041***	0.015
RPL with shifters and full correlation	TS	−0.007	0.010
	TQ	−0.052***	0.014

Notes: Marginal effects represent the change in the predicted probability of choosing the opt-out alternative (SQ) due to the inclusion of the responsibility prompt treatment. Estimates are based on 1000 simulated draws. Robust standard errors reported. *** $p < 0.01$.

with behavioural research showing that question framing can encourage self-reflection and active cognitive processing, thereby increasing message engagement relative to declarative statements (Aronson, 1999; Milkman et al., 2009). Importantly, our results do not imply changes in food handling behaviour per se, but rather show that question-based prompts increase consumers’ willingness to engage with food safety campaigns—an upstream but necessary condition for behavioural change.

While the statement-based prompt (TS) does not significantly reduce opt-out probabilities on average, it increases the attractiveness of specific campaign formats, particularly those using humour or cartoon-based messaging. These findings suggest that responsibility prompts do not operate uniformly across all campaign configurations, but rather interact with the content and style of the campaign itself. Such interaction effects align with prior work in risk communication and health messaging, which highlights that framing strategies are most effective when they complement, rather than substitute for, message style and delivery format Fischhoff (2013) and Hornick et al. (2013).

While prior studies have explored responsibility prompts in health messaging, our study adds to this body of work by examining their role in shaping preferences for campaign design features within a discrete choice framework.

Third, we show that the TQ treatment also reduces inter-individual preference heterogeneity for certain campaign attributes, leading to greater alignment in how consumers evaluate year-round delivery and humorous messaging. This convergence should not be interpreted as increased individual-level choice certainty or reduced randomness in decision-making. Rather, it reflects a treatment-induced narrowing of the distribution of preferences across individuals. These findings align with recent research on message framing effects in consumer decision contexts. The broader framing literature shows that how information is framed – even when objective content is constant – can meaningfully influence attention, engagement and evaluative responses, as individuals process framed messages differently depending on their motivational and cognitive states (Flusberg et al., 2024). Likewise, experimental evidence from consumer behaviour research demonstrates that variations

in message framing can alter engagement levels and choice outcomes in real decision settings related to sustainable consumption (Grappi et al., 2024). In this light, our results that question-framed responsibility prompts increase engagement with food safety campaigns and reduce between-person variability in preferences reflect framing effects documented in broader consumer and behavioural science literatures. In contrast, the TS treatment does not significantly affect the dispersion of preferences, reinforcing the conclusion that the question-framed prompt is more effective in shaping both engagement and consistency in consumer choices of food safety campaigns.

Our modelling approach further contributes to the literature methodologically. By using an RPL model with full correlation among utility coefficients, we capture complex interdependencies among preferences that would be missed in more restrictive models. The significant improvement in model fit validates this more flexible specification and reinforces the substantive insight that preferences for delivery channel, message content and timing are closely related.

Together, these findings offer both theoretical and practical contributions. Theoretically, they support the notion that behavioural interventions, such as responsibility prompts, can shape not only average choices but also the structure of preferences in the population. Practically, they suggest that low-cost framing interventions can be an effective lever for public policy, especially when aligned with content that already resonates with consumers.

In sum, while campaign attributes emerge as the primary determinants of consumer choices, responsibility prompts, particularly when framed as questions, play a meaningful complementary role. The results indicate that question-based framing can increase engagement with food safety campaigns and reduce divergence in how certain campaign features are evaluated, without substituting for the fundamental importance of campaign content and delivery. Taken together, these findings suggest that optimal campaign effectiveness depends not only on the informational features of the message, but also on whether and how responsibility is framed within it. By demonstrating that relatively small, low-cost framing interventions can shape both average preferences and their distribution across individuals, this study contributes to a growing evidence base on behaviourally informed public communication and highlights the value of integrating responsibility framing into the broader design of health-related interventions.

Limitations and avenues for future research

In earlier drafts, we explored heterogeneity in treatment responsiveness using conditional parameters—allowing random coefficients to vary with respondents' observed campaign consideration types. However, we acknowledge the concerns raised in the literature regarding the validity of this approach when the number of choices per respondent is limited (Sarrias, 2020). Conditional parameter estimates can become unstable and potentially biased under such circumstances. Moreover, as one of our reviewers rightly noted, similar insights could have been derived from simpler models incorporating interaction terms with socio-demographic characteristics. For these reasons, and to avoid overcomplicating the analysis with potentially unreliable inferences, we have excluded the conditional parameter results from this version of the paper. We see the exploration of conditional heterogeneity using more robust designs, ideally with a higher number of choice tasks per respondent and richer covariate data, as an important direction for future research.

Demographic considerations

As noted in Table 2, our sample was broadly balanced across treatment groups, but the TQ condition included a somewhat higher share of older respondents (aged 55+). While this imbalance was not adjusted for in the main model specifications, it is important to consider that age may moderate how individuals respond to responsibility prompts in food safety campaigns. Although our exploratory post-estimation

checks found no statistically significant interaction between treatment assignment and age group, we recognize the limitations of statistical power for such subgroup analyses. Future research should investigate age-treatment interactions more formally, ideally with a study design that enables covariate balancing or stratification.

Interpreting small treatment effects and external validity

While our results indicate that question-based responsibility prompts (TQ) have a statistically significant effect on campaign engagement – reducing the probability of opting out by approximately 6.2 percentage points – this effect is modest compared to the influence of core campaign attributes such as delivery channel and message format. However, such magnitude is not unusual in behavioural science, where framing effects are typically small but still policy-relevant due to their low cost and ease of implementation (Loewenstein & Chater, 2017). Importantly, the framing variation between TS and TQ was intentionally subtle to mirror real-world applications in public health messaging. Our findings are consistent with the “question-behaviour effect” literature, which shows that asking individuals to reflect or agree with a message can increase internalization and behavioural intent (Glock et al., 2013; Müller et al., 2016). Nonetheless, we acknowledge the limits of external validity inherent in stated preference experiments and the fact that engagement in hypothetical campaign choices may not fully translate to changes in real-world food handling practices. Future work should examine whether responsibility prompts, particularly in question format, influence observed behaviours outside the survey context. Field experiments or longitudinal designs could further test the durability and behavioural impact of such low-cost framing interventions in real settings.

5. Conclusion and policy implications

This study contributes to the growing body of evidence on how behavioural interventions, specifically responsibility prompts, can influence public engagement with food safety campaigns. Using a discrete choice experiment and a flexible Random Parameter Logit model with treatment-specific shifters and correlated coefficients, we quantified the impact of different responsibility prompt framings and campaign attributes on consumer preferences.

Our results show that while campaign framing matters, it is the content and structure of the campaign itself, particularly delivery via television, year-round timing, and narrative storytelling, that have the most substantial and consistent effects on consumer choices. These attributes produce larger and more robust impacts on the probability of campaign selection than either form of responsibility prompt, highlighting their primary importance in the design of effective public health interventions.

That said, responsibility prompts, particularly when framed as agree/disagree questions, can meaningfully enhance the effectiveness of campaign delivery. The question-framed prompt (TQ) reduced the probability of opting out of a campaign and led to more aligned preferences across respondents for certain messaging styles (e.g., humorous or cartoon-based campaigns and year-round delivery). These effects were modest but statistically and substantively significant, suggesting that question-based prompts can complement well-designed campaign content by promoting engagement and reducing fragmentation in consumer evaluations.

From a policy perspective, these findings offer actionable guidance for practitioners and public health communicators. First, campaign designers should prioritize channels and formats that resonate most with the public—specifically television-based campaigns that run throughout the year and use relatable, narrative-driven content. Second, the inclusion of behavioural prompts framed as questions offers a low-cost, scalable enhancement that can be integrated into multiple media formats, from online banners to printed posters. For example, a question-framed message such as: “Do you agree that food safety starts with

how you prepare food at home?” could be embedded in television ads, supermarket flyers or digital outreach materials. These messages may enhance consumer self-reflection and perceived personal responsibility, particularly when paired with engaging and informative campaign content.

Finally, the findings reinforce the value of integrating behavioural research insights into public communication strategies. Rather than treating responsibility as a standalone message, it can be most effective when strategically aligned with specific campaign features. Future policy efforts should continue to evaluate not just what messages are delivered, but how they are framed and who receives them. Overall, the study provides an evidence-based framework for optimizing food safety communication, balancing robust campaign design with behaviourally informed interventions that are cost-effective, flexible and impactful at scale.

CRediT authorship contribution statement

Madalina Radu: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Seda Erdem:** Writing – review & editing, Validation, Supervision, Software, Resources, Methodology, Funding acquisition, Formal analysis. **Danny Campbell:** Validation, Methodology, Investigation, Data curation.

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Appendix

Table A.7

Opt-out ASC estimates across experimental groups.

Group	Opt-out ASC	Standard error	t-ratio
Control	−0.222	0.061	−3.631***
Treatment Statement (TS)	−0.089	0.088	−1.008
Treatment Question (TQ)	−0.270	0.090	−2.994***

Notes: ****p* < 0.01. Negative ASC values indicate a general preference for selecting one of the campaign alternatives rather than choosing the opt-out option. The Treatment Question group exhibits the strongest aversion to the opt-out alternative, while the Treatment Statement effect remains statistically insignificant.

Data availability

The data that has been used is confidential.

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