Risk Communication Strategies and Consumer Behaviours within Food Related Contexts

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Abstract

This thesis addresses various food safety and food consumption challenges and investigates them from an economic perspective within three different, but related studies. Each study provides public authorities with valuable information that will assist them with the development and implementation of meaningful and targeted food policy interventions designed to positively influence consumer food related behaviours and choices. These studies further contribute to the literature by investigating and presenting several applications of advancements in choice modelling. To address these challenges, two web-based surveys were administrated to respondents in Scotland and the United Kingdom.

The first study that is presented investigates the role of individual responsibility prompts in consumer choices of a food safety campaign, and how these prompts change their stated choices of food safety campaigns that are most likely to influence the way they handle, cook, and store their food. The means by which this investigation is achieved are novel, as a discrete choice experiment is used to assess consumer choices of different types of food safety campaigns. In this context, choice experiments are particularly useful because they allow consumers to evaluate food safety campaigns with multiple characteristics. This is different to previous studies that have used Likert-type rating scales to investigate specific communication channels (e.g., television, newspapers, fact sheets). The findings generated by this analysis reveal that emphasizing consumers' individual responsibility can be a factor that affects the effectiveness of a policy intervention, and that differently framed responsibility prompts can be used to maximise the impact of such policies.

The second study builds on our understanding of the self-persuasive power of questions and uses a multidisciplinary approach to investigate if and how differently framed knowledge-based information can affect consumer processing strategies, and, consequently, their consideration sets of alternatives. Additionally, this study also introduces and explores the use of a novel approach – that of adjunct questions (i.e., questions that aim to draw attention to important aspects of a text) – in stated choice experiment surveys. This particular investigation conjectures that adjunct questions affect individuals' atten-

tion, and accordingly, their intake of information, which, in turn, may impact how they process the consideration set of alternatives in a choice task. This study's findings confirm that individuals' consideration sets are affected, that they vary by differently framed knowledge-based information, and that consumers consider and choose less frequently a "No campaign" option in the adjunct question treatment.

The third study aims to understand a current societal and policy issue: how consumers make trade-offs between meat and plant-based ingredients. It further extends our understanding of choices and decision-making in two ways: (1) when the impact of meat consumption to consumer health is communicated, and (2) when the environmental impact of meat consumption is communicated. In addition to the contextual contribution, this third study also contributes to the literature by exploring the use of Bayesian Truth Serum and Inferred Valuation as hypothetical bias mitigation techniques. Overall, we report differences in choices based on the contextual experimental set-up and the hypothetical bias technique used. The findings in this third study demonstrate the differences and similarities across these experimental setups and assist policymakers to design targeted policy interventions.

Chapter 1

Introduction

The communication of food safety and risk information to consumers plays an important role in public health policies that aim to reduce the prevalence and impact of food-borne illnesses. Despite the widespread use of a range of risk-communication strategies and awareness campaigns run by public authorities, instances of food-borne illnesses remain high (O'Brien et al., 2016; Hoffmann et al., 2017; Holland et al., 2020). According to a review by the Food Standards Agency (2022), an estimated 2.4 million cases of food-borne illness occur each year in the United Kingdom – the new estimate has more than doubled compared to its value of approximately one million in 2009. In Scotland alone, Food Standards Scotland (2017) estimated some 43,000 cases of food-borne illness occurred annually, with around 5800 of these presenting to General Practice, and some 500 of them requiring hospital treatment. Notwithstanding the personal pain and suffering, the economic costs of treating food-borne illnesses are high, and in extreme cases these illnesses can cause death (Rigby et al., 2017; Holland et al., 2020). Alongside these, consumer studies provide an increasing body of evidence that identifies a lack of public awareness and knowledge concerning food safety risks and proper food-handling practices (Cope et al., 2010; Barnett et al., 2011). While information campaigns aim to close the awareness and knowledge gap, recent research indicates the need for new and targeted risk-communication strategies that more effectively influence consumers' behaviour and decrease their food-poisoning risks (Flynn et al., 2018). Considering the challenges that food-poisoning cases cause at both individual and societal levels, it is necessary to understand both consumers' behaviours associated with food safety campaigns, as well as those factors that influence their engagement with these campaigns.

Various factors, including consumers' comprehension of risks and the consequences of not addressing them, misconceptions about food safety, individual habits, and personal (in)experience with the risks and reluctance to behaviour change, can impact the efficacy

of previous food safety campaigns (Kendall et al., 2013; FSA, 2014). Relative to these, previous research has neglected factors that pertain to the role of consumers in ensuring their own food safety. This includes factors like individual responsibility, and the self-generation of arguments in favour of adopting food handling behaviour, that decrease the risks of food poisoning.

The issue of individual responsibility has been mostly addressed in health research, but it is yet to be considered in the food risk communication literature. For example, Forde and Raine (2008) emphasized the need for communication strategies to both facilitate individuals' actions concerning their health, and to increase their personal responsibility for making healthier choices. Research on the assignment of individual responsibility has also been performed with the objective to promote and enhance sustainable consumption among consumers. Wells et al. (2011) reported evidence of a correlation between consumers' perception of environmental responsibility and their environmentally aligned consumption behaviours. This correlation was strengthen by Evans et al. (2017), who reported that individualising consumers' responsibility was associated with an emergent perception of shared and distributed responsibility for more sustainable consumption. Similarly, it has been shown that more sustainable public health expenditure can be achieved if individuals acknowledge their own responsibility for the financial implications of healthcare costs that stem from their choices of risky health behaviours (Borges et al., 2017; Pinho and Borges, 2019).

Within the food safety context, recent investigations into consumers' attitudes and perceptions concerning food safety reveal that individuals tend to attribute the least responsibility to consumers themselves for ensuring proper food safety behaviour (Franc-Dabrowska et al., 2021; Larson, 2021). Despite the requirement for consumers to acknowledge their food safety responsibility Kastner (1995), and the mounting body of evidence supporting the effectiveness of public health policies (Buchanan, 2011; Van der Star and Van den Berg, 2011; Miraldo et al., 2014; Le Clainche and Wittwer, 2015; Borges et al., 2017; Pinho and Borges, 2019), the concept of individual responsibility has yet to be incorporated within the context of food safety campaigns.

Communicating consumers' individual responsibility to ensure their food safety could potentially increase their campaign engagement, but the way in which this is communicated might also play a role in consumers' responses to the campaigns. Predominantly, campaign messages are delivered through the use of statements that do not stimulate consumers to generate their own arguments towards attending the messages of that campaign. This can cause consumers' reactance to persuasion and, as a result, lead to wasted communication resources. One alternative to the conventional way of communicating campaign messages is via self-persuasion techniques, such as questions. These allow consumers' to self-generate their arguments and influence their attitudes and behaviour related to the campaign's objective. For example, in health behaviour and addiction research, Glock et al. (2013) has demonstrated that warning labels formulated as questions have a positive influence on smoking-related risk perceptions, while Müller et al. (2016) demonstrated that such questions had a positive impact on short-term smoking behaviour.

Another critical factor shown to have an influence on consumers' food handling behaviour and the high number of food poisoning cases is their knowledge of food safety. Most food safety related research on has focused on investigating consumers' knowledge of food safety practices that are aimed at preventing food poisoning (Buccheri et al., 2010; Wills et al., 2015; Moreb et al., 2017). Given these literature findings and Covello (2003)'s recommendation[1], we used focus groups to identify consumers knowledge and experiences of food safety campaigns prior to collecting the final data. Most importantly, these focus groups revealed that consumers had a low degree of knowledge regarding the consequences of food poisoning.

Research on choice analysis has also demonstrated the need to account for the influence of consumers' knowledge related to a choice task objective on their attributes' attendance when making choices. Overlooking the role of knowledge can impact both the choices made by consumers, and the way they make decisions (i.e., their processing strategies). This could influence their economic valuations of the choice task objective, and, as a result, produce biased willingness-to-pay estimates (Alemu et al., 2013; Hensher et al.,

[1] Best practices in risk communication imply determining what consumers know, think, or want to be done about risks using methods such as interviews, discussion groups and surveys.

2013; Sandorf et al., 2017; Heidenreich et al., 2018). Based on their processing strategies, consumers form consideration sets to choose from when making choices. A consideration set is defined as a subset of choice alternatives that is actually considered by a consumer during a choice task. It has been reported that the accessibility or salience of a choice objective in a specific choice situation is achieved through knowledge, and that this determines the composition of the consideration set (Nedungadi, 1990). Similarly, research by Tversky and Kahneman (1981) demonstrated that information accessibility, as well as how this information is communicated to consumers, can influence their behaviour.

Another situation when the analysis of stated choice data can generate biased marginal willingness-to-pay estimates is when hypothetical bias is not addressed. Hypothetical bias is the potential difference between consumers' hypothetical willingness-to-pay and real willingness-to-pay that can occur when collecting data in hypothetical choice scenarios. A vast body of research in choice studies has explored various hypothetical bias mitigation techniques to observe consumers' willingness-to-pay and to identify estimates that are closer to the truth. The most commonly used technique to mitigate hypothetical bias in choice experiments is cheap-talk, but other techniques such as oaths or priming for honesty have been recently developed. Depending on both the type of the good that is being investigated, and the choice context, consumers' can be motivated to give less-than-truthful answers. Therefore, it is recommended to thoroughly select the hypothetical bias mitigation techniques that can counter this motivation (Haghani et al., 2021). In the food context, the increasing demand for meat poses significant challenges on both the health system, and on the environment (Dagevos, 2021; Michel et al., 2021; Onwezen et al., 2021). One way to address this challenge is to motivate consumers to reduce their meat intake and increase their consumption of plant-based foods. Research has identified the general lack of awareness that consumers have regarding the extent of impact that meat production and consumption has on the environment (Hartmann et al., 2022). Because of this, and following recommendations of Haghani et al. (2021), it is reasonable to assume that inferred valuation (the asking of questions from the perspective of a third party) and Bayesian truth serum (to incentivise consumers' truthful answers with a monetary reward)

could be appropriate hypothetical bias mitigation techniques to help minimise the number of dishonest answers in a meat-versus plant-based food context study.

In conclusion, considering the complexities and challenges of food safety communication strategies and of food consumption patterns, this thesis aims to improve understanding of consumers' choice behaviour and decision-making heuristics within the food context. Moreover, by better understanding consumers' behaviour and responses to hypothetical choice scenarios, this thesis offers insights that can guide public authorities (such as the Food Standards Scotland or Food Standards Agency) in their development of more meaningful and targeted food policy interventions to positively influence consumers' food related behaviour and choices. An overview of the thesis is presented in the next section.

Overview of the thesis

The thesis comprises three studies, addressing various food safety communication and food consumption challenges. These challenges are investigated from an economic perspective and the resulting studies contribute to the literature by conducting and presenting several applications of advancements in choice modelling. Further, each study provides public authorities with valuable information that will assist them with the development and implementation of meaningful and targeted food policy interventions designed to positively influence consumer food related behaviours and choices.

To explore these objectives, this thesis collected stated preference data by utilising three choice experiments presented to respondents in UK in two different surveys. The first web-based survey was administrated to a random sample of 2,343 individuals drawn from the Scottish adult population in 2018 and included two choice experiments. The collected choice data were used to investigate the objectives aimed by the papers presented in Chapter 2 and Chapter 3. Data collection for the second survey took place in April 2023 by using the second web-based survey. The second survey was completed by 2023 participants living in UK, aged 18 years or over. In included a choice experiment used to collect stated preference data aimed at exploring the objectives of the paper presented in Chapter 4. This approach has a higher predictive power and can reduce in-

consistent behaviours (i.e., fatigue, scale-use bias) that are associated with different data collection methods such as rating tasks (Cohen and Orme, 2004; Campbell et al., 2015; Yang et al., 2021). Moreover, choice scenarios closely mirror the decision-making situations that consumers face in their daily routine, when they are required to make choices based on their preferred outcomes (Adamowicz et al., 1994). Furthermore, by assessing how consumers' preferences vary given the changes in attributes and their levels within a choice scenario, this approach facilitates the quantitative assessment of trade-offs among various attributes of an investigated good. This insight offers a window into individuals' valuation of these attributes and how much they are willing to pay to acquire a particular attribute. Once costs are incorporated as attributes in choice experiments, economic values of the investigated good can be estimated. Deriving consumers' economic values is of particular importance for policy interventions because it provides valuable insights into the main drivers of specific choice outcomes. Not surprisingly, choice experiments have been used in numerous studies that aim to contribute to planning and resource allocation in areas of research ranging from studies in transport economics (Li et al., 2020) to those in environmental economics (Adamowicz et al., 1994), health economics(Telser and Zweifel, 2007), and consumer economics (Alemu and Olsen, 2018).

First study aims to examine the impact of emphasizing individual responsibility for adopting safe food-handling practices on consumers' choices of food safety campaigns and to compare the effects of framing responsibility prompts as statements (direct persuasion) versus questions (self-persuasion) on these choices. To achieve this, a web-based survey was conducted, incorporating a discrete choice experiment to collect data on consumer preferences among various food safety campaign options. The campaign options were defined by different characteristics (i.e., attributes) such as how the campaign is delivered, its frequency and style. The survey included a control group without a responsibility prompt and two treatment groups where the responsibility prompt was framed either as a statement or a question. Participants were presented with choices between two food safety campaigns or opting for none, across a sequence of choice tasks.

From a methodological perspective, this study looked at if and how the framing of

responsibility prompts within food safety campaigns (statement vs. question) affect consumer choices among different campaign options. First, we hypothesise that the introduction of a responsibility prompt, regardless of its framing, will enhance the likelihood of consumers choosing food safety campaigns over the 'no campaign' option, reflecting the positive impact of that highlighting personal responsibility can have on consumers' behaviour. Second, we expect that framing the responsibility prompt as a question (enabling self-persuasion) will be more effective in increasing consumers' choices of food safety campaigns (relative to the 'no campaign' option) compared to a statement framing (direct persuasion).

From a policy perspective, this study analysed whether the strategic emphasis on individual responsibility within food safety campaigns, particularly through self-persuasion techniques, significantly improve consumer engagement with food safety campaigns (reflected by their choices of food safety campaigns over the 'no campaign' option). We expect that food safety campaigns that highlight individual responsibility and employ self-persuasion techniques (i.e., questioning) are more likely to influence consumers food handling behaviour, thereby increasing the overall effectiveness of public health interventions in reducing food-borne illnesses.

This first paper contributes empirical evidence on the significance of individual responsibility in the context of food safety risk communication which, at the moment, in an under-explored area within food risk communication literature. It investigates the novel aspect of framing effects in responsibility prompts (statement vs. question) on consumer choices food safety campaigns, providing insights into the effectiveness of self-persuasion techniques in food safety communication strategies. By employing a discrete choice experiment and data analysis methodology, the study adds methodological value by capturing consumer choices of food safety campaigns and how they vary given different communication approaches.

The insights from this paper could lead to further research questions exploring the psychological mechanisms behind the effectiveness of different framing techniques in risk communication and their broader applicability in other public health domains. Policy-

driven research could further investigate the scalability of these communication strategies across diverse demographics and cultural contexts, evaluating their impact on a wider range of public health challenges. The combination of empirical findings and theoretical insights from this study provides a foundation for developing comprehensive risk communication strategies that incorporate principles of behavioural economics and psychology to maximize their impact on consumer behaviour.

The second study of this thesis investigates the influence of additional knowledge and its framing on individuals' consideration of choice alternatives in stated choice experiments, particularly within the context of food safety campaigns aiming to reduce the number of food-borne cases in Scotland. Further, it aims to examine the efficacy of adjunct questions in enhancing information processing, preference elicitation, and welfare estimation in the context of stated choice experiments. To capture how additional knowledge and its framing influence individuals' choices of food safety campaigns we designed a stated choice experiment that requires respondents to choose between different food safety campaigns. Respondents are randomly assigned to either a control group, whereby information about the consequences of a food-poisoning case is presented to them as a statement, or a treatment group, where the same information is conveyed to them using an adjunct question with a direct instructive effect.

From a methodological perspective, the second study aimed to add to the understanding of how additional knowledge about the choice task objective and its framing, particularly through the use of adjunct questions, influence the individuals' consideration sets and choices in stated choice experiments. We hypothesise that the provision of additional knowledge, especially when framed as adjunct questions, significantly influences the alternatives that individuals consider in a choice task, leading to more informed and reflective choices. Moreover, by prompting individuals to think about and engage with the information presented, the use of adjunct will enable the recall and processing of relevant information, thereby affecting individuals' choices and their welfare estimates.

From a policy perspective, this paper tested whether one possible lead to the optimization of knowledge dissemination and communication strategies can be through the use of

adjunct questions and tailored information framing. We expect that communication strategies that are tailored to individual differences in prior knowledge and that employ adjunct questions to stimulate engagement and self-generated reasoning can improve decision-making processes in food safety, leading to more effective public health outcomes.

This paper contributes to the understanding of information processing heuristics in stated choice experiments, particularly in the context of food safety communication strategies aiming to reduce the number of food-borne cases. It introduces the concept of adjunct questions (prequestions) in stated choice experiments, investigating their impact on consideration sets and information processing strategies, which is a novel approach in this field. The research provides empirical evidence on how the framing of additional knowledge and the use of adjunct questions influence individuals' choices and welfare estimates in stated choice experiments, filling a gap in the literature regarding the role of knowledge and information presentation in consumer decision-making processes.

The findings from this study could lead to further exploration of the psychological and cognitive mechanisms behind the processing of adjunct questions and their impact on decision-making in various public health contexts. Policy-focused research could delve into the tailoring of communication strategies based on demographic and cognitive differences among target populations, enhancing the efficacy of public health campaigns. The integration of insights from consumer behaviour, social psychology, and educational theory in this paper lays the groundwork for developing interdisciplinary approaches to public health communication and policy design.

The main objective of the third study was to investigate the prevalence, magnitude, and direction of hypothetical bias (HB) in stated preference studies, particularly focusing on two HB mitigation techniques: inferred valuation and Bayesian truth serum. Further, it aimed to investigate the effectiveness of these techniques in reducing HB across different choice contexts: baseline, health, and environmental conditions. This was done to understand if and how health and environmental information, presented alongside HB mitigation techniques, influences consumer preferences and valuations for meat and plant-based food alternatives. To provide insights on respondents' behaviour for the two different hy-

pothetical bias mitigation methods, inferred valuation and Bayesian Truth Serum, we collect stated preference data in three main experimental settings: control (C), inferred valuation (IQ), and Bayesian truth serum (BTS). All participants in each experimental scenario were presented with identical choice tasks. However, prior to the decision-making tasks, we provided participants in each group with different background information, focusing on the impact of meat consumption on health and environment. The three conditions were: (1) baseline condition, in which participants were provided no additional information; (2) health condition, in which participants were provided additional information regarding the impact of meat consumption on health; and (3) an environmental condition, in which participants were provided additional information regarding the environmental impact of meat consumption. In total, we established nine distinct experimental conditions, arising from the combination of these three by three factors (3x3).

From a methodological perspective, looked at two of the understudied mitigation methods – inferred valuation, and Bayesian Truth Serum – within different choice contexts. Additionally, from the contextual point of view, this approach aimed to add to the understanding of how consumer preferences vary when considering the health and environmental impact of meat consumption. We hypothesise that the effect of the investigated HB mitigation techniques will vary across different choice contexts (baseline, health, environmental), influencing the accuracy and reliability of stated preference data.

From a policy perspective, this paper shows if and how the integration of health and environmental information, alongside effective HB mitigation techniques, can align consumers' food choices with public health and environmental policy objectives, particularly in terms of reducing meat consumption. We expect that, tailored communication strategies that incorporate health and environmental impacts of meat consumption, can significantly influence some consumers' preferences towards less meat and more plant-based consumption, supporting policy objectives related to public health and environmental sustainability.

This paper contributes to the ongoing discussion on hypothetical bias by investigating two less researched HB mitigation techniques within discrete choice experiments. It pro-

vides empirical evidence on the context-specific effectiveness of inferred valuation and Bayesian truth serum in mitigating HB and offers insights into how these techniques impact the accuracy of stated preference data. Furthermore, this study contributes to an improved understanding of the standpoint from which consumers are more likely to consider reducing their meat consumption, which can also help policymakers to pitch their messages in campaigns that target meat versus plant-based food consumptions.

The findings from this study could lead to further exploration of how different informational contexts and HB mitigation techniques interact, shaping consumer preferences and decision-making processes in the realm of food consumption. Policy-focused research could delve into the development and testing of targeted and context-specific communication strategies to promote healthier and more environmentally sustainable food choices among consumers. The integration of findings from this study offers a comprehensive approach to understanding and addressing hypothetical bias in stated preference studies, with significant implications for the design of more effective public health and environmental policies.

Outline of the thesis

The thesis is structured as follows. The scope, methodology, study design, models, results, and conclusions of three studies are outlined separately in the three following chapters. The final chapter summarises and concludes the thesis with key findings, contributions, policy implications, limitations, and identifies possible future extensions.

Ethics

The ethical approvals of this research are obtained from the University of Stirling's General University Ethics Panel in 2017 and 2022. Copies of the ethical approvals, surveys, electronic consent forms, and participant information sheets are included in Appendix.

Chapter 2

The role of prompting food safety responsibility on individuals' choices of food safety campaigns

Communicating food safety and risk information to consumers is important if food-borne illnesses and their health consequences are to be reduced. Despite the widespread use of risk-communication strategies and food-safety campaigns to achieve this aim, incidences of food-borne illnesses remain high. We propose a new method to test if and how prompting individuals of their responsibility to reduce the risk of getting food poisoning is likely to influence their food-safety campaign choices. We demonstrate that responsibility prompts before choice tasks affect the choice probability of a given food-safety campaign being selected, and that food-safety campaign choices vary between demographic groups. The implications of these findings for policy interventions are discussed.

2.1 Introduction

Communicating food safety and risk information to consumers is important if public health policies that aim to reduce the number of food-borne illnesses and their health consequences are to be effective. However, despite the widespread use of risk-communication strategies and awareness campaigns, food-borne illness. Notwithstanding personal pain and suffering, these food-borne illnesses contribute to high economic costs and, in extreme cases, they can cause death (Rigby et al., 2017; Holland et al., 2020). Evidence from consumer studies points to a lack of awareness and knowledge of food-safety risks and appropriate food-handling practices – how a consumer handles, cooks, and stores their food (Medeiros et al., 2004; Brennan et al., 2007; McCarthy and Brennan, 2009; Cope et al., 2010; Barnett et al., 2011). 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 (Murray et al., 2017; Flynn et al., 2018). Additionally, what constitutes an effective information campaign, and what factors influence its effectiveness, must be known.

Numerous studies have investigated the effectiveness of previous food safety campaigns and noted that their design has often been based on findings of technical risk-assessments (Medeiros et al., 2001; Cope et al., 2010; Jacob et al., 2010; Nesbitt et al., 2014; Janjić et al., 2016; Murray et al., 2017). However, an individual's perception of risk, intention to engage with messages included in a communication strategy, and attitude towards food safety and recommended safe practices also affect the effectiveness of risk-communication strategies (Schroeder et al., 2007; Hornick et al., 2013; Nan et al., 2017; Mucinhato et al., 2022). So too can a consumer's understanding of risks and consequences of not mitigating them, misinformed views of food safety, individual habits, and personal (in)experience with the risks and resistance to behaviour change (Verbeke et al., 2007; Brewer and Rojas, 2008; Redmond and Griffith, 2009; Kendall et al., 2013; FSA, 2014; Farrell et al., 2015). Of these factors, there has been limited research on the role of consumers in ensuring their food safety (e.g., individual responsibility, self-generation of arguments to reduce the risks of food poisoning). While the influence of individual responsibility on health inequality and irresponsible (i.e., risk taking) behaviour has been examined (Roemer, 1993; Cappelen and Norheim, 2005; Dolan and Tsuchiya, 2009; Covey et al., 2010), its influence on food-risk communication has not.

Given the policy requirements of finding new ways to improve the effectiveness of food safety campaigns, this paper looks into how new risk communication strategies can be designed to positively influence consumer behaviour. Hence, we used a stated preference elicitation technique (a discrete choice experiment) to empirically explore consumers' choices of food safety campaigns that differ by their delivery format, frequency and style. Based on recent literature developments, our experimental design includes a control and two treatments.

First, we build upon aspects of the risk-communication and individual responsibility literature to assess the role of individual responsibility within the context of choosing

between different food safety campaigns or choosing no campaigns. Specifically, we aim to test the effect of emphasizing that food risks can only be reduced if consumers adopt safe food-handling practices; hence their individual responsibility (hereafter called responsibility prompt) impact on the trade-offs between different food safety campaigns.

Second, given that recent developments in the literature of warning messages have shown that self-persuasion techniques (i.e. allow consumers to self-generate their arguments), such as questions, can be effective in influencing individuals' attitudes and behaviour (Aronson, 1999; Briñol et al., 2012; Müller et al., 2016), we develop two treatments, and frame the same responsibility prompt in two ways:

(1), Treatment Statement (TS), for which the responsibility prompt is framed as a statement allowing for direct persuasion:

"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."

and (2), Treatment Question (TQ), for which the responsibility prompt is framed as an agree/disagree question allowing for self-persuasion:

"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. Please indicate the extent to which you agree or disagree with this statement[1]*."*

The control setting does not include a responsibility prompt, hence it is used as a baseline.

Participants in each treatment are presented with two food-safety campaigns and a 'none of them' option (status quo). They are then required to choose between them in a sequence of choice tasks. Before each choice task, the prompt about a participant's responsibility to ensure food safety was included. We evaluate how the two types of prompt, question or statement, can influence consumers' choices based on the data collected using a web-based survey. To investigate the differences in consumers' choices under these different experimental settings, random parameter logit (RPL) models with shifters and

[1] Response range: Strongly agree; Agree; Neither agree/disagree; Disagree; Strongly disagree; Do not know

correlation were estimated. In addition, we use a multiple linear regression (MLR) to analyse how these choices vary with respect to consumers' different characteristics.

We hypothesise that introducing a responsibility prompt (regardless of its framing) will increase consumer choices of food-safety campaigns relative to a "no campaign" option. This hypothesis is based on previous empirical evidence suggesting that feeling responsible for the outcome of specific behaviour choices has a positive impact on individuals' behaviour (Le Clainche and Wittwer, 2015; Borges et al., 2017; Evans et al., 2017; Pinho and Borges, 2019). In addition, we hypothesise that the likelihood of a campaign being chosen will increase when the responsibility prompt is framed as an agree/disagree question rather than a statement (Sprott et al., 2006; Loman et al., 2018). Our results generally suggests that, regardless of its framing, a responsibility prompt can be effective in influencing consumers' campaign choices. Additionally, we show that these choices vary with respect to consumer socio-economic characteristics, attitudes toward food risks, knowledge, and previous experiences with food-safety issues.

Further, our paper contributes to the literature on risk-communication guidance specific to food safety by providing empirical evidence for the role of individual responsibility and the effect of differently framed responsibility prompts on consumers' choices of a food safety campaign. Additionally, we provide guidance regarding the characteristics that such campaigns should meet to be perceived by consumers as likely to change their food-handling behaviour. Moreover, by analysing campaign choices under different experimental settings, we can assist policy makers in their endeavours to design targeted risk-communication strategies that aim to improve public health by delivering meaningful information to relevant groups of consumers.

The remainder of this paper is organised as follows. First, we present the theoretical background of our study by examining existing research on risk communication strategies, individual responsibility, and consumer behaviour. Next, the methodology used in this study is described. We then present the results and their implications. Finally, conclusions are followed by future research opportunities.

2.2 Prompting individual's responsibility in risk communication strategies

An effective risk-communication strategy can increase consumer awareness of a specific risk, and enables the consumer to adjust their (in)actions according to its recommendations (Ippolito and Mathios, 1991; Pechmann and Reibling, 2000; Thrasher et al., 2004; Rucker and Petty, 2006). Various factors (e.g., conflicting or uncertain information, inconsistent messages) can negatively impact the effectiveness of these strategies (McCarthy and Brennan, 2009; Regan et al., 2014; Powell and Chapman, 2016).The consequences of a poorly designed communication strategy include distrust in the information source (Ding et al., 2012), and confusion regarding a campaign's key messages. This, in turn, might affect an individual's engagement with the key message or information (McCluskey and Swinnen, 2004; Verbeke, 2005; Verbeke et al., 2007).

There are various measures that can be implemented to increase individuals' engagement with the key messages. For example, in the early 1920s in the United States of America, the number of deaths of children in home accidents decreased because of safety campaigns that emphasized a family's responsibility for their child's safety (Roberts et al., 1993). Local authorities and voluntary organisations in the United Kingdom then adopted this practice in their child safety campaigns. Additionally, unless consumers feel responsible for the financial costs of their healthcare, they will not actively engage in reducing the risk factors in their lifestyle (Miraldo et al., 2014). In this case, more sustainable public health spending might be achieved if individuals felt responsible for the financial cost of the healthcare that their engagement with risky health behaviours caused (Buchanan, 2011; Le Clainche and Wittwer, 2015; Pinho and Borges, 2019). Despite considerable research on the relationship between irresponsible behaviour and health resource allocation (Buchanan, 2011; Van der Star and Van den Berg, 2011; Borges et al., 2017; Pinho and Borges, 2019), to the best of our knowledge, no study has explored how prompting individual responsibility can influence the efficacy of a food-safety campaign.

Communication strategies should support an individual's action regarding their health, and prompt an individual to take more responsibility for better health-related choices

(Forde and Raine, 2008). However, leveraging personal responsibility through public health policies requires an authority to create an appropriate environment that will foster and support an individual's acknowledgement related to their own responsibility Brownell et al. (2010). Along these lines, research has analysed if and how the communication strategies used to engage both personal and social responsibility can increase the effectiveness of policy actions to reduce rates of obesity (Niederdeppe et al., 2014). Studies on the role of individual responsibility assignment are also found in the area of promoting and enhancing sustainable consumption among consumers. The role of individual responsibility assignment has also been explored to promote and enhance sustainable consumption, with Wells et al. (2011) reporting a clear link between consumers' sense of environmental responsibility and their environmentally related consumption behaviours, and Evans et al. (2017) arguing that individualising consumer responsibility led to an emergent sense of shared and distributed responsibility for more sustainable consumption. Additionally, more sustainable public health spending might be achieved if individuals feel responsible for the financial cost of the healthcare generated by their engagement with risky health behaviours (Le Clainche and Wittwer, 2015; Pinho and Borges, 2019). Hence, understanding the conditions under which consumers engage with key messages has significant theoretical and practical implications (Gollust and Cappella, 2014).

Within the food safety context, Kastner (1995) discussed the critical role that consumers played in ensuring food safety, and, thus, a requirement that they acknowledge their personal food-safety responsibility. Although most consumers agree that their decisions and actions impact their food-poisoning risk, consumers with neutral attitudes toward food-safety responsibility are less likely to follow safe food-handling practices (Unklesbay et al., 1998). Additionally, recent studies on consumer attitudes and food safety perceptions showed that individuals consider consumers to be the least responsible for ensuring appropriate food-safety behaviour (Franc-Dabrowska et al., 2021; Larson, 2021). Older individuals are also more aware of their responsibility for food safety, but this awareness is obscured by perceptions of personal invulnerability, optimistic bias, and an illusion of control (Evans and Redmond, 2019). Despite these findings and evidence

from a body of research on the effectiveness of public health policies (Buchanan, 2011; Van der Star and Van den Berg, 2011; Miraldo et al., 2014; Le Clainche and Wittwer, 2015; Borges et al., 2017; Pinho and Borges, 2019), individual responsibility has yet to be examined in food-safety campaigns.

While communicating consumers' individual responsibility to ensure food safety can increase campaign engagement, how this responsibility is communicated can affect the campaign response. However, there is still a gap in the literature on how best to uncover individual responsibility in communication strategies. Previous research has noted that the drawback of communication strategies directed at informing and educating individuals is partly caused by their use of direct forms of persuasion (such as statements and arguments exposure) and their failure to convey risk and safety information (Rucker and Petty, 2006). While providing arguments and clear, evidence-based information using statements is the conventional way for key messages to be delivered, this approach is limited in its ability to prompt individuals to engage with a message (Müller et al., 2009). For instance, using statements to deliver arguments against risky behaviour, or simply requesting individuals change their behaviour, can generate reactance to persuasion (an emotional reaction to pressure or persuasion that results in the strengthening or adoption of a contrary belief), which can lead to wasted communication efforts (Agostinelli and Grube, 2003; Bernritter et al., 2017).

Indirect forms of persuasion (e.g., door-in-the-face (Cialdini et al., 1975), low-ball (Cialdini et al., 1978), disrupt-than-refrain techniques (Fennis et al., 2004), metaphorical claims (McQuarrie and Phillips, 2005)) have been shown to be more subtle than direct forms, and less likely to trigger reactance to a communication strategy (Rothman et al., 2001; Fransen et al., 2015).

Self-persuasion, a form of indirect persuasion, has recently been shown to be more effective at changing behaviours. The distinct benefit of self-persuasion is that it allows individuals to freely generate their own arguments about the specific message included in the communication strategy (Briñol et al., 2012; Bernritter et al., 2017). Using questions while delivering a message has been used as a self-persuasion technique in the health

behaviour and addiction research focusing on smoking or alcohol consumption. For example, Glock et al. (2013) reported that warning labels formulated as questions positively influenced perceptions of smoking-related risk, and Müller et al. (2016) reported such questions positively influenced short-term smoking behaviour. Moreover, Loman et al. (2019) emphasized the importance of allowing individuals to choose to engage freely with the behaviour targeted by a communication strategy when using a self-persuasion technique. This freedom of choice is granted for communication strategies that deliver messages using questioning as a self-persuasion technique. However, despite its popularity in research on health behaviour and addiction, self-persuasion has received little attention in other areas, including food safety.

2.3 Methodology

In this study, the means we measure individuals' views on food safety and risk communication strategies are unique and distinct from previous research. Previous studies have typically relied on questions that are specific to a certain channel of communication such as fact sheets (Burger and Waishwell, 2001), local news media (Fleming et al., 2006) and television (Patrick et al., 2007) and use Likert-type scale statements to evaluate individuals' attitudes that can affect the effectiveness of food safety communication strategies (Redmond and Griffith, 2005).

Instead, this research considers attributes of communication campaigns by utilising discrete choice experiments (DCE). It has been shown that this approach has a higher predictive power and can reduce inconsistent behaviours (i.e., fatigue, scale-use bias) associated with rating tasks via the use of Likerts scales (Cohen and Orme, 2004; Campbell et al., 2015; Yang et al., 2021). Not surprisingly, DCEs have been used in numerous studies aiming to contribute to planning and resource allocation in areas of research ranging from studies in transport economics (Li et al., 2020) to studies in environmental economics (Adamowicz et al., 1994), health economics (Telser and Zweifel, 2007) and consumer economics (Alemu and Olsen, 2018).

2.3.1 Study design

Our experiment required participants to consider two food safety campaigns and select the one that they thought would be the most influential campaign in terms of changing their food handling behaviour. The campaigns are described by three attributes, including 'how the campaign is delivered', 'when it is delivered', and, 'its style'. These attributes and their levels are presented in Table 3.1. Attributes and their levels were determined from a comprehensive literature review (e.g., Brewer and Rojas, 2008; Kher et al., 2013; Feng et al., 2016; Frewer et al., 2016), consultations with national policymakers in Scotland, and series of focus-groups discussions with participants from different socio-demographic backgrounds. Direct interaction with focus-group participants enabled their thoughts, feelings and experiences related to food safety and risk communication strategies to be identified, including recent campaigns and other sources of information, and to identify points and issues that were unapparent from our literature review.

Our survey was tested in nine think-aloud interviews[2]. This helped us to identify the participants' thoughts and opinions on the meaning, clarity, and complexity of questions, and to assess possible survey design issues such as the framing of the concepts, time required to complete the survey, and any points that may be irrelevant to participants. Subsequently, we piloted the survey and fine-tuned the study design before finally fielding it.

The final survey included the discrete choice tasks, questions on consumer opinions, attitudes and knowledge related to food safety issues and, socio-demographic questions. The stated choice experiment consisted of eight choice tasks. Each choice task was composed of two hypothetical food safety campaigns labelled as "Campaign 1" and "Campaign 2", and an option of "no campaign". We included the "no campaign" as a status-quo option to reflect real choice situations where respondents are free to choose none of the presented campaigns as their preferred campaign that they believe would influence their

[2]Think aloud is a qualitative research method that requires participants to speak aloud any thoughts they have while completing a task. The Think Aloud research method has a sound theoretical basis and acts as a validating tool for the tasks that participants are required to complete while thinking aloud (Hagen et al., 2008)

Table 2.1.: 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)[b]; 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)[b];
The campaign style	it uses facts and figures (FF)[b]; it uses someone else's experience (EE); it uses humorous cartoons or fictional characters (HC); it uses snappy slogans (SS).

[b] Base level.

food handling behaviour (Swait and Adamowicz, 2001). An example of a choice task can be seen in Figure 2.1. Prior to presenting the choice tasks to participants, we provided them with a detailed description of the food safety campaign attributes **(see survey in Appendix)**.

The experimental design of the discrete choice experiment, which refers to the specific combinations of attributes and their levels presented to consumers, was comprised of 10 blocks (versions), each having eight choice tasks. Each block was generated using an orthogonal main-effects design, in which attribute levels are chosen independently of other attribute levels, so that each attribute level's effect (utility) may be measured independently of all other effects. Orthogonality ensures one-way and two-way frequency balance. The one-way frequencies exploration showed that the survey design was almost perfectly balanced as six items out of eight corresponding to the two attributes with four levels in our survey were displayed 40 times across all blocks of the surveys, with the other two being displayed 41, respectively 39 times. Similarly, each item corresponding to the attribute with two levels in our survey was displayed 80 times across all blocks of the surveys. Two-way frequencies showed that the survey had a nearly orthogonal main-effects design, in which each item appeared 14.4 times on average with every other item, with a standard deviation of 1.28. The last feature of the orthogonal design is the connec-

tivity between choice tasks. After ensuring a balanced and nearly orthogonal main-effects design, the choice tasks were presented to respondents in a random order. Respondents are then asked to make a series of trade-offs between different campaign options that they consider likely to influence individuals' food handling practices. The same main-effects orthogonal experimental design was used to generate the combination of choice tasks in all three settings (control, treatment with statement and treatment with question).

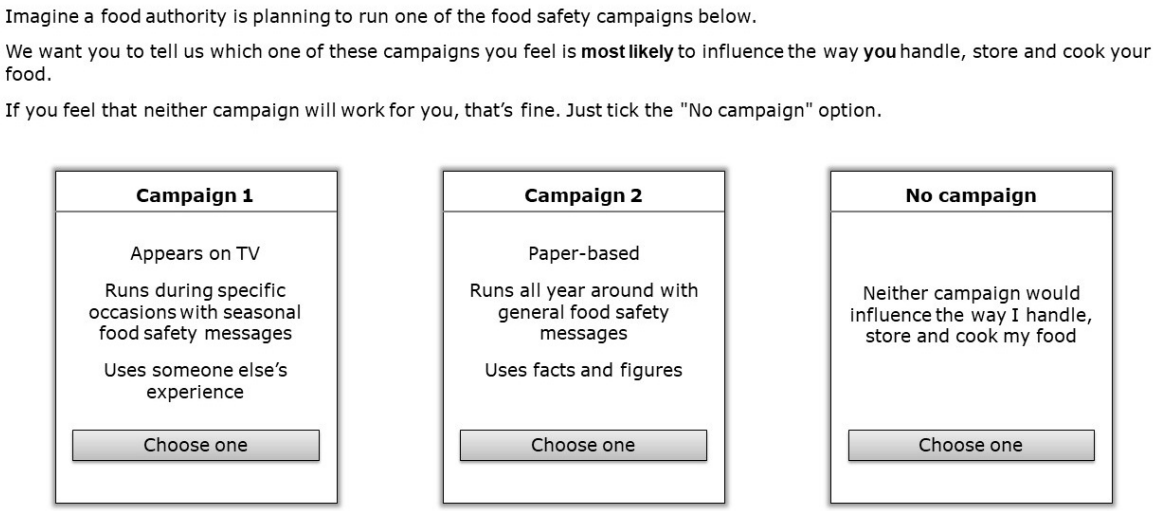

Figure 2.1.: A choice task example

2.3.2 Data collection and sample

The choice data was collected through a web-based survey administrated to a random sample of 2,343 individuals drawn from the Scottish adult (aged 18+ years) population in 2018[3]. Respondents were recruited using an ESOMAR Regulations compliant survey research company[4] For our experimental setting, respondents were randomly assigned to one of the following three groups: control (C, 807 individuals), Treatment Statement (TS, 787 individuals), or Treatment Question (TQ, 749 individuals). As seen from Table 2.2, the sample characteristics are broadly comparable across the three groups (C, TS and TQ). Overall, there was an approximately equal gender distribution in the sample (52%

[3]The study was approved by the General University Ethics Panel of University of Stirling; please see Appendix for approval letter

[4]see http://esomar.org for further details on the ESOMAR regulations

Table 2.2.: Percentage breakdown of individual characteristics by treatment

	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	66	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	2,343

Note: C = Control; TS = Treatment with statement; TQ = Treatment with question.

females). In each, approximately 20% of individuals were aged 18–34 years, and around 44% were >55 years; almost 50% of individuals had a tertiary qualification (Bachelors or higher), and approximately 5% had no tertiary qualification. More than 50% of individuals had experienced a food-borne incident. Nearly half of the individuals regarded their knowledge of how to safely cook their food to be very good, and about the same feel that food safety messages were informative. A low percentage of individuals considered themselves to lack knowledge about how to safely cook their food, and approximately 19% of them regarded food safety messages to be uninformative. Everyone completed eight choice tasks, producing 18,744 observations for choice analysis.

2.3.3 Analysing choices

The data is analysed using probabilistic choice models (Thurstone, 1927; McFadden et al., 1973). In the choice model, it is assumed that the underlying reason for the choice of food safety campaign that is influential on individuals' food handling behaviour cannot be observed with certainty. We observe the choices and the attributes of the alternatives,

but the model incorporates a stochastic component and is written as:

$$U_{nit} = V_{nit} + \varepsilon_{nit}, \tag{2.1a}$$

$$V_{nit} = \beta x_{k_{nit}} \tag{2.1b}$$

where U_{nit} represents the choice of a food safety campaign i that individual n finds most influential in changing their food handling behaviour among J possible campaigns at a choice task t; β is a vector of coefficients corresponding to the attributes of food safety campaigns, $x_{k_{nit}}$ is a matrix denoting the observed characteristics of a campaign chosen in choice task t; and ε_{nit} is the stochastic component of the model assumed independently and identically distributed over the J alternatives.

The specification presented in Eq. 1a assumes homogenous preferences of food safety campaigns across all respondents. To overcome this restrictive assumption and allowing for no-correlation between parameters (as we assumed by design), more flexible models have been developed (Train, 2009; Hensher and Greene, 2003). The Random Parameter Logit – RPL – is one of the models widely recognised as flexible and used in choice data analysis for addressing preference heterogeneity (Czajkowski et al., 2017). However, in the recent developments of the literature it has been highlighted that RPL has mainly been used under the restrictive assumption of uncorrelated random parameters (Mariel and Artabe, 2020). This assumption not only leads to restricted correlation across the estimated coefficients, but also to fixed scale across respondents (Hess and Rose, 2012; Hess and Train, 2017). Moreover, Campbell and Sandorf (2020) noted that allowing for correlation might as well capture the effect of a latent attitude. The common assumption of uncorrelated random parameters predominantly used in the published papers based on RPL is given by the expression $\Gamma = diag(\gamma_{11}, \gamma_{22}, ..., \gamma_{kk})$. In our RPL specification, we assume all parameters are random with a normal distribution and correlated. In this case, the full variance-covariance matrix of the random parameters is:

$$Var(\beta_n) = \Gamma\Sigma\Gamma' \tag{2.2}$$

The random parameters are defined by the following expression for each individual n:

$$\beta_{nk} = \mu_k + \sigma_k \upsilon_{k_n} + \sigma_{k,k-1} \upsilon_{(k-1)_n}, \tag{2.3a}$$

where μ_k and σ_k are, respectively, the mean and standard deviation of the random parameter for attribute k; $\sigma_{k,k-1}$ is the covariance corresponding to attributes k and $k-1$; and, υ_{k_n} and $\upsilon_{(k-1)_n}$ are standard normal deviates.

Additionally, in this paper we investigate the heterogeneity of respondents' choices of food safety campaigns based on the differences in choices that can be determined by the treatment group individual n belongs to: TS – the responsibility prompt delivered as a statement group or TQ – the responsibility prompt delivered as an agree/disagree question group. To capture these possible sources of heterogeneity μ_k and σ_k take the following form:

$$\mu_k = \mu + \zeta_{k_{\mu_{TS}}} \delta_{TS} + \zeta_{k_{\mu_{TQ}}} \delta_{TQ}, \tag{2.3b}$$

$$\sigma_k = \sigma + \zeta_{k_{\sigma_{TS}}} \delta_{TS} + \zeta_{k_{\sigma_{TQ}}} \delta_{TQ}, \tag{2.3c}$$

where μ_k and σ_k are the mean and standard deviation of the taste distributions; $\zeta_{k_{\mu_{TS}}}$, $\zeta_{k_{\mu_{TQ}}}$ and $\zeta_{k_{\sigma_{TS}}}$, $\zeta_{k_{\sigma_{TQ}}}$ are the shifters around the mean and standard deviation, respectively, of the distributions that capture the effects of the two treatments, TS and TQ as opposed to the control condition, on the estimated coefficients. The parameters δ_{TS} and δ_{TQ} are dummy variables taking a value of 1 for individuals belonging to TS group and, respectively, to TQ group. We can rewrite the observed utility in Eq. 1b as in the following equation:

$$V_{nit} = \sum_{k=1}^{K} [(\mu + \zeta_{k_{\mu_{TS}}} \delta_{TS} + \zeta_{k_{\mu_{TQ}}} \delta_{TQ}) + (\sigma + \zeta_{k_{\sigma_{TS}}} \delta_{TS} + \zeta_{k_{\sigma_{TQ}}} \delta_{TQ}) \upsilon_{k_n} + \sigma_{k,k-1} \upsilon_{(k-1)_n}] x_{k_{nit}} \tag{2.4}$$

The conditional probability for individual n of choosing a food safety campaign i among J possible campaigns at a choice task t can be written as:

$$\Pr(i_n|x_n,\beta_n) = \frac{\exp(V_{nit})}{\sum_{j=1}^{J}\exp(V_{njt})} \tag{2.5}$$

The conditional probability that an individual n will choose a sequence of campaigns $y_n = [j_{n1}, j_{n2}, \ldots, j_{nT_n}]$ over the T choice occasions can be expressed as the product of the form in eq. 4. Under the RPL, the unconditional choice probability is the integral of this product over all values of individual specific βs weighted by their $f(\beta|\theta)$ density function, as expressed in Eq. 5:

$$\Pr(y_n|x_n,\theta) = \int \left(\prod_{t=1}^{T=8} \frac{\exp(V_{nit})}{\sum_{j=1}^{J}\exp(V_{njt})} \right) f(\beta|\theta)d\beta, \tag{2.6}$$

where $f(\beta|\theta)$ is the normal density with θ parameters of the distribution (i.e. mean and standard deviation). Following, we maximized the log-likelihood of Eq. 5, using simulated maximum likelihood estimation with 1000 Sobol draws, as shown in Eq. 6. The analysis in our study was performed in R (R Core Team, 2017) using the Apollo package (Hess and Palma, 2019).

$$LL_\theta = \sum_{n=1}^{N} [\ln \Pr(y_n|x_n,\theta)] \tag{2.7}$$

2.4 Results

2.4.1 Descriptives of observed choices and consideration sets

We start our data analysis by looking into the observed choices and potential consideration sets for each group of individuals, as presented in Table 2.3. The breakdown by choices is the summary of the share of choices for each alternative, whereas the breakdown by consideration set alternatives is the summary of the proportion of individuals' choices that correspond to a specific choice rule. This is done with the aim of identifying the effect of

the three different experimental settings (i.e. control, treatment statement and treatment question) on individuals' choices of food safety campaign. We observe that participants in both treatment groups choose "no-campaign" less than participants in control group. This is more prominent in treatment question, where we introduced the responsibility prompt framed as a question, rather than as a statement. This supports our conjecture that the question framing positively influences individuals' choices of a food safety campaign.

Differences between treatments in the shares of "no-campaign" choices are statistically significant (χ^2 test, $p < 0.001$), suggesting that a responsibility prompt (framed as a statement or question) increases the likelihood of a consumer choosing a campaign that they consider will more likely influence their food-handling behaviour. This is an important finding since it has implication on showing how, depending on its framing, that information communicated via a food-safety campaign can affect a consumer's food-safety campaign choice, and, ultimately, their engagement with that campaign.

Table 2.3.: Observed shares for control and experimental treatments

	C	TS	TQ
Number of choices	6,456	6,296	5,992
Number of respondents	807	787	749
Breakdown by choices			
No-campaign	1,846 (29%)	1,688 (27%)	1,403 (23%)
Alternative 1	2,286 (35%)	2,310 (38%)	2,378 (40%)
Alternative 2	2,324 (36%)	2,298 (37%)	2,211 (37%)
Breakdown by respondents' consideration sets of the available alternatives			
Only "no-campaign" alternative chosen	111 (14%)	102 (13%)	70 (9%)
Any campaign alternative chosen	345 (43%)	366 (47%)	372 (50%)
All chosen	351 (44%)	319 (40%)	307 (41%)

Note: C = Control; TS = Treatment with statement; TQ = Treatment with question.

In addition to the observed choices, we also looked at the potential consideration sets to analyse whether or not the treatment effects continues to hold under three possible choice behaviours: (1) participants always choose "no-campaign" in all choice tasks; (2) participants always choose one of the hypothetical alternatives presented (i.e., "Campaign 1" or "Campaign 2") in all choice tasks; and (3) participants choose a mixture of "no-campaign" and hypothetical alternatives throughout the choice tasks. As seen from

the Table 2.3, the number of participants who always consider choosing "no-campaign" in all eight choice tasks was higher in control groups, as compared to both treatments $(111(C) > 102(TS) > 70(TQ))$. Noteworthy that the respective reduction in the share of participants who always consider the "no-campaign" was considerably higher for the second treatment (i.e., 41 fewer participants always choose "no-campaign" in TQ). By testing the significance of the differences between treatments for the analysed consideration sets, we find that these differences are statistically significant at the 5 percent significance level $(p < 0.019)$. This provides evidence that a responsibility prompt, framed as either a statement or a question, decreases the likelihood of consumers considering only the "no campaign" alternative. Moreover, we found that the difference between control and treatment question is significant at 1 percent significance level $(p < 0.001)$. These findings signal differences in treatments compared to control group. More importantly, it indicates that framing the information as a question leads to a substantial increase in the share of individuals who consider choosing and deeming a food safety campaign as likely to change their food handling and cooking practices.

2.4.2 Model estimation results

With the purpose of exploring the role of responsibility prompts and their formats in consumers' choices of a food safety campaign and so, how and for whom these prompts change the campaigns' choices, we pooled the data from the three groups of respondents: control (C), treatment statement (TS) and treatment question (TQ) and used shifters for TS – the responsibility prompt delivered as a statement and shifters for treatment TQ – the responsibility prompt delivered as an agree/disagree question. Prior to conducting the analysis on the pooled data set, it was necessary to test if the scale variances between the three groups are different from zero and statistically significant.[5]. This test gives us indication on whether or not we have to consider the variances of error terms of each

[5] Although the scale factor of the Gumbel errors is typically unidentifiable in any particular empirical data set, we can identify the the ratio of the scale between different data sets (Swait and Louviere, 1993); this can be done by normalising the variance in one treatment group (i.e. setting it to $\pi^2/6$) and then estimating the variance in one treatment relative to the normalised one. For more information on scale see Swait and Louviere (1993) and Train (2009).

condition group when analysing the pooled data. Thus, following Swait and Louviere (1993) and Louviere et al. (2000) we test and reject the joint null hypothesis that the preference structures are equivalent across all three groups, namely control, treatment statement and treatment question. That is, the usage of responsibility prompts and their framing have an influence on consumers' choices of a food safety campaign and the group of consumers that received the responsibility prompt as a question appears to have the lowest variance relative to the other two groups [6]. In other words, chi-squared test showed that C, TS and TQ have significant scale differences.

We continue our data analysis by investigating how the responsibility prompts and their framing affect consumers' choices when we assume preference heterogeneity via the RPL with shifters and RPL with shifters and correlation. Results are presented in Table 2.4 [7].

According to the RPL with shifters model results presented in Table 2.4(a) the Control group reveals that, all else being equal, consumers, on average, prefer a food safety campaign delivered on TV ($\hat{\mu}_{TV}$), all year around with general food safety messages ($AY - baseline$) that uses someone else's experience as style ($\hat{\mu}_{EE}$). Also, the RPL with shifters model results show that, all else being equal, consumers, on average, are less likely to choose to not have a food safety campaign ($\hat{\mu}_{SQ}$) as opposed to have a campaign run by the food authorities. Following, by comparing the mean shifters corresponding to each treatment (control, treatment statement and treatment question), the results confirm the existence of preference heterogeneity across consumers' groups. Additionally, we observe that, in terms of heterogeneity around the mean of the choice distribution, TQ (i.e. the responsibility prompt delivered as an agree/disagree question) determine a

[6] Scale values: C relative to TS $= 0.967$; C relative to TQ $= 0.849$; TS relative to TQ$= 0.88$; all significant at 1 percent significance level ($p < 0.001$).

[7] Labels: $\hat{\mu}_{SQ}$, $\hat{\sigma}_{SQ}$, $\hat{\mu}_{TV}$, $\hat{\sigma}_{TV}$, $\hat{\mu}_{AO}$, $\hat{\sigma}_{AO}$, $\hat{\mu}_{WB}$, $\hat{\sigma}_{WB}$, $\hat{\mu}_{SO}$, $\hat{\sigma}_{SO}$, $\hat{\mu}_{EE}$, $\hat{\sigma}_{EE}$, $\hat{\mu}_{HC}$, $\hat{\sigma}_{HC}$, $\hat{\mu}_{SS}$, $\hat{\sigma}_{SS}$, where μ_k and σ_k are, respectively, the mean and standard deviation of the estimated coefficients and $\hat{\zeta}_{SQ_{\mu_{TS/TQ}}}$, $\hat{\zeta}_{SQ_{\sigma_{TS/TQ}}}$, $\hat{\zeta}_{TV_{\mu_{TS/TQ}}}$, $\hat{\zeta}_{TV_{\sigma_{TS/TQ}}}$, $\hat{\zeta}_{AO_{\mu_{TS/TQ}}}$, $\hat{\zeta}_{AO_{\sigma_{TS/TQ}}}$, $\hat{\zeta}_{WB_{\mu_{TS/TQ}}}$, $\hat{\zeta}_{WB_{\sigma_{TS/TQ}}}$, $\hat{\zeta}_{SO_{\mu_{TS/TQ}}}$, $\hat{\zeta}_{SO_{\sigma_{TS/TQ}}}$, $\hat{\zeta}_{EE_{\mu_{TS/TQ}}}$, $\hat{\zeta}_{EE_{\sigma_{TS/TQ}}}$, $\hat{\zeta}_{HC_{\mu_{TS/TQ}}}$, $\hat{\zeta}_{HC_{\sigma_{TS/TQ}}}$, $\hat{\zeta}_{SS_{\mu_{TS/TQ}}}$, $\hat{\zeta}_{SS_{\sigma_{TS/TQ}}}$ are the shifters around the mean and standard deviation, respectively, of the distributions that capture the effects of the two treatments, TS and TQ as opposed to the control condition, on the estimated coefficients as follows: SQ – status-quo; TV – campaigns that appear on TV, AO – campaigns aired on radio, WB – web based campaigns, PB – paper based campaigns which is the baseline of the "How the campaign is delivered" attribute; SO – seasonal campaigns, AY – all year around campaigns which is the baseline of the "When the campaign runs" attribute; EE – campaigns that use someone else's experience, HC – campaigns that use humorous cartoons or fictional characters, SS – campaigns that use snappy slogans, FF – campaigns that use facts and figures which is the baseline of the "The campaign style" attribute.

Table 2.4.: Estimation results

(a) RPL with shifters

Control							
Mean	Estimate		Std. Error	*Std. dev*	Estimate		Std. Error
$\hat{\mu}_{SQ}$	-1.17	***	0.19	$\hat{\sigma}_{SQ}$	5.12	***	0.27
$\hat{\mu}_{TV}$	2.22	***	0.13	$\hat{\sigma}_{TV}$	2.1	***	0.14
$\hat{\mu}_{AO}$	-0.81	***	0.10	$\hat{\sigma}_{AO}$	1.83	***	0.13
$\hat{\mu}_{WB}$	-0.18	*	0.09	$\hat{\sigma}_{WB}$	1.82	***	0.12
$\hat{\mu}_{SO}$	-0.10	**	0.04	$\hat{\sigma}_{SO}$	0.43	***	0.06
$\hat{\mu}_{EE}$	0.12	*	0.06	$\hat{\sigma}_{EE}$	0.5	***	0.11
$\hat{\mu}_{HC}$	-0.08		0.07	$\hat{\sigma}_{HC}$	0.85	***	0.10
$\hat{\mu}_{SS}$	-0.15	**	0.06	$\hat{\sigma}_{SS}$	0.53	***	0.12
TS							
Mean shifters				*Std. dev shifters*			
$\hat{\zeta}_{SQ_{\mu_{TS}}}$	-0.37		0.28	$\hat{\zeta}_{SQ_{\sigma_{TS}}}$	0.06		0.37
$\hat{\zeta}_{TV_{\mu_{TS}}}$	-0.13		0.17	$\hat{\zeta}_{TV_{\sigma_{TS}}}$	0.20		0.19
$\hat{\zeta}_{AO_{\mu_{TS}}}$	0.14		0.14	$\hat{\zeta}_{AO_{\sigma_{TS}}}$	0.06		0.18
$\hat{\zeta}_{WB_{\mu_{TS}}}$	0.16		0.13	$\hat{\zeta}_{WB_{\sigma_{TS}}}$	0.04		0.17
$\hat{\zeta}_{SO_{\mu_{TS}}}$	0.00		0.05	$\hat{\zeta}_{SO_{\sigma_{TS}}}$	0.11		0.08
$\hat{\zeta}_{EE_{\mu_{TS}}}$	-0.14		0.09	$\hat{\zeta}_{EE_{\sigma_{TS}}}$	0.10		0.16
$\hat{\zeta}_{HC_{\mu_{TS}}}$	0.21	**	0.09	$\hat{\zeta}_{HC_{\sigma_{TS}}}$	0.01		0.13
$\hat{\zeta}_{SS_{\mu_{TS}}}$	-0.01		0.09	$\hat{\zeta}_{SS_{\sigma_{TS}}}$	0.06		0.20
TQ							
$\hat{\zeta}_{SQ_{\mu_{TQ}}}$	-0.78	**	0.28	$\hat{\zeta}_{SQ_{\sigma_{TQ}}}$	0.65	*	0.31
$\hat{\zeta}_{TV_{\mu_{TQ}}}$	-0.10		0.17	$\hat{\zeta}_{TV_{\sigma_{TQ}}}$	0.30	*	0.18
$\hat{\zeta}_{AO_{\mu_{TQ}}}$	0.06		0.13	$\hat{\zeta}_{AO_{\sigma_{TQ}}}$	0.15		0.18
$\hat{\zeta}_{WB_{\mu_{TQ}}}$	0.14		0.13	$\hat{\zeta}_{WB_{\sigma_{TQ}}}$	0.05		0.17
$\hat{\zeta}_{SO_{\mu_{TQ}}}$	0.03		0.05	$\hat{\zeta}_{SO_{\sigma_{TQ}}}$	0.21	**	0.08
$\hat{\zeta}_{EE_{\mu_{TQ}}}$	0.00		0.09	$\hat{\zeta}_{EE_{\sigma_{TQ}}}$	0.39		0.26
$\hat{\zeta}_{HC_{\mu_{TQ}}}$	-0.06		0.09	$\hat{\zeta}_{HC_{\sigma_{TQ}}}$	0.15		0.13
$\hat{\zeta}_{SS_{\mu_{TQ}}}$	-0.03		0.09	$\hat{\zeta}_{SS_{\sigma_{TQ}}}$	0.11		0.16
LL				-13910.05			
$\bar{\rho}^2$				0.3245			
AIC				27916.1			
BIC				28292.36			
$N(obs.)$				18744			
$N(param.)$				48			

*Note 1: ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.*

Note 2: C = Control; TS = Treatment with statement; TQ = Treatment with question.

Note 3: Due to rounding, some of the coefficients appear to be zero.

Note 4: Please see Footnote7 for labels' details.

(b) RPL with shifters and correlation

Control							
Mean	Estimate		Std. Error	*Std. dev*	Estimate		Std. Error
$\hat{\mu}_{SQ}$	-1.49	***	0.37	$\hat{\sigma}_{SQ}$	5.31	***	0.48
$\hat{\mu}_{TV}$	2.38	***	0.16	$\hat{\sigma}_{TV}$	2.54	***	0.14
$\hat{\mu}_{AO}$	-1.19	***	0.13	$\hat{\sigma}_{AO}$	2.09	***	0.15
$\hat{\mu}_{WB}$	-0.39	***	0.11	$\hat{\sigma}_{WB}$	1.72	***	0.12
$\hat{\mu}_{SO}$	-0.10	**	0.04	$\hat{\sigma}_{SO}$	0.46	***	0.06
$\hat{\mu}_{EE}$	0.11		0.08	$\hat{\sigma}_{EE}$	0.93	***	0.11
$\hat{\mu}_{HC}$	-0.09		0.08	$\hat{\sigma}_{HC}$	0.82	***	0.14
$\hat{\mu}_{SS}$	-0.14	**	0.07	$\hat{\sigma}_{SS}$	0.54	***	0.14
TS							
Mean shifters				*Std. dev shifters*			
$\hat{\zeta}_{SQ_{\mu_{TS}}}$	-0.14		0.53	$\hat{\zeta}_{SQ_{\sigma_{TS}}}$	0.24		0.74
$\hat{\zeta}_{TV_{\mu_{TS}}}$	-0.20		0.20	$\hat{\zeta}_{TV_{\sigma_{TS}}}$	0.20		0.18
$\hat{\zeta}_{AO_{\mu_{TS}}}$	0.17		0.17	$\hat{\zeta}_{AO_{\sigma_{TS}}}$	0.04		0.18
$\hat{\zeta}_{WB_{\mu_{TS}}}$	0.22		0.16	$\hat{\zeta}_{WB_{\sigma_{TS}}}$	0.10		0.17
$\hat{\zeta}_{SO_{\mu_{TS}}}$	0.02		0.06	$\hat{\zeta}_{SO_{\sigma_{TS}}}$	0.12		0.08
$\hat{\zeta}_{EE_{\mu_{TS}}}$	-0.15		0.11	$\hat{\zeta}_{EE_{\sigma_{TS}}}$	0.01		0.17
$\hat{\zeta}_{HC_{\mu_{TS}}}$	0.22	**	0.11	$\hat{\zeta}_{HC_{\sigma_{TS}}}$	0.05		0.18
$\hat{\zeta}_{SS_{\mu_{TS}}}$	-0.01		0.10	$\hat{\zeta}_{SS_{\sigma_{TS}}}$	1.21	***	0.19
TQ							
$\hat{\zeta}_{SQ_{\mu_{TQ}}}$	-1.31		0.50	$\hat{\zeta}_{SQ_{\sigma_{TQ}}}$	0.37		0.51
$\hat{\zeta}_{TV_{\mu_{TQ}}}$	-0.55		0.20	$\hat{\zeta}_{TV_{\sigma_{TQ}}}$	0.19		0.17
$\hat{\zeta}_{AO_{\mu_{TQ}}}$	0.76		0.16	$\hat{\zeta}_{AO_{\sigma_{TQ}}}$	0.10		0.18
$\hat{\zeta}_{WB_{\mu_{TQ}}}$	0.96		0.15	$\hat{\zeta}_{WB_{\sigma_{TQ}}}$	0.01		0.16
$\hat{\zeta}_{SO_{\mu_{TQ}}}$	0.29		0.06	$\hat{\zeta}_{SO_{\sigma_{TQ}}}$	0.22	**	0.08
$\hat{\zeta}_{EE_{\mu_{TQ}}}$	-0.34		0.10	$\hat{\zeta}_{EE_{\sigma_{TQ}}}$	0.27		0.17
$\hat{\zeta}_{HC_{\mu_{TQ}}}$	-0.48		0.10	$\hat{\zeta}_{HC_{\sigma_{TQ}}}$	0.48		0.29
$\hat{\zeta}_{SS_{\mu_{TQ}}}$	-0.40		0.10	$\hat{\zeta}_{SS_{\sigma_{TQ}}}$	1.21	***	0.17
LL				-13588.58			
$\bar{\rho}^2$				0.3401			
AIC				27329.16			
BIC				27924.9			
$N(obs.)$				18744			
$N(param.)$				81			

*Note 1: ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.*

Note 2: C = Control; TS = Treatment with statement; TQ = Treatment with question.

Note 3: Due to rounding, some of the coefficients appear to be zero.

Note 4: Please see Footnote 7 for labels' details.

further decrease in consumers' likelihood of choosing not to have a food safety campaign ($\hat{\xi}_{SQ_{\mu_{TQ}}}$). On the other hand, the presence of TS (i.e. the responsibility prompt delivered as a statement) appears to only have a significant effect on the marginal utility of consumers' preferred campaign style. This corresponds to a campaign that uses humorous cartoons or fictional characters ($\hat{\xi}_{HC_{\mu_{TS}}}$).

Turning our attention to the heterogeneity around the standard deviation, we note that shifters around the standard deviations in the TS condition are insignificant, suggesting the absence of differences in standard deviations compared to the C (i.e. Control) condition. However, we see a different pattern when it comes to the treatment with question. We observe relatively wider standard deviations for all variables, but strongly significant particularly for choosing SQ ($\hat{\xi}_{SQ_{\sigma_{TQ}}}$), as well as for choosing a TV based campaign ($\hat{\xi}_{TV_{\sigma_{TQ}}}$) delivered on specific occasions ($\hat{\xi}_{SO_{\sigma_{TQ}}}$). Although, the significant effects of the usage of the responsibility prompt treatments are sparse, their corresponding standard deviations of the distributions are smaller than in the control group. This can suggest that consumers have less variation in their marginal utilities (and perhaps less scale variance) when we introduce the responsibility prompt, regardless of its framing.

Although, RPL models allow for variation in parameters across respondents, in the literature it is widely assumed that the random parameters are uncorrelated (Hess and Train, 2017). To overcome this restrictive assumption and so, to allow for all sources of correlation, we examine the results of the RPL with shifters and full correlation among utility coefficients that is presented in Table 2.4(b). By looking at the model fit, we observe that the RPL with shifters and full correlation among utility coefficients model outperforms the RPL with shifters model (around 300 log-likelihood units in the expense of 28 additional parameters due to correlation), but also in the AIC and BIC (586, respectively 367 units). Moreover, we observe significant standard deviations, confirming the presence of correlation among utility coefficients. As in RPL with shifters model results, the results of the RPL with shifters and full correlation model show that, all else being equal, consumers, on average, prefer a food safety campaign delivered on TV ($\hat{\mu}_{TV}$), all year around with general food safety messages ($AY - baseline$) that uses someone else's experience as

style ($\hat{\mu}_{EE}$). Also, the sign and the magnitude (slightly higher compared to the RPL with shifters) of the SQ estimate strengthen the observation that, on average, consumers are less likely to choose to not have a food safety campaign ($\hat{\mu}_{SQ}$) as opposed to have a campaign run by the food authorities. When moving to the heterogeneity around the mean of the choice distribution results we observe that the only significant influence of the treatments shifters consists in consumers' preference for the campaigns that, compared to the facts and figures style ($FF - baseline$), use humorous cartoons or fictional characters style within TS group ($\hat{\zeta}_{HC_{\mu_{TS}}}$). By looking at the standard deviations of the choice distribution we notice that, compared to control group, both shifters – $\hat{\zeta}_{k_{\sigma_{TS}}}$ and $\hat{\zeta}_{k_{\sigma_{TQ}}}$ – determine a smaller variance in consumers' choices for the characteristics of the food safety campaigns they consider as likely to influence their food handling behaviour (the only exception being a higher variance for the food safety campaigns that use snappy slogans style). As in the RPL with shifters, treatment with question reduces the variation of consumers' choice distribution for the campaigns running all year around ($AY - baseline$ as opposed to $\hat{\zeta}_{SO_{\sigma_{TQ}}}$). Moreover, treatment with question has a significant effect on the variation of consumers' choice distribution for the campaigns that use a snappy slogans style $\hat{\zeta}_{SS_{\sigma_{TQ}}}$. This can suggest that the usage of responsibility prompts delivered as either a statement or an agree/disagree question has a considerable effect on the variation of the choice distribution for the characteristics that describe how and when the food safety campaign will be delivered.

Overall, the results of both the uncorrelated and correlated RPL models are not considerably different in terms of magnitudes and signs of estimates and, for both models the standard deviations of all parameters are significant indicating strong unobserved heterogeneity among respondents' choices. However, we note that by allowing full correlation among utility coefficients, we strengthen our observation that the the usage of the responsibility prompt determines, on average, more consumers to choose a food safety campaign, and also, less variation when it comes to consumers' choices distribution – which can reflect less heterogeneity in taste, scale or choice behaviour. This is an useful insight as it suggests the importance of both, the type and the framing, of the informa-

tion included in a choice task. Moreover, these observations have practical implications since they provide evidence for the likely efficiency improvement of a food safety campaign that reminds consumers about their own responsibility in taking actions to reduce the food poisoning risks.

2.4.3 Treatments' effects and the characterisation of consumer segments

To explore further the insights delivered by our results and how different framing may lead to different policy outcomes, we retrieve the conditional distributions for each estimated coefficient of the RPL with shifters and full correlation model. Following, we used the conditional distribution for status-quo (SQ - the choice of not having a food safety campaign) for each respondent as a response variable (i.e., dependent) in a multiple linear regression (MLR). The multiple linear regression was carried out to investigate the effect of the two treatments (i.e., TS - treatment with statement, TQ - treatment with question), individuals' socio-economic characteristics (i.e, age and education level), attitudes toward food risks (i.e., I generally do/ do not find food safety messages informative), knowledge (i.e., I am very/not knowledgeable about cook food safely), and previous experiences with food safety issues (i.e., I had food poisoning experience) on respondents' choices of food safety campaign, the variable of interest in our study. We also tested for gender and income effect on respondents' choices of not having a food safety campaign (i.e., SQ choices), but these were not statistically significant.

From Table 2.5, we notice that the likelihood of choosing a campaign option (as opposed to "no campaign" option) is relatively higher and significant in treatment with question compared to treatment with statement. This means that as opposed to responsibility prompts in statement format, reminding individuals of their responsibility using prompts in questioning format is likely to increase consumers' choice of a food safety campaign that is likely to influence their food handling practices. One explanation for why this result comes across stronger compared to the models' results (i.e. TQ outperforms TS and C) can be that, in our MLR analysis we use the distribution of each individual's SQ choices as a dependent variable, while in the RPL analysis we generate the average estimates of

the SQ choices in each treatment group.

Furthermore, we observe that different groups in the population react to the campaign choice differently. For example, there is a significant and negative relationship between SQ and young (18 to 34 years old), educated consumers who have had a food poisoning experience and find food safety messages informative. This result confirms that the young consumers' segment view food safety campaigns positively and are likely to receive one if offered (as opposed to having a "no campaign"), and is in line with previous research showing that the perceived informativeness of a campaign plays an important role in consumers' engagement with the campaign and attendance to the messages they aim to deliver (Grunert and Wills, 2007; Kleef and Dagevos, 2015).

Conversely, there is a significant and positive relationship between SQ and consumers over 55 years old, uneducated, and who do not find food safety messages informative. This result shows that the old consumers' segment is likely not to receive a campaign when offered and is consistent with previous research showing that, although information is made available to consumers, if they find it irrelevant or unnecessary, they will neither process nor attend to it (Kleef and Dagevos, 2015). Moreover, Evans and Redmond (2019) stressed that for increased efficiency, food-safety interventions should focus on both improving knowledge of food safety practices, and improving attitudes of older adults toward their risk, control, and responsibility for food safety.

Moreover, we can observe that, although only the relationship between SQ and treatment with question is significant, both treatments have negative effect on SQ, meaning that both treatments can determine people to choose less the no campaign alternative. The overall results are in accordance with previous studies showing that successful campaigns require tailoring food safety messages for specific consumer segments and, an understanding of their food safety-related knowledge, perceptions and attitudes (Jacob et al., 2010; Fein et al., 2011; Nesbitt et al., 2014; O'Neill et al., 2014; Nan et al., 2017). Furthermore, our study shows that switching from the statement to the question framing of the responsibility prompt influences consumers to show significantly more interest in choosing a campaign that they consider is likely to influence their food-handling behaviour. This

Table 2.5.: Post-estimation results

Coefficients	Estimate	Std. Error	t-ratio
Intercept	-0.53 *	0.28	-1.93
Age band: 18-34 adults	-0.70 **	0.25	-2.77
Age band: Over 55 adults	0.78 ***	0.21	3.75
High qualification	-0.32 *	0.19	-1.71
No qualification	1.00 **	0.43	2.32
Food poisoning experience - yes	-0.94 ***	0.19	-4.95
Very knowledgeable about cooking food safely	1.02 ***	0.18	5.54
Not knowledgeable about cooking food safely	-0.17	0.61	-0.28
Food safety messages are not informative - yes	0.68 **	0.26	2.57
Food safety messages are informative - yes	-2.10 ***	0.21	-10.21
TS	-0.24	0.22	-1.09
TQ	-0.60 **	0.22	-2.66
R2	11.82		
N(obs.)	2343		

Note 1: the dependent variable is the distribution of each individual's SQ choices retrieved based on the RPL with shifters and full correlation model estimation.
*Note 2: ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.*
Note 3: TS = Treatment with statement; TQ = Treatment with question.

confirms that information framing can play an important role in the success of a campaign. These observations reveal that an opportunity exists to explore new research on identifying communication elements that will simultaneously meet the most meaningful approach for different consumers groups, and thereby achieve a desired behaviour change.

In summary, the results of our post-estimation investigation reveal that there is room to increase the effectiveness of a campaign, even for individuals who have a positive attitude towards campaigns and are willing to attend and process the information received. One way to achieve this increase is by using responsibility prompts that are framed either as statements or as questions. Moreover, the post-estimation analysis reveals that the responsibility prompt can act as an awareness trigger for safety-conscious individuals. Further, it shows that the framing of the responsibility prompt as a question has the highest and most significant effect on consumers' SQ choices and seems to prompt them to a pro-campaign and information-seeking behaviour. This conclusion is consistent with research reporting individuals to find self-generated answers and conclusions more convincing and trustable compared with information delivered as statements (Mussweiler and Neumann,

2000; Best and Papies, 2017; Loman et al., 2019). Overall, these observations have important policy implications as they can suggest that, unless individuals holding low or no interest in a certain policy intervention are prompted to remember their personal safety responsibility, they are less likely to engage with the respective policy intervention.

2.5 Discussion and Policy implications

We report the role of responsibility prompts in participants choices of a food-safety campaign, and how and for whom these prompts change the stated choices of a campaign that are most likely to influence the way a consumer handles, cooks, and stores their food. We demonstrate that emphasizing the individual responsibility of a consumer can affect the acceptance of a policy intervention, and that responsibility prompts can maximise the impact of such policies. Specifically, our results reveal that the likelihood of choosing a food-safety campaign (as opposed to "no campaign") increases when responsibility prompts are used. This influence varies according to how the responsibility prompt is framed. By testing the use of statements and questions we find that responsibility prompts framed as questions are a stronger cue for survey participants, in that they will choose a food-safety campaign that they perceive will more likely influence their food handling behaviour. Besides the proven self-persuasive power of questions (Aronson, 1999), questions may be more likely to help people to think more deliberatively and to overcome reasoning biases such as lack of attention or optimistic bias (Milkman et al., 2009; Montibeller and Von Winterfeldt, 2015; Thoma et al., 2015). Research has demonstrated that a link between poor food-handling behaviour and behavioural biases (e.g., lack of attention or vigilance, familiarity of the process (that becomes autopilot), or optimistic bias) exists when people underestimate the likelihood of their having a food-borne illness (Redmond and Griffith, 2004; McCarthy and Brennan, 2009; Fein et al., 2011; Young et al., 2017; Evans and Redmond, 2019; Mucinhato et al., 2022). Consumers' food handling and cooking practices can be improved through higher assumed individual responsibility if they are shown how to control food risks (Leikas et al., 2009). One policy recommendation in line with our findings is to design food safety campaigns that address one specific food risk

and educate consumers on how to control and dispose of that food risk. For example, increasing consumers' perceived ability to control food poisoning via Campylobacter might lead to higher assumed responsibility and so, to safer food handling and cooking practices. Voth and Sirois (2009) reported that negative perceptions and emotionally driven attitudes towards food risks might trigger an avoidance coping mechanism that can be reduced by increased individual responsibility. This implies that educating consumers about their personal control over food risks through increased individual responsibility might favour the acceptance of novel foods (e.g., cultured meat) by changing negative perceptions of these foods. In a recent study, Hamlin et al. (2022) noted that interventions aiming to increase the uptake of cultured meat by educating consumers about the advantages of cultured meat are "unlikely to be successful if they focus on the traditional cognitive-level focus of education campaigns with complex, high-level messages and a highly structured framework that is directly related to the products' attributes and long term/distant outcomes". Education interventions focusing on individual responsibility could be an effective alternative to educate consumers about the advantages of cultured meat or about specific food poisoning risks relative to the traditional education interventions focusing on knowledge and product characteristics.

This study also addresses the issue of communicating to heterogeneous audiences recognised as one of the main issues related to risk communication strategies in previous literature (McCarthy and Brennan, 2009). Fischhoff (2013) reported that challenges brought on by differences in consumer profiles could be overcome by listening to understand consumer knowledge and values, and therefore inform them in a relevant and accessible way. Hornick et al. (2013) also note that consumers must be enabled to implement and sustain healthful changes, which requires their current behaviours and concerns to be understood.

Our web-based survey collected data to examine consumers choices of food-safety campaigns that they considered would more likely influence the way they handle, store, and cook their food, the different features of these campaigns, socio-demographic characteristics, and participant attitudes towards food safety issues, risk-taking behaviour, and level of food safety related knowledge. Our post-estimation results (presented in subsec-

tion 2.4.3), have policy implication as they offer policy makers more detailed insights into the differences of consumers' profiles and how they can be tackled to design campaigns that are more likely to reach each of the identified consumer profiles.

2.6 Conclusions

We demonstrate that a responsibility prompt framed as a question (as opposed to statement), on average, is more likely to increase an individual's choice of a food-safety campaign that they believe will more likely influence the way they handle, store, and cook their food. These findings offer policymakers insights into the acceptability of food-safety campaigns, and how they may vary for different population groups, thereby enabling them to better design campaigns to successfully deliver messages to target demographics. For example, a communication strategy framed using questions rather than formal statements may increase engagement with both a campaign message, and its likely impact on safe food-handling practices because responsibility prompts facilitate awareness for individuals who are sensitive to food-safety issues. Additionally, framing the responsibility prompt as a question might heighten pro-campaign behaviour and information-seeking attitudes, because individuals find self-generated answers more convincing and trustworthy than information delivered as statements (Best and Papies, 2017; Loman et al., 2019).

Our choice analysis approach reveals the need for more research on consumers' decision-making processes to understand the role they play in choice selection in food-safety campaigns. By allowing full correlation among utility coefficients we strengthen our observations that introducing a responsibility prompt framed as a statement will improve some consumer choices of a food-safety campaign, that more consumers will reconsider their choices when a responsibility prompt is framed as a question, and that there is less variation in the choice distribution of consumers. This can reflect reduced heterogeneity in taste, scale, or choice behaviour. These results also suggest that consumers may tend to dismiss their responsibility, and that this tendency can be reduced if responsibility prompts are used to improve their decision-making process. We recommend further investigations be undertaken on how the individual responsibility prompts and their fram-

ing can affect consumers' decision-making processes and, therefore, the possible sources affecting their choice heterogeneity.

We demonstrate that a responsibility reminder in a question format positively affects consumer choices in food-safety campaigns. Our post-estimation investigation also suggests that when individuals with low or no interest in a certain policy intervention are prompted to remember their safety responsibility, they are more likely to engage with that intervention. This is consistent with (Newall and Parker, 2018), who report choice architecture manipulations to be more effective than direct education campaigns to change an individual's behaviour, and it demonstrates the impact of different ways of communicating the risk of getting food poisoning on campaign preferences, and that impacts vary for different groups in the population. These results can act as a foundation for subsequent research on finding improved ways to communicate with different consumer groups for effective policy interventions. Furthermore, these findings provide policy makers insights into differences in consumer profiles, and how these can be taken into consideration in the design of more effective campaigns to reach a range of demographics.

Although, the results obtained using the most informative model (i.e., Table 2.4(b)) do not indicate an effect of the two treatments on individuals choices for the status-quo alternative, the post-estimation results (i.e., Table 2.5) show that treatment with question outperforms treatment with statement and control and that this has a positive effect on individuals non-choices for the status-quo alternative. One explanation for why this result comes across stronger compared to the models' results (i.e. TQ outperforms TS and C) can be that, in our post-estimation analysis we use the distribution of each individual's SQ choices as a dependent variable in a MLR, while in the RPL analysis we generate the average estimates of the SQ choices in each treatment group. However, these observed differences in our results highlight the need for further research on how the type of information received and its framing influence individuals' choices when participating in a stated choice experiment.

The importance of scientific evidence is also emphasized from a policy perspective aiming to design new communication strategies that must engage with their target population,

and contribute to the public health policy debate on how to efficiently increase public engagement with policy interventions delivered in a variety of ways (Wall and Chen, 2018). Our post-estimation analysis demonstrates that switching the responsibility prompt from statement to question framing can significantly increase consumer interest in choosing a campaign that they consider as more likely to influence their food-handling behaviour. Further research might find common elements that simultaneously meet the most meaningful way to reach different groups of consumers and achieve a desired behaviour change – any public health policy objective. In summary, our study provides public authorities with insights into how to develop meaningful and targeted risk communication strategies to influence consumers' food handling behaviour, and, as a result, decrease the number of food-poisoning cases.

Chapter 3

Adjunct questions: a hook for consideration process in stated choice experiments?

This paper investigates how knowledge-based information presented in different formats and provided prior to choice tasks can affect individuals' consideration sets, their choices, and estimates of welfare. We design a stated choice experiment that requires respondents to choose between different food safety campaigns. Respondents are randomly assigned to either a control group, whereby information about the consequences of a food-poisoning case is presented to them as a statement, or a treatment group, where the same information is conveyed to them using an adjunct question with a direct instructive effect. We show that the use of an adjunct question in the context of food-safety campaigns influences what a respondent considers when making decisions during the choice experiment, and their willingness to pay estimates for food safety campaigns. These results improve understanding of how individuals make choices, and provide policymakers with insights into how best to prioritise resources for maximum impact from tailored campaigns.

3.1 Introduction

Although stated choice experiments are used across a broad range of domains, with the aim to elicit preferences and willingness to pay for various goods or services, a growing body of literature has identified limitations related to the assumptions used when analysing choice data. Most notably, many studies have highlighted the limitations of the rationality assumptions and the adoption of bounded rationality by individuals when answering stated choice experiments. For example, the continuity axiom assumes that, during a choice task set, individuals consider all of the alternatives and trade-off continuously between all attributes across these alternatives in every choice situation. The processing of all of this information with equal attention implies that individuals have

passive-bounded rationality. This assumption is, however, not often supported in stated choice experiments (Hensher, 2006; Campbell et al., 2008, 2011; Erdem et al., 2014). Instead, individuals are found to adopt various processing heuristics such as satisficing and simplifying decision-making rules (Daniel et al., 2018; Börger et al., 2021; Sandorf et al., 2022). The explanations behind heuristics adoption are multiple and have been extensively researched. For example, depending on participants' engagement and motivation to process the information, individuals may ignore one or more alternatives within a task (Hensher and Ho, 2015; Capurso et al., 2019) and so, consider only subsets of the available alternatives. Additionally, research on choice behaviour has demonstrated that the selection of an alternative is both influenced by the context of choice (Simonson and Tversky, 1992), but also by individual's characteristics such as cognitive capacities (Miller, 1956; Bettman et al., 1990; Boswell et al., 2018) or prior knowledge (Shanteau, 1988; Payne et al., 1992; Kuusela et al., 2017). The discrepancy between theoretical assumptions and real-world behaviours underscores the need for a deeper understanding of how individuals process information in choice tasks.

This paper investigates the impact of additional knowledge related to the choice task objective and its framing on individuals' consideration of choice alternatives in the context of food safety campaigns aimed at reducing food poisoning in Scotland. Specifically, we address the methodological question of how differently framed knowledge influences the alternatives individuals consider in stated choice experiments and explore the efficacy of adjunct questions in enhancing information processing, preference elicitation, and welfare estimation. Our hypotheses suggest that the framing of knowledge and the use of adjunct questions significantly affect individuals' consideration sets, leading to better choice predictions.

Our paper builds upon recent research conducted by Sandorf et al. (2017), where is observed that the level of knowledge related to the choice task objective significantly influenced the attributes individuals attended to in stated choice experiments. Sandorf et al. (2017) further emphasized the repercussions of overlooking this issue and called for further exploration of the role that knowledge plays in the processing strategies adopted by

individuals. However, previous research outwith the stated choice experiment literature, finds that knowledge, in and of itself, does not bear the amount of power required to generate behavioural outcomes (Visser et al., 2016). Nonetheless, knowledge has been attributed to different functions across different areas of research: e.g., the mediating function of knowledge for relevant attitudes formation and attitudes change (Wilson et al., 1989; Wood et al., 1995; Petty and Brinol, 2010; Sawicki et al., 2013; Petty and Krosnick, 2014). This has also been observed in stated preference studies. For example, Payne et al. (2000) highlighted that the willingness to pay attached to an environmental good is determined more by the attitudes individuals held towards that good than by the economic values for that environmental good. However, none of the previous research looked at the effect that differently framed additional information has on the alternatives that individuals attend to in stated choice experiments. As evidenced by the attribute non-attendance literature (Scarpa et al., 2009; Hensher et al., 2013; Alemu et al., 2013; Sandorf et al., 2017; Heidenreich et al., 2018), correctly accounting for information processing strategies is crucial for deriving marginal willingness to pay estimates. We show that the same applies to the processing of alternatives, which is an important contribution of the paper.

Accommodating for processing heuristics in the analysis of choice data can yield more reliable and improved choice predictions and welfare analysis (Hess and Hensher, 2013; Hensher, 2014; Capurso et al., 2019). Thus, employing modelling approaches to account for these processing strategies can be expected to provide a clearer understanding of individuals' preferences and the value they attach to the attributes under investigation. This paper uses stated choice data on food safety campaigns in Scotland and uses modelling approaches developed on the random utility theory (RUT) that account for individual processing heuristics. Our results include evidence that adjunct questions and their framing affect the consideration set of alternatives, which in turn influences stated preferences and welfare estimates.

From a policy perspective, understanding the factors that influence the effectiveness of risk communication strategies in food safety is paramount, given the significant public health, social, and economic implications of food poisoning outbreaks (**?**). Both the daily

life of an individual and their well-being is affected by food poisoning, and, in some cases, it can lead to death. This fact impacts one's family, community, business environment, and even the whole country (Byrd-Bredbenner et al., 2013). Yet, individuals prove to have limited knowledge of the effects that foodborne diseases can have, and they tend to think that short term gastrointestinal symptoms are the only consequences of foodborne diseases – being oblivious to the fact that these illnesses can lead to chronic, life-threatening symptoms (Brewer and Rojas, 2008; Petrun et al., 2015). This paper seeks to answer critical policy questions regarding the optimization of knowledge dissemination and communication strategies in food safety campaigns and the role of individual characteristics in the effectiveness of these strategies. We hypothesize that tailored communication strategies, informed by an understanding of individual differences in prior knowledge, can significantly enhance the decision-making process in food safety, leading to better public health outcomes. Our findings have policy implications by showing that, indeed, individuals' processing strategies and their food safety campaign choices vary when they receive knowledge-based information communicated as an adjunct question relative to the same information communicated as a text. Our paper contributes to the empirical evidence on how different ways of communicating information influences individuals choices of food safety campaigns and their willingness to pay estimates.

Employing a multidisciplinary approach we integrate literature on consumer behaviour, social psychology, education, marketing and economics to meet two objectives—namely to: 1) investigate if and how differently framed additional knowledge related to the choice task objective influences the alternatives actually considered by individuals (i.e., the consideration set of alternatives); and 2) introduce the use of adjunct questions (i.e., questions aiming to draw attention to important aspects of a text) to stated choice experiment surveys, and to explore what impact communicating information in this manner has on information processing strategies, preference elicitation, and welfare estimation.

We motivate these research objectives based on compelling evidence that adjunct questions can have a "direct instructive effect" on readers by enabling them to have a higher level of factual recall of a text, compared to readers that were not required to answer the

adjunct questions (Rothkopf, 1966; Rickards, 1979; Anderson and Biddle, 1975). A meta-analysis study looking at the effects of adjunct questions on prose learning concluded that adjunct questions have a significant effect on individuals recall of factual information (Hamaker, 1986). Rickards (1979) categorised adjunct questions into prequestions (questions inserted before a text segment on separate sheets) and postquestions (questions inserted after a text segment on separate sheets).

More recently, research has focused on the prequestion type of adjunct questions, and provides evidence of the benefits of prequestions in learning (Lewis and Mensink, 2012; Carpenter et al., 2018; St. Hilaire et al., 2019; Pan et al., 2020; St Hilaire and Carpenter, 2020; Pan and Rivers, 2023). For example, Lewis and Mensink (2012) tested the benefits of prequestioning in two online eye-tracking experiments based on the assumption that respondents will allocate additional attention to, and will produce more information from texts that are related to prequestions they have previously read. Both experiments provided evidence of attentional and learning effects that were consistent with previous research of the pioneers of adjunct question theory (Rothkopf and Billington, 1979). Given these recent developments and evidence, we have elected to use the prequestion type of adjunct question in our stated choice experiment, and to investigate the potential effect of these prequestions on individuals' consideration sets. In our survey the adjunct questions and text segments appear on separate screens, the experimental setting of which is detailed in section 3.3 of the paper.

While previous stated preference studies have designed questions to "quiz" individuals (e.g., LaRiviere et al., 2014; Sandorf et al., 2017; Needham et al., 2018), these are primarily intended to ascertain survey participants' prior knowledge of the topic under investigation. In contrast, adjunct questions are intended to prompt survey participants to think about the topic and allow them to self-generate their own arguments on why the topic is relevant to them. Importantly, because of their recognised instructive effect (Rothkopf, 1966; Rickards, 1979; Anderson and Biddle, 1975), we conjecture that adjunct questions will contribute to survey participants' knowledge of issues pertaining to food safety, which should led to more informed stated choices. We anticipate that this may

be reflected in the consideration set and estimated marginal utilities, which, in turn, has repercussions for welfare estimation. Our results do indeed confirm this, which reinforces the need to explore this important topic.

The remainder of this paper is structured as follows: in section 2 we present an overview of question typologies and their implications on respondents behaviour when used in surveys; we then present the adjunct questions and their potential impact on consideration sets when used in stated choice experiments. Subsequently, we present the empirical case study and modelling approach, which is followed by research findings. Finally, discuss these findings and proffer our conclusions and their broader implications.

3.2 Introducing adjunct questions in stated choice experiments

3.2.1 The use of question–behaviour effect in surveys

As stated by Munch and Swasy (1983); Sprott et al. (2006), questions and questioning are unique, and persuasive, forms of social influence and have been shown to represent strong aspects of communication across domains such as marketing, politics, law, media and consumer research. Kearsley (1976) examined verbal questions and grouped them into the two (direct and indirect) main categories. Given the response mode they allowed for, direct questions can be divided into open and closed questions, while indirect questions allow for covert questions only. The taxonomy of questions has been further developed, with new types of questions (e.g., rhetorical, hypothetical, and leading or intention questions) having been shown to influence people's behaviour (Lai and Farbrot, 2014).

Independent of their semantic dimensions, questions are commonly characterised by the underlying mechanism of stimulating cognitive processes. They have been effectively used to increase attention, interest, and acknowledgement of various communication contexts such as political polling, and marketing research and advertising, and, consequently, to impact behaviour (Munch and Swasy, 1988; Howard, 1990; Hosman and Siltanen, 2011; Moore et al., 2012). The direction of the impact on behaviour has been found to rely on the type of question, the nature of the behaviour, and the mechanism triggering

the effect. For example, Moore et al. (2012)noted that intention questions increase individuals' likelihood of engaging in behaviours about which they hold positive attitudes, and decrease their likelihood of engaging in behaviours about which they hold negative attitudes.

Sprott et al. (2006) combined theoretical developments on questions under the concept of question–behaviour effect, and grouped the mechanisms describing their effects into accessibility and social norms. Since then, many researchers have used the newly defined theory to provide evidence for the mechanisms driving the question effects. Of particular interest to us is Moore et al. (2012), who showed the critical role of knowledge accessibility in generating behavioural outcomes by means of hypothetical questions.

3.2.2 Adjunct questions and consideration sets

The theory on adjunct questions was pioneered by Rothkopf (1966); Rothkopf and Bisbicos (1967) who conducted experimental research to test the effects of questions on student learning outcomes. This theory resides in introducing one or two questions either before (prequestions) or after (postquestions) a text paragraph of interest. The term "adjunct" is used to draw attention to the fact that paragraph texts and the questions are displayed separately. Adjunct questions have already been shown to have an effect on individuals knowledge accessibility (Rothkopf, 1966; Rickards, 1979), but in research to present they have been used only in research in educational settings. More recent research focusing on investigating the effects of prequestions on various learning materials such as texts, videos, and class lectures (Lewis and Mensink, 2012; Carpenter et al., 2018; St. Hilaire et al., 2019; Pan et al., 2020; St Hilaire and Carpenter, 2020) has demonstrated that the effect of prequestions on the learning of students is positive, because they focus student attention on the learning material segments that are directly relevant to prequestions. This focused attention also appears to enhance knowledge acquisition of the prequestioned information, because it is more successfully recollected later in time (Carpenter et al., 2018). Most recently, Pan and Rivers (2023) highlighted that "an emerging body of research reveals that engaging in such pretesting can improve memory substantially relative

to nontesting methods (e.g., reading), provided that the correct answers are studied afterwards."

An emerging pattern in research is that consumers either do not know about foodborne illnesses, or that they underestimate the risk of these illnesses, both in terms of consequences and risk sources (Fein et al., 1995; Wilcock et al., 2004; Fischer et al., 2006; Byrd-Bredbenner et al., 2013; Gkana and Nychas, 2018; de Andrade et al., 2019). Based on these literature findings we decided to test if and how the additional information related to the consequences of a food poisoning incident influences individuals' choices of a food safety campaign targeting the reduction of food poisoning cases. Therefore, in the treatment group of our study we introduce the information related to our choice task objective – a food safety campaign targeting the reduction in the number of food poisoning cases in Scotland– via an adjunct question. After allowing respondents to answer the question, we provide a second screen to show the correct answer to the question (for exact wording see section 3.3). The control group received the same information that was shown to the Treatment group in the second screen.

Although, a broad range of question types have been successfully shown to affect individuals behaviour (see Sprott et al. (2006) for a detailed review) and the benefits of prequestions appear to extend across a variety of contexts and learning materials (St Hilaire and Carpenter, 2020), to the best of our knowledge none of the stated choices studies has tested the effect of adjunct questions on individuals' consideration sets.

Consideration sets were initially, mainly studied in marketing research to support decisions regarding product branding or pricing strategies that are considered and accepted differently by prospective consumers (Wright and Barbour, 1977; Nedungadi, 1990; Pancras, 2010; Eliaz and Spiegler, 2011). In the choice literature, Shocker et al. (1991) defines a consideration set as a purposefully constructed set including all of the goal-satisfying alternatives that are salient or accessible on a particular occasion. More recently, Campbell et al. (2014) defined the consideration set to be a subset of alternatives that are actually considered by respondents when making their choices, which is distinct from the universal set that includes all of the alternatives presented to respondents during a choice task. We

are interested in understanding if and how adjunct questions affect respondents' choices for a food safety campaign. In particular, we seek to examine how respondents' processing strategies vary when they receive additional information communicated to them as an adjunct question relative to the same information when communicated as a text. We conjecture this investigation to be important because adjunct questions affect individuals attention and so, their intake of information, which, in turn, may impact how they process the alternatives in a choice task. Because awareness related to a choice objective has been established as a precondition to the choice, the accessibility or salience of a choice objective in a specific choice situation determines the composition of the consideration set (Nedungadi, 1990). The accessibility or salience of a choice objective is achieved through knowledge. Research has emphasized the link between knowledge and reception of new information and noted that, in the study of mass persuasion, greater political knowledge is associated with greater exposure to and understanding of campaign messages (Wood et al., 1995). Additionally, Moore et al. (2012) demonstrated that individuals' voting choices were influenced by the type of hypothetical questions that they have previously answered, and that their choices were consistent with existing knowledge about the choices objective. More specifically, positive questions made positive knowledge accessible, whereas negative questions made negative knowledge accessible. Also, compared to the inconsistent knowledge questions, Moore et al. (2012) have shown that knowledge consistent questions affects voting choices immediately after being asked a hypothetical question, and over time.

We expect that respondents in our treatment will have different consideration sets compared to respondents in our control. More precisely, we expect that by means of using adjunct questions that we will make the knowledge about the consequences of food poisoning more accessible to all respondents in our treatment group, and, as a result, that they will less-frequently consider the status-quo alternative presented in our hypothetical choice scenario. Accounting for choice heterogeneity determined by the consideration sets formation is important for welfare-consistent estimation of stated choice experiments (Campbell et al., 2018). Not accounting for this type of heterogeneity might produce

Table 3.1.: Campaign attributes and levels

Attributes	Levels
The expected reduction of food poisoning cases	2,150 cases 4,300 cases 8,600 cases 17,200 cases
Who would be benefiting most from the campaign	Babies Children and teenagers Adults Elderly
One-time cost of the campaign	£4 £8 £12 £16

biased welfare estimates, and accordingly, inappropriate policy recommendations.

3.3 Methodological approach

3.3.1 Stated choice experiment

Our stated choice experiment aimed to elicit preferences for food safety campaigns focusing on the reduction of food poisoning cases among the Scottish population. Respondents were required to choose between two alternatives and a status quo option. The alternatives are labelled "Campaign 1" and "Campaign 2" respectively, and correspond to campaigns focused on the reduction of food poisoning cases in the Scottish population. The status quo option is labelled “No campaign,” and corresponds to retaining the current situation at no extra cost. Each food safety campaign is described by the attributes and their levels as presented in Table 3.1.

To identify the attributes and their levels for our choice experiment we conducted a comprehensive review of existing literature and engaged in discussions with national policymakers in Scotland. We also organized focus group discussions involving consumers with diverse socio-demographic backgrounds. These interactive sessions allowed us to gain insight into participants’ perspectives, feelings, and experiences regarding food safety and risk communication strategies, including recent campaigns and other informa-

tion sources. Through these discussions, we were able to uncover insights that were not previously covered in the literature review.

To refine our survey, we subjected it to nine think-aloud interviews[1]. This process helped us to understand how individuals interpreted and responded to each question in terms of its clarity, complexity, and overall meaning. We also used the think-aloud interviews to identify potential survey design issues, such as how concepts were framed, the time required for survey completion, and whether certain questions were relevant to the participants. We next fine-tuned the survey based on this feedback, and then fielded it.

The final survey included the stated choice experiment, questions on consumer opinions, attitudes and knowledge related to food safety issues, and socio-demographic questions. The stated choice experiment consisted of eight choice tasks, an example of which is presented in Figure 3.1. Prior to presenting the choice tasks to individuals, we provided them with a detailed description of the food safety campaign attributes (**please see a copy of the survey in the Appendix.**)

The stated choice experiment included two conditions: a Control (C) and a Treatment (T). In Control we followed previous choice studies practice and communicated additional knowledge related to the consequences of a food poisoning case to respondents in a conventional approach – a statement:

Food poisoning can cause diarrhoea, tummy pain, fever, and vomiting. In extreme cases, it can cause death. In addition, food poisoning can also lead to economic costs, such as loss of working hours, medication and other expenses during recovery.

In Treatment we introduced the adjunct question to communicate the same additional knowledge to respondents:

Which of the following do you think are possible consequences of having a tummy bug (also known as food poisoning)? [Please tick all that apply]

- *Diarrhoea*
- *Tummy pain*

[1]Think aloud is a qualitative research method that requires participants to speak aloud any thoughts they have while completing a task. The Think Aloud research method has a sound theoretical basis and acts as a validating tool for the tasks that participants are required to complete while thinking aloud (Hagen et al., 2008)

• *Fever*

• *Vomiting*

• *Death in severe cases*

• *Economic cost, such as loss of working hours, medication and other expenses during recovery*

An important detail is that after allowing respondents to answer the question, we provided them with the correct answer to the question on the next screen. This was identical to the information they received in Control.

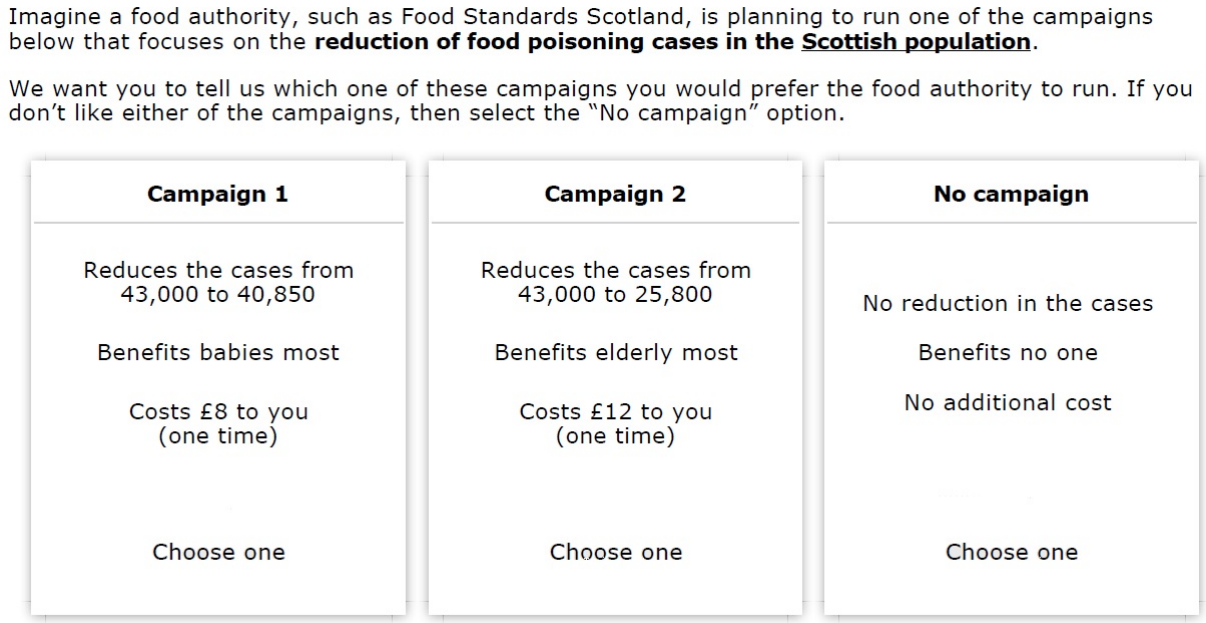

Figure 3.1.: A choice task example

Our rationale for using these two conditions (i.e., C and T) is that they allow us to investigate and understand if presenting the same knowledge-based information either as a statement or an adjunct question affects respondents' consideration sets.

3.3.2 Experimental design

For meaningful comparability, the choice tasks in our survey were generated using the same experimental design. This involved 10 blocks of eight choice tasks within each block and was generated using the Lighthouse Studio version 9.5.3 (Sawtooth Software, 2017). We generated multiple blocks with the aim of mitigating potential context and or-

der effects that could have affect the estimates accuracy. Each block was generated using a main-effects orthogonal experimental design and ensured frequency balance orthogonality, positional balance, and connectivity between choice tasks (Erdem and Campbell, 2017).

The one-way frequencies exploration showed that the survey design was perfectly balanced as each item in our survey was displayed 40 times across all blocks of the surveys. Moreover, the two-way frequencies showed that the survey had a nearly orthogonal main-effects design. After ensuring a balanced and nearly orthogonal main-effects design, the choice tasks were presented to respondents in a random order.

Because the experimental design was identical in both conditions, we might anticipate consistent choices across the two. Nonetheless, this anticipation disregards the potential effect of presenting the same knowledge-based information either as a statement or as an adjunct question on respondents' consideration sets. Following evidence in research involving adjunct questions and the question–behaviour effect, we expect that, in treatment, respondents will have different consideration sets compared with the ones in the control. More precisely, we expect that by means of using the adjunct question that we will make the knowledge about the consequences of food poisoning accessible to all respondents in the treatment group, and, as a result, that they will more-frequently consider a food safety campaign aimed at reducing the food poisoning cases in Scotland, and less-frequently consider the status-quo alternative presented in our hypothetical choice scenario.

3.3.3 Modelling approach

The models presented in this paper were developed based on the random utility theory (RUT) implying that individuals will prefer the alternative that offers the highest expected utility. The RUT theory derives from Thurstone (1927), Luce (1959) and McFadden et al. (1973). RUT states that individuals' choices are formed by a deterministic and a random component that can be written as:

$$U_{nit} = \eta \delta_i + \beta x_{nit} + \varepsilon_{nit} \tag{3.1}$$

where U_{int} is the individual n's utility for the chosen alternative i from J possible alternatives during a choice situation t; β is a vector of coefficients to be estimated and η is a constant for status-quo (SQ) option[2], where δ_i takes the value of one when alternative i is the SQ and zero otherwise; and, ε_{int} is a random (stochastic) part that is independently, identically distributed over the J alternatives with variance $\pi^2/6\lambda^2$, where λ is a scale parameter. However, to avoid confounding issues in our model estimation, we set to one the λ scale factor. This leads to a constant variance equal to $\pi^2/6$.

Under the assumption that individuals consider all the alternatives, the probability of choice at situation t can be given by the following multinomial logit (MNL) model:

$$\Pr(i_{nt}|\eta,\beta,x_{nit}) = \frac{\exp(\lambda(\eta\delta_i+\beta x_{nit}))}{\sum_{j=1}^{J}\exp\left(\lambda(\eta\delta_j+\beta x_{njt})\right)} \tag{3.2}$$

In our choice experiment, each individual is asked to complete a sequence of eight choice tasks, hence the joint probability of each choice in the sequence can be expressed as:

$$\Pr(y_n|\eta,\beta,x_n) = \prod_{t=1}^{T=8}\frac{\exp(\lambda(\eta\delta_i+\beta x_{nit}))}{\sum_{j=1}^{J}\exp\left(\lambda(\eta\delta_j+\beta x_{njt})\right)}, \tag{3.3}$$

where y_n represents the chosen choice tasks sequence over the T choice situations for respondent n, $y_n = \langle i_{n1}, i_{n2}, ..., i_{nT}\rangle$.

While Eq. (3) has the advantage of representing the simplest form for estimating choice probabilities, its sole use is weakened by its underlying assumptions. First, in the literature it has been widely acknowledged the superiority of the approaches that allow for heterogeneity in preferences over the ones assuming homogeneous preferences across respondents (Train, 1998; Scarpa and Willis, 2010). Secondly, the model presented in Eq. (3) also implies a deterministic choice set approach assuming that individuals have an unique consideration set which includes all the alternatives presented to them while completing a choice task.

[2]The decision of including the status-quo alternative in our econometric analysis is based on its acknowledged feature of capturing additional unobserved variation generated by other factors than the attributes included in the choice experiment (Meyerhoff and Liebe, 2009; Stithou et al., 2012).

In consequence, we build a model specification that simultaneously allows for two types of heterogeneity, namely: preferences heterogeneity, as well as for the possibility of processing heuristics in choice. Such an elaborative model specification adds to our understanding and investigation of the effects of using adjunct questions in a stated choice experiment. Our expectation is that these effects will be observed in the heterogeneity structures and/or in the displayed processing strategies. To accommodate for all these issues we used a Random Parameter and Independent Availability Logit model.

Following, we accommodate for preference heterogeneity via a random parameters logit model as explained below for individual n:

$$\tilde{\beta}_{nk} = \mu_k + \sigma_k \upsilon_{k_n}, \tag{3.4}$$

where μ_k and σ_k are, respectively, the mean and standard deviation of the random parameter for attribute k; and, υ_{k_n} is a standard normal deviate.

Under the rational choice behaviour assumption both the multinomial logit (MNL) and random parameter and independent availability logit (RPL-IAL) assume that individuals carefully assess every alternative presented within a choice task prior making their choices. However, there is a growing literature highlighting that due to various reasons such as irrelevance of context, framing of choice tasks, individuals can fail to trade-off between all alternatives they are presented with and as a result, they might adopt simplifying and/or satisficing processing strategies such as ignoring alternatives or choice attributes that are not acceptable to them (Scarpa et al., 2009; Alemu et al., 2013; Hensher et al., 2013; Hensher and Ho, 2015). Also, in the stated choice literature it has been acknowledged that understanding and accounting for the consideration effects can provide better estimates and more accurate predictions of consumer choices (Horowitz and Louviere, 1995; Hensher and Ho, 2015; Capurso et al., 2019).

In this study we focus on a particular processing strategy: whether some participants strategy consists in restricting their processing of the choice task and their 'actual' consideration set based on the SQ alternative.

Therefore, the possible choice behaviour combinations are $C_s = 3$, as described below:

$$C_s = \begin{cases} 1 & \text{gives the subset who always only consider (and choose) the SQ alternative; SQ behaviour} \\ 2 & \text{gives the subset who always consider (and choose) A and B alternatives; NON-SQ behaviour} \\ 3 & \text{gives the subset who consider A, B and SQ alternatives; RUM behaviour.} \end{cases}$$

The three behaviours, $S = C_{s_1}, C_{s_2}, C_{s_3}$ can be dealt with by using a probabilistic framework formulated following Manski (1977) that assists in distinguishing between the deterministic choice set, as generated by the experimental design, and the respondent's 'actual' consideration set – which we defined as the subset of alternatives respondents considered during the choice experiment. For this type of analysis we extend the Independent Availability Logit (IAL) model Ben-Akiva and Boccara (1987, 1995); Chang et al. (2009) with three latent classes, where each class describes a unique consideration set. The class membership probabilities can be derived using an MNL model:

$$\pi_s = \frac{\exp(\omega_s)}{\sum_{s=1}^{S=3} \exp(\omega_s)}, \tag{3.5}$$

where ω_s denotes the constant corresponding to the class with consideration set C_s and where,for identification purposes, one constant is set to zero.

We use the above specifications to build up Eq.(6) that enables us to investigate the two types of heterogeneity (i.e. processing and preferences) as well as the effects of adjunct questions on the processing heterogeneity and so, to contribute to an area that has received limited attention in previous choice analysis (Campbell et al., 2018). Thus, we continue by allowing for different preferences across respondents and accommodate this via the Random Parameter Logit (RPL) model:

$$\Pr(y_n|x_n, \pi_s, \Omega) = \sum_{s=1}^{S=3} \pi_s \int \prod_{t=1}^{T=8} \frac{\exp\left(\lambda(\eta_i + \tilde{\beta} x_{nit})\right)}{\sum_{j=1}^{J} exp\left(\lambda(\eta_j + \tilde{\beta} x_{njt})\right)} f(\Theta|\Omega) d(\Theta), \tag{3.6}$$

where Θ denotes the vector of random parameters; Ω denotes the mean and the variance of these random parameters distributions; $f(\Theta|\Omega)$ denotes the joint density of the parameters

$\tilde{\beta}$. In our model specifications, beside the assumption on the Cost attribute following a log-normal distribution, we assume the same type of distribution on the the expected reduction of food poisoning cases attribute[3]. This was done because respondents were expected to prefer either the status quo or an increase in risk reduction (van Osch et al., 2017). The remaining attribute (i.e., who would be benefiting most from the campaign) was assumed to be distributed normally. The integral presented in Eq.(6) does not have an analytical solution, but is approximated through simulation. Thus, our model represents a combination of a discrete and a continuous mixing model and was estimated using 500 scrambled Sobol draws (Czajkowski and Budziński, 2015).

We note that our model specifications explain the heterogeneity in preferences and processing strategies, but prior to these specifications we had estimated a series of RPL-IAL models with different specifications, such as different distributional assumptions for the random parameters (normal, log-normal), and different correlation structures between random parameters (full correlation, no correlation). Some results of these estimation efforts are presented below:

- RPL-IAL with normal distribution for cost and all random parameters, with full-covariance – allowing for all types of correlation: did not fully estimate;
- RPL-IAL with log-normal distribution for cost and normal for all random parameters, and with full-covariance – allowing for all types of correlation: did not fully estimate;
- RPL-IAL with normal distribution for cost and all random parameters, no correlation: gave the best model fit (Log-likelihood = -6310.15; $\bar{\rho}^2$ = 0.39), but extremely low marginal WTP for all attributes (i.e., average WTP for 10% risk reduction was -0.0000956);
- RPL-IAL with log-normal distribution for cost and normal for all random param-

[3]Reduction of food poisoning cases was assumed to follow a log-normal distribution; coefficients and standard deviations reported in the model estimation results are corrected by $exp(b_p + s_p^2/2)$ and $(b_p + s_p^2/2)x\sqrt{exp(s_p^2) - 1}$ respectively, where b_p is the mean and s_p is the standard deviation of the natural logarithm of the price coefficient (Hole, 2007)

eters, no correlation: gave extremely high marginal WTP for all attributes (i.e., average WTP for 10% risk reduction was 1,326,473);

3.4 Results

3.4.1 Data collection

Our data were collected via a web-based survey administrated to a random sample of 1183 respondents drawn from the Scottish adult population in 2018. The recruitment process was performed by a survey research company that is compliant with the ESOMAR regulations[4]. Of the total number of complete responses, 603 of them corresponded to the Control setting and 580 to the Treatment setting. There was an approximate equal gender (54% females) distribution within the sample. The average age of respondents lies in the 35–44 age range. Approximately half of the respondents have children under the age of 18 years. One third of the respondents lived alone, and almost all respondents had cooking responsibilities. Approximately half of the respondents had higher qualifications, and more than half of them were working.

Table 3.2.: Characteristics of survey respondents

	C	T	Overall
Female	55%	51%	53%
Age 18-34	22%	23%	22%
Age 35-54	39%	31%	35%
Age over 55	39%	46%	43%
Higher education	43%	45%	44%
Low education	52%	48%	50%
No education	5%	7%	6%
Total N (respondents)	603	580	1,183

3.4.2 Model estimation results

In this section we present the results from two different model specifications allowing for the investigation of preferences heterogeneity, as well as of processing heuristics in choice

[4]Please see www.esomar.org for more detail on the ESOMAR regulations

and the effects of using adjunct questions in the context of a stated choice experiment. Table 3.3 reports the results estimated under the assumptions of the multinomial logit (MNL) model and the Random Parameter and Independent Availability Logit (RPL-IAL).

Table 3.3.: Estimation results

	MNL			**RPL-IAL**		
	Estimate		Std. Error	Estimate		Std. Error
μ_{cost}	-0.07	***	0.00	-2.04	***	0.06
σ_{cost}				0.31	***	0.06
Risk reduction						
$\mu_{10\%rr}$	0.37	***	0.05	0.31		0.20
$\sigma_{10\%rr}$				0.31	**	0.10
$\mu_{20\%rr}$	0.69	***	0.05	-0.50	**	0.16
$\sigma_{20\%rr}$				0.80	*	0.35
$\mu_{40\%rr}$	0.99	***	0.04	0.06		0.60
$\sigma_{40\%rr}$				1.25	**	0.40
Target group						
μ_{babies}	0.43	***	0.04	-2.45	***	0.61
σ_{babies}				2.45	***	0.55
μ_{teens}	0.38	***	0.04	-2.45	***	0.25
σ_{teens}				1.14	***	0.09
$\mu_{elderly}$	0.17	***	0.05	0.14		0.26
$\sigma_{elderly}$				1.39	**	0.49
ASC SQ	0.09		0.06	0.00		0.26
ial_AB: T				0.99	***	0.11
ial_AB: C				-0.36	*	0.15
ial_ABSQ: T				0.52	***	0.12
ial_ABSQ: C				-0.29		0.16
Log-likelihood	-9812.35			-8064.53		
Observations	9464			9464		
Respondents	1183			1183		
$\bar{\rho}^2$	0.06			0.22		
AIC	19640.69			16167.06		
BIC	19697.93			16299.83		

Note 1: C = Control; T = Treatment

*Note 2: ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.*

Note 3: Due to rounding, some of the coefficients appear to be zero.

We first focus on the preference homogeneity model as reported under the MNL assumptions in Table 3.3. Consistent with a priori expectations, the marginal utility parameters for the risk reduction and target group attributes are positive and significant. For

the risk reduction attribute, these results imply that respondents prefer higher risk reductions compared to lower ones (the baseline level is a 5% risk reduction). Comparing the relative magnitudes of these coefficients, we observe that respondents place the highest value on the highest risk reduction percentage, whereas the target groups showing who would be benefiting most from the campaign is predicted as having lower importance to respondents. Overall, these results indicate that respondents have positive preferences for the food safety campaigns that focus on reducing food poisoning cases in the Scottish population relative to retaining the current situation at no extra cost. Additionally, we estimate the alternative specific constant for the status quo (SQ) ("No campaign"), whose coefficients can be interpreted as the marginal (dis-)utilities relative to the other alternatives in the choice task. Under the MNL assumptions, the status quo alternative specific constant is positive, but not significant.

As expected, the cost coefficient is negative and significant, suggesting that, all else held constant, respondents are more likely to choose a cheaper food safety campaign compared to a more expensive one.

Moving to the results obtained under the RPL-IAL assumptions which allows for the heterogeneity in preferences and for processing heuristics, we highlight the improvement in model fit compared to the MNL model – an increase by over 1500 log-likelihood units. From Table 3.3 we see that the mean parameter estimates on the attributes risk reduction - 20% and target groups - babies, teens and elderly are significant at 5% and 1% level, respectively. The mean parameter estimates on the remaining levels of the same attributes which are 10%, 40% and elderly are not significant. By looking at the signs and magnitudes of the significant estimates we notice that respondents seem to prefer a campaign aiming to reduce the food poisoning cases by 5% relative to one aiming 20% reduction. These results are aligned with previous research showing that individuals have different sensitivities to given risk magnitudes and so, will differentiate between changes in these magnitudes (Krupnick et al., 1999; Hammitt and Haninger, 2007). Similarly, our results show that respondents prefer a campaign targeting the adult population relative to babies and teens.

The alternative specific constant for "No campaign" option is not significant, indicating that participants do not have strong preferences for either campaign alternatives nor the "no-campaign" option. Additionally, the standard deviations for all estimated parameters are significant, confirming that the preferences for risk reductions and target groups do indeed vary among respondents

The IAL part of the estimated model accounts for the heterogeneity in processing strategies and shows whether some respondents restrict their processing of the choice task and their 'actual' consideration set based on the SQ alternative. In Table 3.3 we present the results of this using three latent classes, where each class describes a unique consideration set: C_1, gives the subset who always only consider (and choose) the SQ alternative –SQ behaviour; C_2, gives the subset who always consider (and choose) A and B alternatives –NON-SQ behaviour; C_3 gives the subset who consider A, B and SQ alternatives –RUM behaviour. The IAL part results are significant and confirm the existence of variation in the consideration sets. Moreover, it shows that the treatment (i.e., using an adjunct question to deliver additional knowledge related to the objective of our choice task) has an effect on respondents' consideration sets. Compared to the control group, across all latent classes the respondents in the treatment group display more NON-SQ and RUM behaviour, relative to the SQ behaviour (the baseline). In addition, by using the unconditional class membership estimate as a guideline, we show in Table 3.4 that the treatment affects the percentages of respondents having a unique consideration set across all three latent classes. Under the treatment condition there is a significant lower percentage of respondents who made their decision using an SQ choice behaviour. Therefore, these results give a strong signal that respondents' processing strategies and their choices vary when they receive knowledge-based information communicated as an adjunct question relative to the same information communicated as a text.

3.4.3 WTP distributions for food safety campaigns

Following, we use the variance-covariance matrix corresponding to the RPL-IAL parameter estimates presented in Table 3.3 to generate simulated sampling distributions for re-

Table 3.4.: Unconditional probability of consideration sets

	C	T
	mean	mean
π_1	0.24	0.19
π_2	0.46	0.50
π_3	0.30	0.31

Note 1: C = Control; T = Treatment

Note 2: π_1 - SQ choice behaviour; π_2 - NON-SQ choice behaviour; π_3 - RUM choice behaviour

spondents' willingness to pay (WTP) for food safety campaigns. In Table 4.7, we present the summary statistics of the WTPs distributions derived from the RPL-IAL model for the whole sample of respondents (i.e., both control and treatment groups). For each attribute level we report the mean, median, 1st and 3rd quartiles and standard deviation of the WTP distributions.

When we look at the summary statistics corresponding to the 10% risk reduction level, we observe that respondents' prefer this risk reduction level relative to the baseline – 5% risk reduction. Mean WTPs reveal that, across the levels of the risk reduction attributes, respondents' highest valuation is for the 10% risk reduction. However, 3rd quartile values indicate that respondents above this value have a strong preference for a 40% risk reduction. The difference between the average WTP at 10% risk reduction compared with that of a 40% risk reduction might be explained by the strong preferences of respondents below the 1st quartile for the baseline risk reduction relative to a 40% one. These observations are common with the findings of previous studies highlighting that the WTP estimates for health risk reductions are highly sensitive to different levels of health risk reduction presented to respondents (Corso et al., 2001; Goldberg and Roosen, 2007). We also notice that, for all risk reduction levels, the standard deviations of the WTP distributions are greater than the corresponding mean values, indicating considerable preference heterogeneity across respondents. These results can suggest that respondents are cautious when it comes to extreme expected reduction of food poisoning cases. In other words, although more desirable, a reduction of food poisoning cases by 40% (17,200 cases) might seem less plausible to respondents compared to a reduction of 5% (2150 cases). More-

over, Hammitt and Haninger (2007) also reported high variations in respondents' WTP for reducing morbidity risks that were linked to their demographic characteristics and perceptions of risk.

Additionally, our WTP analysis looks at the overall results and does not test for statically differences in the respondents' WTPs by the treatment (i.e., using an adjunct question to deliver additional knowledge related to the objective of our choice task) group they belong to. For example, previous studies suggest that the way information about risk reduction is presented can significantly influence respondents' WTP (Corso et al., 2001). Our WTP analysis does not directly accounts for differences in information presentation methods, but the observed preference shifts could be partially attributed to how risk reduction information is framed or understood by respondents. Corso et al. (2001) explicitly finds that the use of appropriate visual aids (a logarithmic scale or an array of dots) makes the estimated WTP consistent with the proportionality to risk reduction, highlighting the importance of effective risk communication.

Table 3.5.: Summaries of WTP distributions

	Risk reduction			Target group		
	10%	20%	40%	babies	teens	elderly
1st Qu.	0.46	-8.38	-5.47	-31.92	-26.78	-6.13
Median	2.21	-3.95	0.95	-17.62	-18.30	0.84
Mean	2.44	-4.42	0.66	-19.46	-20.27	0.96
3rd Qu.	4.06	-0.34	7.02	-5.59	-11.64	7.50
St. Dev	3.39	7.34	10.90	22.33	13.02	12.59

Summary statistics of WTP distributions for the target group levels reveal that respondents are willing to pay more for food safety campaigns targeting the elderly segment of population. Within target group attributes, the elderly level is the only one to have a WTP distribution with a positive mean. Reversely, the means of the babies and teens distributions seem to indicate that respondents strongly dislike the campaigns targeting these segments of population relative to the ones targeting adults. This observation is strengthen by the median values of babies and teens distributions indicating that at least half of the total sample of respondents will pay less for the campaigns targeting babies and teens as compared to the ones targeting adults. Nonetheless, as for the risk reduction attribute, for

babies and elderly levels, the standard deviation of the WTP distributions are larger than the corresponding mean values, indicating considerable preference heterogeneity across respondents. These findings are aligned with previous research showing individuals sensitivity to the perceived vulnerability of different target groups and their higher WTP for reducing risks to children compared to adults (Hammitt and Haninger, 2007). Our results can also be explained considering individuals' sensitivity to the perceived vulnerability since the elderly segment of population is also identified as a vulnerable segment and might be at a higher risk of harm from food-borne illnesses compared to the other consumer segments (Wills et al., 2015; World Health Organization et al., 2015; Kosa et al., 2019). Also, the observations corresponding to the WTP distributions of the target group levels make sense because babies cannot cook or provide for themselves — they require adult assistance (Kosa et al., 2019).

These commonalities across previous research papers underscore the importance of understanding respondents' sensitivity to risk reduction magnitudes, acknowledging preference heterogeneity, effectively communicating risk information, and considering target group specifics in designing and interpreting stated preference studies, whether in the context of food safety or broader public health risk reductions.

3.5 Discussion

Although decision heuristics are known to affect choice analysis, further investigation that involves capturing and accounting for individuals' processing strategies, and analysing their choices is required (Hensher, 2014).While the manipulation of information stimuli related to a choice task objective and made available to individuals contributes to the development of improved choice models (Sandorf et al., 2017; Needham et al., 2018), we have no knowledge of previous studies using adjunct questions to capture their effects on individuals' choice behaviour.

Our article investigates the role of adjunct questions in choice-based experiments and show that additional knowledge related to the choice task objective and communicated as an adjunct question influences individuals' consideration sets. We use random and

discrete modelling approach and show that: individuals consider and choose more SQ in statement compared to adjunct question treatment (i.e., individuals show more SQ choice behaviour when knowledge is communicated in a conventional way); individuals consider and choose less both A and B and, A and B and SQ alternatives in control compared to treatment (i.e., less SQ choice behaviour when knowledge is communicated as an adjunct question).

We contribute to the literature in both investigating if the conventional way of presenting respondents with knowledge-based information affects their consideration sets, and by presenting the same additional information in a way that allows for self-persuasiveness and knowledge recall or acquisition (i.e., adjunct question), followed by an investigation of effects on respondents' consideration sets. Additionally, by demonstrating that adjunct questions have predictable effects on the formation of consideration sets, we contribute to a matter raised over three decades ago, that of accumulating knowledge to support the development of a taxonomy of task characteristics that have predictable effects on individuals' processing strategies (Ford et al., 1989).

We used multidisciplinary approach to study if and how knowledge-based information related to the choice task objective and communicated as an adjunct question influences individuals' choice behaviour, and we report its effects on their consideration sets. There are various alternative ways through which the multidisciplinary approach could benefit the mainstream discrete choice literature. For example, future research might contribute to improved choice predictions and welfare analysis by investigating how to accommodate the choice context for promoting spillovers and their effect on choice behaviour. Dolan and Galizzi (2015) summarised that mere measurement of intention, the fact of answering hypothetical questions or being surveyed (i.e., intention-behaviour effect, question-behaviour effect, respectively survey effect), can influence an individual's behaviour.

The analysis of the WTP distributions revealed that individuals are willing to pay for food safety campaigns aiming for achievable expected reductions (5% and 10%) in the food poisoning cases for adults and elderly. This conclusion is in line with research showing that elderly and young adults have the lowest level of food safety knowledge

(McCarthy et al., 2007; Moreb et al., 2017).

Overall, our results indicate that the way knowledge-based information related to the choice task objective is communicated can influence an individual's choice behaviour, and that individuals are willing to pay for realistic, targeted food safety campaigns. This has policy implications, because it indicates that targeted food safety messages allowing for self-persuasiveness and knowledge recall or acquisition are more likely to reach an audience that is most in need of the communicated food safety message.

3.6 Limitations

It is acknowledged that there are some limitations of the work presented in this study. The data were collected by using hypothetical food safety campaigns scenarios that had to be evaluated by consumers. While designing revealed preferences studies might not be suitable in this particular case, different techniques could have been used to account for the possibility of collecting data affected by the hypothetical bias. However, it is thought that the use of our collected stated choice data does not hinder the results and conclusions of this study.

Another limitation is that, although the attributes and their levels were generated according to a thorough literature review and discussions with national policymakers in Scotland it would have been interesting to have used more attributes and a larger range for some of them, so that further comparisons of the effects of adjunct questions on consumers' processing strategies, food safety campaign choices and valuations, could have been made.

A future extensions of this study might entail investigating the conditional WTP that can allow further observations regarding the treatment effect, and also if and how individuals' valuation of the food safety campaigns differs given their socio-demographic characteristics and attitudes towards food safety knowledge. Another future plan is to extend the analysis of this study's data by estimating the RPL-IAl model with full-covariance and different distributional assumptions not only for cost, but also for the risk reduction levels – since this is an attribute for which each level should be desirable relative to a smaller

level (baseline 5%) or no reduction.

Moreover, the multidisciplinary approach to study if and how knowledge-based information related to the choice task objective and communicated as an adjunct question influences individuals' choice behaviour can be extended to testing the potential effect of adjunct questions formulated as post-questions on stated choice data. Recent research showed that both type of questions (pre-questions and post-questions) improve memory for tested information and sometimes also improve memory for untested information (Pan and Sana, 2021). It will be interesting to investigate further if and how these type of questions have an impact on individuals' choice behaviour and their preferences.

Chapter 4

Analysing Hypothetical Bias in Consumers' Meat vs Plant-based Sausage Choices using Bayesian Truth Serum and Inferred Valuation approaches

Choice experiments are commonly used for data collection in hypothetical scenarios to support research across various domains. However, there is a debate around its accuracy in reflecting consumers' true preferences and valuations of the good/policy in question. Depending on the type of the good being investigated and the choice context, consumers can be motivated to respond with less-than-truthful answers. We test how the implementation of two hypothetical bias-mitigation techniques, inferred valuation and Bayesian truth serum, can impact consumer choices and valuations of one good type, sausages, made from either meat or plant-based ingredients. We demonstrate that regardless of the hypothetical bias conditions, consumers prefer meat-based sausages over plant-based alternatives. However, when survey respondents are provided with additional information that concerns either the effect on their health or that of the environment from meat consumption, the effect on the valuation of sausages made from chicken or beef differs. Consumers recognise the higher carbon footprint of beef production, and hence, are less willing to pay for them compared with sausages made from chicken. This finding may have implications for policy interventions.

4.1 Introduction

Hypothetical bias -the potential difference between hypothetical willingness to pay and real willingness to pay- has been widely debated in stated preferences studies and is recognised that its prevalence, extent and direction differ across disciplines (e.g., health, transport, food, environment and natural resources). Recently, Haghani et al. (2021) defined hypothetical bias (HB) as the deviation in a predefined aggregate or disaggregate measure

because of choice data being collected in a hypothetical setting instead of a more realistic (but not necessarily naturalistic) setting. Most commonly, choice experiments are designed to collect data in hypothetical settings to inform studies that aim to contribute to planning and resource allocation in various research areas such as health, environmental policies, transport, and consumer goods markets.

A controversy arising from the use of hypothetical choice data is whether it accurately reflects consumers' preferences and valuations of the good or policy in question. One way to address this is to investigate and understand the prevalence, magnitude, and direction of hypothetical bias within choice experiment studies. Although an increasing number of studies have come to address the issue of hypothetical bias in stated preferences analysis, researchers still share common concerns regarding the lack of systematic description and widely accepted general theory of respondent behaviour to explain hypothetical bias and its underlying causes (Loomis, 2011; Mitani and Flores, 2014; Haghani et al., 2021).

Recent advancements in the literature, including a comprehensive meta-analysis by Penn and Hu (2018), shed light on the sources of HB and the efficacy of various mitigation techniques. By examining an extensive collection of 131 studies, their meta-analysis surpasses previous ones in scope and depth, incorporating recent developments in willingness to pay elicitation methods and exploring various HB mitigation techniques such as cheap talk, consequentiality or certainty follow-up treatments.

Cheap-talk, developed by Cummings and Taylor (1999), is one of the first hypothetical bias (HB) ex-ante mitigation techniques to be used in contingent valuation studies. Researchers subsequently proposed the use of an Opt-Out reminder to mitigate HB, since which time further HB mitigation techniques have been developed, although none has been intensively researched; examples include religious priming (Stachtiaris et al., 2011), Solemn Oath Script (Jacquemet et al., 2013; de Magistris and Pascucci, 2014), Honesty priming (De-Magistris et al., 2013), inferred valuation (Lusk and Norwood, 2009a,b; Carlsson et al., 2010a) and Bayesian truth serum (Prelec, 2004; Barrage and Lee, 2010). These techniques are designed to prompt respondents into providing truthful responses when stating their preferences. For each, further research is required to establish robust

conclusions (Mariel et al., 2021). For example, recent developments in the literature conducted by Cerroni et al. (2023) introduced the choice matching approach (CMa) as a potential avenue for overcoming the limitations of two of the newly developed ex-ante HB mitigation techniques, inferred valuation and Bayesian truth serum. Challenges such as the requirement for large, indeterminate sample sizes, the necessity of monetary incentives for respondents, increased cognitive demand, and potential fatigue effects that may affect the accuracy of elicited preferences, all pose significant hurdles to the effective implementation of BTS in choice experiments (CEs). By conducting an artefactual field experiment, Cerroni et al. (2023) demonstrated that, while CMa does not enhance the validity of estimated preferences, it does offer a potential increase in their reliability, suggesting an avenue for overcoming some of Bayesian truth serum's noted limitations.

Building upon these insights, our study aims to contribute to the literature on hypothetical bias by testing two of the HB mitigation methods: inferred valuation and Bayesian truth serum. Both these techniques are ex-ante approaches. While both rely on a change in question format, the difference between them is that the Bayesian truth serum tries to mitigate HB by using monetary incentives as a reward for truth-telling. Our rationale for choosing these two is that they share a key common feature: both use an indirect question to determine respondent predictions of the choice of persons that are similar to them, based on an assumption that respondents will use their own choices to make the required predictions (Frank et al., 2017). Both techniques have been used only once in a discrete choice experiment (Menapace and Raffaelli, 2020). In this study we examine the effectiveness of inferred valuation and Bayesian truth serum in mitigating HB across different choice contexts. We investigate how these techniques impact the reliability and accuracy of stated preference data in reflecting consumer valuations that are closer to truth. We hypothesize that both inferred valuation and Bayesian truth serum will significantly reduce HB, leading to more accurate WTP estimates. However, we anticipate that the effectiveness of these techniques may vary depending on the choice context (such as baseline, health, or environmental conditions described in the following paragraphs).

We further contribute to the literature by investigating these two HB mitigation meth-

ods in different choice contexts. Additionally, we aim to improve understanding of how moderating factors can influence the magnitude and/or direction of HB. By doing so we endeavour to follow the recommendation of Haghani et al. (2021) that "it is important to study HB in CEs in a context-specific and nuanced manner while considering potential moderating factors".

Further this study aims to inform more effective policy-making in food consumption and public health by exploring in and how health and environmental information, presented alongside HB mitigation techniques, influences consumer valuations of meat and plant-based alternatives. We posit that the provision of health and environmental information will significantly influence consumer preferences towards plant-based alternatives, reflecting a strategic alignment of consumer behaviour with policy objectives.

To provide insights on respondents' behaviour for the two different hypothetical bias mitigation methods, inferred valuation and Bayesian Truth Serum, we collect stated preference data in three main experimental settings: control (C), inferred valuation (hereafter referred to as indirect questioning IQ), and Bayesian truth serum (BTS). All participants in each experimental scenario were presented with identical choice tasks. However, prior to the decision-making tasks, we provided participants in each group with different background information, focusing on the impact of meat consumption on health and environment. The three conditions were: (1) baseline condition, in which participants were provided no additional information; (2) health condition, in which participants were provided additional information regarding the impact of meat consumption on health; and (3) an environmental condition, in which participants were provided additional information regarding the environmental impact of meat consumption. In total, we established nine distinct experimental conditions, arising from the combination of these three by three factors (3x3).

Our general findings confirm that, depending on the choice context, one HB mitigation technique can have affect consumer valuations for the same good in different ways. For example, we notice that while in the baseline condition the monetary incentives implied by the BTS increased the willingness to pay (WTP) estimates for all attributes, and in the

environmental condition, the monetary incentives implied by the BTS reduce the WTPs for all attributes. When examining our findings across the three experimental settings (C, IQ, BTS) with the same consumer conditions, it becomes evident that consumer valuations of the investigated good differ based on the specific choice context in which they are in (i.e., baseline condition, health condition, or environment condition). For instance, in the baseline condition, except for the 'Organically produced' attribute, consumer valuations for all other attributes increase in the IQ experimental setting compared with the C setting, and in the BTS compared with both IQ and C scenarios. This observation suggests a strong preference among consumers for meat sausages, as indicated by their consistent willingness to pay more for them comparison with plant-based alternatives. The same pattern observed in the baseline condition also emerges when consumers are provided with supplementary information regarding the implications of meat consumption to their health. This suggests that, when making food choices, consumers might already consider the potential impact of that food consumption on their health. This observation is reinforced by the alignment in both sign and magnitude of the class covariates across experimental settings (IQ and BTS) in the baseline and health conditions. These findings might suggest that consumers are not willing to fully substitute meat with plant-based products, but that they are prepared to try plant-based alternatives on different grounds, such as for their health or taking the environmental impact of meat consumption into consideration. Thus, it is possible to reduce meat consumption by raising awareness related to the impact that its production and consumption have on health (both at the individual and societal level), and on the environment.

The remainder of this paper is structured as follows Section 4.2 contains the background; Section 4.3 gives the methodological approach; Section 4.4 presents the modelling approach; in Section 4.5 are presented the results of our study followed by Section 4.6 where we discuss our findings and conclude or study. Section 4.7 presents the limitations of this study and future research recommendations.

4.2 Background

4.2.1 Methods to mitigate HB

Cheap-talk involves informing respondents of HB, and then getting them to answer hypothetical valuation questions as if they would answer them in a real-life setting. Cummings and Taylor (1999) eliminated HB in three independent contingent valuation studies that used cheap-talk to describe HB and some of its possible explanations, and asked respondents to answer choice questions as if they were real. However, subsequent contingent valuation and choice experiment studies that have tested cheap-talk as a method of HB mitigation have produced ambiguous results, and not been able to demonstrate its effectiveness (Lusk, 2003; Barrage and Lee, 2010; Ami et al., 2011; Carlsson et al., 2010b; Bosworth and Taylor, 2012; Moser et al., 2014; Howard et al., 2015). The Opt-Out reminder takes the form of a short script that instructs respondents to choose the opt-out alternative if they consider the proposed hypothetical alternatives to be too expensive (Ladenburg and Olsen, 2014). Based on the assumption that the repeated nature of a choice experiment might determine consumers to forget about the Opt-Out reminder, the authors presented it before each choice task. Results confirmed that inclusion of an Opt-Out reminder in a cheap talk script significantly reduces WTP estimates. However, Ladenburg and Olsen (2014) emphasized that their findings were based on stated preferences only, and that they could not be interpreted as reductions in HB mitigation. Alemu and Olsen (2018) tested the repeated Opt-Out reminder within the context of a private good without adding a cheap talk script in an experimental set-up that also allowed for HB comparison across treatments; they found that a repeat Opt-Out reminder significantly reduced the HB for all attributes, and completely eliminated it for one of them. In the case of the Oath Script, respondents are directly asked to take an oath that commits them to truthfully answer the hypothetical choice questions. The Honesty Priming technique is more subtle, and it aims to influence respondents' subconscious inclination toward truthful responses by exposing them to concepts associated with honesty.

Although BTS differs from inferred valuation in that it involves the use of monetary

rewards to incentivise truthful answers from respondents, they share a feature that requires respondents to make choice predictions that correspond to other people (similar to them). Inferred valuation was developed by Lusk and Norwood (2009a,b) and requires respondents to predict how other survey participants will answer the same questions that they have previously answered. This is implemented through the use of indirect questions relying on the assumption that the HB can be mitigated if respondent focus is shifted from their own choice to that of other respondents, resulting in their WTP being closer to the amount that they would pay in reality. Studies have shown that, compared to direct questions (the choice tasks respondents are required to answer in a choice experiment), indirect questions yield lower WTP (Carlsson et al., 2010a; Olynk et al., 2010; Klaiman et al., 2016; Menapace and Raffaelli, 2020; Raffaelli et al., 2022).

Studies across various domains provide evidence that the magnitude and direction of the HB depends on choice context, measurement methods, and moderating factors such as individual characteristics, knowledge, and familiarity with the good being investigated in the survey. However, (Mariel et al., 2021) also noted that hypothetical bias should not be a concern if incentive compatibility and consequentiality are ensured. Indeed, the lack of consequentiality has been recognised as one of HBs' sources (Haghani et al., 2021). It describes the situation when respondents associate possible consequences with their survey answers and care about the final outcome (Carson and Groves, 2007).

As it has been shown that the consequentiality effect is different depending on the type of good being investigated (ie., whether it is a private or a public good) (Carson and Groves, 2007), in the literature the same differentiation has been made between consequentiality types. Johnston et al. (2017) defined consequentiality as "a condition in which an individual [survey respondent] faces or perceives a nonzero probability that their responses will influence decisions related to the outcome in question and they will be required to pay for that outcome if it is implemented". Later studies have highlighted the importance of differentiating payment consequentiality (individual level) and policy consequentiality (public level) (Vossler and Holladay, 2018; Hassan et al., 2019; Zawojska et al., 2019). Consequentiality can be applied both as an ex-ante or as an ex-post HB

mitigation method to raise respondent awareness regarding the impact of their answers on the choice experiment outcome (Lloyd-Smith et al., 2019; Zawojska et al., 2021).

Often, in the literature the lack of consequentiality has been noted to unfold when a hypothetical survey is not incentive-aligned and so, regardless of their answers, the respondents will not see themselves as better or worse-off after completing the survey (Ding et al., 2005; Mørkbak et al., 2014; Buckell et al., 2020). BTS is a hypothetical bias mitigation technique that allows respondents to see themselves as better-off after completing the survey because it entails utilising monetary incentives to reward respondents that provide the most honest answers to the hypothetical choice questions.

4.2.2 BTS and the theory behind it

Bayesian Truth Serum is an induced truth telling method proposed by Prelec (2004) to asses people's judgemental truthfulness. The author developed a scoring method using monetary incentives to elicit truthful subjective data within contexts where future outcomes are not observable or needed. These type of contexts are very common in stated preference studies.

Barrage and Lee (2010)'s study was the first one that implemented the BTS method in a contingent valuation survey and provides the script they have used within the context of a charity donation. Compared to other ex-ante methods such as cheap talk, consequentiality and solemn oath, BTS requires respondents an implicit and truthful personal choice, as well as a prediction for other people's choices. It is based on the assumption that respondents use their own choices as predictors about the distribution of other people's choices (Barrage and Lee, 2010; Frank et al., 2017). This method, will provide researchers with information on respondents' own choices (given by the answers to the direct questions) and on respondents' predictions for other people's choices (given by the answers to the indirect questions). The answers to the direct questions give respondents' own choices and are used to estimate respondents' WTP for the chosen alternatives. The answers to each corresponding pair of direct (scored by assigning high scores to more common than collectively predicted answers) and indirect questions (scored for accuracy) are the in-

puts used by the BTS algorithm to calculate a respondent-specific score. The monetary incentives will then be assigned to the respondents that obtained the highest scores.

BTS has been implemented in three contingent valuation studies only (Barrage and Lee, 2010; Weaver and Prelec, 2013; Bennett et al., 2019) and one discrete choice experiment (Menapace and Raffaelli, 2020). Although Bennett et al. (2019) found no statistically significant impact for the BTS treatment (compared with the control (i.e., no BTS incentive)), they highlighted the need for further investigation of the BTS reporting on respondents' difference in choices depending on the choice contexts that they faced while completing the survey. The findings of another contingent valuation survey support the idea that BTS effects might vary given the complexity of the good being investigated (Weaver and Prelec, 2013). It has reported that BTS had a statistically different influence on respondents' choices and that it may outperform the solemn oath, a more direct form of truthful choice elicitation. Barrage and Lee (2010) also presented evidence for BTS being effective for one tested good, and observed that the BTS effect was higher for two HB moderating factors: gender and familiarity of the good being investigated in the survey.

To date, the study of Menapace and Raffaelli (2020) remains the only one in the field of discrete choice experiments that has used BTS as a hypothetical bias mitigation method. They contrasted BTS with cheap talk and consequentiality, and determined that BTS can better mitigate the hypothetical bias than these two other methods, but that none of them accomplished fully unbiased WTP estimates. In line with the contingent valuation studies, Menapace and Raffaelli (2020) showed that BTS effects differ depending on the type of the good being investigated in the survey.

4.3 Study set-up

We designed a web-based survey to examine consumer preferences for different types of sausage, their attitudes towards the presented alternatives, and the truthfulness of their answers. Our survey included three sections. The first section explored consumers' preferences for a packet of sausages made from meat or plant-based ingredients using discrete choice experiments. The choice experiments helped to establish how the consumers

traded-off between, and valued different features (or attributes) of sausages (i.e., whether they were meat or plant-based, local or non-local, organic or not organic) under three main experimental settings: control (C), indirect questioning (IQ) and Bayesian Truth Serum (BTS). For meaningful comparability, we divided our sample into three conditions: a baseline condition, in which participants received no additional information; a health condition, in which participants received additional health information; and an environmental condition, in which participants received additional environmental information. Thus, this survey design produced six further experimental settings: C in the health condition; C in the environmental condition; IQ in the health condition; IQ in the environmental condition; BTS in the health condition; and BTS in the environmental condition. The choice experiments also enabled an improved understanding of why some specific sausages, such as plant-based sausages as opposed to beef or pork sausages, were more acceptable than others. Section 2 comprised a set of debriefing questions as a quality check for the data collection, and a set of attitudinal questions that added to the understanding of consumer acceptance of plant-based meat alternatives and any underlying reasons for their refusal and a preference for meat. Section 3 included socio-economic questions related to the respondent's personal characteristics.

4.3.1 Choice experiment set-up

The product category investigated in our stated choices experiment was a packet of sausages. This choice/selection was motivated by various factors. First, sausages are a popular food product within the United Kingdom, with in excess of 400 different kinds of them being produced nationally[1]. A wide variety of sausages are available on the UK market, including those made from plant-based ingredients. Caputo et al. (2022) most recently reported that the success of plant-based alternatives was heavily dependent on both the product's taste, and on the information to which respondents are exposed; they recommended further research on preferences for specific products such as sausages or ground meat. After an extensive literature review we narrowed our selection of product attributes down to

[1] https://englishbreakfastsociety.com/british-sausage.html

four: (1) main ingredient; (2) where it originates from; (3) whether or not it is organically produced; and (4) its price. The attributes and their corresponding levels are presented in Table 4.1.

Table 4.1.: Product attributes and levels

Attributes	**Levels**
Their main ingredient	**pork** **beef** **chicken** **plant-based** (can be derived from plants, such as soybeans, peas, mushrooms and/or wheat)
Where they originate from	**local**, which means the sausages are produced relatively close to where you live (such as within 30 miles, or in your county or region) **non-local**, which means the sausages are not produced relatively close to where you live, but somewhere else in the United Kingdom
Whether or not they are organically produced	**organic** **not organic**
Price	varies from £1.00 to £5.00 per packet of 6/8 sausages by increments of £0.50

Based on these attributes we built a choice experiment to collect stated preference data from a sample of UK consumers. We constructed nine different experimental settings to investigate if and how respondent WTPs varied for control and the two hypothetical bias mitigation methods, indirect questioning and Bayesian Truth Serum, and different information related to the product investigated in our survey: C, IQ, and BTS in the baseline condition; C, IQ, and BTS in the health condition; and C, IQ, and BTS in the environmental condition. To complete the choice tasks, respondents in all experimental settings were required to answer the following direct question: "Which one of the following packets of sausages would you buy?" The choice card included two alternatives (Packet A, Packet B) and a status-quo option (I would not buy either of these sausages). Figure 4.1 displays an example of a choice task, which directly asks respondents what their choice would be. All respondents in all experimental settings were provided with this choice task.

Figure 4.1.: Choice task example

The differences between the three experimental settings are that, in control (C), participants only received direct questions, while in both indirect questioning (IQ) and Bayesian truth serum (BTS) settings participants answered an additional question following upon the direct question. In indirect questioning (IQ) setting, participants are asked to predict how other people similar to them in terms of age and gender would be most likely to choose from the presented choice alternatives. This is demonstrated in Figure 4.2 . Bayesian truth serum (BTS) resembles to the IQ condition, but differs only in terms of the monetary incentive it provides to the participants for making a close prediction about the choices of the target group (i.e., those who are similar to them). The bonus coupons are then assigned to the top 25 participants whose predicted proportions are closest to the average proportions given by other participants. Figure 4.3 presents an example of this question.

Recent research noted that the increasing demand for meat poses significant challenges not only on the health system, but also on the environment (Dagevos, 2021; Michel et al., 2021; Onwezen et al., 2021). However, most consumers are not aware of the impact that consumption of meat has on the environment (Hartmann et al., 2022). Therefore, we aim to investigate how consumers' trade-off between sausages made from meat or plant-

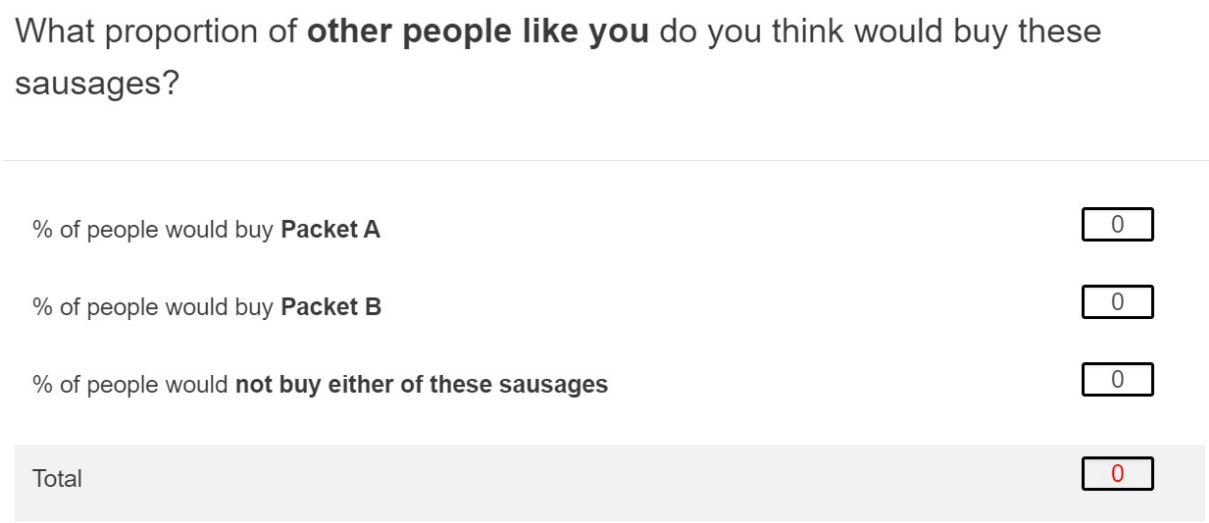

Figure 4.2.: The indirect question used for the IQ experimental settings

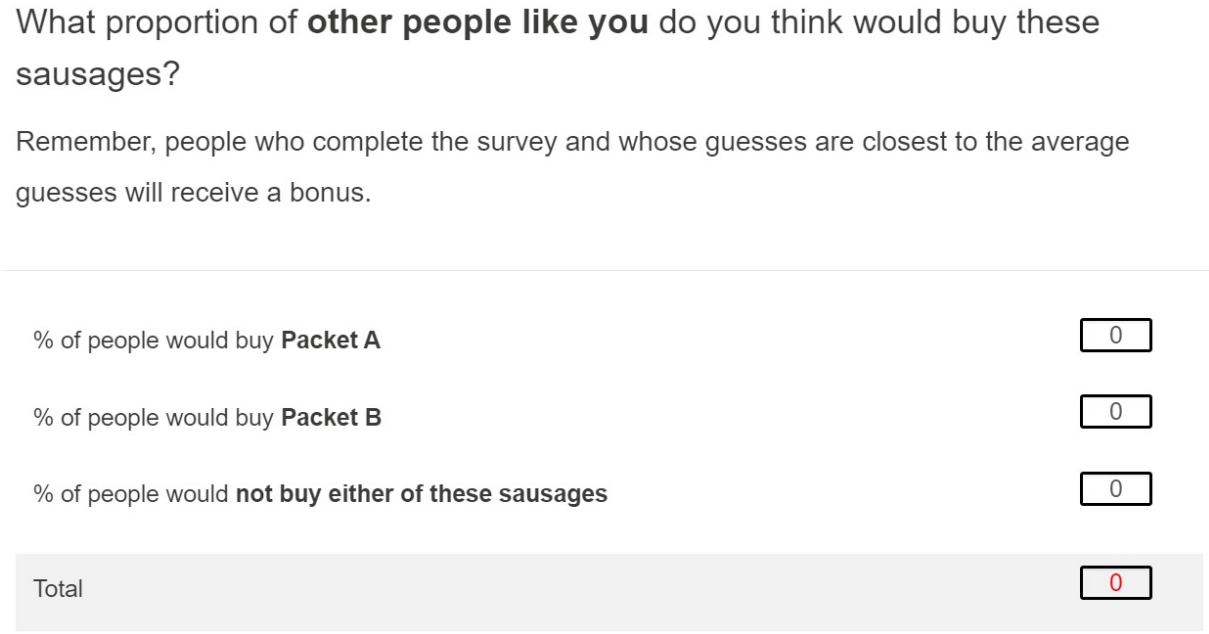

Figure 4.3.: The indirect question used for the BTS experimental settings

based ingredients in two choice contexts: (1) health impact of meat consumption, and (2) environmental impact of meat consumption. We also included a baseline condition wherein no information was provided regarding the impact of meat consumption.

For the health and environmental conditions, we provided the following text prior to the choice tasks:

According to World Health Organization (2021), excessive meat consumption burdens national healthcare systems. It has been estimated that in 2020 there were 2.4 million

deaths worldwide, and over £200 million in healthcare costs, attributable to excessive red and processed meat consumption globally. Plant-based diets have the potential to improve human health. Alongside the benefits to human health, plant-based diets will reduce the cost to the UK healthcare system.

According to scientists, reducing meat and dairy consumption can help reduce their carbon footprint by two-thirds, and thus help reduce the impact of climate change. According to the footprint calculator developed by scientists from the University of Oxford, eating 75 grams of beef —a typical fast-food hamburger— daily for a year contributes greenhouse gas emissions equivalent to driving a car for 7,196 miles —that's crossing the UK about 8.3 times. Compare that to eating 150 grams of beans —about a third of a can— daily for a year, which is equivalent to driving a car 93 miles[2].

The additional information included in the health and environment conditions was presented to respondents prior to the choice tasks. In total, as presented in Table 4.2 we established nine distinct experimental settings, resulting from the combination of these three by three factors (3 x 3).

Table 4.2.: Experimental settings

	Baseline condition	**Health condition**	**Environment condition**
C	ES 1	ES 2	ES 3
IQ	ES 4	ES 5	ES 6
BTS	ES 7	ES 8	ES 9

Note: C = Control; IQ = Indirect questioning; BTS = Bayesian truth serum; ES = Experimental Setting

Further, assuming that respondents in our sample might perceive the investigated good (i.e., a packet of sausages) more as a private good within the baseline and health conditions, while the respondents in the environment group might perceive the same good more

[2]BBC Future has worked with Verve Search and researchers at the University of Oxford to produce our Foodprint Calculator at https://www.bbc.com/future/article/20210204-calculate-the-environmental-footprint-of-your-food and at https://www.bbc.co.uk/news/science-environment-46459714

as a public good we hypothesis the following as summarised in Table 4.3:

H_1: Compared to C, IQ and BTS will provide higher WTPs under the baseline condition.

H_2: Compared to IQ, BTS will provide higher WTPs under the baseline condition.

H_3: Compared to C, IQ and BTS will provide higher WTPs under the health condition.

H_4: Compared to IQ, BTS will provide similar or smaller WTPs under the health condition.

H_5: Compared to C, IQ and BTS will provide smaller WTPs under the environment condition.

H_6: Compared to IQ, BTS will provide smaller WTPs under the environment condition.

Table 4.3.: Hypothesis summary

	Baseline condition	**Health condition**	**Environment condition**
C	H_1	H_3	H_5
IQ	H_1	H_3	H_5
BTS	H_1; $H2$	H_3; H_4	H_5; H_6

Note: C = Control; IQ = Indirect questioning; BTS = Bayesian truth serum

Previous studies across various domains have shown evidence that the magnitude and direction of the hypothetical bias can be dependent on the characteristics of a good marketed by a stated preference method, the choice context, measurement methods and/or moderating factors such as individual characteristics, knowledge and familiarity of the marketed good (Mørkbak et al., 2014; Svenningsen and Jacobsen, 2018; Wuepper et al., 2019; Sanjuán-López and Resano-Ezcaray, 2020). For example, previous research evidenced that the use of WTP estimates regardless of their provenance (stated or incentivized stated preference methods), is problematic in the context of strong moral goods (climate policies; i.e., public good) (Svenningsen and Jacobsen, 2018), while in the context of an amoral good (a restaurant voucher; i.e., private good) the WTP estimates have not been affected by hypothetical bias (Johansson-Stenman and Svedsäter, 2012).

4.3.2 Experimental design

We developed the choice experiment structure in accordance with recent guidelines on stated preference methods (Johnston et al., 2017; Mariel et al., 2021). We then conducted a pilot survey to test and refine the survey instrument and inform the experimental design for the main survey, that employed a Bayesian experimental design with zero priors. A total of 256 pilot survey respondents were sampled from the same underlying population as the subsequent main survey. Based on pilot survey results, a Bayesian D-efficient design was generated for the main survey using estimated preference weights from a multinomial logit (MNL) model for the three attributes (i.e., main ingredient; where the sausage originated from; and whether or not the sausage was organically produced), status-quo, and the alternative specific constants. The design comprised 72 choice tasks, with attribute level balance across the design, and each choice task comprising two experimentally designed alternatives and a "buy neither" option. Each respondent was randomly presented with eight choice sets.

4.3.3 Data collection

Data were collected in April 2023 using a web-based survey instrument. The survey was completed by 2023 participants living in UK, aged 18 years or over, that were recruited from the Prolific Academic online research platform (https://www.prolific.co). Panel members who self-identified as having a dietary restriction or food allergy were excluded because the product being investigated was a packet of sausages that was made from meat or plant-based ingredients; this exclusion criterion ensured that all participants felt equally able to follow the product characteristics when instructed to choose the alternative they would be willing to buy.

As shown in Table 4.4, each of the nine experimental settings included relatively equal numbers of female and male participants. Within each of the experimental settings, as well as across them, for all information conditions (i.e., baseline, health condition, environmental condition) there were higher numbers corresponding to participants aged between 29 and 43 years; the numbers of participants aged between 18 and 28, and 44 and

58 years were approximately equal across all experimental settings, while those aged over 59 years included the lowest proportion of participants. Across all experimental settings there were proportionally more "middle income" respondents, followed by the "low income" segment of respondents. Remaining respondents belonged to the "high income" segment, or to a small percentage of respondents (ranging approximately 2% to 6%) who preferred not to divulge their annual household income.

Table 4.4.: Percentage breakdown of individual characteristics by experimental setting

	Baseline			Health Information			Environment Information		
	Control	IQ	BTS	Control	IQ	BTS	Control	IQ	BTS
Female	50.44 (0.06)	50.64 (0.13)	54.55 (0.06)	51.63 (0.20)	53.81 (0.14)	48.76 (0.06)	51.34 (0.30)	48.84 (0.09)	47.00 (0.21)
Aged 18-28 years	20.80 (0.24)	16.17 (0.10)	17.70 (0.14)	16.74 (0.33)	20.18 (0.01)	21.90 (0.32)	22.32 (0.09)	19.53 (0.22)	23.50 (0.13)
Aged 29-43 years	36.28 (0.37)	45.53 (0.59)	41.15 (0.22)	47.44 (0.19)	38.57 (0.42)	42.56 (0.23)	33.48 (0.20)	40.00 (0.23)	36.41 (0.04)
Aged 44-58 years	26.99 (0.18)	25.53 (0.14)	22.97 (0.32)	23.26 (0.14)	25.56 (0.13)	22.31 (0.01)	27.68 (0.21)	26.98 (0.05)	23.04 (0.26)
Aged over 59 years	15.93 (0.05)	12.77 (0.18)	18.18 (0.13)	12.56 (0.17)	15.70 (0.14)	13.22 (0.03)	16.52 (0.10)	13.49 (0.21)	17.05 (0.10)
Low Income	34.07 (0.01)	34.89 (0.21)	33.97 (0.22)	35.81 (0.45)	44.84 (0.43)	36.78 (0.01)	38.84 (0.10)	39.07 (0.01)	37.79 (0.09)
Midlle Income	47.79 (0.45)	38.30 (0.24)	43.54 (0.21)	37.21 (0.26)	36.77 (0.18)	40.50 (0.43)	43.30 (0.17)	40.00 (0.26)	43.78 (0.09)
High Income	15.93 (0.22)	22.13 (0.40)	17.70 (0.18)	22.33 (0.31)	12.56 (0.46)	18.18 (0.15)	14.29 (0.04)	16.74 (0.12)	14.29 (0.08)
Not say	2.21 (0.14)	4.68 (0.09)	4.78 (0.05)	4.65 (0.05)	5.83 (0.06)	4.55 (0.01)	3.57 (0.03)	4.19 (0.01)	4.15 (0.01)
Total N (respondents)	226	235	209	215	223	242	224	215	217

Note 1: IQ = Indirect questioning; BTS = Bayesian tuth serum; standard errors (in parentheses).
Note 2: Low Income < £25,000; Middle Income = £25,000 - 49,999; High Income > £50,000.

4.4 Econometric modelling

The models presented in this paper were developed based on the random utility theory (RUT) implying that individuals will prefer the alternative that offers the highest expected utility. The RUT theory derives from Thurstone (1927), Luce (1959) and McFadden et al. (1973). RUT states that consumers' choices are formed by a deterministic part and a random component that can be written as:

$$U_{njt} = \beta x_{njt} + C_j + \varepsilon_{njt} \tag{4.1}$$

where U_{njt} is the consumer's n utility for the chosen alternative j from J possible alternatives during a choice situation t; β is a vector of coefficients to be estimated associated with the attributes x; C_j is an alternative specific constant (ASC) (one of which is constrained to be zero to facilitate estimation) and ε_{int} is an unknown part that is independently, identically distributed over the J alternatives. Under these assumptions, choice j

probability at situation t can be given by the following multinomial logit (MNL) model:

$$\Pr\left(j_{nt}|\beta, x_{njt}\right) = \frac{\exp\left(\beta x_{njt} + C_j\right)}{\sum_{j=1}^{J} \exp\left(\beta x_{njt} + C_J\right)}. \tag{4.2}$$

Each individual is asked to complete a sequence of eight choice tasks, hence the joint probability of each choice in the sequence can be expressed as:

$$\Pr\left(y_n|\beta, x_n\right) = \prod_{t=1}^{T=8} \Pr\left(j_{nt}|\beta, x_{njt}\right), \tag{4.3}$$

where y_n represents the choice tasks sequence over the T choice situations for each respondent n in the set $y_n = \langle j_{n1}, j_{n2}, ..., j_{nT} \rangle$. The MNL provides marginal estimates for the homogenous marginal utilities of each of the attributes used in our analysis. Additionally, we use the MNL estimated for all sausages attributes (i.e., full model) to estimate the relative importance of each attribute on consumers' choices and systematically compare the relative fits of equivalent multinomial logit models that, alternatively, omit one attribute at a time (i.e., partial model). As a result (Lancsar et al., 2007), the contribution of each attribute is the difference between the full and partial model log-likelihoods: $\Delta\mathscr{L}_x = \mathscr{L}_{\text{full}(-x)} - \mathscr{L}_{\text{full}}$, where $\mathscr{L}_x$ is the increase in log-likelihood between the full model, $\mathscr{L}_{\text{full}}$, and the full model excluding attribute x, $\mathscr{L}_{\text{full}(-x)}$. Attributes that are more important in explaining choices will contribute more to the log-likelihood of the full model, which will be indicated by the larger differences between the full and partial model log-likelihoods. The relative importance is calculated as the percent change in log-likelihood: $\Delta\mathscr{L}_x / \sum_{x=1}^{X} \Delta\mathscr{L}_x$.

Further, we use latent class models to enhance our understanding of consumers' choices and observe how different segments of consumers choose between sausages having different characteristics. The latent class models accommodate heterogeneity in preferences for the sausages characteristics (i.e., attributes) and so, allow us to explain the differences in choices made by distinct segments of consumers within each of the nine experimental settings. The first step of the latent class modelling process is given by the consumers' classification in Q classes. This classification is based on the assumption that consumers

belonging to the same class have homogeneous preferences. Conditional on belonging to class q, the probability that each consumer n will choose alternative i from J in each choice task t can be expressed as a multinomial logit model:

$$\Pr\left(j_{nt}|\hat{\beta}_q, X_n\right) = \frac{\exp\left(\beta_q X_{njt} + C_j\right)}{\sum_{j=1}^{J} \exp\left(\beta_q X_{njt} + C_J\right)}, \tag{4.4}$$

where β_q is a class-specific vector of coefficients, X_{njt} is a column vector denoting the attribute levels. In our study, consumers are asked to complete a panel of eight choice tasks, hence the probability of the sequence of choices by consumer n is given by the joint probability of each choice:

$$\Pr\left(y_n|\hat{\beta}_q, X_n\right) = \prod_{t=1}^{T_n} \Pr(j_{nt}|\hat{\beta}_q, X_n), \tag{4.5}$$

where $y_n = [i_{n1}, i_{n2}, \ldots, i_{nT_n}]$ is the sequence of choices faced by each individual.

The class assignment of individuals is neither known, nor imposed by the analyst, but is estimated up to a probability as part of the modelling process. The unconditional latent membership probability can be defined for each consumer n belonging to class q (Swait and Adamowicz, 2001; Boxall and Adamowicz, 2002) as follows:

$$\pi_{nq} = \frac{\exp\left(c_q + \gamma_q Z_n\right)}{\sum_{q=1}^{Q} \exp\left(c_q + \gamma_q Z_n\right)}, \tag{4.6}$$

where c_q is a class-specific constant, Z_n is a vector of consumers' individual characteristics (in our specific case, an identifier indicating to which of the two experimental settings, IQ or BTS, participants belong and γ_q is the associated class-specific vector of parameters to be estimated. Note, for identification purposes when $q = 1$, $c_Q = 0$ and $\gamma_Q = 0$. As a result, the coefficients of the class membership function for the remaining $Q - 1$ classes are interpreted relative to the first class. Therefore, the overall choice probability that

accounts for the complete set of choices made by consumer n is given by:

$$\Pr\left(y_n|\hat{\beta}_q, X_n, c, \gamma, Z\right) = \sum_{q=1}^{Q} \pi_{nq} \Pr\left(y_n|\hat{\beta}_q, X_n\right), \tag{4.7}$$

where π_{nq} is the unconditional class probability for consumer n.

Due to differences in scale between latent classes and models, it does not make comparative sense to compare the marginal utility parameter estimates. Instead, a valid comparison that is also consistent with the focus of our paper is a comparison of consumers' valuation for different types of sausages. For this reason, we calculated the conditional willingness to pay (WTP) estimates, which is the ratio of the marginal utility parameters divided by the marginal utility parameter associated with the sausages' price attribute conditioned by the choice probability that accounts for the complete set of choices made by consumer n in each of the q classes. The analysis in our study was performed by using R statistical software (R Core Team, 2021).

4.5 Results

Stated preference data for each main experimental setting (i.e., control, indirect questioning, and BTS) were analysed within the three main information conditions: baseline condition (in which no additional information was provided to participants), health condition (in which additional health information was provided to participants), and the environmental condition (in which with additional environmental information was provided to participants). We first ran the standard MNL model assuming preferences homogeneity and error variance in our sample and used the MNL estimates for all sausage attributes (i.e., full model) to compute the relative importance of each attribute to consumer choices. The attributes importance on consumer choices is presented in Table 4.5.

Next, we investigated preference heterogeneity by using a Latent Class (LC) model within each condition of consumers and identified three latent classes. The results of our analysis is presented in Table 4.6. The selection of the three-class parsimonious model was established based on Akaike Information Criterion (AIC) and Bayesian Information

Criterion (BIC), which are commonly used for model selection (Boxall and Adamowicz, 2002; Greene and Hensher, 2003). Therefore, we will focus on LC model with three classes in this paper.

4.5.1 Attributes importance on consumers' preferences

We present the results obtained from the partial log-likelihood analysis in Table 4.5. Examining the baseline condition showed in Table 4.5(a) we notice that the order of impact of the excluded attributes is the same in each of the three experimental settings (i.e., C, IQ, BTS). Further, we observe that, across all three experimental settings, the highest model fit difference between the full model and the partial model occurs when the 'Main ingredient' is the excluded attribute (with a relative effect of 46%, 67%, respectively 68% in C, IQ, BTS, respectively). This observation also indicates that 'Main ingredient' is the dominant attribute in IQ and BTS experimental settings meaning that, when in baseline condition, consumers may not have equally considered all the attributes when making the trade-offs between them. The next strongest impact on stated sausages' preferences is given by the exclusion of the 'Cost' attribute. With a relative effect of 42%, 26%, respectively 22%, we notice that the cumulative effect of the 'Main ingredient' and 'Cost' attributes approximates %90 in each experimental setting. In reverse, the omission of the remaining two attributes, 'Local' and 'Organic' have a much smaller relative influence on consumers preferences (approximately %10 for their cumulative effect).

Moving to the health condition reported in Table 4.5(b) we observe that, compared to the baseline condition, the order impact of the excluded attributes on the model fit remains the same in the IQ and BTS experimental settings. While in IQ and BTS the ranking order by attribute importance is 'Main ingredient' (45%, 44%), 'Cost' (40%, 40%), 'Local' (0.08%, 0.08%) and 'Organic' (0.06%, 0.08%), in C the most important attribute is 'Cost' (50%) followed by 'Main ingredient' (33%), 'Local' (12%) and 'Organic' (0.06%). Hence, compared to the baseline condition, the relative effect of the 'Main ingredient' in health condition decreased by 22% and 23% in IQ and BTS experimental settings. These results show that the 'Main ingredient' attribute lost its dominance displayed in IQ and

Table 4.5.: Attribute importance for consumers' preferences

(a) Baseline condition

	Attribute level excluded from the analysis	Log-likelihood	Partial effect - change in log-likelihood	Relative effect - % sum of change in log-likelihood	Cumulative %	Order of impact
C	None (full-model)	-1,793.58				
	Cost	-1,900.64	107.06	0.42	0.42	2
	Main ingredient	-1,912.03	118.45	0.46	0.88	1
	Local	-1,812.92	19.34	0.08	0.96	3
	Organic	-1,804.48	10.91	0.04	1.00	4
IQ	None (full-model)	-1,790.94				
	Cost	-1,884.25	93.31	0.26	0.26	2
	Main ingredient	-2,030.94	240.00	0.67	0.93	1
	Local	-1,807.22	16.28	0.05	0.98	3
	Organic	-1,799.48	8.54	0.02	1.00	4
BTS	None (full-model)	-1,567.75				
	Cost	-1,647.99	80.24	0.22	0.22	2
	Main ingredient	-1,809.96	242.20	0.68	0.90	1
	Local	-1,585.63	17.87	0.05	0.95	3
	Organic	-1,585.14	17.39	0.05	1.00	4

C = Control; IQ = Indirect Questioning; BTS = Bayesian Truth Serum

(b) Health condition

	Attribute level excluded from the analysis	Log-likelihood	Partial effect - change in log-likelihood	Relative effect - % sum of change in log-likelihood	Cumulative %	Order of impact
C	None (full-model)	-1,707.64				
	Cost	-1,831.03	123.39	0.50	0.50	1
	Main ingredient	-1,788.99	81.35	0.33	0.83	2
	Local	-1,736.26	28.62	0.12	0.94	3
	Organic	-1,721.60	13.96	0.06	1.00	4
IQ	None (full-model)	-1,748.29				
	Cost	-1,870.20	121.91	0.40	0.40	2
	Main ingredient	-1,884.32	136.03	0.45	0.85	1
	Local	-1,773.61	25.32	0.08	0.94	3
	Organic	-1,766.82	18.53	0.06	1.00	4
BTS	None (full-model)	-1,850.41				
	Cost	-1,997.63	147.22	0.40	0.40	2
	Main ingredient	-2,011.96	161.55	0.44	0.84	1
	Local	-1,881.10	30.68	0.08	0.92	3
	Organic	-1,879.37	28.95	0.08	1.00	4

C = Control; IQ = Indirect Questioning; BTS = Bayesian Truth Serum

(c) Environment condition

	Attribute level excluded from the analysis	Log-likelihood	Partial effect - change in log-likelihood	Relative effect - % sum of change in log-likelihood	Cumulative %	Order of impact
C	None (full-model)	-1,758.97				
	Cost	-1,877.88	118.91	0.36	0.36	2
	Main ingredient	-1,918.62	159.65	0.48	0.84	1
	Local	-1,792.18	33.21	0.10	0.94	3
	Organic	-1,777.48	18.51	0.06	1.00	4
IQ	None (full-model)	-1,706.19				
	Cost	-1,798.13	91.95	0.38	0.38	2
	Main ingredient	-1,827.75	121.56	0.50	0.88	1
	Local	-1,726.49	20.31	0.08	0.97	3
	Organic	-1,714.17	7.99	0.03	1.00	4
BTS	None (full-model)	-1,689.25				
	Cost	-1,821.50	132.25	0.40	0.40	2
	Main ingredient	-1,845.81	156.56	0.47	0.87	1
	Local	-1,717.72	28.47	0.09	0.95	3
	Organic	-1,705.81	16.56	0.05	1.00	4

C = Control; IQ = Indirect Questioning; BTS = Bayesian Truth Serum

BTS, meaning that, when receiving the health information, consumers may have made more careful trade-offs between the attributes. Additionally, although the drop of the relative importance of the the 'Main ingredient' attribute in C experimental setting is the smallest within the health condition (13%), it changes the ranking of attributes impact order. Hence, the most notable change determined by the extra health information received by consumers in health condition is the relative importance displayed by the 'Cost' attribute in C experimental setting. It has the highest impact on the model fit with a relative effect cumulating %50. This results might indicate that consumers' preferences are influenced by the extra health information they are provided with in the health condition. Moreover, compared to the other two conditions, health condition appears to favour the most balanced relative effect change in the model fit (highest entropy corresponding to the relative effects generated by the attribute importance analysis in health condition).

As in the baseline condition, in the environment condition presented in Table 4.5(c), the order of impact of the excluded attributes on the model fit is the same in each of the three experimental settings (i.e., C, IQ, BTS). The 'Main ingredient' has the highest relative effect on model's log-likelihood in each of the three experimental settings: 48%, 50%, respectively 47%. However, in line with the findings highlighted in health condition, compared to the baseline condition, in environment condition we observe that the variation in attributes importance is lower. This indicates that consumers preferences are also affected by the extra environment information. This supports our conjecture that receiving relevant extra information related to meat consumption will determine consumers to assess all the available information when forming their preferences. As in the previous conditions, no outstanding differences are found for the impact of the last two ranked attributes on the model fit (ie., 'Local' and 'Organic').

4.5.2 Estimation Results

Table Table 4.6 shows the results from the analysis of the choice data. By focusing on the results obtained for the baseline condition in table Table 4.6(a) we see that, all else being equal, in Control (C) class 1 accounts for 42% of the C sample, while class 2 and

class 3 account for almost equal percentage of the sample (28%, respectively 30%). In IQ class 1 and class 2 have the same sizes (31%), while class 3 amounts 38% of the IQ sample. In contrast, in BTS, class 2 and class 3 account for almost equal percentage of the sample (37%, respectively 38%), while class 1 accounts for 25% of the BTS sample. First, to gain more insight into the characterisation of the classes, we ran the Latent Class model that included socio-demographic characteristics in the class membership function. However, the significance of these class covariates was sparse, and at the expense of 14 additional estimated consumer parameters, we elected to drop them from analysis (the same applied for the health and environmental conditions). When investigating how the classes differed given the experimental settings (relative to C), it is apparent that belonging in the IQ experimental setting affects only class 3 membership probabilities, but belonging in the BTS experimental setting affects both class 2 and 3 membership probabilities (for identification reasons we fixed parameters for class 1 at zero). Hence, it is apparent that consumers belonging in the IQ experimental setting are more likely to belong to class 3, while those in BTS are more likely to belong in both classes 2 and 3 compared to class 1. The significance of the class covariates indicates that belonging to different experimental settings contributes to explaining heterogeneity in sausage preferences.

Comparing the estimated marginal utilities for the baseline condition across the three latent classes we observe notable and significant differences. Compared to classes 2 and 3, class 1 consumers prefer plant-based sausages to any other type of meat. Another striking difference is noticed in the sign change in the two alternative-specific constants (ASC 1 and ASC2) when moving from class 1 to class 2 and class 3. In class 1 the alternative-specific constants are estimated with relatively large positive and significant signs, meaning that, all else being equal, this subsample of consumers is highly likely to choose one of the two presented alternatives. The reverse is true for the significantly negative estimates of the alternative-specific constant in class 3 (these are also negative in class 2, but differences are not statistically significant).

Despite these differences, some similarities are apparent across the three classes. In all three classes, consumers significantly prefer local and organic sausages that cost less.

Table 4.6.: Latent class logit model results

(a) Baseline condition

	Class 1		Class 2		Class 3	
Class size by covariates						
C	0.42		0.28		0.30	
IQ	0.31		0.31		0.38	
BTS	0.25		0.37		0.38	
Marginal utilities (β)						
Main ingredient: beef	-0.76**	(0.27)	2.97***	(0.39)	3.19***	(0.47)
Main ingredient: chicken	-0.89***	(0.19)	3.08***	(0.74)	1.35	(1.02)
Main ingredient: pork	-0.04	(0.16)	3.24***	(0.57)	5.23***	(0.55)
Origin: local	0.49***	(0.09)	0.42***	(0.10)	0.82***	(0.15)
Organically produced: yes	0.57***	(0.12)	0.34*	(0.16)	0.52***	(0.15)
Price	-0.65***	(0.06)	-0.49***	(0.13)	-0.59***	(0.14)
ASC 1	2.25***	(0.21)	-0.36	(0.62)	-2.54***	(0.41)
ASC 2	2.36***	(0.22)	-0.47	(0.62)	-2.72***	(0.39)
Class constant (c)						
Constant	0.00		-0.38	(0.21)	-0.33	(0.21)
Class covariates (Z)						
IQ	0.00		0.39	(0.29)	0.55*	(0.25)
BTS	0.00		0.78**	(0.25)	0.75**	(0.24)
Log-likelihood	-4,456.33					
Observations	5,360					
Respondents	670					
$\bar{\rho}^2$	0.22					
AIC	8,972.66					
BIC	9,166.46					

All standard errors (in parentheses) are robust and clustered at the consumer level. *, ** and *** indicate statistical significance at the 10, 5 and 1 percent levels, respectively, using the p-value of a one-sided test.

(b) Health condition

	Class 1		Class 2		Class 3	
Class size by covariates						
C	0.47		0.31		0.22	
IQ	0.36		0.35		0.29	
BTS	0.43		0.30		0.27	
Marginal utilities (β)						
Main ingredient: beef	-0.64***	(0.18)	1.92*	(0.84)	3.45***	(0.50)
Main ingredient: chicken	-0.70***	(0.18)	1.68**	(0.63)	2.64***	(0.44)
Main ingredient: pork	0.11	(0.18)	6.24***	(0.71)	3.95***	(0.45)
Origin: local	0.65***	(0.07)	1.03**	(0.38)	0.59***	(0.11)
Organically produced: yes	0.51***	(0.07)	0.61	(0.41)	0.58***	(0.11)
Price	-0.75***	(0.05)	-0.90***	(0.24)	-0.49***	(0.07)
ASC 1	2.60***	(0.22)	-3.03**	(1.01)	-1.72***	(0.46)
ASC 2	2.66***	(0.22)	-3.32***	(0.98)	-1.74***	(0.47)
Class constant (c)						
Constant	0.00		-5.61***	(0.89)	-0.34*	(0.17)
Class covariates (Z)						
IQ	0.00		4.87***	(0.90)	0.38	(0.27)
BTS	0.00		4.63***	(0.88)	0.02	(0.24)
Log-likelihood	-4,708.98					
Observations	5,480					
Respondents	685					
$\bar{\rho}^2$	0.22					
AIC	9,477.97					
BIC	9,676.23					

All standard errors (in parentheses) are robust and clustered at the consumer level. *, ** and *** indicate statistical significance at the 10, 5 and 1 percent levels, respectively, using the p-value of a one-sided test.

(c) Environment condition

	Class 1		Class 2		Class 3	
Class size by covariates						
C	0.58		0.34		0.08	
IQ	0.54		0.33		0.13	
BTS	0.51		0.40		0.09	
Marginal utilities (β)						
Main ingredient: beef	3.65***	(0.24)	0.01	(0.23)	-15.15**	(5.16)
Main ingredient: chicken	2.80***	(0.19)	0.21	(0.20)	-2.21***	(0.62)
Main ingredient: pork	4.79***	(0.27)	0.68**	(0.22)	-1.99**	(0.70)
Origin: local	0.69***	(0.08)	0.68***	(0.09)	0.73*	(0.29)
Organically produced: yes	0.25**	(0.08)	0.57***	(0.08)	0.55*	(0.24)
Price	-0.49***	(0.05)	-0.75***	(0.07)	-0.76***	(0.16)
ASC 1	-2.42***	(0.26)	2.79***	(0.28)	1.96**	(0.60)
ASC 2	-2.45***	(0.25)	2.70***	(0.28)	2.06**	(0.66)
Class constant (c)						
Constant	0.00		-0.51**	(0.16)	-1.94***	(0.30)
Class covariates (Z)						
IQ	0.00		0.37	(0.26)	0.49	(0.40)
BTS	0.00		0.25	(0.26)	0.20	(0.42)
Log-likelihood	-4,432.64					
Observations	5,248					
Respondents	656					
$\bar{\rho}^2$	0.23					
AIC	8,925.29					
BIC	9,122.26					

All standard errors (in parentheses) are robust and clustered at the consumer level. *, ** and *** indicate statistical significance at the 10, 5 and 1 percent levels, respectively, using the p-value of a one-sided test.

These are consistent with our expectations, and are an evidence for the internal validity of the employed empirical approach. Recalling the class memberships, we highlight that, consumers who prefer to eat meat are more likely to belong to class 2 and class 3. Moreover, the significance of covariates implies that (relative to C) consumers who prefer to eat meat are more likely to be from IQ and BTS experimental settings. Results for the latent class model for the health condition are presented in Table 4.6(b). The class membership analysis reveals that in C, all else being equal, class 1 accounts for approximately half of the sample (47%), while class 3 comprises the lowest percentage of consumers (22%) in C. Class 2 amounts 31% of the C sample. By looking at the class memberships across the three experimental settings (C, IQ, BTS) within the health condition we notice that the same ranking of the class sizes as in C also prevails for IQ and BTS experimental settings. Specifically, in IQ class 1 amounts 36% of the sample, while class 2 and class 3 account for 35%, respectively 29% of the IQ sample. In BTS we observe the same order with class 1 comprising the highest amount of consumers (43%) and class 3 the lowest (27%) amount in the BTS sample. Class 2 accounts for 30% of the BTS sample. Inspecting the class covariates, we highlight that class memberships are partially explained by the experimental settings. Precisely, compared to class 1, class 2 and class 3 are more likely to include consumers that belong in both IQ and BTS experimental settings than in C.

The constants corresponding to classes 2 and 3 are negative and significant, suggesting that, overall and all else being equal, and relative to class 1, consumers in these classes are less likely to be in experimental setting C. In fact, as evidenced by the class sizes across all experimental settings, class 3 comprises the lowest share of consumers (although results corresponding to class 3 covariates are not statistically different).

Interpretation of marginal utilities reveals that, as for the baseline condition, the same commonalities and differences between classes remain valid for the health condition. Hence, the most notable difference between classes is that consumers in class 1 prefer a plant-based type of sausage to any meat alternative. However, as indicated by the estimated coefficients (all 'Main ingredient' levels are highly positive and statistically significant), all else being equal, consumers in classes 2 and 3 display strong preferences for

meat sausages compared with plant-based ones. There is also more variability in preferences for the 'Main ingredient' levels in class 2. Another prominent difference between class 1 and classes 2 and 3 relates to the marginal utility of the alternative-specific constant. In class 1 both ASC 1 and ASC 2 have positive coefficients, indicating that, all else being equal, consumers are highly likely to choose one of the two alternatives. Contrarily, the significantly negative estimates of the alternative-specific constants in classes 2 and 3 signal that consumers in these classes are less likely to choose one of the presented alternatives. Whilst significant, the rather small magnitude of the local and organically produced marginal utilities in all three classes can signal that, when it comes to different types of sausages, consumers are not very interested in the provenance of a sausage, or if it has an organic certification or not. Similarly, in all three classes, the price coefficient is significant and negative, which is expected and consistent with economic theory, and indicates that, all else being equal, as the price increases the utility decreases.

Table 4.6(c) presents the latent class model results for the environmental condition. Starting with the class memberships we see striking differences compared to the first two conditions (i.e., baseline and health conditions). In the environment condition, we observe the same ranking of the classes shares for all three experimental settings: class 1 accounts for the largest share of consumers in each subsample of consumers (0.58% in C, 0.54% in IQ and 0.51% in BTS); class 2 also accounts for a high percentage in each of the three experimental settings (0.34% in C, 0.33% in IQ and 0.40% in BTS); while class 3 accounts for very small shares of consumers in C (0.08%), IQ (0.13%) and BTS (0.09%). Regarding class covariates, we first highlight that, all else being equal, the class constant estimates suggest that, in the environmental condition, consumers in classes 2 and 3 are less likely to belong to the C experimental setting. This result is expected and in line with the observed class shares for this condition.

If we continue by looking at the estimated coefficients we underline one distinguishable difference between the three latent classes. Although, in each experimental setting (C, IQ, BTS) class 3 accounts for very small amount of the sample, consumers in this class exhibit strong dislike towards the meat sausages, but also more variability in preferences for the

'Main ingredient' levels. Although in each of the three conditions (baseline, health, environmental) there is a consumers' class that prefers plant-based sausages, relative to the first two conditions in the environmental condition, this class is particularly small with higher magnitudes corresponding to the 'Main ingredient' levels. Another notable distinction between the classes, is the negative sign of the two alternative-specific constants in class 1 suggesting that, all else being equal, consumers in this class are less likely to choose one of the two alternatives; the opposite applies for the significantly positive estimates of the alternative-specific constant in class 2 and class 3. Compared to the first two analysed conditions (baseline and health) we emphasize the dissimilarity between the signs of the alternative-specific constants, meaning that in the environment condition more consumers are likely to choose one of the presented alternatives. On the other hand, as in the previous conditions, for all three classes in the environment condition, we find that the price coefficient is significant and negative and that consumers prefer local and organic sausages at lower prices.

Because each class and model are subject to different scales in the latent class analysis, we refrain from making further comparisons of class-specific marginal utilities and continue by comparing the marginal WTP estimates by experimental setting.

4.5.3 Willingness to pay summaries

Table 4.7(a) presents the descriptive statistics of the means of the conditional (i.e., individual-specific) willingness to pay (WTP) distributions for each experimental setting (C, IQ, BTS) in the baseline condition. For each condition the mean, median, and 1st and 3rd quartiles of the conditional WTP distributions obtained from Models I, II, and III are presented in Table 4.6. The WTP estimates are conditional on consumer's preferences and attribute levels in each experimental setting.

WTPs derived from the model for the baseline condition indicate that consumers below the 1st quartile prefer plant-based sausages, and that those above the 3rd quartile have a strong preference for meat sausages. Mean WTPs reveal the highest valuation to be for pork sausages, and for the lowest to be for organically produced sausages. Average

WTPs for all attribute levels notably increase for both IQ and BTS experimental settings relative to that of the C setting. This result aligns with previous stated choice research that examined the effectiveness of BTS on HB mitigation Menapace and Raffaelli (2020): BTS reduced the WTP for all public attributes (guaranteed fair prices paid to farmers; employment of disadvantaged people; processed with renewable energy; 100% Italian durum wheat; produced from ancient grain varieties) of durum wheat organic pasta in the form of "penne rigate" (the good investigated in their experiment), but not for a private one (slow dried). Nevertheless, our study differs from theirs since we used the control experimental setting as a reference point for the WTP, while they have used revealed preference data. Another strand of literature (i.e., three contingent valuation studies using BTS to investigate its effect on the HB) found that the BTS effect might vary depending on factors such as choice context and the type of the researched good (i.e., public/private goods); in each the need to further investigate BTS in choice studies was highlighted (Barrage and Lee, 2010; Weaver and Prelec, 2013; Bennett et al., 2019).

We next present the conditional WTP summaries for the health and environment conditions and analyse if the additional information related to the impact of meat consumption affects the conditional WTPs.

The summary of the conditional WTP distributions for the health condition is given in table Table 4.7(b). As for the baseline condition, the consumers in health condition that are below the 1st quartile prefer plant-based sausages, and those above the 3rd quartile prefer meat-based ones. Although the signs for the 1st and 3rd quartiles are the same in both baseline and health conditions, the magnitude of the conditional WTPs points corresponding to the 3rd quartile in the health condition is smaller than the same quartile points in the baseline condition. This can suggest that although consumers above the 3rd quartile in both conditions (baseline and health) have a strong preference towards meat sausages, their WTP for the meat sausages will diminish once they receive additional information on how meat consumption can affect their health. A common observation across the three experimental settings (C, IQ, BTS) in the health condition is that the marginal WTPs for the attributes levels are higher in BTS than they are compared with

Table 4.7.: Willingness to pay summaries

(a) Baseline condition

	Main ingredient: beef			Main ingredient: chicken			Main ingredient: pork			Origin: local			Organically produced: yes		
	C	IQ	BTS	C	IQ	BTS	C	IQ	BTS	C	IQ	BTS	C	IQ	BTS
1st Qu.	-1.12	-0.27	2.73	-1.34	-0.52	1.98	-0.02	0.79	4.06	0.76	0.78	0.84	0.76	0.74	0.72
Median	5.26	5.39	5.39	2.29	2.30	2.42	6.57	6.63	6.65	0.86	0.89	0.88	0.87	0.87	0.86
Mean	2.85	3.59	4.01	1.90	2.41	2.86	4.50	5.42	5.79	0.98	1.03	1.04	0.83	0.82	0.81
3rd Qu.	5.50	5.73	5.77	4.70	5.09	5.70	7.99	8.71	8.58	1.24	1.37	1.34	0.88	0.88	0.88

C = Control; IQ = Indirect Questioning; BTS = Bayesian Truth Serum

(b) Health condition

	Main ingredient: beef			Main ingredient: chicken			Main ingredient: pork			Origin: local			Organically produced: yes		
	C	IQ	BTS	C	IQ	BTS	C	IQ	BTS	C	IQ	BTS	C	IQ	BTS
1st Qu.	-1.10	-0.64	-1.04	-1.16	-0.76	-1.11	-0.04	0.38	0.01	0.83	0.80	0.85	0.67	0.67	0.67
Median	3.08	4.30	4.09	1.16	1.17	1.16	3.68	5.33	4.86	0.92	0.92	0.92	0.68	0.71	0.69
Mean	1.96	2.57	2.19	1.10	1.46	1.16	3.43	4.23	3.83	0.97	0.99	0.99	0.83	0.85	0.82
3rd Qu.	4.51	4.61	4.44	3.56	3.86	2.91	5.68	7.32	7.12	0.95	1.22	1.16	1.06	1.11	1.01

C = Control; IQ = Indirect Questioning; BTS = Bayesian Truth Serum

(c) Environment condition

	Main ingredient: beef			Main ingredient: chicken			Main ingredient: pork			Origin: local			Organically produced: yes		
	C	IQ	BTS	C	IQ	BTS	C	IQ	BTS	C	IQ	BTS	C	IQ	BTS
1st Qu.	0.01	0.01	0.01	0.27	0.27	0.27	0.91	0.91	0.91	0.90	0.92	0.91	0.51	0.51	0.51
Median	6.50	4.97	4.50	5.27	4.63	3.79	9.04	7.99	6.62	1.36	1.29	1.22	0.53	0.56	0.60
Mean	2.62	1.48	2.03	3.11	2.78	2.76	5.66	5.20	5.10	1.19	1.17	1.16	0.61	0.62	0.63
3rd Qu.	7.38	7.37	7.36	5.66	5.66	5.65	9.67	9.67	9.65	1.39	1.39	1.39	0.75	0.74	0.75

C = Control; IQ = Indirect Questioning; BTS = Bayesian Truth Serum

the C setting, but they are lower in BTS compared with the IQ setting. These results can be explained by the private good perspective that consumers' might attach to the good marketed in our choice experiment. Under the health condition, given the additional health information that respondents received, the discrepancies across the WTPs estimates might be explained by their reluctance regarding the healthiness of the presented plant-based alternatives. This characteristic of our marketed good (i.e., plant-based ingredient) might determine some of the respondents to not state their true value for it (Meyerhoff and Liebe, 2008).

Results for the conditional WTPs derived from the model for the environmental condition are presented in Table 4.7(c). Here, it is apparent that, with the exception of the organically produced attribute level, the mean WTPs for all other attribute levels are lower in BTS compared with the C experimental setting. Additionally, in this condition, the ranking of the median point follows the expected WTPs order in each experimental setting (i.e., the WTP in the C setting is higher than the WTPs in the IQ and BTS settings) for all attribute levels, except one (organically produced). This exception is not surprising given that organically produced food products are perceived to be more environmentally friendly by the majority of consumers (Lazzarini et al., 2016; Roman et al., 2017; Hartmann et al., 2022). Other notable differences compared with the first two conditions are given by the 1st and 3rd quartile point values. In the environmental condition, the values of the conditional WTPs in the 1st quartile suggest that consumers are not willing to pay for plant-based sausages, but values of the conditional WTPs in the 3rd quartile reveal that they strongly prefer meat sausages. Conversely, in baseline and health conditions, the values of the conditional WTPs for consumers below the 1st quartile reveal that they are willing to pay for plant-based sausages and they are not willing to pay for meat sausages.

Overall, both IQ and BTS experimental settings reveal the average WTP for 'beef' to be smaller in the health condition compared with the baseline condition, and that it decreases further in the environmental condition compared with the health condition. This indicates that people value beef sausages less when the environmental impact of meat consumption has been communicated to them prior to their making a choice, as opposed

to health impacts. However, both health and environmental conditions resulted in a lowered WTP for beef sausages when compared with baseline values where no information was provided. When it comes to chicken sausages, in both IQ and BTS experimental settings, consumers were willing to pay less when conditioned by the health impacts as opposed to environmental impacts of meat consumption. The relative dislike for chicken sausages, and thus lowered WTP when informed by health impacts, might be because of the familiarity with food-borne diseases caused by consumption of unfit chicken, and media coverage about these incidences. The mean WTPs for 'Main ingredient: chicken' decrease in IQ and BTS experimental settings in the health condition compared with the baseline condition, but increase in the environmental condition compared to the baseline condition. This indicates that participants were influenced in opposing directions by the health and environmental impact when it concerned product type. The higher WTP for chicken sausages in the environmental condition may be because of the common knowledge of the reduced environmental impact of chicken production compared to that of beef (Food and Agriculture Organization of the United Nations, 2017).

Regarding the other two attributes 'Origin' and 'Organically produced', we found a positive WTP in all conditions across all experimental settings. This result is supported by previous research that has shown that being locally sourced is an important product feature for UK consumers, with locally sourced product associated with benefits such as trustable traceability and provenance, and because it supports UK farmers and local agricultural economics (Dibb and Fitzpatrick, 2014; Gillison et al., 2022). Similarly, the organic feature of a product is positively perceived by consumers and is associated with improved environmental care (Sanchez-Sabate and Sabaté, 2019; Yang and Renwick, 2019; Sullivan et al., 2021; Faber et al., 2022).

Although, the implementation of HB mitigation techniques in our study generated smaller average WTPs for meat sausages in health and environment choice contexts compared to the baseline, these WTPs were always positive showing the preference towards meat sausages compared to the plant-based ones. These results can suggest that depending on the available information, consumers might reduce their own meat consumption,

but are not willing to fully substitute it with plant based products. Overall, our findings can indicate that consumer preferences are significantly shaped by the choice context, with health and environmental information playing a pivotal role in guiding their food choices.

4.6 Discussion and Conclusions

This study aims to contribute to the literature on mitigating HB in discrete choice experiments by investigating two understudied mitigation methods, inferred valuation (as IQ) and BTS in three choice contexts: baseline condition (in which no additional information was provided to participants); health condition (in which additional information on the health impact of meat consumption was provided to participants); and an environmental condition (in which additional information on the environmental impact of meat consumption was provided to participants). Our empirical findings reveal that, depending on the choice context, both methods have an influence on the conditional WTP values across the experimental settings. For example, both IQ and BTS contribute towards reducing the conditional WTPs for one of levels of the most important attribute (i.e., 'Main ingredient: beef') in our choice experiment. Moreover, in the baseline condition, with the exception of the 'Organically produced' attribute, for all other attributes the mean WTPs increase BTS relative to IQ, and in IQ relative to C. This result might indicate that, in reality, consumers have strong preferences towards meat sausages and that they will always be willing to pay more for meat sausages compared with plant-based sausages. The same tendency found in the baseline condition is noticed when consumers receive additional information regarding the impact of meat consumption on their health, indicating that, when choosing their food, consumers might already consider the implications of that food consumption on their health. This observation is strengthened by the similarity between the class covariate signs and magnitudes corresponding to the experimental settings (IQ and BTS) in baseline and health conditions. However, given that in the health condition, BTS reveals higher mean WTPs than in the C setting, but lower than in IQ setting, we might conjecture, as Menapace and Raffaelli (2020) demonstrated, that there

is a better-than-average effect that results in respondents considering that they valued the meat sausages more than other consumers similar to them. Additionally, compared with the baseline condition (when no additional information related to meat consumption was provided), consumers in the health condition state lower WTPs when they receive the indirect question, and when they are incentivised to tell the truth (BTS experimental setting). This result can indicate that, depending on the good investigated, the choice context might vary by simply offering additional information to consumers.

Regardless, when consumers receive additional information of the impact of meat consumption on the environment, with the exception of the 'Organically produced' attribute, the BTS experimental setting reveals that for all other attributes that consumers are willing to pay less than in the C setting. Although, consumers are willing to pay slightly more for chicken and pork sausages in the IQ setting compared with the BTS setting, they will always pay less for meat sausages in the IQ setting compared with that of the C setting. Similarly, for meat sausages, the mean WTPs of consumers in the BTS setting are smaller than the mean WTPs of consumers in the C setting. Additionally, the class covariates indicate that in the environmental condition the strong preferences for meat sausages are diminished. Although LC model estimation results reveal that there remain two classes of consumers (1 and 2) that prefer meat sausages, the marginal estimates for the meat ingredients are only significant for pork. Conversely, the marginal estimates in class 3 present high magnitudes and are significant, suggesting that, although more likely to be in the IQ and BTS experimental settings, consumers in the environmental condition show stronger preferences for plant-based sausages than meat-based ones.

Our results confirm that, indeed depending on the choice context, the same HB mitigation technique can have different effects on consumers' valuations of the same good. For example, we note that in the environmental condition, the monetary incentives implied by the BTS reduce the WTPs for all attributes, whereas in the baseline condition the monetary incentives implied by the BTS increase the WTPs for all attributes. These results can be determined by the specificity of the good (meat sausages vs plant-based sausages) investigated in our choice experiment. This could also explain our finding that

the most important attribute for consumers in our choice experiment is 'Main ingredient.' It appears that, for this type of good, the indirect questions in the IQ and BTS experimental settings (i.e., whether they are or are not monetarily incentivised) determines whether consumer have higher WTPs for the meat sausages. Hence we recommend further research on different types of good in choice experiments to enrich the knowledge of the BTS and IQ contribution in mitigating HB in discrete choice experiments.

Generally, the higher average WTP for meat sausages relative to plant-based sausages across all experimental settings (i.e., C, IQ, and BTS) in all choice contexts (i.e., baseline, health, and environmental) might indicate that most consumers in our sample always preferred meats sausages. This is not unexpected because research on consumer acceptance of plant-based meat alternatives has identified negative associations toward meat alternatives (Michel et al., 2021) and demonstrated that there is at least one segment of consumers (old, not educated, and living in a small city) who are reluctant to and would never accept plant-based meat alternatives (Carlsson et al., 2022). However, what we report is a reduction in the size of marginal WTPs when the choice context changes from health to environmental impacts for different product categories (chicken or beef versus plant-based sausages). We also report that incorporating HB using BTS and IQ further reduced the marginal WTPs, which suggests that these two techniques, more or less, have equal impact in minimising the untruthful answers (e.g., high WTPs).

To delve deeper into the understanding of the effectiveness of inferred valuation and Bayesian truth serum in mitigating HB we could follow the approach of Cerroni et al. (2023) and conduct future research to examine the differences between IQ and BTS in terms of reliability. Cerroni et al. (2023) showed that the CMa-based DCE does not improve the validity of estimated preferences, but does increase their reliability. Our study's findings, on the other hand, might provide insights into how inferred valuation and Bayesian truth serum affect the reliability of preferences in various choice contexts, offering a broader perspective on HB mitigation. Another area for future work extending beyond the scope of this dissertation is testing for statistical differences across the estimated WTP values.

As stated in section 4.1, we sought also to contribute to an understanding of how moderating factors influence the magnitude and/or direction of HB. For this, we ran a Latent Class model by including the socio-demographic characteristics presented in Table 4.4. However, the significance of these class covariates was sparse, so at the expense of 14 additional estimated consumers parameters, we elected to exclude them from our analysis (the same applied to all of baseline, health, and environmental conditions). Hence, these results strengthen the recommendation made by Haghani et al. (2021) that more research is needed in choice experiments on the study of these moderating factor effects on the HB given different choice contexts and good types.

4.7 Limitations

Although, this paper highlights the importance of investigating the inferred valuation and bayesian truth serum hypothetical bias mitigation techniques in different choice contexts and for different types of goods, we identify several limitations which warrant further investigation. Consistent with previous studies that have examined different types of goods (Mørkbak et al., 2014; Svenningsen and Jacobsen, 2018; Wuepper et al., 2019), we are limited in what we can extrapolate from our findings because we investigate a very specific good. We also note that our empirical findings across the experimental settings with the same conditions differ given the choice context that consumers' are faced with. This means that our conclusions are context specific, so further research could examine consumer choice behaviour within other familiar and unfamiliar contexts.

The different choice contexts in our study were defined by the additional information related to the impact of meat consumption on health and environment. This information provided consumers with facts from reputable authorities. However, the effect of the additional information within and across the corresponding conditions (i.e., health condition and environmental condition) on consumers' choice behaviour can be investigated further by using different framing for the same information.

To address the main objective of this study, each of the choice contexts in our choice experiment (i.e., baseline, health, and environmental conditions) were further divided in

three experimental settings (C, IQ, and BTS). This produced nine distinct conditions, resulting in the collected stated choices data corresponding to each of them diminishing relative to the entire sample. This may have impacted estimates and marginal WTPs. Although this shortcoming has been previously highlighted in choice-experiment studies (Mørkbak et al., 2014; Meginnis and Campbell, 2017; Van Loo et al., 2018), we have been cautious when interpreting the valuation estimates. Further research might benefit from increasing the sample sizes for the investigated conditions.

A further limitation is that we generated the reference point for comparing consumer WTPs (and so the effects of the two investigated HB mitigation methods) by using stated preference data collected via the control experimental setting, rather than by using revealed preference data, as (Menapace and Raffaelli, 2020) had done. Consequently, it is possible that the hypothetical nature of the control experimental setting may explain why we did not identify more striking results for the contribution of IQ and BTS on HB mitigation. Further research might consider designing and including a revealed study to observe how stated and revealed choice behaviour compare.

As in (Menapace and Raffaelli, 2020), the incentive scheme employed in our study implies that a percentage of the top performers receive a fixed prize. Prelec (2004) introduces a scoring system but leaves out the details on how to financially incentivise subjects based on this system. There are concerns related to this mechanism since compensating only the top performers with a fixed prize might compromise the incentive compatibility of the mechanisms. As noted, this concern is not tied to the pay-all versus pay-one debate but rather pertains to the incentive compatibility of the mechanisms per se. Given that a mechanism is considered incentive compatible when a proper incentive scheme is used, one possible avenue to address this concern and so to better align with the incentive compatibility requirements, is to remunerate all subjects based on their actual performance, utilising the score as a weighting factor associated with a maximum potential reward.

We plan to further investigate the rich data collected under different model specifications that accommodate the indirect questions included in IQ and BTS experimental settings. A promising direction for future investigation of our data involves the use of

latent variables (Stolz et al., 2011) to explore the effects of indirect questions, as well as further group segmentations and valuations based on opinion and attitude questions in our survey. Integrating choice models with latent variables can help better understand consumer preferences, and more accurately identify the value of an investigated good if additional available data in our full data set are used.

Chapter 5

Summary and conclusions

Various challenges in our food system, including the emergence of new pathogens, limited knowledge of food safety practices and the undesirable effects of increasing meat production and consumption on the human health and environment, pose significant pressure on the policy makers aiming to manage and diminish the sources and effects of these challenges (World Health Organization et al., 2015; Moreb et al., 2017; Michel et al., 2021).

This thesis looked into several food safety and food consumption challenges and applied economic theory and multidisciplinary approach to shed light on some of theses challenges presented within the three different, but related studies. These studies have policy implications as they provide valuable insights that can help in designing effective communication strategies or other policy interventions reducing the harm to consumers. This section presents an overview of the findings, contributions, policy implications and potential future development for each of the three studies.

The first study investigated the role of individual responsibility prompts in consumers' choices of a food safety campaign. It explores how and for whom these prompts change the stated choices of food safety campaigns that are most likely to influence the way consumers handle, cook and store their food.

Food safety campaigns have largely been designed based on the findings of technical risk assessments. However, other factors also play a significant role in the effectiveness of risk communication strategies. These factors include individuals' perceptions of risk, intentions to engage with communication messages, attitudes toward food safety, and adherence to recommended practices. Additionally, consumers' understanding of risks, misinformed views, personal habits, (in)experience with the risks, and resistance to behavior change impact campaigns' effectiveness. While the implications of individual responsibility have been addressed in health and sustainable behaviours studies, its role in

food risk communication has been overlooked. This provided the motivation to address the gap by examining the impact of individual responsibility of ensuring food safety on consumers' choices of food safety campaigns. Along with addressing the gap, this study explores the effect of how the individual responsibility is prompted to consumers on their choices.

Recent advancements in the field of communication evidenced the effectiveness of self-persuasion techniques, such as using questions to encourage individuals to self-generate their arguments, in influencing individuals' attitudes and behaviour. The first study applies this approach to the food safety context, and provides an empirical evidence on how choices vary when the format of information provided to participants before choice experiments varies.

The mean by which this study investigated consumers' views on food safety campaigns is novel. It differs from past studies on risk communication strategies in that it considered multiple attributes (i.e., characteristics) of food safety campaigns and asked respondents to directly choose the most preferred campaign by using discrete choice experiments (DCE) rather than using a Likert-type rating scale (e.g., strongly agree to strongly disagree) to asses specific communication channels (eg. TV, newspapers, fact sheets). The DCE approach has a higher predictive power and can reduce inconsistent behaviours (i.e., fatigue, scale-use bias) associated with rating tasks via the use of Likert-type rating scales (Cohen and Orme, 2004; Campbell et al., 2015; Yang et al., 2021).

The choice experiment required individuals to consider two food safety campaigns and select the one that they thought would be the most influential campaign in terms of changing their food handling behaviour. The campaigns are described by three attributes, including 'how the campaign is delivered', 'when it is delivered', and, 'its style'. The final survey included the discrete choice tasks, questions on consumer opinions, attitudes and knowledge related to food safety issues and, socio-demographic questions. The survey was completed online by 2,343 respondents drawn from the Scottish adult population in 2018. Respondents were randomly assigned to one of the following three versions of the survey: control – presents the campaigns with no responsibility prompt; Treatment State-

ment – presents the campaigns with the responsibility prompt framed as a statement; and Treatment Question – presents the campaigns with the responsibility prompt framed as an agree/disagree question. To observe how the responsibility prompts and their framing have an effect on consumers' choices the choice data in this study was analysed using the Random Parameter Logit models.

The results of the analysis showed that emphasizing consumers' individual responsibility can be a factor that affects consumers' acceptance of food safety campaigns. Particularly, the likelihood of choosing a food safety campaign (as opposed to a 'no-campaign' case) increases when responsibility prompts are used. We observed a variation of this influence when the responsibility prompts were framed differently. Compared to the responsibility prompt framed as a statement, the same prompt framed as a question acted as a stronger cue for consumers' choice of having a food safety campaign that they see as likely to influence their food handling behaviour.

Our choice analysis approach highlighted the need for future research on how the individual responsibility prompts and their framing can affect consumers' decision-making processes and, therefore, the possible sources affecting their choice heterogeneity. The results of this study can act as a foundation for subsequent research on finding improved ways to communicate with different consumer groups for effective policy interventions.

From a policy perspective, the findings of this study show that one possible way to improve consumers' food handling and cooking practices is through higher assumed individual responsibility. This can be achievable if consumers are shown how to control food risks. One policy recommendation in line with our findings is to design food safety campaigns that address one specific food risk and educate consumers on how to control and dispose of that food risk. For example, increasing consumers' perceived ability to control food poisoning via campylobacter might lead to higher assumed responsibility and so, to safer food handling and cooking practices. This study also addressed the issue of communicating to heterogeneous audiences and identified different consumers' profiles that can be used by policy makers to design tailored campaigns that are more likely to reach each of the identified consumer profiles.

The second study was built on our understanding of the self-persuasive power of questions. It investigated how knowledge-based information presented in different formats and provided prior to choice tasks affect individuals' consideration sets and thus, their choices. Using a multidisciplinary approach we integrated literature in consumer behaviour, social psychology, education, marketing and economics to (1) implement and investigate if and how differently framed additional knowledge related to the choice task objective influences the alternatives actually considered by individuals (i.e., the consideration set of alternatives); (2) and to introduce the use of adjunct questions, (i.e., questions aiming to draw attention to important aspects of a text), to stated choice experiment surveys and and to investigate their impact on information processing strategies and preference elicitation.

Research in choice literature showed that individuals' level of knowledge regarding the choice objective significantly impacted their attributes' attendance in stated choice experiments and recommended further exploration of knowledge's role in individuals' processing strategies (Sandorf et al., 2017). However, knowledge alone does not bear the amount of power required to drive behavioural outcomes (Visser et al., 2016). Despite this, knowledge has been assigned various functions across different research domains. For example, it mediates the formation and change of relevant attitudes. Accordingly, research in stated preference studies highlighted that individuals' willingness to pay for an environmental good is more influenced by their attitudes toward the good than its economic values. However, to the best of our knowledge, this is the first study that examined how differently framed knowledge-based information affected the formation of individuals' consideration sets.

The data was collected through an web-based survey administrated to a sample of 1183 respondents drawn from the Scottish adult population in 2018. Respondents were randomly assigned to two groups: control – knowledge-based information communicated as a statement and treatment – knowledge-based information communicated as an adjunct question. This paper employed advanced modelling approaches to accommodate and account for processing heuristics in the analysis of the collected choice data. We im-

plemented a Random Parameter and Independent Availability Logit model specifications to investigate respondents' preferences heterogeneity, as well as their processing heuristics in choice and the effects of using adjunct questions in the context of a stated choice experiment.

This study's results confirmed that individuals consideration sets are affected and vary by the differently framed knowledge-based information. Specifically, our findings showed that individuals consider and choose more the "No campaign" option in statement compared to the adjunct question treatment. The analysis of the willingness to pay (WTP) distributions showed that individuals are willing to allocate funds for food safety campaigns that target feasible and realistic reductions in the food poisoning cases for adults and elderly.

An extension of this study consists in exploring the differences in individuals' WTP given the group they are in and their socio-demographic characteristics and attitudes towards new knowledge acceptance and food safety campaigns. Moreover, future research could contribute to improved choice predictions and welfare analysis by looking into accommodating the choice context for promoting spillovers and investigating their effects on choice behaviour. For example, it has been shown that mere measurement of intention, the fact of answering hypothetical questions or being surveyed (i.e., intention-behavior effect, question-behavior effect, respectively survey effect) can have an influence on individuals' subsequent behaviour (Dolan and Galizzi, 2015).

Overall, the findings of this study shed-light on what to pay attention when designing a food safety campaign. They also provide evidence to policymakers on how best to design public policy campaigns, and prioritise their limited resources. For example, designing campaigns with targeted food safety messages allowing for self-persuasiveness and knowledge recall or acquisition as may increase the reach of the messages to the public.

The increasing demand for meat has negative impacts not only on the health system, but also on the environment (Dagevos, 2021; Michel et al., 2021). One way to address these negative impacts is to motivate consumers to reduce their meat intake and increase

their consumption of plant-based foods. Previous studies highlighted consumers' lack of awarenesses related to the massive impact that production and consumption of meat has on the environment (Hartmann et al., 2022).

The third study investigated how consumers' traded-off between sausages made from meat and those made from plant-based ingredients in three information conditions: (1) a baseline condition, in which study participants were provided no additional information; 2) a health condition, in which study participants were provided with additional information regarding the impact of meat consumption on their health; and (3), an environmental condition, in which study participants were provided additional information about the environmental impact of meat consumption. Methodologically, this study contributes to the literature by investigating how the implementation of two hypothetical bias (HB) mitigation techniques, inferred valuation (IQ) and Bayesian truth serum (BTS), affect consumers' stated preferences and their WTPs of the investigated good across each of the three conditions. Nine experimental settings were constructed to investigate if and how respondents choices varied for control and the two HB mitigation techniques, and different information related to the good being investigated in the survey.

Data were collected in April 2023 by using an web-based survey instrument administrated through an online research platform to 2023 respondents living in UK, aged 18 years or over. Within the choice experiment respondents were asked to choose between different types of sausages which differed in term of four attributes: main ingredient, origin and whether or not they were organically produced.

We analysed the stated preference data for each main experimental setting (i.e., control, indirect questioning and bayesian truth serum) within the three main information conditions: baseline condition with no additional information; health condition with additional health information and environment condition with additional environment information. We investigated consumers' preferences heterogeneity and valuations of sausages by using a Latent Class (LC) model with three latent classes within each condition.

Empirical findings reveal that, depending on the information condition, both HB miti-

gation techniques influence the conditional WTP values across the experimental settings. For example, both IQ and BTS contribute towards a reduction in the conditional WTPs for one level of the most important attribute, 'Main ingredient: beef,' in our choice experiment. Moreover, when in the baseline condition, excepting the 'Organically produced' attribute, the mean WTPs for all other attributes increase in BTS relative to IQ, and in IQ relative to C settings. These results might indicate that, in reality, consumers have strong preferences towards meat sausages, and that they will always be willing to pay more for them compared with a plant-based alternative. The same tendency as in the baseline condition is apparent when consumers receive additional information regarding the impact of meat consumption on their health, suggesting that, when choosing their food, consumers might already consider the implications of that food consumption on their health. This observation is strengthened by the similarity between the class covariate signs and magnitudes corresponding to the experimental settings (IQ and BTS) in baseline and health conditions. Additionally, compared with the baseline condition, consumers in the health condition state lower WTPs when they receive the indirect question (IQ experimental setting) and also when they are incentivised to tell the truth (BTS experimental setting). This result suggests that, depending on the good being investigated, that the choice context might vary by simply offering additional information to consumers. Furthermore, these findings confirm that, depending on the choice context, the same HB mitigation technique can have a different effect on consumer valuations of the same good. For example, it is apparent that in the environmental condition, the monetary incentives implied by the BTS reduce the WTPs for all attributes, but in baseline condition these monetary incentives implied by the BTS increase the WTPs for all attributes. These results can be determined by the specificity of the good (meat sausages vs plant-based sausages) investigated in our choice experiment.

These findings can guide policy makers on designing interventions that use information related to the impacts of meat production and consumption on human health and environment to motivate consumers to reduce their meat intake. Education interventions focusing on these impacts can be an effective alternative to educating consumers about the advan-

tages of plant-based foods relative to more traditional education interventions that focus on knowledge and product characteristics.

Hence, future research on different types of good in choice experiments can enrich the knowledge of the BTS and IQ contribution in mitigating hypothetical bias in discrete choice experiments. Moreover, the different choice contexts in our study were defined by the additional information related to the impact of meat consumption on health and environment. Building on our findings from the first two studies, we recommend investigating further the effect of the additional information within and across the corresponding choice contexts on consumers' choice behaviour by using different framing for the same information.

In summary, this thesis addresses various food safety and food consumption challenges, and investigates them from an economic perspective within three different, but related and integrated studies. The first study investigated the role of individual responsibility prompts in consumer choice of a food safety campaign, and how these prompts affect their stated choice of a food safety campaign that they regard will most likely influence the way they handle, cook, and store their food. The second study explored the role of adjunct questions in choice experiments, and demonstrated that knowledge-based information related to the choice task objective and communicated as an adjunct question could influence consumer processing strategies. The third study investigated two under-studied hypothetical bias mitigation techniques, inferred valuation and Bayesian truth serum to understand if and how consumer preferences and valuations of sausages vary in different choice contexts. These three studies provide public authorities (such as Food Standards Scotland, or Food Standards Agency) invaluable information to assist them in the design, development, and implementation of meaningful and targeted food policy interventions to positively influence consumer food-related behaviours and choices. Finally, these studies contribute to the literature by investigating and presenting some applications of advancements in choice modelling.

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Appendix

General University Ethics Panel (GUEP)
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Madalina Radu
Stirling Management School
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24 August 2017

Dear Madalina

Re: Ethics Application: Eliciting preferences for risk communication strategies, risk perceptions and consumers' attitudes towards food safety- GUEP 205

Thank you for your submission of the above to the General University Ethics Panel.

I am pleased to confirm that GUEP has approved your application, and you can now proceed with your research.

Please ensure that your research complies with Stirling University policy on storage of research data http://www.stir.ac.uk/is/researchers/data/afteryourresearch/

Please note that should any of your proposal change, a further submission (amendment) to GUEP will be necessary. If you have any further queries, please do not hesitate to contact the Committee by email to guep@stir.ac.uk.

Yours sincerely,
Pp

On behalf of GUEP
Professor Helen Cheyne

TitleStart

Your preferences for ways of receiving food safety information

Thank you for taking part in this survey. Your involvement is greatly appreciated.

In this study, we want to hear about your preferences for ways of receiving information about food safety and food risks. To do so, we will ask you a series of choice and opinion questions.

It will take approximately 15-20 minutes to complete the survey.

This is an **anonymous** survey. Your responses will be treated in the strictest confidence. You can quit the survey at any point without giving any reason.

If you have any questions, please do not hesitate to contact us:

Madalina Radu
Email: madalina.radu@stir.ac.uk
School of Management
University of Stirling
FK9 4LA, Stirling, Scotland, UK

Or her supervisor:

Dr Seda Erdem
Email: seda.erdem@stir.ac.uk
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University of Stirling
FK9 4LA, Stirling, Scotland, UK
Tel: 01786 46 7478

NEXT

0% 100%

consent

CONSENT FORM

Before starting the questionnaire we want to make sure that you provide us your consent.

• I agree to participate in this study carried out by Madalina Radu of the University of Stirling, to aid with this research.

• I have been informed of and understand the purposes of the survey and I have been provided with the contact details of the researchers for any questions I may have about the study.

• I am fully aware that data collected will be stored securely, safely and in accordance with the Data Collection Act (1998).

• I am fully aware that I am not obliged to answer any question, but that I do so at my own free will.

• I understand that this survey is anonymous and my data will be confidential, and that I will not be identified in any report.

I have read and understood all statements above, and give consent to participate. (If you do not wish to participate in the study, please decline participation by clicking on the "disagree" button.)

consent=1 Agree

consent=2 Disagree

NEXT

0% 100%

FeaturesDescription

BACKGROUND INFORMATION

Imagine a food authority is planning to run a new campaign focusing on food safety and risks. This campaign can be delivered in different ways at different times and can have different delivery styles. We explain these below.

How the campaign is delivered:
• the campaign can appear on TV. For example, TV series, adverts, cooking programmes, news;
• the campaign can be aired on radio. For example, adverts, cooking programmes, news;
• the campaign can be paper-based. For example, wall/bus posters, leaflets, newspapers, magazines; or,
• the campaign can be web-based. For example, blogs, social media, NHS website, Government website, retailers' website.

The campaign style:
• the campaign uses facts and figures to explain consequences of non-compliance;
• the campaign uses someone else's experience to deliver the message;
• the campaign uses humorous cartoons or fictional characters to deliver the message; and
• the campaign uses snappy slogans to deliver the message.

When the campaign runs:
• the campaign runs during specific occasions, such as Christmas, BBQ and summer seasons with seasonal food safety messages;
• the campaign runs all year around with general food safety messages.

To start the questionnaire, please click on the "next" button below.

NEXT

0% 100%

dce1C_Random1

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 Runs during specific occasions with seasonal food safety messages Uses someone else's experience	Paper-based Runs all year around with general food safety messages Uses facts and figures	Neither campaign would influence the way I handle, store and cook my food.
dce1C_Random1 Choose one	dce1C_Random1 Choose one	dce1C_Random1 Choose one

NEXT

0% 100%

dce1T1_Random1

Food safety campaigns inform people on how to handle, store and cook food safely. Information provided by such campaigns will help people understand how and why it is important to follow safe food practices.

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.

Imagine a food authority is considering running one of the food safety campaigns below.

We want you to tell us which of these campaigns you feel is **most likely** to influence the way that **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 Runs during specific occasions with seasonal food safety messages Uses someone else's experience	Paper-based Runs all year around with general food safety messages Uses facts and figures	Neither campaign would influence the way that I handle, store and cook my food.
dce1T1_Random1 Choose one	dce1T1_Random1 Choose one	dce1T1_Random1 Choose one

NEXT

0% 100%

RespAgree

Food safety campaigns inform people on how to handle, store and cook food safely. Information provided by such campaigns will help people understand how and why it is important to follow safe food practices.

While campaigns provide information about how to prevent risks of getting food poisoning, these risks are only reduced by adopting safe food practices promoted in the campaigns.

Please indicate the extent to which you agree or disagree with this statement.

- RespAgree=1 ○ Strongly agree
- RespAgree=2 ○ Agree
- RespAgree=3 ○ Neither aggree/disagree
- RespAgree=4 ○ Disagree
- RespAgree=5 ○ Strongly disagree
- RespAgree=6 ○ Do not know

NEXT

0% 100%

dce1T2_Random1

Imagine a food authority is considering running one of the food safety campaigns below.

We want you to tell us which of these campaigns you feel is **most likely** to influence the way that **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 Runs during specific occasions with seasonal food safety messages Uses someone else's experience	Paper-based Runs all year around with general food safety messages Uses facts and figures	Neither campaign would influence the way that I handle, store and cook my food.
dce1T2_Random1 Choose one	dce1T2_Random1 Choose one	dce1T2_Random1 Choose one

NEXT

0% 100%

Difficult3

How difficult did you find it to choose between the campaigns presented to you?

- Difficult3=1 Very difficult
- Difficult3=2 Fairly difficult
- Difficult3=3 A little difficult
- Difficult3=4 Neither difficult nor easy
- Difficult3=5 A little easy
- Difficult3=6 Fairly easy
- Difficult3=7 Very easy
- Difficult3=8 Do not know

NEXT

WhyOptOut3

What was the main reason for choosing neither of the campaigns in previous tasks? [Please tick all that apply]

WhyOptOut3_6 ☐ This was the easiest choice

WhyOptOut3_1 ☐ I did not have sufficient information to make a choice

WhyOptOut3_5 ☐ I didn’t understand the questions

WhyOptOut3_4 ☐ I found both campaigns very similar

WhyOptOut3_3 ☐ I did not feel that any of the campaigns would influence the way I handle, store and cook my food

WhyOptOut3_2 ☐ I am not interested in food safety campaigns

WhyOptOut3_7 ☐ WhyOptOut3_7_other Other

NEXT

0% 100%

taskCertainty3

Thinking back to the previous tasks, how certain are you that you made the right choices?

taskCertainty3=1 Very uncertain

taskCertainty3=2 Somewhat uncertain

taskCertainty3=3 Neither certain nor uncertain

taskCertainty3=4 Somewhat certain

taskCertainty3=5 Very certain

taskCertainty3=6 I don’t know

NEXT

0% 100%

RankCharCamp

Can you choose the top 5 characteristics of a food safety campaign in terms of their importance to you from the list below?
[1= most important, 5= least important]

RankCharCamp_5 Runs during specific occasions with seasonal food safety messages

RankCharCamp_4 Is web-based

RankCharCamp_3 Is paper-based

RankCharCamp_10 Uses snappy slogan

RankCharCamp_7 Uses facts and figures

RankCharCamp_6 Runs all year around with general food safety messages

RankCharCamp_9 Uses humorous cartoons or fictional characters

RankCharCamp_2 Is aired on radio

RankCharCamp_1 Appears on TV

RankCharCamp_8 Uses someone else's experience

NEXT

0% 100%

secondDCEbackgroundCredu

In this part of the questionnaire, we will ask you further questions about your preferences for different food safety campaigns. These campaigns provide information to **the general public in Scotland.**

Food poisoning can cause diarrhoea, tummy pain, fever, and vomiting. In extreme cases, it can cause death. In addition, food poisoning can also lead to economic costs, such as loss of working hours, medication and other expenses during recovery.

NEXT

secondDCEfeaturesCredu1

Before asking you to choose between food safety campaigns, we would like to describe their features to you.

1. The expected reduction in the number of food poisoning cases:

Currently, 43,000 people in Scotland get sick from food poisoning every year. A food safety campaign will lead to reductions in the number of food poisoning cases. The maximum number of reductions that will be achieved is 17,200.

2. Who would be benefiting most from the campaign:

The campaign will be most beneficial for certain groups in the population, such as babies, children and teenagers, adults and elderly in Scotland.

3. Cost of the campaign:

Your one-time contribution towards running a new campaign will range from £4 to £16.

NEXT

dce2CR_Random1

Imagine a food authority, such as Food Standards Scotland, is planning to run one of the campaigns below that focuses on the **reduction of food poisoning cases in the Scottish population**.

We want you to tell us which one of these campaigns you would prefer the food authority to run. If you don't like either of the campaigns, then select the "No campaign" option.

Campaign 1	Campaign 2	No campaign
Reduces the cases from 43,000 to 40,850	Reduces the cases from 43,000 to 25,800	No reduction in the cases
Benefits babies most	Benefits elderly most	Benefits no one
Costs £8 to you (one time)	Costs £12 to you (one time)	No additional cost
dce2CR_Random1 Choose one	dce2CR_Random1 Choose one	dce2CR_Random1 Choose one

NEXT

0% 100%

Treduction

In this part of the questionnaire, we will ask you further questions about your preferences for different food safety campaigns. These campaigns provide information to the general public in Scotland.

Which of the following do you think are possible consequences of having a tummy bug (also known as food poisoning)? [Please tick all that apply]

- ☐ Treduction_1 Diarrhoea
- ☐ Treduction_2 Tummy pain
- ☐ Treduction_3 Fever
- ☐ Treduction_4 Vomiting
- ☐ Treduction_5 Death in severe cases
- ☐ Treduction_6 Economic cost, such as loss of working hours, medication and other expenses during recovery

NEXT

0% 100%

FoodPoisonInfo

Thanks!

Food poisoning can cause diarrhoea, tummy pain, fever, and vomiting. In extreme cases, it can cause death. In addition, food poisoning can also lead to economic costs, such as loss of working hours, medication and other expenses during recovery.

NEXT

dce2TR_Random1

Imagine a food authority, such as Food Standards Scotland, is planning to run one of the campaigns below that focuses on the **reduction of food poisoning cases in the Scottish population**.

We want you to tell us which one of these campaigns you would prefer the food authority to run. If you don't like either of the campaigns, then select the "No campaign" option.

Campaign 1	Campaign 2	No campaign
Reduces the cases from 43,000 to 40,850	Reduces the cases from 43,000 to 25,800	No reduction in the cases
Benefits babies most	Benefits elderly most	Benefits no one
Costs £8 to you (one time)	Costs £12 to you (one time)	No additional cost
dce2TR_Random1 Choose one	dce2TR_Random1 Choose one	dce2TR_Random1 Choose one

NEXT

0% 100%

Difficult9

How difficult did you find it to choose between the campaigns presented to you?

- Difficult9=1 Very difficult
- Difficult9=2 Fairly difficult
- Difficult9=3 A little difficult
- Difficult9=4 Neither difficult nor easy
- Difficult9=5 A little easy
- Difficult9=6 Fairly easy
- Difficult9=7 Very easy
- Difficult9=8 Do not know

NEXT

WhyOptOut6

What was the main reason for choosing neither of the campaigns in previous tasks? [Please tick all that apply]

WhyOptOut6_5 ☐ I didn't understand the questions

WhyOptOut6_2 ☐ I am not interested in food safety campaigns

WhyOptOut6_1 ☐ I did not have sufficient information to make a choice

WhyOptOut6_6 ☐ This was the easiest choice

WhyOptOut6_3 ☐ I did not feel that any of the campaigns would prevent food poisoning cases in the Scottish population

WhyOptOut6_4 ☐ I found both campaigns very similar

WhyOptOut6_7 ☐ WhyOptOut6_7_other Other

NEXT

0% 100%

taskCertainty6

Thinking back to the previous tasks, how certain are you that you made the right choices?

- taskCertainty6=1 ○ Very uncertain
- taskCertainty6=2 ○ Somewhat uncertain
- taskCertainty6=3 ○ Neither certain nor uncertain
- taskCertainty6=4 ○ Somewhat certain
- taskCertainty6=5 ○ Very certain
- taskCertainty6=6 ○ I don’t know

NEXT

0% 100%

opinions

OPINION QUESTIONS

In this section we are interested in your opinions on food safety matters. For each statement indicate the extent to which you agree or disagree.

	Strongly agree	Agree	Neither aggree/disagree	Disagree	Strongly disagree	Do not know	Not Applicab
I generally do not find food safety messages informative.	opinions_r4=1	opinions_r4=2	opinions_r4=3	opinions_r4=4	opinions_r4=5	opinions_r4=6	opinions_r
I think there is too much hype around food safety issues.	opinions_r6=1	opinions_r6=2	opinions_r6=3	opinions_r6=4	opinions_r6=5	opinions_r6=6	opinions_r
I am certain in my ability of handling and cooking food in a safe manner.	opinions_r2=1	opinions_r2=2	opinions_r2=3	opinions_r2=4	opinions_r2=5	opinions_r2=6	opinions_r
I am always careful to follow proper preparation and cooking steps when I cook.	opinions_r1=1	opinions_r1=2	opinions_r1=3	opinions_r1=4	opinions_r1=5	opinions_r1=6	opinions_r
Previous food safety messages have changed the way I prepare and cook food.	opinions_r5=1	opinions_r5=2	opinions_r5=3	opinions_r5=4	opinions_r5=5	opinions_r5=6	opinions_r
I read and follow the cooking instructions on the labels of the food products I buy.	opinions_r3=1	opinions_r3=2	opinions_r3=3	opinions_r3=4	opinions_r3=5	opinions_r3=6	opinions_r

NEXT

0% 100%

opinions1

OPINION QUESTIONS

In this section we are interested in your opinions on food safety matters. For each statement indicate the extent to which you agree or disagree.

	Strongly agree	Agree	Neither aggree/disagree	Disagree	Strongly disagree	Do not know	Not Ap
I generally enjoy eating my food without thinking about its safety.	opinions1_r3=1	opinions1_r3=2	opinions1_r3=3	opinions1_r3=4	opinions1_r3=5	opinions1_r3=6	opinion
Knowing the consequences of poor food safety practices influences how I store, handle, and cook my foods.	opinions1_r4=1	opinions1_r4=2	opinions1_r4=3	opinions1_r4=4	opinions1_r4=5	opinions1_r4=6	opinion
I have total control over the safety of food that I cook and eat.	opinions1_r1=1	opinions1_r1=2	opinions1_r1=3	opinions1_r1=4	opinions1_r1=5	opinions1_r1=6	opinion
I don’t mind contributing towards food safety campaigns to reduce food risks among the public.	opinions1_r5=1	opinions1_r5=2	opinions1_r5=3	opinions1_r5=4	opinions1_r5=5	opinions1_r5=6	opinion
I am not at risk from food poisoning as much as other people.	opinions1_r2=1	opinions1_r2=2	opinions1_r2=3	opinions1_r2=4	opinions1_r2=5	opinions1_r2=6	opinion
I am very confident when it comes to adopting good food safety practices.	opinions1_r6=1	opinions1_r6=2	opinions1_r6=3	opinions1_r6=4	opinions1_r6=5	opinions1_r6=6	opinion

NEXT

0% 100%

TVusage

How often during a week do you use each the followings?

	Never	Once a week	2-3 days a week	More than 3 days a week
TV	TVusage_r1=1	TVusage_r1=2	TVusage_r1=3	TVusage_r1=4
Internet	TVusage_r4=1	TVusage_r4=2	TVusage_r4=3	TVusage_r4=4
Newspapers/Magazines	TVusage_r3=1	TVusage_r3=2	TVusage_r3=3	TVusage_r3=4
Radio	TVusage_r2=1	TVusage_r2=2	TVusage_r2=3	TVusage_r2=4

NEXT

0% 100%

infoType2

How would you prioritise the following food safety information that you feel you would most like to receive from food authorities?
[1= highest priority to 8= lowest priority]

infoType2_2 Specific viruses and bacteria that can cause food poisoning

infoType2_4 How to store food safely

infoType2_6 Stories of real people who have had food poisoning

infoType2_3 How to cook food safely

infoType2_5 How to handle food safely

infoType2_1 General food safety information

infoType2_8 Types of food risks – information on the various foods and behaviours that are most risky

infoType2_7 Information/reports about outbreaks of food poisoning in your own area or across Scotland

NEXT

0% 100%

generalknld

How would you rate your knowledge for each of the following?

	Very knowledgeable	Somewhat knowledgeable	Not knowledgeable	I don't know
General food hygiene	generalknld_r4=1	generalknld_r4=2	generalknld_r4=3	generalknld_r4=4
General kitchen and utensils hygiene	generalknld_r5=1	generalknld_r5=2	generalknld_r5=3	generalknld_r5=4
How to cook food safely	generalknld_r1=1	generalknld_r1=2	generalknld_r1=3	generalknld_r1=4
Consequences of poor food safety practices	generalknld_r7=1	generalknld_r7=2	generalknld_r7=3	generalknld_r7=4
Bugs causing food poisoning	generalknld_r6=1	generalknld_r6=2	generalknld_r6=3	generalknld_r6=4
Difference between: "use by date", "best before date", "sell by date", "display until date"	generalknld_r8=1	generalknld_r8=2	generalknld_r8=3	generalknld_r8=4
How to handle food safely	generalknld_r3=1	generalknld_r3=2	generalknld_r3=3	generalknld_r3=4
How to store food safely	generalknld_r2=1	generalknld_r2=2	generalknld_r2=3	generalknld_r2=4

NEXT

InfoInfluence1

What type of information do you consider will influence the way you handle, store and cook your food?
[Please tick all that apply]

- [ ] InfoInfluence1_2 Information on how to store food safely
- [ ] InfoInfluence1_7 Information on the consequences of poor food safety behaviour and what might happen if I don't store, handle or cook food properly
- [ ] InfoInfluence1_3 Information on how to cook food safely
- [ ] InfoInfluence1_6 Information on a specific food bug causing food poisoning and how to prevent it
- [ ] InfoInfluence1_8 Information on the economic burden of foodborne illness to my country
- [ ] InfoInfluence1_1 Information on how to handle food safely
- [ ] InfoInfluence1_5 Descriptions of personal experiences from people who have suffered from food poisoning
- [ ] InfoInfluence1_4 Facts and figures on food poisoning incidence in my country
- [ ] InfoInfluence1_9 None of them

NEXT

InfoInfluenceNone2

Why did you think none of the information presented before would influence the way you handle, store and cook your food?
[Please tick all that apply]

- [ ] InfoInfluenceNone2_1 I already know all of them
- [ ] InfoInfluenceNone2_4 They are not relevant to me
- [ ] InfoInfluenceNone2_2 I am certain in my ability of handling and cooking food in a safe manner
- [ ] InfoInfluenceNone2_3 I think none of these information types will influence my behaviour

NEXT

FSInfoLoc

Where would you like to hear more about food safety related information?

	Yes	No	Not applicable
Local butcher	FSInfoLoc_r10=1	FSInfoLoc_r10=2	FSInfoLoc_r10=3
Hospitals	FSInfoLoc_r14=1	FSInfoLoc_r14=2	FSInfoLoc_r14=3
Supermarkets	FSInfoLoc_r8=1	FSInfoLoc_r8=2	FSInfoLoc_r8=3
Local council	FSInfoLoc_r11=1	FSInfoLoc_r11=2	FSInfoLoc_r11=3
Workplace	FSInfoLoc_r12=1	FSInfoLoc_r12=2	FSInfoLoc_r12=3
GP surgery	FSInfoLoc_r6=1	FSInfoLoc_r6=2	FSInfoLoc_r6=3
Radio	FSInfoLoc_r9=1	FSInfoLoc_r9=2	FSInfoLoc_r9=3
Local library	FSInfoLoc_r7=1	FSInfoLoc_r7=2	FSInfoLoc_r7=3
Government websites	FSInfoLoc_r5=1	FSInfoLoc_r5=2	FSInfoLoc_r5=3
Social media	FSInfoLoc_r4=1	FSInfoLoc_r4=2	FSInfoLoc_r4=3
Cooking programmes on TV	FSInfoLoc_r2=1	FSInfoLoc_r2=2	FSInfoLoc_r2=3
Cooking websites and blogs	FSInfoLoc_r3=1	FSInfoLoc_r3=2	FSInfoLoc_r3=3
TV adverts	FSInfoLoc_r1=1	FSInfoLoc_r1=2	FSInfoLoc_r1=3
Local community centre	FSInfoLoc_r13=1	FSInfoLoc_r13=2	FSInfoLoc_r13=3

NEXT

0% 100%

cookingResp

Which of these best describes the level of responsibility you have for the cooking in your household?

cookingResp=1 ○ Responsible for all or most of the cooking

cookingResp=2 ○ Responsible for about half of the cooking

cookingResp=3 ○ Responsible for less than half of the cooking

cookingResp=4 ○ Not responsible for any of the cooking

NEXT

exp

Have you or someone you know (e.g. family, friend) ever had food poisoning? [Please tick all that apply]

- [ ] exp_1 Yes (me)
- [ ] exp_2 Yes (someone from my family)
- [ ] exp_3 Yes (someone I know)
- [ ] exp_4 No

NEXT

Gender

What is your gender?

My gender is...

AGE1

Which of the following age groups do you fall into?

My age group is...

Income

Which of these bands does your household, pre-tax, annual income fall into?
(if you have a spouse/partner include their income with yours)

My household income is...

household

How many people are there in your household altogether, including any children and yourself?

Please choose from the list

genHealth

How would you describe your general health?

My health is...

NEXT

0% 100%

ScotRegion

Which of these best describes where in Scotland you live?

- ScotRegion=1 ○ Northern Scotland (Grampian, Highland, Perth/Tayside, Western Isles, Orkney, Shetland)
- ScotRegion=2 ○ Central Scotland (Glasgow, Ayrshire, Lanarkshire, Argyll, Edinburgh & Lothians, Fife, Central)
- ScotRegion=3 ○ Southern Scotland (Borders/Dumfries & Galloway)
- ScotRegion=4 ○ Do not live in Scotland

ChildrenAge

Do you have any children in your household of the following ages?
[Please tick all that apply]

- ChildrenAge_1 ☐ Currently expecting
- ChildrenAge_2 ☐ Any under 5 years old
- ChildrenAge_3 ☐ Any 5 - 11 years old
- ChildrenAge_4 ☐ Any 12 - 15 years old
- ChildrenAge_5 ☐ Any 16 - 17 years old
- ChildrenAge_6 ☐ No children under 18 years old

NEXT

EmploymentStatus

Which best describes your current working status?

- EmploymentStatus=1 ○ Self-employed full time (30+ hours per week)
- EmploymentStatus=2 ○ Self-employed part-time (less than 30 hours per week)
- EmploymentStatus=3 ○ In paid full-time employment (30+ hours per week)
- EmploymentStatus=4 ○ In paid part-time employment (less than 30 hours per week)
- EmploymentStatus=5 ○ Unemployed
- EmploymentStatus=6 ○ Retired from paid work altogether
- EmploymentStatus=7 ○ On maternity/paternity leave
- EmploymentStatus=8 ○ Looking after family or home
- EmploymentStatus=9 ○ Full-time student/ at school
- EmploymentStatus=10 ○ Long term sick or disabled
- EmploymentStatus=11 ○ Unable to work because of short-term illness or injury
- EmploymentStatus=12 ○ On a government training scheme
- EmploymentStatus=13 ○ EmploymentStatus_13_other Doing something else (please write in) _____
- EmploymentStatus=14 ○ Would prefer not to say

Education

What is your highest level of education?

- Education=1 ○ No qualifications
- Education=2 ○ Below degree level (e.g. GCSE, A-level, SVQ2)
- Education=3 ○ Degree or Graduate education (e.g. BSc, BA, SVQ3)
- Education=4 ○ Post-graduate education (e.g. PhD, MSc, MA, SVQ5)
- Education=5 ○ Vocational education (e.g. NVQ, HNC, HND, SVQ4)
- Education=6 ○ Prefer not to say

NEXT

Personality

How well do the following statements describe your personality?

I see myself as someone who...

	Disagree strongly	Disagree a little	Neither agree nor disagree	Agree a little	Agree strongly
...is reserved	Personality_r1=1	Personality_r1=2	Personality_r1=3	Personality_r1=4	Personality_r1=5
...is generally trusting	Personality_r2=1	Personality_r2=2	Personality_r2=3	Personality_r2=4	Personality_r2=5
...tends to be lazy	Personality_r3=1	Personality_r3=2	Personality_r3=3	Personality_r3=4	Personality_r3=5
...is relaxed, handles stress well	Personality_r4=1	Personality_r4=2	Personality_r4=3	Personality_r4=4	Personality_r4=5
...has few artistic interests	Personality_r5=1	Personality_r5=2	Personality_r5=3	Personality_r5=4	Personality_r5=5
...is outgoing, sociable	Personality_r6=1	Personality_r6=2	Personality_r6=3	Personality_r6=4	Personality_r6=5
...tends to find fault with others	Personality_r7=1	Personality_r7=2	Personality_r7=3	Personality_r7=4	Personality_r7=5
...does a thorough job	Personality_r8=1	Personality_r8=2	Personality_r8=3	Personality_r8=4	Personality_r8=5
...gets nervous easily	Personality_r9=1	Personality_r9=2	Personality_r9=3	Personality_r9=4	Personality_r9=5
...has an active imagination	Personality_r10=1	Personality_r10=2	Personality_r10=3	Personality_r10=4	Personality_r10=5

NEXT

0% 100%

riskbeh

People can behave differently in different situations. How would you rate your willingness to take risks in the following areas?

	Avoid risks 0	1	2	3	4	5	6	7	8
...while driving?	riskbeh_r1=1	riskbeh_r1=2	riskbeh_r1=3	riskbeh_r1=4	riskbeh_r1=5	riskbeh_r1=6	riskbeh_r1=7	riskbeh_r1=8	riskbeh_r1=9
...in financial matters?	riskbeh_r2=1	riskbeh_r2=2	riskbeh_r2=3	riskbeh_r2=4	riskbeh_r2=5	riskbeh_r2=6	riskbeh_r2=7	riskbeh_r2=8	riskbeh_r2=9
...while cooking?	riskbeh_r3=1	riskbeh_r3=2	riskbeh_r3=3	riskbeh_r3=4	riskbeh_r3=5	riskbeh_r3=6	riskbeh_r3=7	riskbeh_r3=8	riskbeh_r3=9
...during leisure and sport?	riskbeh_r4=1	riskbeh_r4=2	riskbeh_r4=3	riskbeh_r4=4	riskbeh_r4=5	riskbeh_r4=6	riskbeh_r4=7	riskbeh_r4=8	riskbeh_r4=9
...in your occupation?	riskbeh_r5=1	riskbeh_r5=2	riskbeh_r5=3	riskbeh_r5=4	riskbeh_r5=5	riskbeh_r5=6	riskbeh_r5=7	riskbeh_r5=8	riskbeh_r5=9
...while eating out?	riskbeh_r6=1	riskbeh_r6=2	riskbeh_r6=3	riskbeh_r6=4	riskbeh_r6=5	riskbeh_r6=6	riskbeh_r6=7	riskbeh_r6=8	riskbeh_r6=9
...with your health?	riskbeh_r7=1	riskbeh_r7=2	riskbeh_r7=3	riskbeh_r7=4	riskbeh_r7=5	riskbeh_r7=6	riskbeh_r7=7	riskbeh_r7=8	riskbeh_r7=9
...your faith in other people?	riskbeh_r8=1	riskbeh_r8=2	riskbeh_r8=3	riskbeh_r8=4	riskbeh_r8=5	riskbeh_r8=6	riskbeh_r8=7	riskbeh_r8=8	riskbeh_r8=9

NEXT

0% 100%

riskTaking

How do you see yourself:

Are you generally a person who avoids taking risks or a person who is fully prepared to take risks?

	0	1	2	3	4	5	6	7	8
Avoid risks	riskTaking_1=1	riskTaking_1=2	riskTaking_1=3	riskTaking_1=4	riskTaking_1=5	riskTaking_1=6	riskTaking_1=7	riskTaking_1=8	riskTaking_1=9

NEXT

0% 100%

thank

Thank you for completing this survey!

If there is anything else you would like to tell us about the survey (question format, how easy/hard the questions were, whether the information provided was sufficient) or any issues raised in it, please do so here:

Submit Survey

University of Stirling
Cottrell 3B1
Stirling
FK9 4LA

10/08/2022

Dear Madalina

Ethics Application Form : Eliciting consumers' preferences and attitudes towards plant based meat alternatives 7632

Thank you for your submission of the above ethics application.

The ethical approaches of this project have been approved and you can now proceed with your project.

Please note that should any of your proposal change, a further amendment submission will be necessary.

If you have any further queries, please do not hesitate to contact the Panel by email to ethics@stir.ac.uk

Yours sincerely,

General University Ethics Panel

Welcome to the research study!

Thank you for your interest in our study, which aims to understand how people with different interests and backgrounds think about meat and plant-based alternatives.

It is vital to our study that we collect responses from people who devote their full attention to the questionnaire. We request that you carefully read the instructions and answer all questions.

The questionnaire is expected to take about 10-15 minutes. For more information about the study, please click on the "next" arrow.

»

NOTE: *EACH TEXT BLOCK/ QUESTION WAS INDIVIDUALLY AND FULLY DISPLAYED ON SCREEN*

Participant information sheet

What is this project about?

This project aims to understand people's attitudes and preferences regarding meat and plant-based food.

Why have I been invited to take part?

You have been invited to participate in this web-based survey because you are a member of the Prolific panel, resident in the United Kingdom and aged 18 years or over.

Do I have to take part?

No. Your participation in this survey is voluntary. You may refuse to take part in the research or exit the survey at any time without penalty by closing the browser. You can also withdraw your data within two months. To withdraw your data email madalina.radu@stir.ac.uk with your unique identifier number (located at the bottom of each page).

What happens if I take part?

You will need to complete the questionnaire, and this should take approximately 10-15 minutes. You will be given a range of questions to answer on different topics.

Are there any potential risks in taking part?
There are no foreseeable risks involved in participating in this survey.

Are there any benefits in taking part?
For taking part in this research and completing the survey, you will be receiving a small payment using your Prolific account.

Legal basis for processing personal data
As part of the project, we will be collecting anonymised data relating to you (age, employment status, education level, income, the area where you live). This will be processed in accordance with the General Data Protection Regulations (GDPR).

What happens to the data I provide?
We will not collect any data that could directly identify you. Your answers will be completely anonymous, and we will use all reasonable endeavours to keep them confidential. Your data will be stored in a password-protected file and may be used in an aggregated format in academic publications. Your IP address will not be stored. The data you provide us through your answers will be kept for six months on password-protected secure data platform of the University of Stirling, and then will be lodged in the online open-access repository, STORRE: Stirling Online Research Repository.

Will the research be published?
Yes, the research will be published in scientific journals. Unless the publisher requirements prevent us, all research will be publicly disseminated through the open access repository at the University of Stirling.

Who is funding the research?
This research is part of the project "Risk Perceptions, Risk Communication Strategies, and Consumer Behaviours" that was jointly funded by Food Standards Scotland (FSS) and University of Stirling.

Who has reviewed this research project?
The ethical approaches of this project have been approved by the General University Ethics Panel of the University of Stirling (#: GUEP7362).

Your rights
You have the right to withdraw from this project at any time without giving reasons and without consequences to you. You also have the right to object to us processing relevant data associated with your unique identifier number. However, please note that once the data are being analysed and/or results published it may not be possible to remove your data from the study.

Whom do I contact if I have concerns about this study or I wish to complain?
If you would like to discuss the research with someone or obtain further information about the project, please contact Madalina Radu (madalina.radu@stir.ac.uk). If you wish to complain, please contact the Head of the Economics Division at the University of Stirling Management School, Professor Mirko Moro (mirko.moro@stir.ac.uk).

Thank you very much for participating in this survey.

»

Consent form

Please confirm that you give consent to take part in this research study.

By participating in this study:

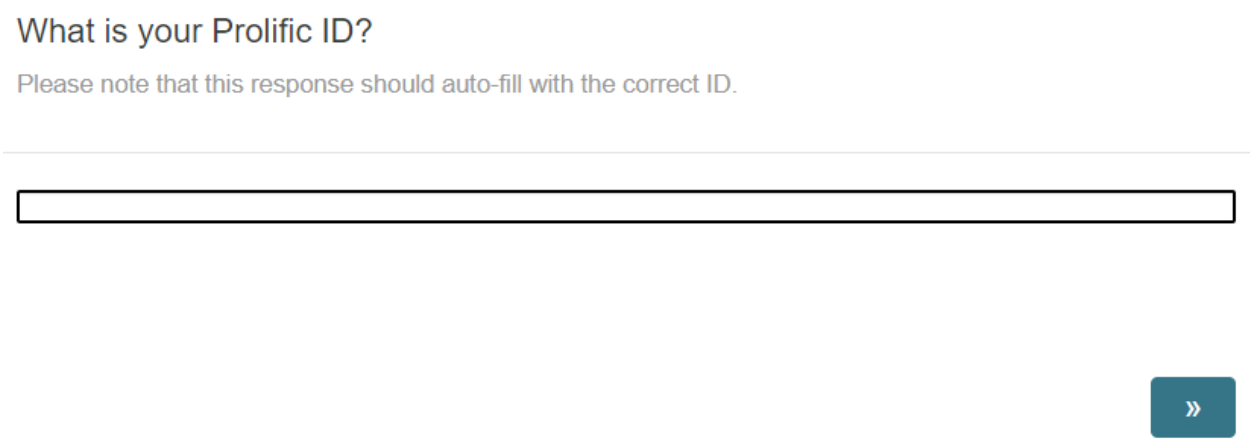
- You confirm that you are aged 18 years or over.
- You confirm that you have read and understood the information sheet explaining the research project and have the opportunity to ask questions about the project.
- You understand that your participation is voluntary and that you are free to withdraw at any time during the survey, but that any data collected up until this point may be used in the analysis. You understand that beyond two months when results are published it may not be possible to remove your data from the study.
- You have been given a unique identifying number (located at the bottom of each page) and know whom to contact should you wish to obtain a copy of the data the researchers hold about you.
- You understand that your responses will be kept anonymous and you give permission for members of the research team to have access to your anonymised responses.
- You agree for the research data collected in the study to be made available to other researchers. You understand that any data that leaves the research group will be fully anonymised so that you cannot be identified.

I **agree** to take part in this research study

I **do not agree** to take part in this research study

»

Prolific ID



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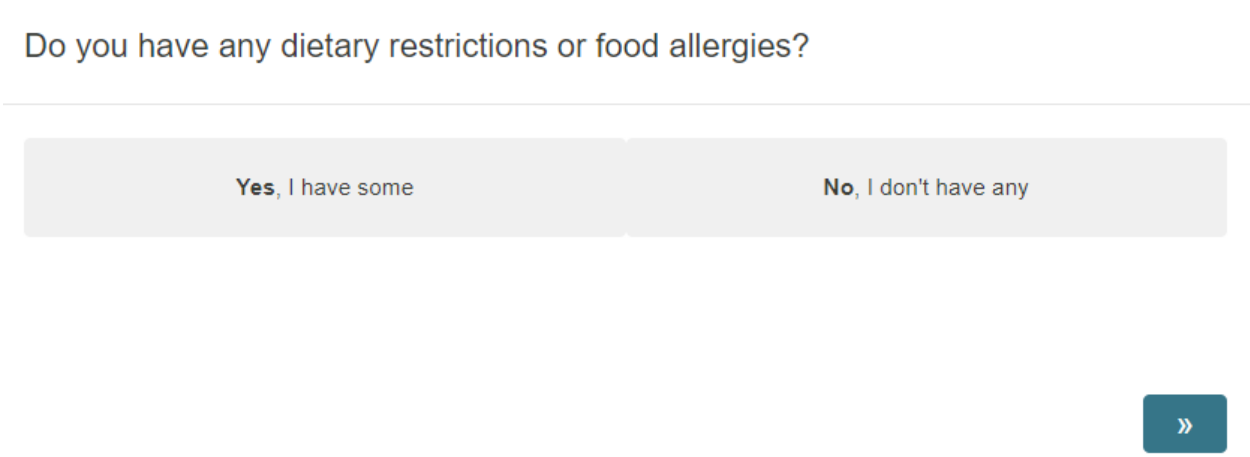


Background Information – C, Control experimental setting

Your preferences

For the following questions, you will be presented with a number of sausage options and asked to choose which one you would most likely purchase if they were available in the place where you generally buy food.

The packets of sausages differ according to four characteristics.

- **Their main ingredient**:
  - *pork*;
  - *beef*;
  - *chicken*; or,
  - *plant-based* (can be derived from plants, such as soybeans, peas, mushrooms and/or wheat).
- **Where they originate from**:
  - *local*, which means the sausages are produced relatively close to where you live (such as within 30 miles, or in your county or region); or,
  - *non-local*, which means the sausages are not produced relatively close to where you live, but somewhere else in the United Kingdom.
- **Whether or not they are organically produced**:
  - *organic*; or,
  - *not organic*.
- **Their price**:
  - varies from *£1.00* to *£5.00* per packet of 6/8 sausages.

There will be 8 of these questions. While they might look similar, they are different.

Please carefully consider the questions and answer as honestly as you can.

»

Background Information – Inferred valuation, IQ experimental setting

Your preferences

For the following questions, you will be presented with a number of sausage options and asked to choose which one you would most likely purchase if they were available in the place where you generally buy food.

The packets of sausages differ according to four characteristics.

- **Their main ingredient**:
  - *pork*;
  - *beef*;
  - *chicken*; or,
  - *plant-based* (can be derived from plants, such as soybeans, peas, mushrooms and/or wheat).
- **Where they originate from**:
  - *local*, which means the sausages are produced relatively close to where you live (such as within 30 miles, or in your county or region); or,
  - *non-local*, which means the sausages are not produced relatively close to where you live, but somewhere else in the United Kingdom.
- **Whether or not they are organically produced**:
  - *organic*; or,
  - *not organic*.
- **Their price**:
  - varies from *£1.00* to *£5.00* per packet of 6/8 sausages.

There will be 8 of these questions. While they might look similar, they are different.

Following each question, we will also ask your opinion on what proportion of other people similar to you, in terms of age and gender, would be most likely to choose.

Please carefully consider the questions and answer as honestly as you can.

»

Background Information – Bayesian Truth Serum, BTS experimental setting

Your preferences

For the following questions, you will be presented with a number of sausage options and asked to choose which one you would most likely purchase if they were available in the place where you generally buy food.

The packets of sausages differ according to four characteristics.

- **Their main ingredient**:
  - *pork*;
  - *beef*;
  - *chicken*; or,
  - *plant-based* (can be derived from plants, such as soybeans, peas, mushrooms and/or wheat).
- **Where they originate from**:
  - *local*, which means the sausages are produced relatively close to where you live (such as within 30 miles, or in your county or region); or,
  - *non-local*, which means the sausages are not produced relatively close to where you live, but somewhere else in the United Kingdom.
- **Whether or not they are organically produced**:
  - *organic*; or,
  - *not organic*.
- **Their price**:
  - varies from *£1.00* to *£5.00* per packet of 6/8 sausages.

There will be 8 of these questions. While they might look similar, they are different.

Following each question, we will also ask your opinion on what proportion of other people similar to you, in terms of age and gender, would be most likely to choose.

25 participants who complete the survey and whose proportions are closest to the average proportions given by other respondents will receive a bonus of £20.

Please carefully consider the questions and answer as honestly as you can.

»

Additional information in Health group

According to World Health Organization, excessive meat consumption burdens national healthcare systems. It has been estimated that in 2020 there were 2.4 million deaths worldwide, and over £200 million in healthcare costs, attributable to excessive red and processed meat consumption globally. Plant-based diets have the potential to improve human health. Alongside the benefits to human health, plant-based diets will reduce the cost to the UK healthcare system.

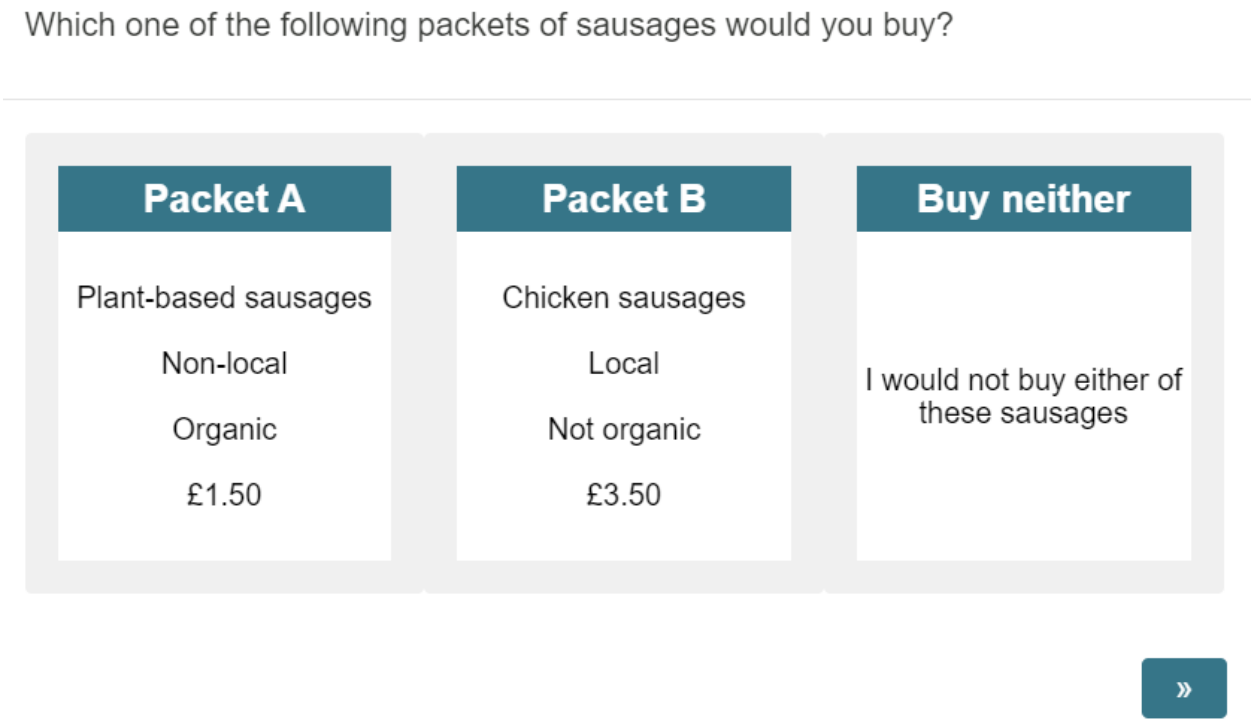
»

Additional information in Environment group

According to scientists, reducing meat and dairy consumption can help reduce their carbon footprint by two-thirds, and thus help reduce the impact of climate change. According to the footprint calculator developed by scientists from the University of Oxford, eating 75 grams of beef—a typical fast-food hamburger—daily for a year contributes greenhouse gas emissions equivalent to driving a car for 7,196 miles—that's crossing the UK about 8.3 times. Compare that to eating 150 grams of beans—about a third of a can—daily for a year, which is equivalent to driving a car 93 miles.

»

Choice task and direct question examples in C, IQ and BTS



Indirect question example in IQ

What proportion of **other people like you** do you think would buy these sausages?

% of people would buy **Packet A**	0
% of people would buy **Packet B**	0
% of people would **not buy either of these sausages**	0
Total	0

»

Indirect question example in BTS

What proportion of **other people like you** do you think would buy these sausages?

Remember, people who complete the survey and whose guesses are closest to the average guesses will receive a bonus.

% of people would buy **Packet A**	0
% of people would buy **Packet B**	0
% of people would **not buy either of these sausages**	0
Total	0

»

WHY_ALL_SQ

What was the main reason(s) for choosing neither of the packets of sausages in previous tasks?

Please select as many as it applies.

- I was not too fond of any of the packets of sausages
- It was not easy to make a choice between packets of sausages
- I did not understand the questions
- They looked very similar to me
- I did not have sufficient information to make a choice
- Other reasons – please specify

»

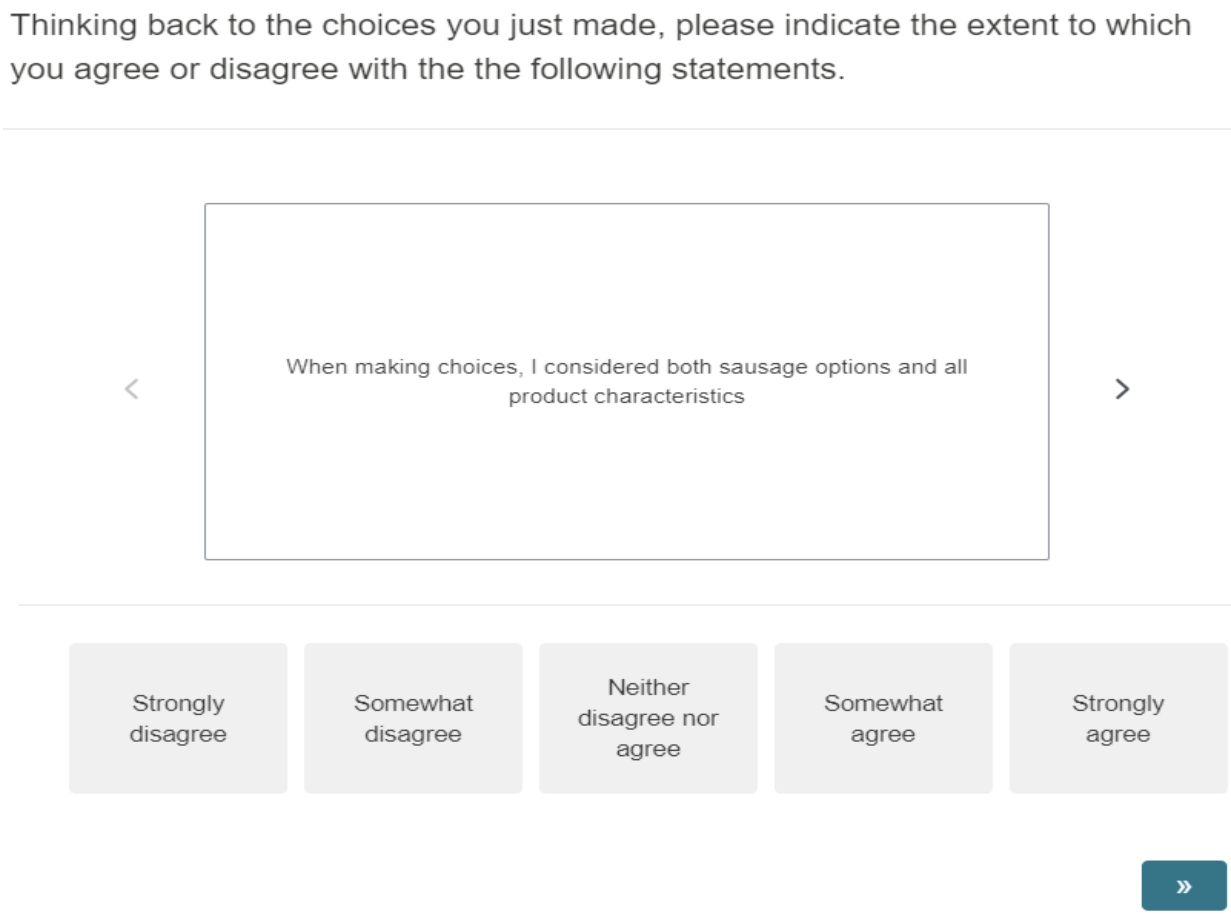
Q31CERTAINTY

Thinking back to the choices you just made, how certain are you that you would make the same choices in a real shopping environment?

Very uncertain	Somewhat uncertain	Neither certain nor uncertain	Somewhat certain	Very certain	I don't know

»

Q32HB



Complete list of statements:

S1: I fully understood what I needed to do
S2: I would make similar choices if presented these options in a real setting
S3: When making choices, I considered both sausage options and all product characteristics
S4: The potential health benefits of a plant-based diet influenced my choices
S5: The potential environmental benefits of a plant-based diet influenced my choices

Your views on the meat and plant-based food

We would now like to ask some questions related to your views on **meat and plant-based food**.

There are no right or wrong answers. We are only interested in your opinions, so please answer all questions as honestly as you can. Remember, all your answers will be kept confidential.

»

Q01SHOPRESP

Which of these best describes the level of responsibility you have for food purchasing in your household?

Responsible for **all or most** of the food purchasing	Responsible for **about half** of the food purchasing	Responsible for **less than half** of the food purchasing	**Not responsible** for any of the food purchasing

»

Q02EATMEAT

In a typical week, on average, how often do you eat meat?

Never	Once a week	2-3 times a week	More than 3 times a week

»

Q03SHOPTYPE

Where do you normally buy your food?

Please select as many as it applies.

Supermarket	Local/corner shop (including newsagents)
Convenience store	Market (including stalls or farmer's markets)
Specialty store	Farm

»

Q04MAVAILABLE

Does the place you normally go for grocery shopping sell meat sausages?

Yes	No	I don't know

»

Q05MEATS

Thinking back to the last month (since 17 Jul 2023), did you (or someone who does shopping for you) buy meat sausages?

Yes	No

»

IF Q05MEATS = NO: Q06NOMEATS

Why did you not buy meat sausages in the last month (since 17 Jul 2023)?

Please select as many as it applies.

- I don't like their taste
- I didn't want to eat any
- I find them off-putting
- I think they are expensive
- Other reasons – please specify
- I think they are unhealthy

»

Q07MEATSFREQ

How many times did you (or someone who does shopping for you) buy meat sausages in the last month (since 17 Jul 2023)?

1 time	2-3 times	4-5 times	6-10 times	More than 10 times

»

Q08MEATSHPACK

Did any of these meat sausages have a health claim on the packet?

Yes	No	I don't know

»

IF Q08MEATSHPACK = YES: Q09MEATSHEALTH

Was having a health claim on the packet important to you when buying meat sausages?

Yes	No	I don't know

»

Q10MEATSEPACK

Did any of the meat sausages have an environmental claim on the packet?

Yes	No	I don't know

»

IF Q10MEATSEPACK = YES: Q11MEATSENVIR

Was having an environmental claim on the packet important to you when buying meat sausages?

Yes	No	I don't know

»

Q12PBAVAILABLE

Does the place you normally go for grocery shopping sell plant-based sausages?

Yes	No	I don't know

»

Q13PBS

Thinking back to the last month (since 17 Jul 2023), did you (or someone who does shopping for you) buy plant-based sausages?

Yes	No

»

IF Q13PBS = NO: Q14NOPBS

Why did you not buy plant-based sausages in the last month (since 17 Jul 2023)?

Please select as many as it applies.

- I don't like their taste
- I find them off-putting
- I think they are expensive
- I think they are unhealthy
- Other reasons – please specify
- I didn't want to eat any

»

IF Q13PBS = NO: Q15PBSPRO

Which, if any, of the following would encourage you to buy plant-based sausages?

Please select as many as it applies.

- If other people in my household or friends try them
- If they look appetising
- If they are properly regulated
- If I know they are safe to eat
- If they are cheaper than traditional meat
- If they became easily available for me to buy
- If I know they will make my diet healthier
- If I know they are better for the environment
- Other reasons – please specify
- Nothing would make me try them

»

Q16PBSFREQ

How many times did you (or someone who does shopping for you) buy plant-based sausages in the last month (since 17 Jul 2023)?

1 time	2-3 times	4-5 times	6-10 times	More than 10 times

»

Q17PBSHPACK

Did any of the plant-based sausages have a health claim on the packet?

Yes	No	I don't know

»

IF Q17PBSHPACK = YES: Q18PBSHEALTH

Was having a health claim on the packet important to you (or the person who does shopping for you) when buying plant-based sausages?

Yes	No	I don't know

»

Q19PBSEPACK

Did any of the plant-based sausages have an environmental claim on the packet?

Yes	No	I don't know

»

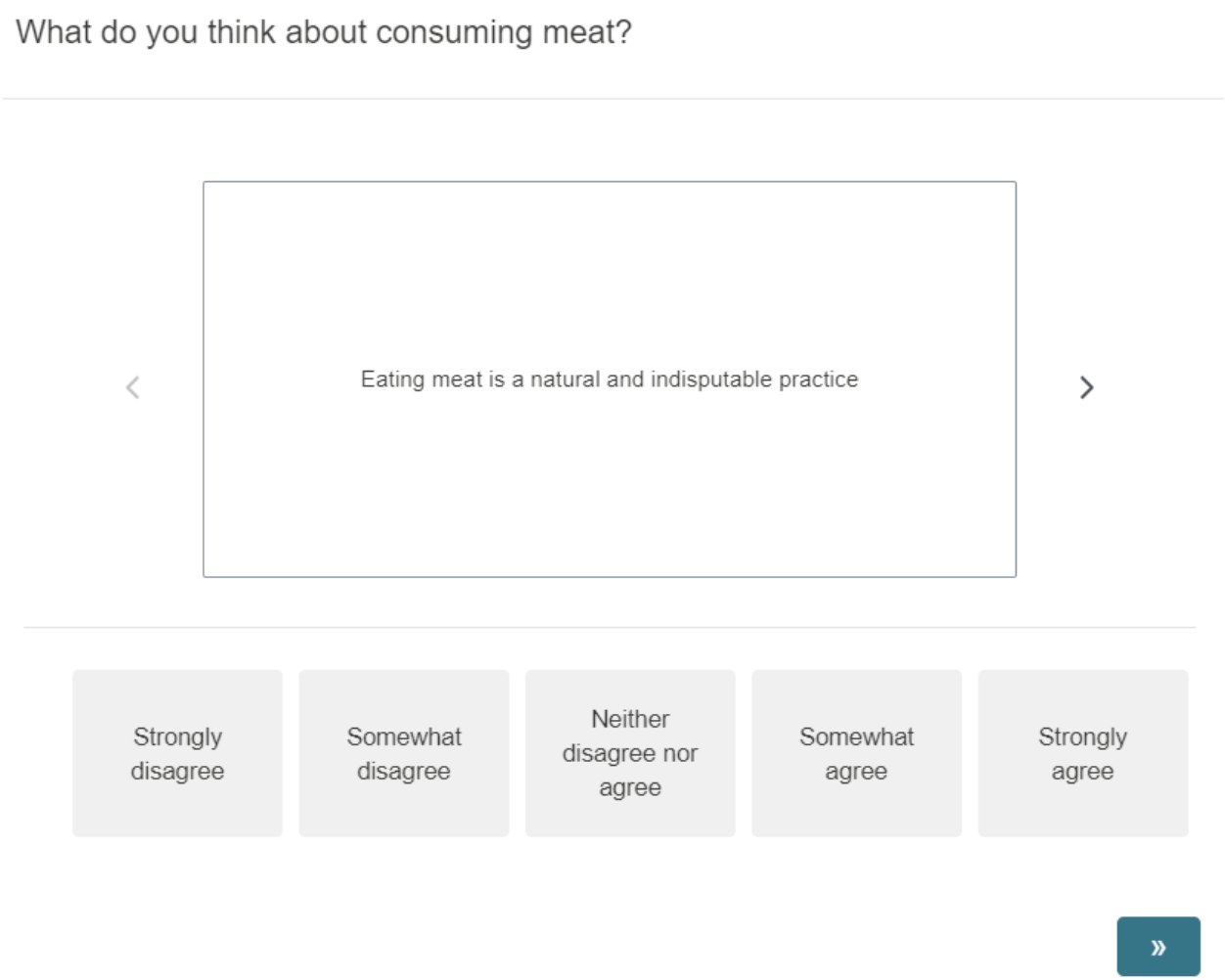
IF Q19PBSEPACK = YES: Q20PBSENVIR

Was having an environmental claim on the packet important to you (or the person who does shopping for you) when buying plant-based sausages?

Yes	No	I don't know

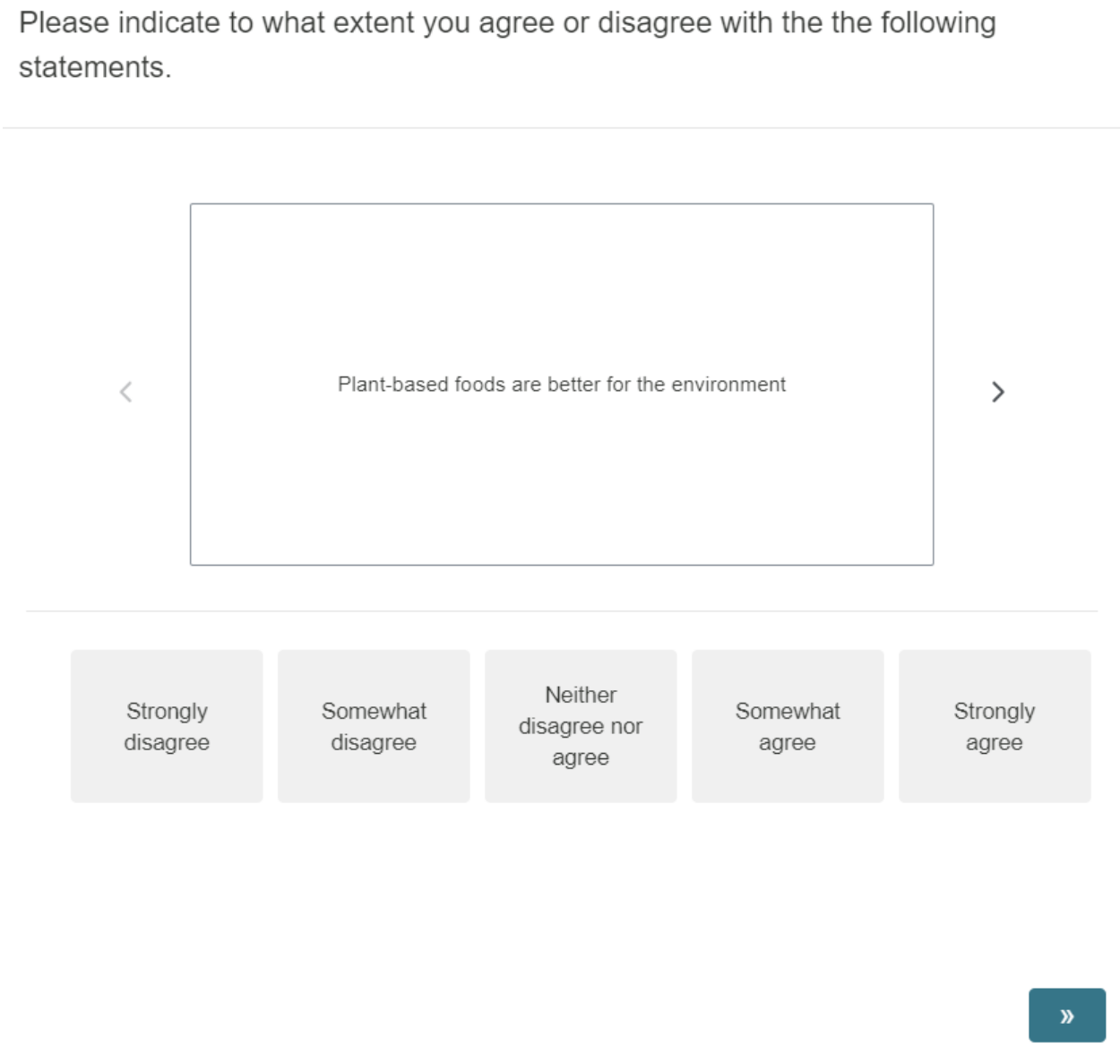
»

Q21MEAS



Complete list of statements:
S1: To eat meat is one of the good pleasures in life
S2: I'm a big fan of meat
S3: A good steak is without comparison
S4: By eating meat, I'm reminded of the death and suffering of animals
S5: To eat meat is disrespectful towards life and the environment
S6: Meat reminds me of diseases
S7: To eat meat is an unquestionable right of every person
S8: According to our position in the food chain, we have the right to eat meat
S9: Eating meat is a natural and indisputable practice
S10: I don't picture myself without eating meat regularly
S11: If I couldn't eat meat, I would feel weak
S12: I would feel fine with a meatless diet
S13: If I was forced to stop eating meat, I would feel sad
S14: Meat is irreplaceable in my diet

Q22PBACCEPT



Complete list of statements:
S1: I am willing to try plant-based foods
S2: Plant-based foods are better for public health
S3: Plant-based foods are better for the environment

About you

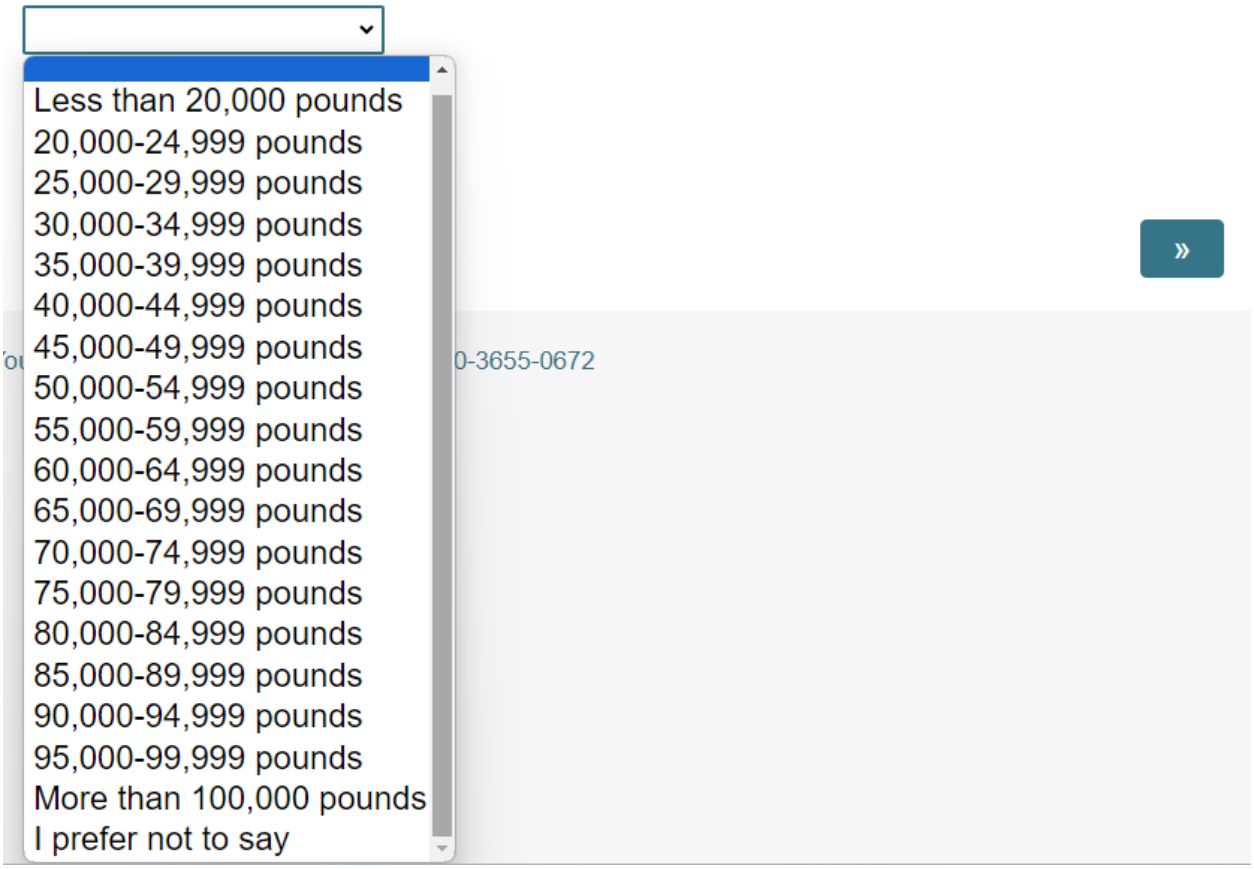
We would like to ask you a few questions about yourself.

Remember, all information collected through this survey will be held securely and treated in the strictest confidence. No identifiable information will be shared with anyone.

»

Q23INCOME

What is your current annual income before taxes?



Q23GENHEALTH

How would you describe your general health?
My health is:

Very good	Good	Satisfactory	Poor	Bad

»

Q24DIET

Which of the following statements best describes your personal diet?

- Flexitarian/Semi-Vegetarian (mostly follow a vegetarian diet, but occasionally eat meat or fish)
- Vegetarian (do not eat meat or fish, but do eat dairy and eggs)
- Vegan (do not eat meat, fish, dairy, eggs, honey or any food derived from animals)
- Regularly consume meat, fish/seafood, or products derived from animals
- Other

»

Q25CHANGEMEAT

Do you think participating in this survey will influence your future meat consumption?

Yes	No

»

IF Q25CHANGEMEAT = YES: Q26FUTUREMEAT

How do you think participating in this survey will influence your future meat consumption?

I will consume ***much less***	I will consume ***somewhat less***	I will consume ***somewhat more***	I will consume ***much more***

»

Q27CHANGEPB

Do you think participating in this survey will influence your future plant-based food consumption?

Yes	No

»

IF Q27CHANGEPB = YES: Q28FUTUREPB

How do you think participating in this survey will influence your future plant-based food consumption?

I will consume ***much less***	I will consume ***somewhat less***	I will consume ***somewhat more***	I will consume ***much more***

»

END_TEXT

Finally, please use the space below to share your thoughts on the questionnaire. In particular, let use know your views on how easy/hard the questions were, whether the information provided was sufficient and if you feel there are any aspects that need to be improved?

»

THANKYOU

Thank you for taking part in this study. Please click the proceed button to be redirected to Prolific and register your submission.

»