Perceptions and Risks: Food-borne Pathogens in the Domestic Environment

A Thesis submitted to the University of Manchester for the degree of Doctor of Philosophy in the Faculty of Humanities

2012

Caroline Millman
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Abstract

Caroline Millman, Perceptions and Risks: Food-borne Pathogens in the Domestic Environment

Degree of Doctor of Philosophy, University of Manchester, June 2012

Food-borne illness is a significant burden both with regard to public health and financially. Efforts to reduce the level of food-borne illness continue to concentrate on the full food supply chain with particular regard given to Campylobacter, the most commonly reported zoonosis and the greatest burden to public health. The focus of this research is domestic food safety practises, where there is no regulation. Food safety is reliant on people’s knowledge or awareness, their ability to adopt safe food handling practises and for the correct behaviours to achieve this, to be routine. The elicitation of awareness and perceptions with regard to food safety are problematic due to the complexities of human nature, including the presence of several forms of bias, such as social desirability bias and optimistic bias. The research was designed in order to try to minimise such biases, whilst further understanding influences on food safety preparation behaviour. Food safety preparation behaviours and kitchen hygiene were investigated between people who had campylobacteriosis in comparison to people who had not had food poisoning. Whilst no difference was noted in the kitchen hygiene between the two groups, significant differences were noted in self-reported food preparation behaviours. Optimistic bias was exhibited by both groups but when tested again after six months had elapsed, the group who had not had food poisoning increased their optimism, introducing a significant difference in optimistic bias between the two groups. Awareness of a number of unsafe food behaviours was explored for individuals and groups of people using a method developed as part of the research. This method of hazard awareness uses video as a stimulus, creating an interactive survey, combined with attitudinal and demographic data. Changes were made to perceptions of knowledge and risk following the hazard perception challenge, with the number of hazards missed, influencing this movement in perception. The risk perception of unsafe food handling behaviours was examined using a novel technique Best-Worst Scaling, in order to identify relative risks. This technique, in conjunction with latent class modelling, demonstrated a difference in perceptions between food safety experts and members of the general public. However, these differences are nuanced and demonstrate that heterogeneity exists both within and across the groups. Taken together, these findings have extended the research on domestic food safety behaviour and risk perceptions. It has done so by developing and testing novel methods to elicit relative risk perceptions and hazard perception with regard to food safety behaviours. The results provide valuable evidence for stakeholders particularly with regard to the novel methods used in identifying the heterogeneity and influences of food safety behaviour between groups of people. It also provides important tools for stakeholders, risk managers and communicators to use in future research, communication and education.
**Declaration**

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To my “other” baby, Evie.

And to a supportive and patient husband, Andrew.
Acknowledgement

Of course it is common courtesy to thank everyone who has helped in the development of this thesis. I decided long ago that more than that was needed and that it simply would not all fit on a page, so apologies for that.

Naturally I wish to acknowledge the Economics Social Research Council for the studentship (ES/G030782/1) funding that provided me with the opportunity to undertake this research. But, the real thanks needs to go to my supervisors for firstly appointing me the studentship and then for getting me to this point – Dan Rigby and Ada Wossink in Manchester, Davey Jones and Gareth Edward-Jones in Bangor. Not only did you have to deal with the unexpected arrival of Evie but also a mature student who had forgotten (if she ever knew) what academia was all about – sorry about that. Being in an Economics department was a shock at first but thanks to Davey for providing the science comfort blanket whenever it was needed. Gareth was supportive, motivating and always told it like it was – just what we like in Yorkshire. I am just extremely sad that you could not see the end result.

Of course I owe huge gratitude to Dan for getting me to this point – he has persevered beyond what a supervisor is probably required to do, supplied the hard and nice feedback just when it has been necessary and most of all made it interesting and fun - Clickin’ Tonight would not have been the same without that name. Your enthusiasm and commitment are endless and whilst you are a detail freak, it is just what I have needed.

The research would not have been possible without Professor Sarah O’Brien’s interest, her enthusiasm and experience offered as a guiding hand – thank you Sarah and also Kathryn Jackson for helping get me through the research design and ethics process. And of course gratitude must go to the ladies at the Greater Manchester Health Protection Unit for your patience with the recruitment process and Lorraine Lighton for being a champion of my work. Dave Mitchell and Dave Brandon, cheers for reminding me what to do in a laboratory and helping me get the results – not quite what we had hoped for but still interesting all the same. Phil Styles did a fantastic job with Clickin’ Tonight, coping with mine and Dan’s constant demands and changes to...
make a fantastic and fun piece of research. But thanks to Davey and Gareth for the money to do it and to the policeman who sent Davey on that speed awareness course.

Ex-colleagues have played a huge part in this thesis development – probably more than they realise. I look back on my work experiences with happy memories. Those experiences have helped shape who I am now and what I have been able to contribute to research in this thesis. Special mention needs to go to Helen Sisson for being a great teacher and friend and Kaarin Goodburn for always being on the end of the phone.

Family and friends, I could write an entire page for each of you expressing my gratitude for your support over the last three years and all of the years that we have known each other before but I fear that space is too limited for that. Special mention needs to go to; Claire, a true friend and role model of how to juggle family and work and Paula and Julia for always having a listening ear. Special, special mention needs to go to Auntie B (Barbara Thackray) for her huge support of my efforts and to Helen Thackray for always being there for me in my many times of need - you make the distance across the Atlantic seem not so great. Of course thanks to Dad for being interested, I hope that Mum would have appreciated my efforts too.

Andrew, I could not have done this without your patience, support and belief and finally, thank you to Evie for all of the love and fun that you have bestowed on me. You have made it all worthwhile.
## List of Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
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<td>ACMSF</td>
<td>Advisory Committee on the Microbiological Safety of Food</td>
</tr>
<tr>
<td>BWS</td>
<td>Best-Worst Scaling</td>
</tr>
<tr>
<td>CFA</td>
<td>Chilled Food Association</td>
</tr>
<tr>
<td>EFSA</td>
<td>European Food Standards Agency</td>
</tr>
<tr>
<td>ESRC</td>
<td>Economic and Social Research Council</td>
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<tr>
<td>FSA</td>
<td>UK Food Standards Agency</td>
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<tr>
<td>HPA</td>
<td>Health Protection Agency</td>
</tr>
<tr>
<td>HPU</td>
<td>Health Protection Unit</td>
</tr>
<tr>
<td>IID</td>
<td>The First Study of Infectious Intestinal Disease in the Community</td>
</tr>
<tr>
<td>IID2</td>
<td>The Second Study of Infectious Intestinal Disease in the Community</td>
</tr>
<tr>
<td>NHS</td>
<td>National Health Service</td>
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<td>OB</td>
<td>Optimistic bias</td>
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<tr>
<td>RELU</td>
<td>Rural Economy and Land Use programme</td>
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Preface

Caroline worked for over 15 years in the food industry gaining valuable experience and contacts in retail, consultancy and manufacturing. During Caroline’s undergraduate studies (BSc (Hons) Food Technology) she was awarded the Grimsby Food Town Young Person Award in recognition of her contribution to the Food Industry. She went on to gain a scholarship with Marks and Spencer for the final year of her studies before joining the head office food technology team. Caroline moved into consultancy with The Food Safety Consortium Ltd where she became a director of the company, managing a team of consultants and accounts with Marks and Spencer and major chilled food manufacturers contributing to over 60% of the turnover. The core business included food safety consultancy, troubleshooting, auditing and training with new business generated purely by networking, referrals and reputation. This highly successful international business was sold to an auditing company (National Britannia) following changes to food auditing accreditation. At this time Caroline took the opportunity to work for one of her major clients Hazlewood Foods (now Greencore Group Plc), as a food technical controller, reporting directly to the Group Technical Controller. During the 7 years at Greencore she was technical controller responsible for central technical services, the supplier auditing team and food safety at the chilled factories, including ready meals, pizza, sandwiches and Sushi. Caroline chaired the Chilled Foods Association Microbiology and Hygiene Working Group for two years in addition to co-authoring documents with the Chilled Food Association for best practice in the industry, liaising with manufacturers. Whilst working in the food industry, Caroline established a significant network of contacts at a senior level, with food retailers, manufacturers, the service industry and the Food Standards Agency on behalf of the company and industry groups she represented. In 2008 she decided to use her acquired experience and expertise to undertake research towards a PhD.

In addition to many internal policies, manuals and guidance documents, Caroline has written or co-authored publications for industry. A list of these along with the personal professional development training that Caroline has undertaken is outlined in Appendix 8.1.
1 Introduction

1.1 Background

Food poisoning causes significant financial and social burden. There are an estimated 17 million cases of intestinal infectious disease each year with an estimated 11 million work days lost (FSA, 2011d, Tam et al., 2012). As a result, the economic burden of food-borne illness is reported to be approximately £2 billion in the UK (FSA, 2010/2011). Considering bacterial food-borne illness alone, *Campylobacter* is the most reported zoonosis in the EU with over 200,000 confirmed cases reported in Europe in 2010 and 56,767 in the UK (EFSA, 2012, FSA, 2010/2011). Although using the estimations provided by the IID2 study, this is more likely to be nearer to 500,000 cases per annum in the UK due to under reporting, with a rate of 9.3 cases per 1000 person-years (Tam et al., 2012). Whilst the public health burden of *Campylobacter* is highly significant it has a comparatively low mortality rate when compared to *Listeria*, which whilst rare is also of significant concern due to a 40% mortality rate (FSA, 2010/2011).

Between 2000 and 2005 there was an overall reduction in reported food-borne illness. However, over recent years this trend has been reversed due to significant increases in reported *Campylobacter* cases. An 8% increase in *Campylobacter* was noted in the UK between 2009 and 2010. This is a situation that has also been evident in Europe. In summary, whilst food-borne illness has generally trended downwards, as seen with the continued decrease in *Salmonella* cases, the same cannot be said for *Campylobacter* (EFSA, 2012, FSA, 2010/2011).

Estimates of infectious intestinal disease and economic costs have been derived from the IID2 project which sought to explain the likely gap between reported and confirmed cases and those which go unreported (Tam et al., 2012). This same lack of reporting makes the source of infection difficult to estimate. As a result, outbreak data is often referred to in order to provide a pattern of infection source. Whilst this has been a good indicator for many intestinal infections this has not been the case for *Campylobacter*.
Campylobacter is thought to be more associated with sporadic cases, i.e. single instances of infection whilst Salmonella is more regularly associated with outbreaks where more than one case is reported - the reasons for this still remain unclear.

An estimate of the overall number of domestic cases of food-borne illness is unknown, but strong evidence associated with outbreak data provided by the EU suggest that 38.7% of such outbreaks are attributable to households (EFSA, 2012). In the UK, it has previously been reported that 11% of outbreaks are associated with food prepared in the home, for extended family or community events (FSA, 2001).

More recently it has been reported that the number of Campylobacter outbreaks has increased, although this seems to be associated with a trend of undercooking chicken livers and does not provide any specific insight or comment into the source of sporadic infection (HPA, 2012, Strachan et al., 2012).

Whilst infection may originate from ingredients such as poultry (Rodrigues et al., 2001), food safety hurdles and controls are introduced in procurement and manufacturing, through legislation, enforcement and specifications to try to reduce this. The Food chain is very complex, covering manufacture, retail and the consumer and is often summarised as “farm to fork”. Whilst contamination may occur at any step in the food chain the adoption of safe food preparation in the home is essential to ensure that the 4 C’s (cooking, cleaning, cooling and avoiding cross-contamination) are embraced by the consumer (FSA, 2006).

1.2 Significance of the study

Promotion of food safety, personal risk and the risk to others with respect to food safety in the home is an area that continues to be high on the agenda for the FSA in order to meet the aims of their food-borne disease strategy (FSA, 2001, FSA, 2011b).

Whilst Campylobacter and Listeria risk management programmes have recently been established with manufacturers and retailers (FSA, 2009, FSA, 2010a, FSA, 2011c), additional steps have and continue to be taken in the area of consumer food safety. The annual food safety week is one of many campaigns to promote food safety in the home (FSA, 2001, FSA, 2012a). In addition, consumer behaviour is an area that continues to be researched to provide data to potentially reduce food poisoning (FSA,
2012b), with a number of studies previously funded with behaviour research as the main priority (FSA, 2005a, FSA, 2005b, FSA, 2011a, Redmond et al., 2001). This body of work seeks to provide additional data for understanding consumer behaviour with respect to food safety in the home. The research reported here designs and constructs methods that are appropriate to elicit awareness, risk perceptions and behaviours in the household kitchen. The focus on the home accords with the FSA Disease Strategy (FSA, 2011b) - “whilst controls in the food production sector can make a contribution to the control of Campylobacter infection, the greatest reductions in Campylobacteriosis at present are also likely to be brought about by action in the catering and domestic settings” (FSA, 2001:20).

1.3 Literature

A literature search was conducted of published work in addition to research in progress. The search was undertaken using electronic library and research databases as well as those provided by individual publishers. In addition, research reports were reviewed from the FSA and copies requested where the research was relevant. Published papers and research reports also yielded reference lists that provided additional relevant literature for review. Once key publications, individual papers and appropriate sources on the Internet were identified, RSS links and other forms of alert were established to keep up to date with the latest news in the research area, in addition to keeping the literature review live throughout the course of the study.

As there is substantial literature regarding food and food safety, it was important as part of the literature review to focus the search down to the areas of immediate interest. Examples keywords included food safety; domestic; household; kitchen; survey; sampling; Salmonella; Campylobacter; risk; behaviour; perception; attitude; awareness; hazard. The resulting literature from this search is discussed in each of the chapters to follow.

1.4 Definitions

Hazard: “A biological, chemical or physical agent in, or condition of, food with the potential to cause an adverse health effect” (Codex, 2001:pg43).
RISK: “A function of the probability of an adverse health effect and the severity of that effect, consequential to a hazard(s) in food” (Codex, 2001 :pg 44).

The above definitions relate to food and have been proposed by Codex in an attempt to provide an internationally agreed standard (to be used in policy development and legislation). This is a working definition until harmonisation is agreed across disciplines.

There is much discussion over the definition of risk perception or perceived risk which extends beyond that of food. Risk perception has been investigated in connection with potential public health issues as well as food related issues (Cousin et al., 2011, Fischer and Frewer, 2009, Flynn et al., 1993, Frewer, 1999, Frewer et al., 1997, Kraus et al., 1992, McDaniels et al., 1997, Slovic, 1987, Slovic, 1985, Slovic et al., 1995). Risk perception is believed to be related more on subjective judgement of risk by an individual than any form of formal risk assessment. Slovic (1987) suggests that risk perception relies on intuitive risk judgements which tend to originate from the media rather than personal experience with the hazard. Boholm (1998) suggested that individuals evaluate hazards by the use of intuitive judgements with their risk assessments, influenced by factors such as the risk posed to them personally, their knowledge of the risk, levels of trust and the newness of the hazard.

Risk Perception: The evaluation made by an individual of the likelihood of an adverse event occurring and its likely consequences (Sparks and Shepherd, 1994a).

1.5 Nature of the research

Recapping on the type of research undertaken in relation to food safety practices, Redmond and Griffith (2003a) found that the majority of the studies used interview or self-completion questionnaires. There are many examples of such surveys with content ranging from general food safety questions through to more detailed analysis of food-handling practices, for example (Brennan et al., 2007, FSA, 2010b, Gilbert et al., 2007, Jay et al., 1999a, McCarthy et al., 2007, Redmond and Griffith, 2004a). Face to face interviews were found to be the most popular method of consumer research (Redmond and Griffith, 2003a). Online surveys appear to have been limited in their use.
with only two surveys being reviewed by Redmond and Griffith (2003a), although it would be expected that the number may have increased in subsequent years.

Surveys or interviews are often carried out in conjunction with other types of study to complement the research undertaken such as observations, microbiological sampling, re-enactments, (Abbot et al., 2007, Anderson et al., 2004, Fischer et al., 2007, Parry et al., 2004, van Asselt et al., 2009, Worsfold and Griffith, 1997) and to ensure that social desirability bias is minimised.

As food safety and hygiene are very personal areas for discussion, where individuals’ responsibilities and behaviour are being questioned, social desirability bias is one of a number of self-protection mechanisms that arise. Social desirability bias occurs when the individual responds more positively in order to appear to be ‘good’ (Beattie, 2010, Oppenheim, 1998). This in turn creates an attitude-behaviour problem, especially when personal responsibilities, attitudes and behaviours are considered (Beattie, 2010).

Public perceptions of food safety risks are reported to also be vulnerable to optimistic bias (Fischer et al., 2006, Miles et al., 1999, Miles and Scaife, 2003, Parry et al., 2004, Weinstein, 1987) where individuals believe that food safety issues will not affect them, their risk of food poisoning is underestimated or that they are less likely to be affected in comparison to other people. This in turn can create a barrier to food safety messages along with established habitual behaviours.

(Miles and Scaife, 2003) completed a review of studies that have measured optimistic bias in food with respect to general food and nutrition related issues, indicating the method by which the optimistic bias was measured and any significance that was found.

Since this time, a key piece of research was completed by Parry et al. (2004) using optimistic bias as a measure in a case control study, with people who had had *Salmonella* food poisoning in comparison to those who did not (ignoring *Campylobacter*). The study was designed to measure perception, risk, knowledge and control associated with food poisoning in case and control respondents. No significant difference in optimistic bias was found between their case and control samples (Parry
et al., 2004). No longitudinal element was conducted to investigate any change in bias with time elapse following the salmonellosis.

After food safety interventions, it is thought that people may modify their behaviour for safer methods for only a short period of time, then reverting back to their previous perhaps less safe habits – The FSA have conducted work that demonstrates food poisoning is reduced for only a period of 4 weeks after the food safety week campaign (Martin, 2008). “Automatic” actions occur when the behaviour/action has been repeated frequently, thus providing a habit. Habit can therefore become a barrier to change in the home. Whilst the intention and attitude may have been changed, the behaviour remains due to habit. Understanding the extent to which the food preparation step is habitual may provide some explanation as to the effort required to change behaviour or to estimate the success of interventions (Fischer et al., 2006).

In summary, it can be deduced from previous studies, that a combined methods approach may provide reduction in the varying biases reported with social and in particular food behaviour research.

### 1.6 Funding

This interdisciplinary research was undertaken as part of an ESRC studentship (ES/G030782/1). The studentship is linked to a parent project funded under the UK Research Councils’ Rural Economy and Land Use (RELU) programme – ‘Reducing *E.coli* O157 risk in rural communities’ (RES-229-31-0003).

### 1.7 Interdisciplinary research

As stated in 1.3, the studentship was linked to a parent project funded by RELU. As a result, the work was introduced as part of the *E.coli* project and therefore able to draw on the objectives of RELU¹ witnessing how interdisciplinary research is core to the success of the RELU programme.

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¹ The objectives of the Rural Economy and Land Use (RELU) programme:

*Science objective*
It was necessary for the research to be conducted in an interdisciplinary manner, with funding and supervision crossing the natural and social science disciplines. As a result, my natural science skills had to be supplemented through the life of the PhD, to undertake and meet the objectives of the research. However, the use of knowledge and experience from across the disciplines meant that I was able to embrace and consider the work as one project whilst at the same time drawing on the work and experience of scientists (e.g. microbiologists, epidemiologists, food scientists) and social scientists (e.g. economists, sociologists, social researchers, psychologists).

The term interdisciplinary has many definitions. Harvey (2006 :pg 331) points out that “there are nearly as many definitions of this term as there are researchers trying to do it” before providing a useful analogy “Interdisciplinary interaction is somewhat like hybridisation between different species (disciplines), hopefully producing hybrid vigour and special fitness for purpose as a result. While being potentially highly productive, interdisciplinary research in this analogy is infertile, incapable of continued development by itself, but relying on continued interbreeding of disciplines. Multidisciplinary working is not to be confused with that of an interdisciplinary approach. “Interdisciplinarity differs from disciplinarity and multidisciplinarity in the emphasis it places on interaction and joint working, which brings the knowledge claims and conventions of different disciplines into a dialogue with each other, yielding new framings of research problems” (Lowe and Phillipson, 2006 :pg 167).

- To deliver integrative, interdisciplinary research of high quality that will advance understanding of the social, economic, environmental and technological challenges faced by rural areas and the relationship between them.

**Capacity-building objective**

- To enhance and expand capabilities for integrative, interdisciplinary research on rural issues.

**Knowledge transfer objective**

- To enhance the impact of research on rural policy and practice by involving stakeholders in all stages of RELU, including programme development, research activities and communication of outcomes.

Through the use of an interdisciplinary approach it was hoped that the research reported in this thesis would be more relevant, with the results of greater interest to stakeholders.

### 1.8 Aims and objectives

This body of work examines individuals’ awareness and behaviour regarding safe food preparation in the home. It explores the links between perceptions, attitudes and food behaviours of individuals and groups of people in the domestic environment, with particular emphasis on *Campylobacter*.

The above is examined by the following objectives:

- To consider any differing food safety and hygiene behaviours between people who have and have not suffered food poisoning
- To investigate the level of awareness with regard to unsafe food preparation behaviours in a domestic setting
- To examine perception of food safety in the home and factors influencing perceptions between individuals and groups of people
- To assess the risk perception of unsafe food behaviours and how they vary between individuals and groups of people

### 1.9 Structure of the research

It was decided that to address the objectives, three discreet pieces of research would be necessary, with some overlapping elements such as the measurement of optimistic bias and perception of food safety in the home.

The following section sets out the research that was identified, taking into account the findings of the literature review and resources available. Subsections are then included to introduce more detail of the research design and methodology, survey design and piloting and data analysis. Discussion with regard to the ethics approval process has also been given, providing additional detail on the recruitment process, in particular.
In order to consider any differing food safety and hygiene behaviours between people who have and have not had food poisoning, it was evident that primary data collection would be necessary. Initially, there was some consideration given to using the contacts made with IID2 project and for this reason an application was put into the committee. However, following discussions amongst the IID2 committee, it was felt that the contacts would in fact be out of date and the episode of illness could be some months prior to any contact that would be made as part of this research. To pursue the collection of primary data, the recruitment process was investigated at length, and through contacts made with the Health Protection Unit in Great Manchester, a study design was developed, to include direct access to people who had had food poisoning (following informed consent). It was initially decided to target people who had had either Salmonella or Campylobacter food poisoning. This was later changed to focus on Campylobacter, removing any confounding issues between the potential source of the infection. Salmonella is seen to be more associated with outbreaks than Campylobacter and as a result the behaviours of people who have had Campylobacter were seen to relate more to domestic infection, the core of this research.

In order to investigate awareness of food safety, the literature indicated that most awareness research had been done by interview or survey. It was decided to investigate the use of a novel approach in order to try to reduce any social desirability bias and to try to elicit responses based on personal behaviours or habits than those that the participant thinks the researcher wants. As a result, it was decided that a fast moving survey was required to reduce the time that individuals had to think. Following the use of the “worm” used during the 2010 election campaign and the driving hazard perception test, the idea of Clickin’ Tonight was produced.

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2 The “worm” was used in the televised debates for the 2010 election campaign [http://news.bbc.co.uk/1/hi/uk_politics/election_2010/8636745.stm](http://news.bbc.co.uk/1/hi/uk_politics/election_2010/8636745.stm)

3 The driving hazard perception test was introduced into the driving test for all new learners in November 2002. It is also used in road safety awareness courses.
In order to assess the risk perception of unsafe food behaviours a survey was developed to present a list of food behaviours consisting of some well known hazards and some that were less well known. In order to elicit risk perceptions a novel method using Best Worst Scaling (BWS) was utilised to present the behaviours to participants.

Food safety perceptions were assessed in all three studies using a measure of optimistic bias to assess personal perceptions and those for others and then comparing this information between groups of people.

In addition to the objectives it was necessary to break this down further to provide more specific research questions to report in each paper. Whilst these can be found in each paper they are also listed in the following section as a summary of each piece of research is discussed.

1.9.1 Research design and methodology

To discuss the design and methodology that was adopted in this research, the three studies will be referred to

- Case control study
- Clickin’ Tonight
- Food risk perceptions

The following sets out the basics of each study, referring to appendices where appropriate.

1.9.1.1 Case control study

The case control study comprises three parts:-

1. Perceptions and behaviours survey
2. Analysis of kitchen hygiene
3. Longitudinal study of food safety behaviour and perceptions

For each part, a comparison was made between people who had food poisoning and people who have not had food poisoning. All participants were asked to complete a questionnaire for part 1. To then recruit participants into the additional parts
described above, a number of options were devised and presented on the consent form (see Appendix 8.2) for the participant to choose one - they were:-

1. Complete a repeat questionnaire in 6 months time (Parts 1 and 3)
2. Have the researcher visit you at home now (Part 2)
3. Have the researcher visit you at home now and in 6 months time, as well as completing a repeat questionnaire in 6 months time (All parts)

Taking each part in turn,

1. Perceptions and behaviours survey

In this part of the study we wished to investigate the self reported behaviours and perceptions of individuals that have had laboratory confirmed food poisoning by *Campylobacter*, in comparison to individuals that have not had laboratory confirmed food poisoning. This was to be completed by asking survey questions to enquire about individual’s opinions and their food handling practices.

A letter of invitation, information sheet, consent form and reply paid envelope was mailed out by the Greater Manchester HPU, to individuals that were confirmed with *Campylobacter* and matched controls to these cases. A paper-based questionnaire was also enclosed in the pack. Cases and controls that gave consent to participate in the study were asked to complete the questionnaire. A reply paid envelope was included for the return of the consent and questionnaire. For the ease of participants who prefer to use the internet, the option to complete the survey online was provided.

The main survey was to establish any evidence of ‘optimistic bias’. Optimistic bias is best defined, as individuals believing that food safety will not affect them or that they are less likely to be affected than other people. It is believed that individuals that see themselves at a lower risk of food poisoning because of optimistic bias. In addition, the frequency and degree of cooking and competency of cooking in comparison to food safety knowledge was to be assessed, to establish any link.

Copies of the Case and Control questionnaires are found in Appendices (8.4 & 8.6) respectively.
2. Analysis of Kitchen Hygiene

To compare domestic kitchen microbiological standards, a review of kitchen hygiene was undertaken.

Visits were made to consenting individuals that were confirmed with Campylobacter and matched controls to these cases. Contact was be made to the participant by telephone, using the number supplied on the consent form, to arrange the visit at a time to suit them.

Four swabs of the kitchen food preparation area were taken for analysis for hygiene indicator organisms (Total Viable Counts, Enterobacteriaceae, and E.coli) and the dishcloth in use was exchanged for a new one and analysed for pathogens, Salmonella and Campylobacter as well as the hygiene indicator organisms.

A copy of the home visit schedule can be found in Appendix 8.9. This was for reference during the home visit and not intended for the participant to have sight of. Notes were made of items such as the visual levels of cleanliness and out of date food in the fridge. Whilst it would have been ideal to conduct some form of interview during the visit, in fact the ethics committee advised against this.

3. Longitudinal study of Food Safety Behaviour and Perceptions

In order to establish if there was any change in behaviour following the food poisoning incident, research with recruited individuals was to be repeated six months later. This included repetition of the survey and the analysis of kitchen hygiene, if consent was provided.

Six months after the original research, a paper-based survey was again mailed out to individuals that have agreed continued participation in the research. Where individuals completed the first questionnaire online and indicated this as their preferred method, an email with the link to the questionnaire was sent where possible. Repeat visits were made to individuals that consented, to again assess kitchen hygiene by the use of swabs and analysis of their dishcloth after six months elapsed.

Copies of the Case and Control questionnaires sent after six months had elapsed are found in Appendices (8.7 & 8.8) respectively.
In summary, the research questions that we asked in the case control study were:

- What is the level of optimistic bias and perception of food hygiene and food safety of individuals in the home and does having had campylocobacteriosis promote any difference in optimistic bias in comparison to an individual that has not had food poisoning?
- Does behaviour and optimistic bias change with time lapse following campylocobacteriosis?
- Is kitchen hygiene different between people who have and have not recently had campylocobacteriosis?

1.9.1.2 Clickin’ Tonight

In the survey ‘Clickin’ Tonight’ we wished to investigate the food hygiene and food safety perceptions and awareness of individuals. In addition to asking survey questions participants were asked to take part in a hazard perception challenge with regard to preparing and cooking food in the home.

This research developed and used an interactive tool to identify respondents’ perceptions of food hazards and provide feedback to them on these perceptions. This was done in real time via a web-based movie with which viewers interacted via a mouse or keyboard to identify when, and where, hazards occurred in a movie clip. The temporal and spatial pattern of viewer responses was recorded in a database for further analysis of participants’ awareness of food hazards.

The research required a series of movie clips to be filmed. Within these clips a number of food safety hazards were evident, with some more obvious than others. Safe practices commonly incorrectly perceived to be hazardous were also incorporated. The film included the preparation of a meal involving chicken given the research emphasis on Campylobacter.

The video footage was converted to Flash format and hosted on a University website. The participants were asked to watch the movie and identify food hazards via mouse clicks. The system recorded the timing of each click as well as its location on the screen. In this case the viewers’ identification of food hazards (whether correct or
false) was recorded and scored. The responses and associated scores were stored in a database. The stored hazard identification data was then to be analysed to assess participants’ awareness of food risks.

In summary the survey contained two main elements as listed below:

- An interactive hazard perception challenge (described above) where the participant was asked to identify hazards within a movie clip of food preparation in the home, using the computer mouse.

- A related demographic and attitudinal linked survey. The survey was to establish any evidence of ‘optimistic bias’. Optimistic bias is best defined, as individuals believing that food safety will not affect them or that they are less likely to be affected than other people. It is believed that individuals that see themselves at a lower risk of food poisoning because of optimistic bias.

An invitation to take part in the survey was emailed out with the online link to the questionnaire. This was sent to individuals of different groups including “experts” in food safety and members of the general public. Potential participants were approached using established employment, research and personal networks. Both in the email and the closing screen of the questionnaire, the participant is invited to forward the invitation (to take part in the study), on to colleagues and friends. Additionally, the survey was posted on to topical websites, forums and other forms of social media to increase the exposure of the survey.

A copy of the online questionnaire is found in Appendix 8.11.

The research questions that we asked in the development and testing of Clickin’ Tonight were:

- What is the level of hazard awareness of specific unsafe food preparation behaviours?

- How do the number of hazards identified and identification of individual hazards vary over observed characteristics?

- To what extent do people’s self-perceptions change following the hazard perception challenge?
What is the relationship between any change in perceptions and performance in the hazard perception challenge?

1.9.1.3 Food risk perceptions

The food risk perceptions online survey contained a number of elements as listed below:

- Best worst scaling exercise used to rank perceived food poisoning risks. The participant was shown repeated subsets of behaviours that may cause food poisoning. They were then asked to identify the most and least likely to cause food poisoning. This method and the subsequent analysis enabled the researcher to rank the perceived risks.

- The survey was to establish any evidence of ‘optimistic bias’. Optimistic bias is best defined, as individuals believing that food safety will not affect them or that they are less likely to be affected than other people. It is believed that individuals that see themselves at a lower risk of food poisoning because of optimistic bias.

- A number of questions were asked with regard to food and lifestyle, in order to segment the participants into groups depending on how often they cook and the type of cooking they do.

- Demographic information was also collected.

Analysis of the data was to look at people’s assessment of how risky various food practices are and these perceptions of relative hazard assessed between different groups of people.

An invitation to take part in the survey was emailed out with the online link to the questionnaire. This was sent to individuals of different groups including “experts” in food safety and members of the general public. Potential participants were approached using established employment, research and personal networks. Both in the email and the closing screen of the questionnaire, the participant is invited to forward the invitation (to take part in the study), on to colleagues and friends.

A copy of the online questionnaire is found in Appendix 8.13.
In summary the research questions asked were:

- Can BWS be used to elicit risk perceptions of food preparation behaviours?
- Is there heterogeneity in the risk perceptions? If so, can this be explained?
- Is there a difference in risk perceptions between food safety experts and members of the public?

### 1.9.2 Survey design and piloting

All surveys were designed taking into account best practice and in consultation with relevant text (Bryman, 2008) and resources such as Question Bank\(^4\), as well as advice from the supervision team.

In some cases a number of questions were utilised from other questionnaires or research. The following table identifies the origin of questions used in the four questionnaires for the case control study and those question sections that originate from other validated tools. Where a question section is not documented in this master document, it is original work and was written specifically for this study.

<table>
<thead>
<tr>
<th>Question section</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Your illness</td>
<td>(FSA, 2000)</td>
</tr>
<tr>
<td>Contact with animals</td>
<td>(HPA, 2004)</td>
</tr>
<tr>
<td>Eating out/take aways</td>
<td>(HPA, 2008)</td>
</tr>
<tr>
<td>You and your kitchen</td>
<td>(Redmond and Griffith, 2004a)</td>
</tr>
<tr>
<td>Food and lifestyle</td>
<td>(Buckley et al., 2007)</td>
</tr>
<tr>
<td>Food safety</td>
<td>(Parry et al., 2004)</td>
</tr>
<tr>
<td>About you and your work</td>
<td>(Census, 2001)</td>
</tr>
<tr>
<td>Income</td>
<td>(NRS, 2010)</td>
</tr>
</tbody>
</table>

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\(^4\) Question Bank (Social Surveys Online) provides a database of questions from surveys that have been pretested: http://qb.soc.surrey.ac.uk/
In all cases, the surveys were tested and piloted prior to official release. The initial construction and testing was limited to the supervision team and then once it was felt that the surveys were ready for release more detailed pilots were run. In the first instance a number of interviews were conducted either alongside, or on completion of the surveys. This cognitive interviewing was to better understand the responses that had been provided and to ensure that the questions had been interpreted correctly. From these interviews any changes to wording were made prior to running a second pilot without the interviews and prior to releasing. In the case of Clickin’ Tonight, additional piloting was conducted to test the software and the method principle – this is explained more fully in Chapter 3.

It is appreciated that a structured sampling technique was not used in the recruitment of participants into the surveys, with the exception of cases for the case control study. A general recruitment or seed email was compiled including an attachment of the information sheet and a URL for the online survey. This email was then sent to a number of personal, food industry and academic contacts. Within the email (and reiterated at the end of the questionnaire), individuals were asked to complete the survey and to pass it on to others for completion.

Snowball sampling has a number of advantages and disadvantages, which were considered during the design of the recruitment strategy. Advantages include the speed of participant recruitment and low cost of implementation. In addition targeted sampling could be utilised in order to recruit experts in food safety into the study. Snowball sampling is widely recognised as being useful in hidden or difficult to access populations. Disadvantages include the use of non-probability sampling and the bias that is potentially generated (Goodman, 1961, Heckathorn, 1997). It was felt that due to the extensive personal network and contacts from 15 years in the food industry, in addition to academic links and those of my supervisors, the advantages of snowball sampling would out weigh those listed as disadvantages.

As there was a clear need to recruit experts into the sample for Clickin’ Tonight and Food risk perceptions, seed emails were targeted to individuals that fitted this criteria, in the knowledge that they would in turn pass it on to colleagues who would also fit the criteria. In fact this prompted the seed email being passed to all members of the
North West Zoonoses Group and a large proportion of the Chilled Foods Association membership. In addition, as part of the recruitment of general public participants a number of emails were sent to target the older generation (i.e. of retired age) that may be missed out from the snowball sampling. Whilst the sampling is non-probability in nature, it is hoped that some of the bias has been reduced by the selection of the initial or seed email recipients.

1.9.3 Data Analysis
Once all of the data was collected, each study was analysed individually. The software that was used in the analysis of the study was SPSS (version 16) and STATA (version 11).

The additional software that was used in the development and analysis of the food risk perceptions study was Sawtooth Software SSI Web (version 7.0.10) and LatentGOLD Choice (version 4.5). The analysis and model definitions are detailed in each chapter.

1.9.4 Ethics
Ethical approval was required by the University and in the instance of the Case Control study, the NHS\textsuperscript{5}. This was due to the collection of primary data from members of the public and in the case of the NHS ethical approval, due to the interaction with patients who had been diagnosed with \textit{Campylobacter}. Additionally, the Research and Development unit\textsuperscript{6} for the Greater Manchester PCTs had to be informed of the research and ethical approval for the case control study.

In summary the following ethics submissions were made:

I. You and Your Food – Case control study was submitted to the NHS Research Ethics Committee and the University

II. Clickin’ Tonight was submitted to the University

\textsuperscript{5} http://www.nres.nhs.uk/

\textsuperscript{6} http://www.gmregroup.nhs.uk/
III. You and Your Food – Food poisoning risks was submitted to the University

Whilst the overall process of seeking ethical approval is time consuming, the requirements seek to protect the participants from poorly constructed, inappropriate or unsafe research as well as seeking to protect the reputation of the academic institution and the safety of the individual researcher.

The ESRC publish the following principles for ethical research (ESRC, 2010):

1. Research should be designed, reviewed and undertaken to ensure integrity, quality and transparency.

2. Research staff and participants must normally be informed fully about the purpose, methods and intended possible uses of the research, what their participation in the research entails and what risks, if any, are involved.

3. The confidentiality of information supplied by research participants and the anonymity of respondents must be respected.

4. Research participants must take part voluntarily, free from any coercion.

5. Harm to research participants and researchers must be avoided in all instances.

6. The independence of research must be clear, and any conflicts of interest or partiality must be explicit.

In the preparation for each of the ethical applications, documentation had to be in place to demonstrate how the research would meet all of the ethical criteria. This included the presentation of the research design, the surveys themselves, recruitment strategies, information for potential participants, consent forms and details of how data would be handled and analysed. Additionally, a Criminal Records Bureau (CRB) check was made on the researcher (Caroline Millman).

Procedures for the application of ethical approval were followed for both the University\(^7\) and the NHS\(^9\). In the case of the NHS procedure, the application was

\(^7\) [http://www.socialsciences.manchester.ac.uk/intranet/pg/ethics/](http://www.socialsciences.manchester.ac.uk/intranet/pg/ethics/)
submitted online via the Integrated Research Application System (IRAS)\textsuperscript{10}. In all cases, the research had to be presented for consideration in advance of a committee hearing to discuss the application. Questions were then asked during this meeting for clarification before a decision was made.

The questions that were raised by the ethics application included

I. Overview of the research including the main ethical and design issues and how they have been addressed, the scientific justification for the research and the research questions of the project

II. Risks and ethical issues
   a. Research participants targeted
   b. Research procedures risks
   c. Recruitment and informed consent
   d. Confidentiality
   e. Incentives and payments

III. Scientific and statistical review

IV. Management, research sponsor and insurance

In order to discuss the ethics applications further, pertinent sections outlined from those above will be detailed further, with examples provided from the three applications. The NHS application was essentially more detailed and structured slightly differently to those submitted to the University. The main elements remained the same between the two versions.

\textsuperscript{8} Since the time that ethics forms were submitted to the University, there have been some changes to the Social Science application - templates for completion have been provided to assist in the process.

\textsuperscript{9} \url{http://www.nres.nhs.uk/}

\textsuperscript{10} \url{https://www.myresearchproject.org.uk/Signin.aspx}
Research participants targeted

Inclusion and exclusion criteria required some detailed thought for the case control study due to the sensitivities of contacting people who had been previously confirmed as having *Campylobacter* food poisoning. The final criteria were listed in the application as:

- Cases will be over the age of 18 and have had a laboratory confirmed episode of *Campylobacter* food poisoning.
- Controls will be over the age of 18 and not have had a laboratory confirmed episode of food poisoning in the last 5 years.
- In all instances, participants will live in the North West of England and must be able to provide written informed consent.

It was necessary for the study to investigate people who have actually had food poisoning and therefore the first hurdle was to distinguish an upset stomach from actual food related illness, namely Campylobacter or Salmonella. As most people, when asked, will be able to think of a time that they had been ill, for this research it was necessary to only talk to people who had food poisoning confirmed by their doctor. This would help to reduce any bias that might arise from the participant not being sure if they had food poisoning. For this reason, the Health Protection Agency laboratory confirmed cases were an ideal source of information, as these laboratories provide the results of faeces samples for the GP’s.

Exclusions included:

- Patients who do not speak English and for whom a suitable interpreter is not available
- Children under the age of 18 years old
- Prisoners
- Patients whose transmission of food poisoning has been identified to originate from an outbreak under investigation

This positioning of these criteria proved to be more difficult than expected and in fact resulted in an initial application to the NHS Research Ethics Committee being rejected.
In the first application, exclusions also included patients with a terminal illness and patients with severe mental incapacity. These prompted significant discussion as to how this information could be obtained without the consultation of medical records. The committee agreed on the second application for these exclusions to be removed.

For the online studies (Clickin’ Tonight and Food risks), the participants targeted were more straightforward due to the self selecting process. However children under the age of 16 were excluded.

Research procedure risks

During the research design process of the case control study, we had to take into account that some individuals may be embarrassed if asked about their illness or about their hygiene standards in the kitchen. As a result, the informed consent process made it clear that the study was voluntary and that if they did not wish to take part in any parts of the study, they were free to decline. We also made it clear that they could leave the study at any time. If they did not want a home visit, they did not need to choose that option.

Another risk that had to be taken into account was the safety of the researcher. Home visits were conducted at a time that was deemed safe to do so. On all occasions of a home visit the researcher ensured that a detailed timetable was available and contact was made with a nominated "buddy" prior to entering any home and immediately on exit to ensure that personal safety was maintained. Telephone contact was only made after consent had been provided, reducing the risk of unhelpful respondents entering the study.

Recruitment and informed consent

For the case control study it was necessary to recruit the cases utilising a Consultant in Communicable Disease Control (CCDC) from the Greater Manchester Health Protection Unit. They receive these laboratory results automatically under the Public Health (Control of Disease) Act 1984 and the Public Health (Infectious Diseases) Regulations 1988 for the purposes of routine public health follow-up. They mailed a study information pack to laboratory-confirmed cases of Salmonella or Campylobacter.
Initially they also mailed their routine questionnaire – this was later dropped to improve the recruitment rate.

The recruitment of controls was conducted via snowball sampling. Initially participants were asked if they had any friends who may be interested in taking part in the study – a postcard was provided for them to pass on. This in actual fact yielded very few controls and it was necessary to submit a substantial amendment to widen the scope of snowball sampling.

Because of the longitudinal nature of the study, it was necessary to try to recruit people from the beginning for the full project, to ensure that a suitable sample size could be obtained for the latter parts of the study, taking into account attrition. The information sheet and flow diagrams were designed to take into account the different parts of the study. It was accepted that not everyone would not want to invite a researcher into their home to review their kitchen and in fact this was a point raised by the ethics committee. As a result, it was necessary to segment this piece of work from the questionnaire to ensure that sample numbers were not limited for the overall study.

Consent forms for the case control study (see Appendix 8.2) were sent out to the participants in the study information pack. As described previously the information sheet set out the options for taking part, summarising the decision making process in a flow chart prior to completing the consent form. In addition, the consent form again set out the options. As there was an option of completing the questionnaire online, the Information Sheet was available as a downloadable document for potential participants when registering their interest and again available if participants choose to complete the questionnaire online. This online version also included a consent step. Whilst this online consent form was deemed to be sufficient for completion of the questionnaire, written consent was required for the home visit component of the study.

For the other surveys that would be conducted online (Food risks and Clickin’ Tonight), the consent process was very straightforward as the participant was simply given the choice to exit the survey at anytime after they had been provided with information
regarding the survey. Additionally the online surveys could be completed anonymously.

Information sheets were given (or provided online for the web based surveys) at the point at which consent was required. Information sheets can be found in the appendices - for Clickin’ Tonight (Appendix 8.10), Relative Risk (Appendix 8.12) and the case control study (Appendices 8.3 & 8.5).

Confidentiality

The procedure for the management of data was documented for the ethics committees, to demonstrate how information once collected was managed in an orderly, secure and confidential manner. It was important to be able to demonstrate that personal details would not be shared or could be accessed by anyone outside of the scope of the study.

In the case of all surveys conducted, participants were allocated a participant identification number – for online surveys this was allocated automatically by the software and for the paper based surveys this number was allocated manually. On receipt of all data, the personal details of the participant were removed from the data and stored separately, leaving the analysis to be conducted using the participant identification number. The participant identification number was the only reference used in all data analysis and no personal details have been used in reporting results. In fact the original details were only referred to in order to contact the participants who wished to take part in the home or longitudinal study.

In order to ensure that confidentiality and data protection was maintained, the paper consent forms, from the case control study, were physically stored in a locked filing cabinet. All electronically stored details and the datasets were stored on a password secured computer and no data connecting participant identification was accessible from this computer. All data was encrypted using Truecrypt.

Incentives and payments

Incentives were not paid to participants for the completion of the two online surveys. However, an incentive was required for the case control study where home visits were conducted, by way of compensation for their time. This was set out in the information
Following the successful ethics applications, processes were maintained to ensure that the information provided to the ethics committees was carried through in the actual research process. For example, a document control system was set up to ensure that the latest and approved version of any document was maintained. In addition, records of all changes and any subsequent amendments to the ethics application were undertaken – one such amendment was the change to the recruitment of controls in the case control study. Due to the lack of response using the designed postcard system, a wider strategy of snowball sampling was introduced including approaching groups in the North West.

1.10 Structure of the thesis

The structure of the thesis was discussed in the early stages of the research with my supervisors, following a lengthy review of other relevant theses. It was agreed that the alternative format of writing papers for publication, than a traditional thesis, would better suit the style of the research. Additionally, writing the thesis in an alternative paper style, meant that supervisory and co-author discussions could address the sections most pertinent to them, for example, the involvement of The Greater Manchester Health Protection Unit in the case control study meant that Lorraine Lighton needed to comment on the contents of that chapter. The target journals are those with a food safety and policy audience and in the case of the last paper, a risk based journal.

This thesis is structured into six chapters. Chapters two, three, four and five have, or are about to be submitted for journal publication, as articles in their own right. They are structured such that each paper contains a literature review, full methodology, results and discussion. Each chapter has been co-authored, with co-authorship relating to supervisory involvement, discussions relating to research design, data analysis and
findings. All of the writing has been completed by me with copy editing and suggestions for improvements made by the co-authors.

Chapter two investigates whether the food safety perceptions and behaviours of people differ between people who have had food poisoning and those who have not. In order to do this, a case control study is utilised to assess microbiological differences in kitchen hygiene between people who have had campylobacteriosis and people who have not had recent food poisoning. Whilst this aims to investigate behaviours of a sub population, the full sample are asked questions to elicit self-reported kitchen behaviours. Perceptions are also tested between cases and controls, in the form of optimistic bias.

Chapters three and four explore a new method of eliciting hazard perception with regard to domestic food safety. Chapter three sets out the novel method, which has been developed in order to assess hazard perception. It uses an intuitive survey method incorporating a video ‘hazard perception challenge’ within a web based interactive survey. Chapter four uses this method, to assess awareness of a number of unsafe domestic food preparation habits. More traditional survey techniques are also used to capture characteristics and perceptions. The hazard response profiles across groups of people are then analysed.

In chapter five a novel method for eliciting relative risk perception of food safety behaviours is used. This method uses Best-Worst Scaling and latent class analysis to not only elicit relative risk perceptions but explore heterogeneity amongst respondents. To provide a comparison group, the sample population included experts in food safety as well as members of the general public.

Chapter six discusses the main findings of chapters’ two to five, consolidating and contextualising them within the overall aims of the thesis. The contributions of this thesis are documented with limitations and recommendations for future research emerging from the study.
2 Perceptions, behaviours and kitchen hygiene of people who have and have not suffered campylobacteriosis: A case control study

This chapter is submitted for publication as: Millman, C., Rigby, D., Edward-Jones, G., Lighton, L., Jones, D. (2012) Perceptions, behaviours and kitchen hygiene of people who have and have not suffered campylobacteriosis: A case control study

2.1 Abstract

Whilst the scale of food poisoning in the home is not fully understood, the increase in sporadic cases of *Campylobacter* continues to place focus on home hygiene and domestic food safety practices. Domestic hygiene has rarely been identified as a risk factor for the incidence of campylobacteriosis but due to the high levels of sporadic cases of *Campylobacter*, cross contamination from kitchen practices remains of significant interest. Due to the complexities of human nature, finding the true risk perceptions and practices that take place in the kitchen is challenging, with social desirability bias affecting the results of surveys and optimistic bias influencing risk perceptions. This study looks at self-reported kitchen behaviours and perceptions of people who have had campylobacteriosis in comparison to people who have not had food poisoning. It also investigates kitchen hygiene within a smaller sample. The survey crucially includes a longitudinal element to investigate any change that may take place after a period of six months has elapsed. Optimistic bias was evident in both groups and no significant difference in perception was noted in the baseline study. However, the longitudinal study showed that individuals who had not had food poisoning increased their optimism, introducing a significant difference in optimistic bias between the two groups after six months had elapsed. Self-reported kitchen behaviours also exhibited a difference between the two groups, with the individuals who had campylobacteriosis responding more favourably with the exception of washing chicken and washing salad leaves sold in a bag. No evidence of kitchen hygiene differences could be found between the people who had suffered campylobacteriosis in comparison to people who had not had food poisoning.
2.2 Introduction

Each year, 11 million working days are lost in the UK due to infectious intestinal disease which is estimated to cost the UK approximately £2 billion annually (FSA, 2010/2011). *Campylobacter* is the most commonly reported bacterial pathogen (9.3 cases per 1000 person-years), with an estimated 500,000 cases occurring annually in the UK (Tam et al., 2012).

Despite the high recorded and estimated incidence of *Campylobacter*, outbreaks are rarely identified, with much of the incidence being attributed to sporadic infection. More recently it has been reported that this pattern has started to change, with an increasing number of outbreaks associated with undercooked chicken and chicken livers (HPA, 2011, Little et al., 2010, Strachan et al., 2012). Studies of campylobacteriosis have highlighted risk factors that include travel abroad, raw meat, milk, untreated water and handling pets with diarrhoea (Adak et al., 1995, Doorduyn et al., 2010, Kapperud et al., 2003, Neimann et al., 2003, Rodrigues et al., 2001). The consumption of poultry (particularly chicken) is the most frequently identified source of infection, with Neimann et al. (2003) listing 11 studies in a 20 year period (1979-1998). However, Rodrigues et al. (2001) suggest that consumption of chicken may be less important as a source for sporadic *Campylobacter* cases than cross contamination from raw poultry (Kapperud et al., 2003), indicating that poor domestic hygiene practices may be a significant risk factor.

Studies of kitchen practices generally take the form of self-reported surveys, which focus on specific questions of practice or attitudes and perceptions towards food safety (Gilbert et al., 2007, Redmond and Griffith, 2004a). Focus groups have been used to investigate practices in sub-groups of the population (Gauci and Gauci, 2005, Gettings and Kiernan, 2001, Sudershan et al., 2008, Trepka et al., 2006). However, observational studies (Abbot et al., 2007, Anderson et al., 2004) have been key in revealing kitchen practices (Redmond and Griffith, 2003a). Microbiological studies often include observational elements in addition to sampling (Fischer et al., 2007, Gorman et al., 2002, Haysom and Sharp, 2005, Mylius et al., 2007) and in many cases laboratory analysis has been based on re-enactments of behavioural studies (Mylius et al., 2007, Redmond et al., 2001). Only Parry et al. have investigated the perceptions
and practices of people who have had confirmed food poisoning (Parry et al., 2004, Parry et al., 2005).

Although it is not known what proportion of cases of Campylobacter can be attributed to food prepared or eaten at home, the UK Food Standards Agency (FSA) has identified improved domestic food safety as critical in reducing the burden of illness (FSA, 2001). Consumer behaviour is not regulated and in this regard the prevention of food safety hazards depends on good food safety and hygienic practices being adopted and becoming ‘second nature’ in the home. In other words, food safety practices have to become an ingrained habit to ensure that they are repeatable on each occasion that food preparation is undertaken. In order to make progress in this unregulated area it is essential that consumer behaviour is better understood and that education and food safety communication strategies are developed appropriately, in order to try to direct the consumer towards making the safe preparation of food a habit (Fischer et al., 2006, Redmond and Griffith, 2004b).

Whilst a more detailed understanding of food risk perceptions are necessary to establish what people do or don’t do in order to address poor practices, it is widely reported that risk perceptions are influenced by optimistic bias (OB), so analysis of personal risk has also focussed on the presence, extent and causes of OB (Fischer et al., 2006, Miles et al., 1999, Miles and Scaife, 2003, Parry et al., 2004, Sargeant et al., 2010, Sharot, 2011, Weinstein, 1987). Optimistic bias is “the inclination to overestimate the likelihood of encountering positive events in the future and to underestimate the likelihood of experiencing negative events” (Sharot, 2011: pg xv). OB is evident in many situations. With respect to food safety, OB occurs where individuals who believe that they are less likely to be affected by food safety hazards also believe that their risk of food poisoning is less than the average person. OB is also evident in the finding that people believe that they are in control of microbiological hazards when they prepare food themselves (Miles et al., 1999), but food prepared by others is much more hazardous to them (Frewer et al., 1994, Miles et al., 1999). It is believed (Redmond and Griffith, 2004b) that individuals who see themselves at a lower risk of food poisoning (because of optimistic bias) are less likely to be sensitive to food safety awareness campaigns, believing that the messages are not for them. This can
make educational initiatives to reduce risk more challenging, as the intended audience become immune to the messages.

Explanations of OB are categorised into either motivational or cognitive, with motivational explanations based on the theory that “assume that individuals are motivated to make risk judgements that will not induce negative affect or threaten self-esteem, and so will maintain or promote psychological wellbeing” (Miles and Scaife, 2003: pg 15). Cognitive explanations for optimistic bias are centred on the failure of the individual to adopt the perspective of others. Individuals may conclude incorrectly that their chances differ from those of others, be influenced by any past experience (or absence of experience) or by comparison of themselves with a stereotype and incorrectly conclude that the hazard will not apply to them as they do not fit the stereotype (Miles and Scaife, 2003).

This study uses principles of research undertaken by Parry et al to investigate the food safety perceptions and extent of OB, in addition to assessing kitchen hygiene (Parry et al., 2004, Parry et al., 2005). Whilst the work of Parry focussed on people who had Salmonella, in comparison to people who have not had salmonellosis, we compare individuals who have had laboratory confirmed campylobacteriosis, with individuals who have not had laboratory confirmed food poisoning. We further extend this research by introducing a longitudinal element, revisiting food safety perceptions six months later.

Whilst the main survey elicited information regarding the existence and levels of OB, the use of questionnaires to elicit attitudes, awareness and behaviours suffers from certain limitations due to discrepancies between self reported practices and those in reality. This was partly addressed by environmental microbiological sampling in the kitchens of a small group, drawing on past research by Redmond et al. (2001), Fischer et al. (2007) and Parry et al. (2004, 2005).

In summary, the research questions that we asked are:

- What is the level of optimistic bias and perception of food hygiene and food safety of individuals in the home and does having had campylobacteriosis
promote any difference in optimistic bias in comparison to an individual that has not had food poisoning?

- Does behaviour and optimistic bias change with time lapse following campylobacteriosis?
- Is kitchen hygiene different between people who have and have not recently had campylobacteriosis?

### 2.3 Materials and methods

The case control study was conducted using a survey of self reported kitchen behaviours and food safety perceptions, in addition to a kitchen sampling programme for a sub group of the main study. A longitudinal study surveyed kitchen behaviours and food safety perceptions six months later in the same cohort. Cases were defined as people aged 18 or over, who have had laboratory confirmed campylobacteriosis in Greater Manchester, England, whilst controls were matched (gender, age and general geographic location) individuals with no laboratory confirmation of food related illness in the previous five years.

#### 2.3.1 Case and control recruitment

Participants in the study were recruited via two routes: via the Greater Manchester Health Protection Unit (HPU) and by snowball sampling for the recruitment of controls. The HPU receives laboratory reports on all isolates of *Campylobacter* from people resident in Greater Manchester and at the time of the study routinely sent enhanced surveillance questionnaires to all cases of *Campylobacter*. For this study, cases were initially contacted by the HPU with a letter of invitation, information sheet (see Appendices 8.3 & 8.5), consent form (see Appendix 8.2) and paper-based questionnaire (with an online option provided). Informed consent was established by the individual returning their consent form to the HPU permitting direct contact by the researcher. The recruitment and research design was approved by an NHS Research Ethics Committee. It was intended that controls be recruited by the use of a referral system whereby postcards were provided for cases to pass onto friends to apply for involvement in the study. In fact this method yielded few controls and supplementary
methods of recruitment were necessary including: the use of social media to advertise on local group sites, snowball sampling using contacts in Greater Manchester, and visiting societies and groups in the region. The controls also completed the same consent form to take part in the study.

### 2.3.2 Data collection

As part of the informed consent process for both cases and controls, the participant was asked if they wished to take part in a home study involving a kitchen visit, a further questionnaire in 6 months’ time or simply complete the initial questionnaire.

#### 2.3.2.1 Survey

The questionnaire was designed to investigate self-reported behaviours and perceptions of individuals with regard to food safety in the home. The questions used by Parry et al. (2004) with regard to risk, control and knowledge were presented to elicit perceptions and the existence and level of optimistic bias, with a seven-point Likert scale. These comprised a series of three pairs of questions to measure respondents’ perceived levels of risk, control and knowledge regarding food poisoning in the home, in comparison to their perception of that of the average person. The questions were:

- How much risk do you think there is to you personally (the average person) from food poisoning in the home?
- How much control do you think you personally have (the average person has) over getting food poisoning in the home?
- How much knowledge do you think you personally have (the average person has) about the risk of getting food poisoning in the home?

Participants were asked how involved they were in the preparation of food in the home. Questions relating to more specific behaviours in the domestic kitchen were also included in the survey (Figure 2-1). Additionally, cases were asked about their recent illness and their perception of its origin, including recent travel abroad. Copies of the case and control surveys can be found in the appendices (see Appendices 8.4 & 8.6).
### YOU AND YOUR KITCHEN

**Thinking about what you or the ‘house chef’ get up to in the kitchen...**

1. Please answer the following questions, by circling the number which best indicates your response on the scale of 1 to 5
   
   *Some questions have a * by them - Do not answer them if you do not buy or cook meat.*

<table>
<thead>
<tr>
<th>Question</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>I use different chopping boards for the preparation of raw meat and nothing else.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I smell leftover food to decide if it is still okay to use.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I would eat eggs even if the egg yolk was still very runny.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I would eat cooked meat a day after its “use by” date.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I use the drying up cloth (or tea-towel) to dry my hands.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I defrost foods in the fridge rather than on the worksurface/worktop.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I wash chicken (whole bird, joints or pieces of) under the tap before cooking.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I follow manufacturers’ cooking instructions on food packaging.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I clean the work surface after food preparation using an antibacterial spray.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I would eat a beef burger that was cooked to ‘medium’ (slightly pink in the middle).</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I wash salad leaves that are sold in a bag before eating them.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I leave hot foods out of the fridge to cool overnight.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

**Figure 2-1 Kitchen behaviours from the initial and the +6 month survey**
To establish if there was any change in behaviour and any change in OB through time following the food poisoning incident, research with consenting individuals was repeated six months later, repeating the risk, control, knowledge and kitchen behaviour questions. Copies of these additional questionnaires for cases and controls can be found in the appendices (see Appendices 8.7 & 8.8). These were posted to individuals or a URL forwarded by email where online completion was requested.

### 2.3.2.2 Kitchen sampling

A review of kitchen hygiene was undertaken for a subgroup of recruits who had consented to a home visit. Visits were pre-arranged in the same manner for both controls and cases. Environmental swabs were taken for analysis of hygiene indicator organisms and the dishcloth in use was exchanged for a new one and analysed for the pathogens, *Salmonella* and *Campylobacter* as well as hygiene indicator organisms.

The following sample points were targeted to ensure consistency in sampling across respondents’ kitchens: chopping boards, kitchen sink surround and the bottom shelf of the refrigerator. Surfaces were sampled aseptically using alginate tipped swabs (Medical Wire & Equipment Co.) pre-moistened in 10 ml MRS Neutralising Broth containing Peptone (vegetable origin), Disodium Phosphate, Lecithin, Tween 80 and Sodium Thiosulphate, to mitigate effects of chlorine, quaternary ammonium compounds and phenolics, based household cleaning agents. The sampling method was controlled by ensuring that no more than a 5 x 5 cm² area was swabbed and that the swab tip was rolled and turned across the selected area.

If the household had a dishcloth or sponge, this was removed for analysis by inverting a sterile Stomacher bag (Seward UK), re-inverting and sealing with an identifying label. Where the dishcloth or sponge was found to be soaking in household bleach or was new and unused, it was not sampled. For each dishcloth removed, the participant was given a replacement.

Samples were transported under chilled conditions (4 ± 2°C) until testing at a UKAS accredited microbiology laboratory. Wherever practicable, samples were transported and prepared for analysis within 10 hours of sampling, with all samples prepared within 24 hours of sampling. Samples were labelled with a code number to prevent the
laboratory knowing the origin of the samples and to ensure that there was no indication of their case/control status.

2.3.3 Data analysis

2.3.3.1 Laboratory analysis
Swabs were vortexed (VWR) for 30 seconds to elute bacteria into solution. 0.5 ml was then transferred to 4.5 ml of Maximum Recovery Diluent MRD (Oxoid CM0733), vortexed for 30 seconds to disperse the sample and further serial dilutions were prepared as required.

Dishcloths and sponges were weighed and an equivalent volume of MRD added to the Stomacher bag. This was then massaged by hand for 30 seconds and 0.5 ml removed and transferred to 4.5 ml of MRD, vortexed for 30 seconds to ensure consistency of mixing and serial dilutions prepared as required. 25 ml aliquots were transferred to 225 ml Buffered Peptone Water BPW (Oxoid CM0509) and Bolton Broth (Oxoid CM983) for Salmonella and Campylobacter isolation respectively.

Counts were prepared from serial dilutions for both swab and dishcloth/sponge samples as above and 0.5 ml aliquots removed for each test:

Enumeration of Aerobic Colony Count (ACC) was based on ISO 4833 (Microbiological examination of food and feeding stuffs: enumeration of micro-organisms colony count technique) at 30°C using Plate Count Agar (Oxoid CM325) incubated aerobically at 30°C for 48 hours.

Enumeration of Enterobacteriaceae was based on ISO2158-2 4833 (Microbiological examination of food and feeding stuffs: Enumeration of Enterobacteriaceae. 2004) using Violet Red Bile Glucose Agar (VRBGA) (Oxoid CM485) incubated aerobically at 37°C for 24 hours.

Enumeration of Escherichia coli was based on BS ISO 16449 (Microbiology of food and animal feedstuffs – horizontal. Method for the enumeration of B-gluconoridonidase positive E.coli Part 2: colony count at 44°C, 2001) by plating on Tryptone Glucoronidase X Agar (Oxoid CM945) at 44°C for 24 hours.
Salmonella isolation followed ISO 6579 (Microbiological examination of food and animal feedstuffs. Detection of Salmonella part 4 2002) using a pre-incubation step in BPW for 20 hours at 37°C, 0.1 ml transferred to 10 ml Rappaport Vassiliadis Soya Peptone Broth (RVS) (Oxoid CM0866) incubated at 41.5°C ± 1°C for 18-24 hours and 1 ml transferred to 9 ml of Muller Kaufmann Tetrathionate Broth (MK-TTn) (Oxoid CM0029) incubated at 37°C for 21-27 hours. 5 μl was then removed and streaked onto both Brilliant Green Agar (BGA) (Oxoid CM0263) and Xylose Lysine Decarboxylase Agar (XLD) (Oxoid CM0469) from both selective broths. Typical colonies were purified and identified using physiological, morphological, biochemical and serological profiles.

Campylobacter isolation followed BS EN ISO10272-1:2006 (Microbiological examination of food and animal feeding stuff. Detection of thermotolerant Campylobacter). The samples were incubated in micro-aerophilically in Bolton Broth (Oxoid CM983) at 37±1°C for 3-5 hours, transferred to 41.5±1°C up to 48 hours, 5 μl was streaked onto Campylobacter Blood-Free Selective Medium (Modified CCDA - Preston (Oxoid CM0739) with selective supplement (Oxoid SR0155)) and incubated micro-aerophilically for 48 hours at 41.5±1°C. Typical colonies were purified and identified using physiological, morphological, biochemical and serological profiles.

2.3.3.2 Statistical analysis
The microbiological results were tested for case/control differences by swab area (sink, chopping board and fridge) and microorganism using the Wilcoxon Mann-Whitney test. In order to measure optimistic bias from the survey data, a difference or bias score was calculated between a respondent’s answers to the questions about themselves and those about the average person. Typically, OB has been tested using a one-sample t-test (Parry et al., 2004, Sargeant et al., 2010, Weinstein, 1987). However, as the difference scores are technically ordinal not interval we used the Wilcoxon Mann-Whitney test to test the hypothesis that the sample median is equal to zero and therefore shows no bias. Any difference between cases and controls in optimistic bias was then analysed, in addition to any change apparent through the longitudinal study. The kitchen behaviours were analysed in the same manner to identify differences between cases and controls and longitudinally. Chi-square was utilised to test for association with case/control status, gender, responsibility in the kitchen and age. Age
bands were chosen to compare with the findings of Gillespie et al. (2009), which demonstrates age-related changes in *Campylobacter* incidence (1990-2007) with greatest increasing risk of infection in 60+ year olds.

2.4 Results

Questionnaires were mailed out to 836 cases over a five month period. 202 were returned but 3 were excluded because they were completed by people who did not fit the case definition i.e. were under the age of 18. In addition, 17 people who had travelled abroad within 7 days prior to their illness were removed from the sample. A total of 182 case questionnaires were therefore analysed. 185 controls were recruited. For the longitudinal study, 118 cases and 96 controls consented to complete the survey 6 months later, yielding 77 case and 44 control useable questionnaires with a completion rate of 65% and 46% respectively. Twenty five cases were visited after agreeing to take part in the home study. The same number of matching controls was identified and visited.

2.4.1 Perceptions and optimistic bias

The questions relating to risk, designed to elicit the existence of OB, were completed by 355 individuals. Of this sample, 42.5% believed themselves to be at greater or about the same risk of getting food poisoning in the home as the average person. In contrast, 57.5% of participants believed that they were at a lower risk of getting food poisoning in the home than the average person.

Testing the difference scores for risk, control and knowledge, the three scores are significantly different from zero and demonstrate OB. The participants have indicated that the average person is at a significantly greater risk of getting food poisoning than himself or herself (z=13.031, p<0.001), has significantly less knowledge (z=-13.701, p<0.001) and significantly less control (z=-7.461, p<0.001) over food poisoning in the home. This bias score was converted into a simple rating (Figure 2-2) to show the existence of OB. No significant difference was found between cases and controls.

For the longitudinal study the same analysis was repeated, again demonstrating the existence of OB, with 25.21% believing themselves to be at greater or about the same
risk of getting food poisoning in the home as the average person in comparison to 74.79% who believed themselves to be at lesser risk. The participants continued in their beliefs that the average person was at a significantly greater risk of getting food poisoning than himself or herself ($z=8.612$, $p<0.001$), had significantly less knowledge ($z=-3.498$, $p<0.0005$) and significantly less control ($z=-9.095$, $p<0.001$) over food poisoning in the home. A simple rating was calculated as before (Figure 2-3). On this occasion a significant difference between cases and controls was identified for the risk questions ($z=-2.314$, $p=0.021$) but not for the control ($z=0.182$, $p=0.856$) or knowledge ($z=-1.929$, $p=0.054$) questions.

Figure 2-2 Initial survey results showing OB for risk, control and knowledge for cases and controls
Due to the change in sample numbers between the initial and longitudinal survey it was necessary to calculate a score change to identify the actual movement in bias between the two survey occasions. Individuals with an increased level of OB were defined as those who developed OB during the study, or who were previously pessimistic and developed no bias. Increased bias for controls was found to be 36.36% in contrast to 19.18% for cases. 13.7% of cases reduced bias (to no or pessimistic bias) in contrast to 2.27% of controls. This is displayed in Figure 2-4.

Chi-square testing of risk scores and risk ratings for the initial and longitudinal survey against age, gender and responsibilities in the kitchen showed no significance with the exception of the risk rating from the longitudinal survey against age band ($\chi^2(1)=6.693$, $p=0.010$), age band for controls ($\chi^2(1)=4.728$, $p=0.030$) and gender ($\chi^2(1)=5.716$, $p=0.017$).

**Figure 2-3 Longitudinal survey results showing OB for risk, control and knowledge for cases and controls**
2.4.2 Kitchen behaviours

The mean Likert response for the kitchen behaviours was calculated for both cases and controls to highlight any areas of interest. Significant differences between the responses of cases and controls was evident in answer to: the use of chopping boards, eating runny eggs, eating cooked meat a day after its “use by” date, following manufacturers’ instructions for cooking, using antibacterial spray and eating pink beef burgers. In all of these instances, the cases answered more favourably than the controls. The mean Likert scores are shown in Table 2-1, along with the p value indicating significant differences between cases and controls.

Cases were significantly more likely than controls to wash poultry and ‘ready to eat’ salad leaves. The advice from the FSA is that raw poultry and other meat should not be washed in order to avoid cross contamination. This advice differs from that provided previously, where evisceration and processing was not as comprehensive and washing to remove blood was therefore carried out. In the case of raw vegetables and salad ingredients, whilst the general advice is to wash vegetables and salad ingredients, items sold ‘ready to eat’ in a bag do not require further washing before consumption. For these products, washing has been carried out by the manufacturer to a more satisfactory standard than can be achieved in the home (ACMSF, 2008, Palumbo et al.,...
and further preparation in the kitchen may increase the risk of cross-contamination. 69.63% of respondents reported that they washed raw chicken before cooking, compared with the FSA ‘Food and You survey’ in 2010 which reported that 63% of people wash poultry and red meat some of the time, with 41% of people always carrying out this practice (FSA, 2010b). It was found that there was no significant association with gender ($\chi^2(4)=1.031$, ns) but there was a significant association with responsibility for food preparation or responsibilities in the kitchen ($\chi^2(8)=16.618$, $p=0.034$). 72.9% of people who were responsible for food preparation stated that they wash chicken in comparison to 61.66% who have no responsibilities in the kitchen. Significance was also found for case control status ($\chi^2(4)=12.097$, $p=0.017$), with 65.32% of controls stating that they wash chicken in comparison to 73.86% of cases. Age was also found to affect the responses ($\chi^2(12)=28.799$, $p=0.004$). 69.63% stated that they washed chicken with 62.9% for 20-59 year olds in comparison to 80.45% for people aged 60+. With regard to salad leaf washing there was no significant relationship with responsibility in the kitchen ($\chi^2(8)=4.632$, ns), or case control status ($\chi^2(4)=6.593$, ns). However, significance was found with gender ($\chi^2(4)=15.244$, $p=0.004$) and age ($\chi^2(12)=12.994$, $p=0.015$). Whilst overall, 79.67% stated that they washed salad leaves sold in a bag, 85.93% of people aged 60+ wash leaves in comparison to 75.45% for 20-59 year olds.
Table 2-1 Kitchen behaviour results for case and controls for the initial survey

<table>
<thead>
<tr>
<th>Kitchen Behaviours</th>
<th>Case Mean</th>
<th>Standard deviation</th>
<th>Control Mean</th>
<th>Standard deviation</th>
<th>Mann-Whitney p value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>*I use different chopping boards for the preparation of raw meat and nothing else.</td>
<td>3.71</td>
<td>1.54</td>
<td>3.09</td>
<td>1.70</td>
<td>0.0008*</td>
</tr>
<tr>
<td>I smell leftover food to decide if it is still okay to use.</td>
<td>3.80</td>
<td>1.50</td>
<td>3.64</td>
<td>1.38</td>
<td>0.106</td>
</tr>
<tr>
<td>I would eat eggs even if the egg yolk was still very runny.</td>
<td>2.25</td>
<td>1.50</td>
<td>2.96</td>
<td>1.58</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>*I would eat cooked meat a day after its “use by” date.</td>
<td>2.25</td>
<td>1.32</td>
<td>2.95</td>
<td>1.45</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>I use the drying up cloth (or tea-towel) to dry my hands.</td>
<td>2.75</td>
<td>1.45</td>
<td>2.91</td>
<td>1.55</td>
<td>0.349</td>
</tr>
<tr>
<td>I defrost foods in the fridge rather than on the work surface/worktop.</td>
<td>3.13</td>
<td>1.36</td>
<td>3.14</td>
<td>1.12</td>
<td>0.940</td>
</tr>
<tr>
<td>*I wash chicken (whole bird, joints or pieces of) under the tap before cooking.</td>
<td>3.43</td>
<td>1.71</td>
<td>2.91</td>
<td>1.69</td>
<td>0.0051*</td>
</tr>
<tr>
<td>I follow manufacturers’ cooking instructions on food packaging.</td>
<td>4.56</td>
<td>0.85</td>
<td>3.98</td>
<td>1.10</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>I clean the work surface after food preparation using an antibacterial spray.</td>
<td>3.83</td>
<td>1.41</td>
<td>2.88</td>
<td>1.52</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>*I would eat a beef burger that was cooked to ‘medium’ (slightly pink in the middle).</td>
<td>1.44</td>
<td>1.01</td>
<td>2.09</td>
<td>1.43</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>I wash salad leaves that are sold in a bag before eating them.</td>
<td>3.52</td>
<td>1.53</td>
<td>3.21</td>
<td>1.54</td>
<td>0.0443*</td>
</tr>
<tr>
<td>I leave hot foods out of the fridge to cool overnight.</td>
<td>2.77</td>
<td>1.62</td>
<td>2.87</td>
<td>1.49</td>
<td>0.476</td>
</tr>
</tbody>
</table>

Likert score: 1=never, 3=sometimes, 5=always
*significant at p<0.05

Perceptions and Risks: Food-borne Pathogens in the Domestic Environment
When the questions were repeated six months later, the responses changed marginally. For example, washing of chicken for the cases (mean=3.74, SD 1.59) showed a marginal increase whilst controls exhibited a decrease (mean=2.88, SD 1.66) with a significant difference between the two groups (p=0.0045). With regard to the washing of salad leaves, cases remained similar after 6 months (mean=3.47, SD 1.52) but the controls reduced (mean=2.75, SD 1.62), increasing the statistical significance (p=0.0167).

### 2.4.3 Kitchen sampling

Microbiological analysis of the swab locations (fridge, chopping board and sink) in the 25 case and 25 control kitchens indicated no difference between the two groups of people, thereby indicating no significant difference in kitchen hygiene between people who have had campylobacteriosis and people who have not. Table 2-2 illustrates the swab results tested for Aerobic Colony Counts, *Enterobacteriaceae* and *E. coli* and the Wilcoxon Mann-Whitney p-value. *E. coli* was found on a chopping board and a sink surround in one case kitchen but in both instances this was at a level of less than 100 cfu/ml. Higher counts of *Enterobacteriaceae* and Aerobic Colony Counts were found in the sink areas as expected, with marginal differences between chopping boards and the fridge. Dishcloths were taken from 17 cases and 20 controls. Neither *Salmonella* nor *Campylobacter* were detected in any of the dishcloths, so confirmatory pathogen testing was not required. *E. coli* was identified on one dishcloth, but with a low count of 150 cfu/ml. A difference at 5% significance was noted between the case and control dishcloths for both Aerobic Colony Counts and *Enterobacteriaceae*. 
Table 2-2 Microbiological sampling results of case and control kitchens

<table>
<thead>
<tr>
<th>Sampling site</th>
<th>Analysis</th>
<th>n</th>
<th>Case or Control</th>
<th>Min (cfu/ml)</th>
<th>Max (cfu/ml)</th>
<th>Mean (cfu/ml)</th>
<th>Wilcoxon Mann-Whitney p value*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fridge</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td>Aerobic colony count</td>
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<td>Case</td>
<td>&lt;10</td>
<td>3.40E+05</td>
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<td></td>
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<td>25</td>
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<td>1.30E+05</td>
<td>6.92E+03</td>
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<td>25</td>
<td>Case</td>
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<td>3.20E+02</td>
<td>0.559</td>
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<td></td>
<td></td>
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<td>Control</td>
<td>&lt;10</td>
<td>4.10E+03</td>
<td>1.99E+02</td>
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</tr>
<tr>
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<td><em>E. coli</em></td>
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<td>Case</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
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<tr>
<td></td>
<td></td>
<td>25</td>
<td>Control</td>
<td>&lt;10</td>
<td>&lt;10</td>
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<tr>
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<td>Aerobic colony count</td>
<td>25</td>
<td>Case</td>
<td>&lt;10</td>
<td>8.00E+04</td>
<td>8.20E+03</td>
<td>0.414</td>
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<td></td>
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<td>Control</td>
<td>&lt;10</td>
<td>2.00E+05</td>
<td>1.37E+04</td>
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<td>9.80E+03</td>
<td>4.36E+02</td>
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<td>1.40E+03</td>
<td>7.32E+01</td>
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<td>Case</td>
<td>&lt;10</td>
<td>7.00E+01</td>
<td></td>
<td></td>
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<td></td>
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<td>Aerobic colony count</td>
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<td>Case</td>
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<td>2.10E+05</td>
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<td></td>
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<td>3.00E+05</td>
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<td>Case</td>
<td>&lt;10</td>
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<td></td>
<td></td>
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<td>&lt;10</td>
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<td><strong>Dishcloth</strong></td>
<td>Aerobic colony count</td>
<td>17</td>
<td>Case</td>
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<td>7.00E+06</td>
<td>2.41E+06</td>
<td>0.019*</td>
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<td>2.80E+07</td>
<td>8.11E+06</td>
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<td><em>Enterobacteriaceae</em></td>
<td>17</td>
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<td>2.70E+06</td>
<td>3.07E+05</td>
<td>0.043*</td>
</tr>
<tr>
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<td>2.64E+05</td>
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<td><em>E. coli</em></td>
<td>17</td>
<td>Case</td>
<td>&lt;10</td>
<td>1.50E+02</td>
<td></td>
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<tr>
<td></td>
<td></td>
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<td>Control</td>
<td>&lt;10</td>
<td>&lt;10</td>
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</tr>
<tr>
<td></td>
<td><em>Campylobacter</em></td>
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<td>Case</td>
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<td>Not detected</td>
<td></td>
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<td></td>
<td></td>
<td>20</td>
<td>Control</td>
<td>Not detected</td>
<td>Not detected</td>
<td></td>
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<tr>
<td></td>
<td><em>Salmonella</em></td>
<td>17</td>
<td>Case</td>
<td>Not detected</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20</td>
<td>Control</td>
<td>Not detected</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

*significant at p<0.05

cfu = colony forming units
2.5 Discussion

Whilst the impact of home food preparation on the scale of food poisoning is not fully understood, efforts to stem the increase in campylobacteriosis include a focus on home hygiene and domestic food safety practices. This study looks at kitchen hygiene amongst people who have had campylobacteriosis in comparison to people who have not had food poisoning. It also looks at self-reported kitchen behaviours and perceptions to establish any difference between a larger sample of cases and controls and any change that may take place after a period of six months has elapsed.

Pathogens (Salmonella and Campylobacter) were not found from the sampling of dishcloths from control and case kitchens, and no difference was noted between cases and controls for the swab results taken from the fridge, chopping board and sink areas. Whilst there was some difference between cases and controls with regard to the dishcloth for indicator organisms, this difference is considered irrelevant in the absence of pathogens. Whilst the results of Parry et al. (2005) could not be replicated in this study in terms of pathogen isolation (they found that even when Salmonella was isolated from 10% of the case dishcloths in comparison to 5% of the control dishcloths, this difference was not statistically significant) they also concluded that there was no evidence of differing hygiene practices between the case and control samples. Although Salmonella was isolated from the kitchens in that study, there was insufficient evidence to suggest that this was a cause of infection.

Dishcloths have been used in several studies (Gorman et al., 2002, Hilton and Austin, 2000, Mattick et al., 2003a, Mattick et al., 2003b) as an indicator of kitchen hygiene. They are often used to wipe all the surfaces in the kitchen and therefore provide an ideal opportunity to pick up contamination. Whilst in this study pathogens were not found on the dishcloths, this should perhaps be considered with the knowledge that the isolation of Campylobacter is notoriously challenging to isolate due to its viable nonculturable stage (Rollins and Colwell, 1986), requirement for microaerophilic conditions and its rapid decline on surfaces after the initial contamination in comparison to Salmonella (Cogan et al., 2002). This may support the view that sporadic campylobacteriosis is more likely to be caused by cross contamination during preparation and transient, rather than residual contamination on surfaces.
In order to ensure that we adopted ethical practices during the sampling section of the study it was necessary for announced kitchen sampling visits to be conducted. Whilst it is understood that by being announced, this visit would have permitted an element of “tidying”, the participant was unaware of the sampling sites and the possibility of dishcloth removal. It should be noted that the cases and controls were provided with equal notice of the kitchen visits to avoid any one group having more or less notice and therefore minimising any bias. Unfortunately, the sample size for the kitchen hygiene section was restricted due to low recruitment levels and the challenges of ethical approval and consent. It might be expected that a general reluctance to allow a researcher into the house, also contributed to the low recruitment levels. Indeed this concern was raised by the NHS Research Ethics Committee.

With respect to the responses to questions about kitchen behaviours, the significant difference exhibited between cases and controls may be explained in one of two ways. Either the difference is an actual representation of kitchen behaviour or social desirability bias may have influenced the cases to a greater degree. Respondents can seek to appear be to be “good” leading to a social desirability bias (Oppenheim, 1998) and perhaps the cases did not want to reflect that their case of food poisoning may have originated from their own practices, creating the difference in response. This however does not fully explain the two behaviours of washing chicken and washing salad leaves sold in a bag. Either respondents adopted incorrect practices, or they claimed to practice incorrect behaviours in the mistaken belief that they were giving the correct answers. The FSA ran food safety campaigns advising against the practice of washing poultry and raw meat on TV and radio, including one run prior to Christmas 2007 and again pre-Christmas 2009. The cohort effect reported here suggests that the younger generation may have been influenced by such food safety campaigns, or washing poultry may have become a habit that was adopted by the older participants, before the public health message was made explicit. With respect to washing salad leaves there may have been some misinterpretation of the FSA advice to wash vegetables, given during 2011 following a vegetable related *E. coli* O157 outbreak. This advice excluded ready-to-eat salad leaves sold in a bag. With respect to both washing chicken and salad leaves, it would appear that the kitchen preparation behaviours of
the individuals aged 60+ are not changing in line with the introduction of pre-washed products onto the market, which negate the need for washing in the home.

The results of the perception and subsequent OB analysis, whilst demonstrating no difference between cases and controls, diverged during the longitudinal study with controls exhibiting an increased bias which was not replicated by the cases. Whilst at first, this result appears counterintuitive, one of two explanations may be considered for this increased bias; an effect of campylobacteriosis with cases causing their perceptions to be tempered or controls exhibiting increased OB because they have continued to not experience food poisoning. Miles et al. (2003) highlight that OB may be influenced by any past experience (or absence of experience) and that “Optimistic bias is linked with the belief that lack of experience with a hazard in the past is protective against experience in the future” (Miles and Scaife, 2003: pg 17). In this situation, the controls have continued to not experience food poisoning and therefore may have increased their OB as a result. This highlights the importance of a longitudinal element for an insight into the influence of food poisoning or, possibly more importantly, the lack of food poisoning. This lack of a negative experience and creation of OB increases the likelihood that food safety messages, such as those highlighted by the kitchen behaviours (washing chicken and salad leaves sold in a bag), do not alter behaviour (Miles and Scaife, 2003). With these results in mind, an understanding of food safety behaviours in the home would benefit from further research of optimistic bias in relation to age and level of experience of food preparation in the home.

In conclusion, no evidence of kitchen hygiene differences (using microbiological assessment) could be found between the people who had suffered campylobacteriosis in comparison to people who had not had food poisoning. Optimistic bias was evident in both groups but again no significant difference was noted in the initial study. However, the longitudinal study showed that individuals who had not had food poisoning increased their optimism, introducing a significant difference in optimistic bias between the two groups after six months had elapsed. Self-reported kitchen behaviours also exhibited a difference between the two groups,
with the individuals who had *Campylobacter* responding more favourably, with the exception of washing chicken and washing salad leaves sold in a bag.

**Acknowledgements**

This research was undertaken as part of an ESRC studentship (ES/G030782/1) funded by the Economics Social Research Council, linked to ‘Reducing *E. coli* O157 Risk in Rural Communities’ (RES-229-31-0003) funded under the UK Research Councils’ Rural Economy and Land Use Programme. The authors thank all those who participated in the study, the team at the Greater Manchester Health Protection Unit for making the recruitment a success, Dave Brandon and Dave Mitchell for helping with the microbiological analysis and to Professor Sarah O’Brien and Kathryn Jackson for their valuable help with the ethics process and recruitment design.
3 Developing an intuitive test of food hazard perceptions

This chapter is submitted for publication as: Millman, C., Rigby, D., Jones, D. Edward-Jones, G., (2012) Developing an intuitive test of food hazard perceptions

3.1 Abstract

Purpose:

Food poisoning attributable to food prepared in the home causes significant harm and economic costs, yet is an unregulated and largely unobserved domain. Investigating levels of food safety knowledge and routine practices is fraught with difficulties because of both conscious and unconscious misreporting. We develop a new, real time, interactive survey tool to elicit food safety awareness using a simple, intuitive format. We report the approach’s development, piloting and validation.

Design/methodology/approach:

We develop and implement a technique to elicit hazard perceptions using an online survey interface in which respondents watch and engage with a film, in real-time, via mouse clicks. The film includes hazardous food behaviours and the system records the temporal and spatial location of the respondents’ hazard-clicks. The system allows assessment of variations in hazard awareness and how the measured awareness relates to self reported levels of knowledge.

Findings:

The technical system developed which integrates footage of food behaviours with respondents’ responses via mouse clicks functions well. User engagement is high, and the approach generated interest from industry and regulatory stakeholders. It was picked up by the UK FSA which included it in Food Safety Week material.

Originality/value:

A new, intuitive and engaging real-time survey tool to elicit hazard awareness is developed with high levels of user engagement and stakeholder interest. The approach is entirely generic, and may be adapted to elicit hazard perceptions in a wide range of settings. The approach has educational, training as well as research potential.
3.2 **Introduction**

There are many instances where an assessment of hazards and the level of awareness of these hazards are required. This may be as part of a test of knowledge (such as an examination after a training course) or for research purposes. This paper sets out the development of a novel, interactive, method to elicit individuals’ hazard awareness. In this first development of the method, the focus is knowledge of food hazards, however the method developed is entirely generic. In the development of the method, we also attempt to draw on cognitive processes in order to elicit knowledge or hazard awareness that is practically applied to everyday life by the participant.

3.2.1 **Self reported versus true behaviour**

It is usual to conduct an assessment of an individual’s awareness by asking a series of questions either by a self-complete survey or by interview. Redmond and Griffith (2003a) found that 75% of food safety studies were conducted by survey in a 25 year period. Such assessments are often designed using multiple-choice questions, open questions or scaled-response questions such as those using Likert scales. Whilst self-reported awareness may be the most simple and convenient way to conduct such assessments, it is widely recognised that there is a discord evident between the findings of such methods and practice or behaviour (Abbot et al., 2007, Beattie, 2010, Curtis, 1993, Kendall et al., 2004, Medeiros et al., 2001, Redmond and Griffith, 2003a, Redmond and Griffith, 2003b, van Asselt et al., 2009). This gulf between stated and actual behaviour is most likely when discussing a topic that may cause an individual to answer more positively than is actually true, for example, when considering personal responsibilities and attitudes (Beattie, 2010).

Of the biases identified in this context, ‘social desirability bias’ is perhaps the most significant in terms of leading to systematic misreporting of knowledge or practice. Redmond and Griffith (2003a) highlight the concern that surveys are limited in their “efficacy, scope and accuracy” due to discrepancies between self reported practices and actual practice in addition to over reporting of behaviours that are perceived to be ‘good’. There is a tendency to respond to questionnaires in a way such that a positive image is portrayed (Beattie, 2010, Oppenheim, 1998).
Beattie (2010) shows that social desirability bias creates an attitude-behaviour problem, especially when personal responsibilities, attitudes and behaviours are considered. He summarises the work done in psychology to investigate attitudes in both their explicit (conscious or deliberate) and implicit (unconscious) form. The argument for, and evidence of, an ‘attitude-behaviour problem’ whereby attitudes measured using such methods as Likert scales do not accurately predict behaviour, has prompted the development of alternative methods to reveal unconscious, or implicit, attitudes which better predict behaviour.

In order to try to identify unconscious, or implicit, attitudes, Greenwald developed Implicit Association Testing (IAT) to assess the role of implicit attitudes in behaviour (Greenwald et al., 1998). During a review of predictive validity of IAT, Greenwald found that when attitudes are socially sensitive and social desirability concerns are present, explicit measures (stated or conscious) are poor predictors of behaviour and implicit explanations need to be sought (Greenwald et al., 2009). The specific forms of IAT vary but a central element is the respondent completing tasks under time pressure with implicit association measured using response times. Greenwald et al. review IAT testing, reporting that the “predictive validity of self-report measures (but not of IAT measures) was sharply reduced when research topics were socially sensitive and that IAT measures had greater predictive validity than did self-report measures for criterion measures involving interracial behaviour and other intergroup behaviour” (Greenwald et al., 2009).

Habit is also a barrier when considering behaviour in comparison to self-reported knowledge, attitudes and behaviours (Fischer et al., 2006). “Automatic” actions occur when the behaviour has been repeated frequently, forming a habit. Whilst intention and attitude may be influenced by (changes in) knowledge, the behaviour may remain due to habit (Fischer et al., 2006). Kahneman (2003) identifies two cognitive processes in judgment and decision-making – an intuitive and a controlled mode, labelled as System 1 and System 2 respectively. System 1 involves intuition including typically fast, automatic and implicit operations associated with habit while System 2 involves reasoning with slower more controlled and consciously monitored operations (Kahneman, 2003). Standard survey techniques tend to prompt the participant to be
more reasoned in their responses so the survey process may derive responses based in System 2 thinking whilst much habitual behaviour are driven by System 1 thinking.

The system developed here seeks to induce the respondent to reveal knowledge based on implicit attitudes and habitual behaviours drawing on System 1 thinking. It seeks to do this by using a stimulus which is intuitive (video footage of routine behaviour) and, crucially, by eliciting responses under time pressure. Before outlining the approach, we consider methods that have previously been used to assess knowledge and awareness.

3.2.2 Methods of assessing knowledge and awareness

The extant literature on food safety perceptions has employed several methods which Redmond and Griffith, assessing studies over a 25 year period (Redmond and Griffith, 2003a, Redmond and Griffith, 2003b), categorise as: self-completion questionnaires, interviews, focus groups and observational studies. Whilst questionnaires and interviews are the most commonly used, they were also most associated with the discord between self-report and behaviour (Redmond and Griffith, 2003a). To reduce this gulf, such methods are often carried out in conjunction with other methods including microbiological assessment and behavioural observation (Abbot et al., 2007, Anderson et al., 2004, Curtis et al., 2003, Evans, 2011, Fischer et al., 2007, Jay et al., 1999b, Kendall et al., 2004, Parry et al., 2004, van Asselt et al., 2009, Worsfold and Griffith, 1997).

While efforts are made in observational research to be unobtrusive, people have a tendency to behave differently if they are watched or observed. Two limitations to observation research are cited by Redmond and Griffith (2003a): 1) Observer bias could threaten reliability due to the observer’s perceptions varying to that of the observed individual, thereby creating a difference between the observed event and reality (Heiman, 1995) and 2) The knowledge of being studied could distort behaviour – known as the ‘Hawthorne Effect’. The Hawthorne Effect is often referred to as experimental artefact and can be subdivided into three categories – indexicality (changes in behaviour that subjects make according to the situation that they find themselves in), experimenter effects (the way that a particular experiment may influence the behaviour of the individual such as the use of laboratory settings) and
subjects’ mediation through interpretation (individuals not experiencing or understanding the independent variable being studied in the same way as the next individual) (Gill and Johnson, 1997).

To overcome potential biases with observer recorded data, the assessment is often carried out in combination with other activities such as surveys (Jay et al., 1999b, Kendall et al., 2004, van Asselt et al., 2009) or to adopt a style that seeks to ensure that the participant is not too distracted by the presence of the observer (Clayton and Griffith, 2001, Evans, 2011).

There are many methods to assess knowledge and awareness but each have limitations when considering the elicitation of routine behaviour as opposed to stated behaviour. We now focus on awareness, and more specifically hazard awareness, and its elicitation.

3.2.3 Hazard perception

Elicitation of hazard awareness or hazard perception uses a broader process than that of purely recall of theory or knowledge. One way to assess hazard perception is to test an individual’s ability to identify inappropriate behaviours or indeed dangerous conditions or events taking into account the surroundings of the environment, processes that are taking place (and those that may take place), whilst drawing on knowledge and experience (Endsley, 1995). In summary, this form of awareness may therefore be linked to the knowledge of a hazard and cognitively to behaviour influences such as past experiences as well as an assessment of the hazards likelihood.

Situation Awareness (SA) is a concept which has been applied in a few areas of hazard awareness testing, and has parallels with the concepts of System 1/2 thinking and implicit attitudes discussed above. SA is defined as: ‘The perception of the elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future’ (Endsley, 1995). Situation awareness testing is typically conducted by the use of video footage or a simulator. The simulation is viewed by the participant and they are asked to respond to hazards as they appear during the sequences.
Methods rooted in SA have been used to elicit hazard perception regarding highly skilled operator tasks such as driving, aircraft piloting and air traffic control (Durso, 1995, Gaba, 1995, Rowe, 2001, Wright, 2004). Common elements are time pressure on the respondent and, typically, responses provided in a physical, rather than verbal or written, form.

The method developed in this paper elicits hazard perceptions using a stimulus that is both intuitive, and prompts non verbal responses under time pressure. It is aimed at inducing respondents to reveal more about their knowledge and perceptions by inducing them to use System 1 thinking.

3.3 The interactive video challenge survey

Having reviewed the methods typically used to elicit hazard perception and knowledge, and the potential drawbacks associated with them, we now set out the development and testing of a new interactive video challenge survey tool for eliciting hazard perception. Whilst the approach is entirely generic, we use it here to elicit knowledge of food safety hazards in the domestic setting.

The tool allows assessment of the level of public awareness of potentially hazardous food behaviours by asking respondents to view and respond, by clicking the computer mouse, to hazards embedded in video footage of food preparation. This is done online, in real-time. Following on-screen explanatory details regarding the research, participants take the interactive challenge test which is embedded within a standard survey, including questions to elicit demographic, behavioural and attitudinal characteristics. Refer to Figure 3-1, showing the starting screen of the video challenge section.
As the respondent watches the video footage they click on the screen with the mouse when and where they perceive a hazard to occur. The time and spatial location of each click, in this case the viewers’ identification of food hazards (whether correct or false), is registered, recorded and stored in a database for later analysis. The participant is later provided with general feedback of the hazards contained in the film, some explanation of why the behaviour is hazardous and a picture taken from the hazard sequence in the film, shown on completion of the video challenge.

As previously stated, this tool is entirely generic but has been tested to investigate domestic food safety behaviours. The UK Food Standards Agency (FSA) has identified improved domestic food safety as important to reducing food-borne disease (FSA, 2001). However, domestic food preparation is unobserved, unregulated and there is no requirement for food safety training. For example, food such as raw chicken can present a significant risk if mishandled by the untrained and unobserved person in the domestic kitchen, particularly with respect to the bacterial pathogens Campylobacter.
and *Salmonella* (Neimann et al., 2003, Parry et al., 2002). Consequently, the initial application of the technique concerned the preparation of a chicken meal in the domestic environment in which known hazardous behaviour associated with raw chicken were included along with other, more general, food safety hazards.

### 3.3.1 Hazard selection, definition and filming

The video challenge footage used the preparation of chicken salad, with notable hazards included that were filmed as part of the sequence. These included behaviours that may occur in a domestic kitchen and which could contaminate either the food prepared, the ‘cook’ or surfaces/items in the kitchen, with pathogens such as *Salmonella* or *Campylobacter*. Table 3-1 details the hazards featured in the video footage stimuli.

#### Table 3-1 Hazards used in the film

<table>
<thead>
<tr>
<th>Hazards</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td><strong>High refrigerator temperature</strong></td>
</tr>
<tr>
<td>Cross contamination</td>
<td><strong>Incorrect storage location of raw chicken in the refrigerator</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Washing of chicken next to a draining board of clean items</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Radio touched without washing hands after handling raw chicken</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Hands not washed after cutting chicken before getting a clean bowl</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Hands not washed after cutting chicken before getting a bottle of marinade</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Utensils used on raw chicken, used again to remove cooked chicken from the pan</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Pouring marinade used on raw chicken over a salad</strong></td>
</tr>
<tr>
<td></td>
<td><strong>The chopping board and knife only wiped down between preparing raw chicken and salad</strong></td>
</tr>
<tr>
<td>Poor personal hygiene</td>
<td><strong>Wiping nose during salad assembly</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Poor hand washing</strong></td>
</tr>
</tbody>
</table>

The hazards included were intended to vary in terms of likelihood of identification by respondents, to ensure that a mix of hazard difficulty could be achieved during compilation of the film. For example, the refrigerator thermometer showing an
excessive temperature was expected to be identified by relatively few people and therefore considered ‘low ease of identification’, compared to using the same knife to cut raw chicken and salad ingredients, classified as ‘high ease of identification’. Whilst it would appear that the obvious hazard of undercooked chicken was not included, chicken cooking was difficult to show as a specific hazard during this footage and therefore text was employed as a substitute to indicate that the chicken was fully cooked.

The hazards were defined by time and space in the film, including a margin of error to allow for lags in response time and some degree of inaccuracy on mouse cursor placement. Care was also taken to ensure that there was a sufficient gap between hazards, to minimise the risk of misattribution (a late click for one perceived hazard being interpreted as a click for a subsequent, temporally near hazard). The hazards were characterised as either static or dynamic. A static hazard is defined as a hazard fixed at a point in time and space, for example the temperature of the refrigerator. A dynamic hazard develops as part of a sequence of events, for example wiping down the chopping board and knife between preparing raw chicken and salad ingredients.

During filming and editing, delivery of the hazards had to be carefully managed to ensure that hazards were appropriately visible, without obvious signposting, and that inadvertent hazards were not introduced. It was therefore necessary to storyboard the film and map out the hazards and the way in which the kitchen space was to be used during the filming. Figure 3-2 shows the locations used in the kitchen for the filming and Figure 3-3 shows the storyboard for the filming of the fridge temperature hazard.
Reference points for filming locations

Figure 3-2 Kitchen layout with filming references
Hazard – Incorrect Fridge Temperature

- **Hazard – temperature of fridge too high**
- Fridge door (A) is opened and items of food are put away according to the fridge plan.
- Filming to take place from (F) looking across to (G) and (A) and then moving to look into (A) directly.
- Shot to show internal of the fridge as the unpacking is done, with arm cutting across the shot to put items in.
- Digital readout of the fridge thermometer to be included in this shot.

Figure 3-3 Storyboard and images from the film of the fridge sequence showing the temperature hazard
Figure 3-3 (continued) Storyboard and images from the film of the fridge sequence showing the temperature hazard
Two films were made, comprising different combinations of the hazards listed in Table 3-1. Participants were only shown one film, to which they were allocated at random. Hazard interactions with those around it such as the number, sequence or ease of identification of hazards can be compared using the two films. For example, was there any significant difference in response rate for the identification of hands not being washed before touching the radio between the two films? This hazard appears in each version of the film and therefore a statistically similar response rate may indicate that there is no hazard interaction. While the planning, filming and editing of the film sought to show behaviour as naturalistically as possible, there is always the danger of a behaviour or item being perceived as a hazard simply because it appears in the film. Using two versions of the film permits this to be tested, with each featuring two versions of the behaviour – one hazardous, one benign. For example, in one film the refrigerator temperature displayed is safe and in the second film, a hazardous refrigerator temperature is displayed. Comparison of hazard identification between these two versions allows analysis of actual knowledge of the correct temperature as opposed to people taking the focussing on the temperature as a clue that it was hazardous.

Table 3-2 shows the running order for each film, the ease of identification of each hazard and whether it is a static or dynamic hazard. The films were converted to Adobe Flash format for web delivery and were then embedded in the web based survey.
Table 3-2 Hazards contained in the video challenge

<table>
<thead>
<tr>
<th><strong>Film A</strong></th>
<th><strong>Ease of identification</strong></th>
<th><strong>Static/Dynamic</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Behaviours</strong></td>
<td>Refrigerator temperature 8.9 °C</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Chicken stored correctly in the fridge</td>
<td>No hazard</td>
</tr>
<tr>
<td></td>
<td>Washing of chicken next to a draining board of clean items</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Radio touched without washing hands*</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Hands not washed after cutting chicken before getting a bottle of marinade*</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Poor hand washing</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Clean chopping board used</td>
<td>No hazard</td>
</tr>
<tr>
<td></td>
<td>Check mobile text</td>
<td>No hazard</td>
</tr>
<tr>
<td></td>
<td>Wiping nose during salad assembly</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Cooking</td>
<td>No hazard</td>
</tr>
<tr>
<td></td>
<td>Utensils used on raw chicken, used again to remove cooked chicken from the pan*</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Pouring marinade used on raw chicken over a salad*</td>
<td>High</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Film B</strong></th>
<th><strong>Ease of identification</strong></th>
<th><strong>Static/Dynamic</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Behaviours</strong></td>
<td>Refrigerator temperature 4.7 °C</td>
<td>No hazard</td>
</tr>
<tr>
<td></td>
<td>Chicken stored incorrectly in the fridge</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Chicken not washed</td>
<td>No hazard</td>
</tr>
<tr>
<td></td>
<td>Radio touched without washing hands*</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Hands not washed after cutting chicken before getting a clean bowl*</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Hands washed well</td>
<td>No hazard</td>
</tr>
<tr>
<td></td>
<td>Chopping board and knife wiped down only between preparing raw chicken and salad</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Check mobile text</td>
<td>No hazard</td>
</tr>
<tr>
<td></td>
<td>Cooking</td>
<td>No hazard</td>
</tr>
<tr>
<td></td>
<td>Utensils used on raw chicken, used again to remove cooked chicken from the pan*</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Pouring marinade used on raw chicken over a salad*</td>
<td>High</td>
</tr>
</tbody>
</table>

*Hazards repeated in alternative film
3.3.2 Data recording and analysis

Software was developed to enable the online hazard identification clicks to be recorded in real-time. Both the temporal and spatial location of each click in response to the film was recorded in a server side database which lay ‘behind’ the web interface experienced by respondents. The video response tool integrates the two elements to create the real-time recording for analysis.

Figure 3-4 shows a screenshot of the video challenge in progress. The clicks are recorded in the database and the respondent is able to witness their clicks being registered.

Figure 3-4 The web interface showing the click counter

Whilst this example demonstrates the interactive video challenge survey tool using domestic food safety behaviours it is worth re-emphasising that the basic principles of this tool are generic. The film could be one from an entirely different environment,
hazard placement is simply defined by time and space and the survey that the system is embedded into can be changed easily. The click behaviour is then unique to the film and hazard definitions.

Respondent click behaviour is the translation of the hazard definitions (in time and space) and the respondents’ clicks, into hazard hits (correctly timed and located click) and false hits (incorrectly timed and located click). These data are then combined with characteristic information supplied by the participant at the end of the film clip such as demographic information and whether they have specialist knowledge in food safety.

Explanations for the variability in response across groups of people are then investigated using these characteristics, for example, are there any differences between the number of hazards identified between food safety experts and the public? Specific hazards can be analysed to establish if there are any systematic differences across groups in identifying that hazard, for example, are experts and members of the public equally likely to identify the washing of chicken as a hazard?

In summary, analysis can be undertaken by single hazard or groups of hazard (e.g. Cross-contamination). It can also focus on individual participants or pre-defined or latent groups of participants. Table 3-3 shows the type of, and variability in, click behaviour, the method generates. The illustrative click patterns displayed highlighting the individuals’ results by hazard, and by example personal characteristic (expert status). It shows the method generates both hazard hits, number of false hits, and total clicks. The columns show example hazard results, with space between them representing the hazard-free periods in which any clicks are false hits.

It can be seen that (illustrative) persons 1, 2, 3 and 4 all have identified the 8 hazards in the film. Person 1 has identified all of the hazards without any clicks outside of the hazard periods, whilst person 3 has identified all of the hazards but equally clicked during the hazard free periods. This example highlights that personal characteristics, such as expert status, may be used to explain click behaviour.
Table 3-3 Illustration of click variability

<table>
<thead>
<tr>
<th>Time in film</th>
<th>Fridge</th>
<th>Wash</th>
<th>Radio</th>
<th>Bottle</th>
<th>Hands</th>
<th>Nose</th>
<th>Utensils</th>
<th>Marinade</th>
<th>Expert/Public</th>
<th>False hits</th>
<th>Hazard hits</th>
<th>Total clicks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person 1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Expert 0</td>
<td>8</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>Person 2</td>
<td>5</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>7</td>
<td>5</td>
<td>16</td>
<td>5</td>
<td>Expert 0</td>
<td>8</td>
<td>50</td>
<td>58</td>
</tr>
<tr>
<td>Person 3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>16</td>
<td>21</td>
</tr>
<tr>
<td>Person 4</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>Expert 3</td>
<td>8</td>
<td>14</td>
<td>21</td>
</tr>
<tr>
<td>Person 5</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td>Person 6</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>6</td>
<td>Public 5</td>
<td>3</td>
<td>13</td>
<td>18</td>
</tr>
</tbody>
</table>

Whilst persons 1-4 identified all hazards, their click behaviour, evident in the number of false hits and total clicks are very different and therefore a simple score based on the hazard hits may not be appropriate. The development of a hit rate has been considered to take into account these false hits in addition to the hazard hits by the introduction of a weighting. This would prevent individuals who may have clicked continuously through the film, without having as much awareness of the hazards (person 3), being compared directly with someone who was able to identify the hazards correctly (person 1). Such a method would also take into account multiple correct clicks within a hazard period, illustrated by persons 2, 4 and 6. These multiple correct clicks may be due to the dynamic nature where a hazard evolves during a sequence of events such as the act of washing the chicken and the subsequent cross contamination.

During the development and testing of the method 2 issues arose worthy of discussion: whether to include a pause button and whether to allow retries. The initial intention was not to include a pause button since it had the potential to undermine the time-pressure element at the heart of the process, creating time to consider...
scenes. However piloting and further reflection indicated that even a very small interruption (the phone ringing, a child calling from somewhere in the home) could result in the respondent being forced to abandon the process or restart from the beginning. This increased the likelihood of losing respondents. A pause button was introduced but the system was amended to record the time point in the video, and the frequency of pauses to be recorded. This allows the use of pauses to be controlled for during analysis.

In addition to the pause button an option to repeat the video challenge was provided. This was included to allow participants to repeat because of interruption or a belief they could improve their performance. A question was posed to those who opted to repeat asking their reason. Multiple completions, and their causes, were assigned to the respondent so that repetition could be controlled for and any trends in performance observed.

In this study, additional attitudinal questions were asked prior to the film, to elicit the respondents’ level of optimistic bias. These comprised a series of three pairs of questions to measure respondents’ perceived levels of risk, control and knowledge regarding food poisoning in the home, in comparison to their perception of that of the average person (Parry et al., 2004). The three pairs of questions were of the form:

- How much risk do you think there is to you personally from food poisoning in the home?
- How much risk do you think there is to the average person from food poisoning in the home?

These questions were repeated, after the video challenge was completed and feedback received. The respondent’s initial responses were displayed and they were offered the opportunity to amend their assessments of their own, and the average person’s, levels of control, knowledge and risk in relation to food poisoning.

Thus the approach allows comparison between self reported levels of control, knowledge and risk and the click scores and, further, an analysis of the degree of ex post adjustment in those assessments once feedback has been received on the click hazards. Questions are also asked to assess food safety training and experience in
order to determine any differences between those with and without food safety experience (or knowledge).

### 3.4 Results

As this is a methods paper, we focus on the rationale, development and testing of the method, with the results from the main application of the technique to be reported subsequently. In this section we discuss the method’s testing, evaluation and validation.

Once the tool was developed, it was tested and analysed in the following stages:

- Pilot testing
- Analysis and evaluation
- Post pilot testing and evaluation
- Launch to main survey

#### 3.4.1 Testing and evaluation

Pilot testing was completed by accompanied participation where ten individuals completed the test locally whilst being observed. During the test these individuals were able to ask questions of the researcher and then on completion they were asked some additional questions to check for robustness of the design and to ensure that the instructions for the video challenge section were correctly interpreted. After this testing a few modifications were carried out including the insertion of a question with regard to the speed of the challenge.

Following this accompanied participation and evaluation, the tool was released online to forty people for post pilot testing. This was to test the clarity of the instructions and robustness of the survey design and to stress test the responsiveness of the server and web interface before general release.

The initial testing and pilot testing was completed by a mixture of individuals including a cross section of ages (17-83) and backgrounds to prevent bias with respect to subject matter or familiarity with technology causing any bias.
Recruitment for the main survey was conducted by snowball sampling, using a general seed email with explanatory information and the URL of the online study. This email was sent to forty personal, food industry and academic contacts asking individuals to complete the survey and to pass it on. In turn, individuals emailed it out to their contacts, with some posting it on their workplace network or industry group website. This resulted in a wide range of participants from hospitals, schools, government departments (local and national), universities (academics and students), private companies (both within and outside the food industry), industry bodies and to members of the general public. In addition, the link was posted on a number of website forums for participation, including sites focussed on young mothers and recipe and cooking sites as well as using social media networks such as posting on Facebook and Twitter. This additional sampling was designed to target a greater cross section of the general public.

3.4.2 Validation

The video challenge is conducted in real time with the intention of eliciting immediate, intuitive responses under time pressure rather than the more considered, and perhaps less revealing, responses of standard surveys. There is a risk however that the pace is so fast as to reduce respondent’s ability to comprehend and respond to the stimulus. Hence a question was inserted following the video challenge to assess if the speed of the film (and the participant’s ability to keep pace) was a problem. The question asked if the film speed was “fine”, “a little fast but I managed” or “too fast”. The subsequent results show that in fact this is shown not to have posed any significant concern to individuals – In the pilot testing, 88% were “fine” with the speed of the challenge, 10% said that it was “a little fast but I managed” and 2% identified the challenge as being “too fast”.

Individuals were presented with additional survey questions alongside the interactive survey including questions on demographics, characteristics and a number of food-specific questions relating to experience of food illness, any dietary requirements and any knowledge of food safety. This information provided details that permit the grouping of individuals, to assess any influence of a particular set of characteristics and circumstances on the results. For example, individuals who work in food safety may
answer differently to those who do not. Equally, vegetarians/vegans may identify the hazards differently than those people who are used to handling chicken, the main focus of the footage.

Within the situation awareness literature there are examples of validity measurement of experienced versus novices where the more experienced individuals reacted faster to hazards than novices (Horswill, 2004, McKenna and Crick, 1991). Any change in the individuals’ perception of food safety, or ‘optimistic bias’ prior to and following completion of the film, in addition to overall experience and knowledge of food safety, will be assessed for validity measurement.

3.4.3 Ongoing evaluation and feedback

The collection of data for the main survey was a fast process via email snowball sampling and posting on websites and using social media. Over 300 participations were completed within the first three weeks. Also as a result of the snowballing, there were responses from several countries outside of the UK, including The Netherlands, France, Ireland, the USA and Australia. In total, over 550 responses were collected for analysis.

During the survey, participants were asked in general terms if they had any comments with regard to the research. The following provide a small selection of the type of feedback attained:

“I think the video is a very nice method to see if people are aware of where the risks are. I think it is much more efficient than a questionnaire for example”

“Very innovative and realistic video”

“Interesting to have a video clip instead of the usual boring old tick box questionnaire”

“Great Learning experience”

“This was interesting - I had done Food and Nutrition at Higher Level but obviously had forgotten a lot of it!”

Participants demonstrated their acceptance of the method with positive feedback and comments both in the survey and on forums where the survey was posted. The common theme of the feedback was that the method was interesting, engaging and provided a survey alternative to more typical survey formats. This extensive positive
feedback, and the rapid data collection rate, emphasised the interest in the subject matter and satisfaction with the method.

Staff at the UK Food Standards Agency became aware of the survey through the snowball sampling and contacted the researchers to discuss it. As a result it was included in the FSA 2011 Food Safety Week literature and Facebook page, for interested parties (including local authorities) to use as a prompt for discussion during the week. Additionally, some individuals commented on the method as a generic tool and that it would be useful in their field of work outside of domestic food safety. As a result they were keen to establish if the approach could be extended to fit their particular need.

3.5 Conclusions and recommendations

Poor practices in storing and preparing food in the home cause significant health and economic damages. In the UK it is estimated that there are 17 million cases of infectious intestinal disease, with an estimated cost of £2 billion in 2009 (FSA, 2010/2011, Tam et al., 2012). Whilst, the overall number of domestic cases of sporadic food-borne illness is unknown, food-borne pathogen outbreak data imply that 11% of outbreak cases are associated with food prepared in the home for extended family or community events (FSA, 2001). Whilst calculated differently, this figure for household attributed outbreaks is estimated to be 38.7% in Europe for 2010 (EFSA, 2012).

Understanding, and potentially improving, people’s level of food safety knowledge in the home offers potential to improve the effectiveness of food safety communication strategies. This study was initiated to assess the awareness of food safety in the domestic kitchen and led to the development of a new interactive survey technique, which seeks to elicit hazard perceptions in an intuitive manner in real time.

The method seeks to reduce the biases identified with standard surveys such as social desirability and observer bias. Using the approach of Situation Awareness, we try to
place the participant in the natural surrounding of a “normal” domestic kitchen to replicate the simulation offered by Situation Awareness testing (see 3.2) and ask them to complete the study online. This ensures that the participant is in familiar surroundings and not potentially influenced by a test or laboratory environment. Since the interactive survey is conducted online in the participant’s own natural surroundings, the indexicality and experimenter effect elements of observer bias are also reduced. The use of real-time responses creates a time pressure thereby encouraging the use of the cognitive process of System 1 thinking utilising fast, automatic, associative processes. Utilising time pressure and real-time measurement, the method also aims to reveal implicit attitudes, argued to be the real roots of attitudes thought to be held in the unconscious in comparison to those held consciously. This principle is adopted from IAT, limiting the amount of time that an individual has to consider the hazards, in turn allows less time for the respondent to consider what they should ‘do’ and increases the likelihood they will respond in accordance with their own routine behaviours. Elicited hazard perceptions are therefore more likely to be derived from habits.

During the development of the tool and feedback from participants in the study and representatives from various sectors of the food and service industries, a number of applications have been considered for the interactive tool, for use in the food industry and other sectors, where hazard perception is assessed. Such examples include:

- Research, where implicit attitudes and awareness can be assessed using video footage
- In assessment, during or at the end of training exercise to establish knowledge recall in real-time rather than simply by use of standard question forms.
- In teaching, to permit the use of interactive elements to modules.
- In consumer research, to assess message uptake of advertising campaigns.

\[11\] A household kitchen was used in the filming rather than a restaurant or catering kitchen which would not be used or familiar to most participants.
With regard to the original research, the domestic kitchen footage can continue to be used in order to further test the method, testing different groups of people to identify any trends in awareness. In addition, it would be beneficial to attempt to test the direct level of discrepancy between standard methods of food safety knowledge testing and the additional implicit measurement that this survey tool provides.

The generation and provision of real-time feedback for an individual, in addition to simple interchangability of video footage and hazard definition would significantly enhance the capabilities of this system. This makes the method a powerful tool for trainers, managers, regulators and researchers.

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4 Testing food hazard perceptions using an intuitive interactive survey

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4.1 Abstract

This paper presents the use of a new interactive intuitive survey method using a hazard perception challenge and demonstrates its use in quantifying people’s perception of food safety in domestic environments. As food safety knowledge and perceptions are often elicited in such a way that social desirability bias and optimistic bias influence the outcomes, this method aims to reduce both by inducing participants to use System 1 thinking, drawing on quick rather than considered responses. We use this method to assess the level of awareness of selected hazardous food safety behaviours in the domestic kitchen, asking participants to respond to video footage as they observe a hazard occurring. We use this real-time measurement in conjunction with collected demographics and characteristics such as food safety qualifications to explore the hazard response profiles. Participants are also asked to rate their personal perceptions of risk, control and knowledge of food poisoning in the home as well as those of an average person, prior to and on completion of the hazard perception challenge. Knowledge proved to be important in performance, both in terms of number of hazards identified and the identification of specific hazards. Individuals who had some food safety qualifications were more able to identify some hazards, such as incorrect fridge temperature. A change in personal perception and optimistic bias (knowledge), following the hazard perception challenge, was also related to performance i.e. number of missed hazards. However, this change was less amongst people with food safety qualifications. The results of the hazard perception challenge confirm that food safety education is important for the identification of some hazardous behaviour. Perceptions of risk and knowledge are changed following the challenge highlighting that the tool has not only collected survey data but prompted education and re-evaluation amongst the respondents.
4.2 Introduction

The incidence of food-borne infectious intestinal disease continues to be a financial burden to the UK with 11 million working days lost each year, costing an estimated £2 billion annually (FSA, 2010/2011, FSA, 2011d). Risk management programmes have been developed in the UK for the two pathogens providing the greatest burden and mortality rates – *Listeria* and *Campylobacter*. *Campylobacter* causes the most cases of food-borne illness in the UK and Europe and whilst the number of *Campylobacter* outbreaks is increasing incidence remains associated with sporadic cases of unknown origin and therefore potentially associated with food safety in the home (EFSA, 2012, HPA, 2012). As a result the UK Food Standards Agency (FSA) is targeting improved domestic food safety to help reduce food-borne disease (FSA, 2010/2011). In order to make improvements, insights into food safety behaviour in the home are essential to inform and target resources appropriately.

This paper seeks to test individuals’ levels of food safety awareness regarding hazardous food behaviours in the domestic kitchen. We do this via a novel intuitive interactive survey. Respondents are asked watch a film and identify hazards via mouse clicks. The recording of these clicks allows the hazard data to be analysed in conjunction with other questions, both attitudinal and demographic.

In this paper we test the method and specifically ask the following questions: What is the level of hazard awareness of specific unsafe food preparation behaviours? How do the number of hazards identified and identification of individual hazards vary over observed characteristics? To what extent do people’s self-perceptions change following the hazard perception challenge? And what is the relationship between any change in perceptions and performance in the hazard perception challenge?

4.2.1 Eliciting food safety awareness and behaviour

There are many methods of eliciting awareness and knowledge in the food domain. Redmond and Griffith (Redmond and Griffith, 2003a, Redmond and Griffith, 2003b) summarised studies over a 25 year period identifying the self-completed questionnaires and interviews to be the most common form of assessment. Whilst
this method is the most utilised, it is widely accepted to give rise to a discord between
survey findings and actual practised behaviour (Abbot et al., 2007, Beattie, 2010,
Curtis, 1993, Kendall et al., 2004, Medeiros et al., 2001, Redmond and Griffith, 2003a,
Redmond and Griffith, 2003b, van Asselt et al., 2009). The discord between stated and
actual behaviour is enhanced when individuals are asked questions that may cause an
individual to answer more positively than is actually true, such as providing insights
into personal responsibilities and attitudes. This is termed ‘Social desirability bias’
which is also recognised as an attitude-behaviour problem.

This attitude-behaviour problem has prompted psychologists to investigate attitudes in
both their explicit (consciously or deliberate) and implicit (unconscious) form. Where
attitudes are measured using such methods as Likert scales, there is evidence that they
do not accurately predict behaviour, therefore revealing conscious attitudes in
comparison to the real roots of attitude which are held in the unconscious (Beattie,
2010).

To reduce the attitude-behaviour discord, survey methods are often complemented by
additional methods such as microbiological assessment and behavioural observation
(Abbot et al., 2007, Anderson et al., 2004, Fischer et al., 2007, Parry et al., 2004,
Redmond et al., 2000, Worsfold and Griffith, 1997). Observation may involve the
observer being present with the participants (Curtis et al., 2003, Evans, 2011) or the
use of video surveillance (Anderson et al., 2004, Jay et al., 1999b, Kendall et al., 2004,
van Asselt et al., 2009). While efforts are made in such observational research to be
unobtrusive, or to adopt a style that minimises the distraction by the presence of the
observer (Clayton and Griffith, 2001, Evans, 2011), people tend to behave differently if
they are watched (Gill and Johnson, 1997, Heiman, 1995, Redmond and Griffith,
2003a).

Optimistic bias (OB) has been identified as a possible influence of the attitude-
behaviour gap and a contributor to the discord in self-reported studies (Fischer et al.,
2006, Miles et al., 1999, Miles and Scaife, 2003, Parry et al., 2004, Sharot, 2011, Sparks
and Shepherd, 1994a, Weinstein, 1987). Optimistic bias is “the inclination to
overestimate the likelihood of encountering positive events in the future and to
underestimate the likelihood of experiencing negative events” (Sharot, 2011:xv), or
“underestimate the risks associated with many potentially risky behaviours or events” (Fischer and Frewer, 2009:577). In the context of food safety, OB occurs where individuals believe that they are less likely to be affected by food safety hazards and that their risk of food poisoning is less than the average person. Because of optimistic bias, it is believed (Redmond and Griffith, 2004b) that people who exhibit this bias are more likely to ignore food safety awareness campaigns, assuming that the message is not intended for them. OB, as a barrier to education is therefore an important consideration.

Habit is also a barrier when considering “true” behaviour in comparison to self-reported attitudes and behaviours (Fischer et al., 2006). A habit forms when behaviours are repeated frequently and whilst intention and attitude may be influenced by knowledge, habits may remain (Fischer et al., 2006). Automatic actions associated with habits are associated with System 1 thinking, involving intuition, fast, automatic and implicit operations. Kahneman (2003) identifies two cognitive processes in judgment and decision-making – an intuitive and a controlled mode, labelled as System 1 and System 2 respectively. Whilst System 1 involves cognitive processes associated with habit, System 2 involves reasoning with slower more controlled and consciously monitored operations (Kahneman, 2003). Standard survey techniques, previously discussed, tend to prompt a more reasoned and considered response associated with System2 thinking, whilst much habitual behaviour is driven by System 1 thinking.

The method tested here seeks to compel the respondent to reveal knowledge based on their habitual behaviours, by identifying behaviours that they believe are unsafe or hazardous. A non verbal response, time pressure and a familiar environment are intended to induce System 1 thinking, associated with habit, minimising the opportunity for consideration and social desirability bias. A lack of response to a hazard would suggest either a little knowledge or the hazardous behaviour is adopted and seen as satisfactory and may be regarded as a habit.

Hazard awareness, it is often linked to prior knowledge of a hazard and therefore elicitation of hazard awareness may be influenced by past experiences and perceptions of the likelihood of experiencing the hazard. We refer to this as ‘hazard perception’.
Elicitation of hazard perception is more than purely recall of theory or knowledge. One way to assess hazard perception is to test an individual’s ability to identify inappropriate or unsafe behaviours, or conditions, whilst the individual is taking into account the environment and processes taking place (or that may take place), whilst at the same time drawing on knowledge and previous experience (Endsley, 1995).

Situation Awareness (SA) is one form of testing that has been used to assess hazard perception. It is typically conducted by the use of video footage or a simulator where the process or simulation is viewed by the participant and they are asked to respond to hazards as they appear during the sequences. SA can be defined as: ‘The perception of the elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future’ (Endsley, 1995). This method of testing overcomes some of the methodological issues previously raised. Response to scenarios in a test environment is more likely to elicit habitual implicit behaviours, rather than providing opportunity to consider answers, based on knowledge alone.

Methods rooted in SA have mostly been used to elicit hazard perception in association with highly skilled operator tasks such as driving, aircraft piloting and air traffic control but has also found a place in many other fields including sport, healthcare and chess (Durso, 1995, Gaba, 1995, Rowe, 2001, Wright, 2004).

The method tested in this research elicits hazard perceptions using a video stimulus which in conjunction with an element of time pressure, induces respondents to reveal more about their knowledge and perceptions of food safety, inducing them to use System 1 thinking, revealing implicit attitudes and habits.

### 4.3 Materials and Methods

We now set out the development and use of a video challenge survey tool for eliciting hazard perception of food safety hazards in the domestic setting. Following on-screen explanatory details, participants take the interactive hazard perception challenge which is set within a standard survey, including questions to elicit demographic and attitudinal characteristics. The tool provides a method to assess the level of awareness of potentially hazardous domestic food behaviours. It does so by asking respondents to
view a video of food preparation and respond, by clicking the computer mouse, when embedded hazards are identified. This is done online, in real-time.

4.3.1 The hazard perception challenge

As the respondent watches video footage they click using the computer mouse when they perceive a hazard to occur. The time of each click, in this case the viewers’ identification of food hazards (whether correct or false), is registered, recorded and stored for later analysis. The participant is provided with general feedback of the hazards contained in the film along with some explanation of the hazardous nature of the behaviours. This is shown on completion of the video challenge before moving on to further attitudinal questions.

The hazard perception challenge footage used the preparation of a marinated, cooked chicken salad in a domestic kitchen, with hazardous food behaviours included as part of the video sequence. The behaviours included ones that are known to occur in a domestic kitchen, which could contaminate the food prepared, ‘cook’ or surfaces in the kitchen, with pathogens such as *Salmonella* or *Campylobacter*. Table 4-1 details the hazardous food behaviours featured in the video footage. The hazards included were intended to vary in terms of expected likelihood of identification by respondents. For example, the refrigerator thermometer showing an excessive temperature was expected to be identified by relatively few people and therefore ‘low ease of identification’, compared to using the same knife to cut raw chicken and salad ingredients, classified as ‘high ease of identification’.

During filming and editing, the location and sequencing of hazards had to be carefully managed to ensure that they were appropriately visible, without obvious signposting, and to prevent the inclusion of inadvertent hazards. Sequencing of the hazards was important to ensure that there was no overlap as well as a sufficient gap between hazards. This was to minimise the risk of misattribution, a late click for one perceived hazard being interpreted as a click for a subsequent hazard.
Table 4-1 Food safety hazards used in the film

<table>
<thead>
<tr>
<th>Hazards</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>• High refrigerator temperature</td>
</tr>
<tr>
<td>Cross contamination</td>
<td>• Incorrect storage location of raw chicken in the refrigerator</td>
</tr>
<tr>
<td></td>
<td>• Washing of chicken next to a draining board of clean items</td>
</tr>
<tr>
<td></td>
<td>• Radio touched without washing hands after handling raw chicken</td>
</tr>
<tr>
<td></td>
<td>• Hands not washed after cutting chicken before getting a bottle of marinade</td>
</tr>
<tr>
<td></td>
<td>• Hands not washed after cutting chicken before getting a clean bowl</td>
</tr>
<tr>
<td></td>
<td>• Utensils used on raw chicken, used again to remove cooked chicken from the pan</td>
</tr>
<tr>
<td></td>
<td>• Pouring marinade used on raw chicken over a salad</td>
</tr>
<tr>
<td></td>
<td>• The chopping board and knife only wiped down between preparing raw chicken and salad</td>
</tr>
<tr>
<td>Poor personal hygiene</td>
<td>• Wiping nose during salad assembly</td>
</tr>
<tr>
<td></td>
<td>• Poor hand washing</td>
</tr>
</tbody>
</table>

Participants were shown one of two films, to which they were allocated at random. Each film contained a different combination of hazards listed in Table 4-1. While the planning, filming and editing of the film sought to show behaviour as naturalistically as possible, there was still the danger of a behaviour or item being perceived as a hazard simply because it appears in the film. Using two versions of the film permits this to be tested. For example, each film features a different version of the behaviour – one hazardous, one benign, such as the use of a correct and incorrect fridge temperature. Table 4-2 shows the running order for each film and the expected ease of identification of each hazard.
Table 4-2 The running order and nature of the food safety hazards in the two films

<table>
<thead>
<tr>
<th>Film 1</th>
<th>Expected ease of identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behaviours</td>
<td></td>
</tr>
<tr>
<td>Refrigerator temperature 8.9 °C</td>
<td>Low</td>
</tr>
<tr>
<td>Chicken stored correctly in the fridge</td>
<td>No hazard</td>
</tr>
<tr>
<td>Chicken washed</td>
<td>Medium</td>
</tr>
<tr>
<td>Radio touched without washing hands*</td>
<td>Medium</td>
</tr>
<tr>
<td>Hands not washed after cutting chicken before getting bowl and marinade*</td>
<td>High</td>
</tr>
<tr>
<td>Hands washed badly</td>
<td>Medium</td>
</tr>
<tr>
<td>Clean chopping board used</td>
<td>No hazard</td>
</tr>
<tr>
<td>Wipe nose during salad assembly</td>
<td>Low</td>
</tr>
<tr>
<td>Cooking</td>
<td>No hazard</td>
</tr>
<tr>
<td>Raw utensils used at the end of cooking to remove chicken from the pan*</td>
<td>Medium</td>
</tr>
<tr>
<td>Pouring some marinade on the salad*</td>
<td>High</td>
</tr>
<tr>
<td>Film 2</td>
<td>Expected ease of identification</td>
</tr>
<tr>
<td>Behaviours</td>
<td></td>
</tr>
<tr>
<td>Refrigerator temperature 4.7 °C</td>
<td>No hazard</td>
</tr>
<tr>
<td>Chicken stored incorrectly in the fridge</td>
<td>Medium</td>
</tr>
<tr>
<td>Chicken not washed</td>
<td>No hazard</td>
</tr>
<tr>
<td>Radio touched without washing hands*</td>
<td>Medium</td>
</tr>
<tr>
<td>Hands not washed after cutting chicken before getting bowl and marinade*</td>
<td>High</td>
</tr>
<tr>
<td>Hands washed well</td>
<td>No hazard</td>
</tr>
<tr>
<td>Chopping board and knife wiped down only between preparing raw chicken and salad</td>
<td>High</td>
</tr>
<tr>
<td>Cooking</td>
<td>No hazard</td>
</tr>
<tr>
<td>Raw utensils used at the end of cooking to remove chicken from the pan*</td>
<td>Medium</td>
</tr>
<tr>
<td>Pouring some marinade on the salad*</td>
<td>High</td>
</tr>
</tbody>
</table>

*Hazard repeated in alternative film
The films were edited and converted to Adobe Flash format for web delivery and the hazards defined in time through each of the two films, including a margin of error to allow for lags in response time. The films were then embedded in the web based survey and software developed to enable the online hazard identification clicks to be recorded in real-time. The timing of each click in response to the film was recorded in a server side database which lay ‘behind’ the web interface experienced by respondents. The clicks were recorded in the database along with data from the survey element. The video response tool integrates the two elements to create the real-time recording for analysis.

### 4.3.2 Additional information

In this study, additional attitudinal questions were asked prior to the film, to measure respondents’ perceived levels of risk, control and knowledge regarding food poisoning in the home, in comparison to their perception of that of the average person (Parry et al., 2004):

- How much risk do you think there is to you personally (to the average person) from food poisoning in the home?
- How much control do you think you personally have (the average person has) over getting food poisoning in the home?
- How much knowledge do you think you personally have (the average person has) about the risk of getting food poisoning in the home?

These questions were repeated, after completing the video challenge (and receiving feedback), to assess whether the process prompted the respondents to re-evaluate their initial perceptions of risk, control and knowledge. Individuals were also presented with additional survey questions including questions on demographics, characteristics and a number of food-specific questions relating to experience of food illness, diet and any training or qualifications in food safety.
4.3.3 **Recruitment**

Recruitment was conducted by snowball sampling, using a general seed email containing the URL of the online study and explanatory information. This email was sent to forty personal, food industry and academic contacts to complete and pass the survey on. Individuals also emailed it out to their contacts, resulting in a wide range of participants from hospitals, schools, government departments (local and national), universities (academics and students), private companies (both within and outside the food industry), industry bodies and to members of the general public. Social media networks were utilised—Facebook and Twitter and the link was also posted on a number of website forums, including sites focussed on young mothers and cooking to target a greater cross section of the general public.

4.3.4 **Research approach**

Revisiting the research questions posed earlier, we split the analysis into four elements – Identification of hazards, perceptions of risk, knowledge and control, explanation of the variation in both hazard awareness and perception change.

The level of hazard awareness of specific unsafe food preparation behaviours is identified by analysing the respondent click behaviour. This is the translation of the hazard definitions, by time and the respondents’ clicks, into correctly identified hazards (hazard hits). We measure the number of correctly identified hazards by respondent and the percentage number of respondents who identified each hazard.

People’s perceptions of risk, knowledge and level of control may play an important role in explaining the variation in hazard awareness. For this reason we will first set out the analysis on perceptions before returning to the research questions.

Perceptions are measured from the attitudinal questions of risk, control and knowledge regarding food poisoning in the home. From these perception questions, optimistic bias is tested using a difference score, calculated between a respondent’s answers to the questions about themselves and those about the average person. Typically, OB has been tested using a one-sample t-test (Parry et al., 2004, Sargeant et al., 2010, Weinstein, 1987). However, as the difference scores are ordinal not interval we use the non-parametric Wilcoxon Mann-Whitney test to test the hypothesis that
the sample median is equal to zero and therefore shows no bias. We measure OB for risk, knowledge and control, extending the work of Parry et al. (2004). Whilst optimistic bias is a group effect (Parry et al., 2004, Rothman et al., 1996), we create a bias rating (0=no bias, 1=bias) for individuals in order to assess sub-groups (Parry et al., 2004, Sargeant et al., 2010). We return to this data with subsequent analysis.

In order to test the effect of characteristics on the number of hazards identified and individual hazards, we test for explanation in the variation of hazard awareness. Click behaviour, perceptions and additional information, supplied by the participant at the end of the film clip are utilised. To test for variation in the number of hazards identified we use a right censored Poisson regression. Variability in identification of specific hazards is analysed using binary logit regression. See model expositions in section 4.3.5.

We now return to the perception data to ask; to what extent do people’s self-perceptions change following the hazard perception challenge and what is the relationship between any change in perceptions and performance in the hazard perception challenge?

From the perception Likert responses, a “change rating” is calculated for the difference in response between the personal perception questions (for risk, control and knowledge) prior to and following the video challenge. This is repeated for the questions in relation to the average person. With respect to OB, a “change score” is calculated between the difference score (used to calculate OB) prior to and following the video challenge. Using these different measures of change, prior to and following the video challenge, the effect of performance and characteristics on any change was tested for significance using ordinal logistic regression.

4.3.5 Modelling approach

In the analysis of the data, we utilise a right censored Poisson regression to model the number of hazards identified (hazard hits), binary logit regression to model the probability of identifying an individual hazard and ordinal logistic regression to test the effect of performance (and characteristics) on any perception changes. This section formally sets out these models.
Whilst we assume a Poisson distribution for the dependent variable of the number of hazard hits, as the number of hazards is defined at 8 for the first film and 6 for the second film, it is necessary to account for this truncation. We therefore model this count data using a right censored Poisson (Hilbe and Judson, 1999).

A random variable $Y$ is said to have a Poisson distribution with parameter $u$ if it takes values $y = 0, 1, 2,...$ with a probability

$$P(Y = y) = \frac{e^{-u}u^y}{y!}$$  \hspace{1cm} (1)

The likelihood function is documented as follows for the censored Poisson (Hilbe and Judson, 1999)

$$L(u, X) = \prod_{i=1}^{N} I(p_i = 1) f(x_i, u)^I(p_i = 1) \left( \sum_{j=0}^{x_i} f(j, u) \right)^{I(p_i = 0)} \left( 1 - \sum_{j=0}^{x_i} f(j, u) \right)^{I(p_i = -1)}$$  \hspace{1cm} (2)

where:

- $N$ is the number of cases
- $p_i = 1$ if the $i$th observation is not censored, $0$ if left censored, $-1$ if right censored
- $I(p_i)$ is the indicator function, taking the value one when the statement in parentheses is true, otherwise taking the value 0
- $f$ is the probability density function of a Poisson random variable with parameter $u$
- $u = \exp(X\beta)$
- $1 - \sum_{j=0}^{x_i} f(j, u)$ is the probability of observing $x_i$ or more events when $E(Y) = u$
- $\sum_{j=0}^{x_i} f(j, u)$ is the probability of observing $x_i$ or fewer events when $E(Y) = u$
- $x_i$ are characteristics

A logit was used to model the identification of specific hazards. A simple binary response was modelled where $Y=1$ for hazard identification or $Y=0$ for a missed hazard.
The model takes the linear form with $K$ attributes:

$$Y = \alpha + \sum \beta_k X_k + \varepsilon \quad (3)$$

$$P(Y = 1) = \frac{\exp(\alpha + \sum \beta_k X_k)}{1 + \exp(\alpha + \sum \beta_k X_k)} \quad (4)$$

where $X$ are characteristics and $\beta$ the coefficients to be estimated.

To test the effect of performance and characteristics on any perception changes following the hazard perception challenge, ordinal logistic regression was used, to take into account the degree of any change. The probability of observing outcome $i$ takes the form:

$$P(\text{outcome}_j = i) = P(k_{i-1} < \beta_1 x_{1j} + \beta_2 x_{2j} + \ldots + \beta_k x_{kj} + u_j \leq k_i) \quad (5)$$

where:

- $u_j$ is assumed to be logistically distributed
- $\beta_1, \beta_2, \ldots, \beta_k$ are the coefficients to be estimated
- $x_1, x_2, \ldots, x_k$ are the characteristics
- $k_1, k_2, \ldots, k_{k-1}$ are the cut points where $k$ is the number of possible outcomes
- $k_0$ is $-\infty$ and $k_k$ is $+\infty$

### 4.4 Results

#### 4.4.1 Recruitment and demographics

The collection of data for the main survey was a fast process with over 300 people completing it within the first three weeks. In total, over 576 responses were collected for analysis with 404 (70.14%) of the participants female and 172 (29.86%) male. As a result of the snowballing, there were responses from several countries outside of the UK (13.89%), including The Netherlands, France, Ireland, the USA and Australia. The demographic characteristics of the participants are set out in Table 4-3.
Table 4-3 Demographic characteristics of participants who undertook the video-based food safety hazard perception challenge and summary of characteristics used in the analysis

<table>
<thead>
<tr>
<th>Demographic characteristics</th>
<th>No. (%) participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>172 (29.86)</td>
</tr>
<tr>
<td>Female</td>
<td>404 (70.14)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
</tr>
<tr>
<td>White British</td>
<td>400 (69.44)</td>
</tr>
<tr>
<td>Other white</td>
<td>107 (18.57)</td>
</tr>
<tr>
<td>Mixed</td>
<td>15 (2.61)</td>
</tr>
<tr>
<td>Asian</td>
<td>9 (1.56)</td>
</tr>
<tr>
<td>Black</td>
<td>12 (2.08)</td>
</tr>
<tr>
<td>Chinese</td>
<td>3 (0.52)</td>
</tr>
<tr>
<td>Other</td>
<td>7 (1.22)</td>
</tr>
<tr>
<td>Preferred not to say</td>
<td>23 (4.00)</td>
</tr>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>18-29 years (Young adults)</td>
<td>112 (19.44)</td>
</tr>
<tr>
<td>30-59 years (Adults)</td>
<td>381 (66.15)</td>
</tr>
<tr>
<td>60+ years (Mature)</td>
<td>55 (9.55)</td>
</tr>
<tr>
<td>Not Given</td>
<td>28 (4.86)</td>
</tr>
<tr>
<td>Household</td>
<td></td>
</tr>
<tr>
<td>No. Adults in the house</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>134 (23.22)</td>
</tr>
<tr>
<td>2</td>
<td>306 (53.03)</td>
</tr>
<tr>
<td>≥3</td>
<td>137 (23.75)</td>
</tr>
<tr>
<td>Children in the house</td>
<td></td>
</tr>
<tr>
<td>Aged 0-4</td>
<td>160 (27.78)</td>
</tr>
<tr>
<td>Aged 75</td>
<td>75 (13.02)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Min</th>
<th>Max</th>
<th>SD</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (0 Male, 1 Female)</td>
<td>0</td>
<td>1</td>
<td>0.458</td>
<td>0.701</td>
</tr>
<tr>
<td>Young Adults (0, 1)</td>
<td>0</td>
<td>1</td>
<td>0.396</td>
<td>0.194</td>
</tr>
<tr>
<td>Adults (0, 1)</td>
<td>0</td>
<td>1</td>
<td>0.474</td>
<td>0.661</td>
</tr>
<tr>
<td>Mature (0, 1)</td>
<td>0</td>
<td>1</td>
<td>0.294</td>
<td>0.095</td>
</tr>
<tr>
<td>Children in the household (0, 1)</td>
<td>0</td>
<td>1</td>
<td>0.448</td>
<td>0.278</td>
</tr>
<tr>
<td>Food safety training and qualifications (0, 1)</td>
<td>0</td>
<td>1</td>
<td>0.499</td>
<td>0.462</td>
</tr>
<tr>
<td>Food poisoning in the last 5 years (0, 1)</td>
<td>0</td>
<td>1</td>
<td>0.436</td>
<td>0.255</td>
</tr>
<tr>
<td>Vegetarian (0, 1)</td>
<td>0</td>
<td>1</td>
<td>0.315</td>
<td>0.111</td>
</tr>
<tr>
<td>Personal perception of risk (0 None at all-6 A great deal)</td>
<td>0</td>
<td>6</td>
<td>1.145</td>
<td>1.688</td>
</tr>
<tr>
<td>Personal perception of control (0 None at all-6 A great deal)</td>
<td>0</td>
<td>6</td>
<td>1.411</td>
<td>4.865</td>
</tr>
<tr>
<td>Personal perception of knowledge (0 None at all-6 A great deal)</td>
<td>0</td>
<td>6</td>
<td>1.372</td>
<td>4.493</td>
</tr>
<tr>
<td>Exhibits OB (Risk) (1=Yes, 0=No)</td>
<td>0</td>
<td>1</td>
<td>0.483</td>
<td>0.632</td>
</tr>
<tr>
<td>Exhibits OB (Control) (1=Yes, 0=No)</td>
<td>0</td>
<td>1</td>
<td>0.484</td>
<td>0.373</td>
</tr>
<tr>
<td>Exhibits OB (Knowledge) (1=Yes, 0=No)</td>
<td>0</td>
<td>1</td>
<td>0.433</td>
<td>0.750</td>
</tr>
<tr>
<td>Speed fine</td>
<td>0</td>
<td>1</td>
<td>0.484</td>
<td>0.559</td>
</tr>
<tr>
<td>Speed “a little fast but I managed”</td>
<td>0</td>
<td>1</td>
<td>0.421</td>
<td>0.204</td>
</tr>
<tr>
<td>Speed “too fast”</td>
<td>0</td>
<td>1</td>
<td>0.133</td>
<td>0.020</td>
</tr>
<tr>
<td>Missed hazard hits</td>
<td>0</td>
<td>8</td>
<td>2.141</td>
<td>2.467</td>
</tr>
</tbody>
</table>
Questions were asked about diet with 99 (17%) of participants reporting that they had a special diet and 64 (11%) stating that they were vegetarian or vegan. 147 (25.52%) of participants stated that they had had food poisoning in the last 5 years. However, only 29 visited the doctor and 16 of these were then confirmed by laboratory analysis to have had food poisoning. Of the people who participated, 266 (46.18%) claimed to have some knowledge, experience or qualifications in food safety.

As the video challenge is conducted in real time with the intention of eliciting immediate, intuitive responses under time pressure, a question was inserted following the video challenge, to assess if the speed of the film (and the participant’s ability to keep pace) was in fact a problem. Participants responded favourably, highlighting that the speed did not pose any significant concern with 367 (63.72%) of individuals stating that the speed was “fine”, 129 (22.4%) “a little fast but I managed” and 11 (1.91%) “too fast”, with the remainder not commenting. In addition, extensive positive feedback was provided. The common theme of the feedback was that the method was novel and engaging and providing an interesting survey alternative.

### 4.4.2 Identification of hazards

Individual click behaviour was analysed to calculate the number of hazards identified (hazard hits) and the number of hazards which were not identified (missed hazards). Figure 4-1 shows the total number of hazard identified by the participants, split by film. The maximum number of hazards is 8 (film 1) and 6 (film 2). Figure 4-2 details the hazards that were featured in the hazard perception challenge and the percentage number of participants that identified them. The most commonly identified hazards were found to be cross contamination whilst getting the bowl from the cupboard (84%), storage of the chicken incorrectly in the fridge (81%) and wiping down the chopping board and knife rather than using a clean one for the salad ingredients (79%). In comparison the incorrect use of tongs was identified the least (53%).
The film versions (1, 2) which included each hazard are shown in brackets

Figure 4-2 Percentage hazard hits (both films)

Comparison of hazards between the two films was made with regard to the incorrect fridge temperature of 8.9°C in film 1 and a correct fridge temperature of 4.7°C in film 2. 159 (56.9%) participants identified the incorrect temperature, whilst 141 (47.47%) identified the correct temperature as a hazard, shown in film 2.
4.4.3 Perception

The existence of OB was tested using the difference (between personal and average) scores for risk, control and knowledge. In all cases, the scores are significantly different from zero and therefore OB was demonstrated for the group. The participants have indicated that the average person is at a significantly greater risk of getting food poisoning in the home than himself or herself ($z=17.365$, $p<0.001$), has significantly less knowledge ($z=-18.965$, $p<0.001$) and significantly less control ($z=-11.648$, $p<0.001$) over food poisoning in the home. The same analysis was repeated for the questions after the completion of the challenge with similar results. A simple rating was calculated to show the split in bias, categorising participants as exhibiting bias or not (0, 1), for risk, control and knowledge. We refer to these ratings as OB (Risk), OB (Control) and OB (Knowledge). 63.19% of participants exhibited OB (risk), 37.33% for OB (control) and 75% for OB (knowledge) prior to the video challenge. Following the video challenge, there was little change in overall bias rating; 65.1% of participants exhibited OB (risk), 38.54% for OB (control) and 75.69% for OB (knowledge).

4.4.4 Explaining variation in hazard awareness

Using a right censored Poisson; the effect of independent variables (characteristics) on the number of hazards identified, was tested. The characteristics were: gender, age (young adults, adults, mature), children in the household, food safety qualifications, food poisoning in last 5 years, vegetarian, personal perception of risk, personal perception of control, personal perception of knowledge, OB (Risk) exhibited pre challenge, OB (Control) exhibited pre challenge, OB (Knowledge) exhibited pre challenge, speed ( "Too fast but I managed" and "Too fast"). A summary of these can be found in Table 4-3. They were tested in a multivariable model (Model 1, Table 4-4) and removed from the model using a stepwise approach until all remaining variables were significant at $p\leq0.05$ to produce Model 2, Table 4-4.
Looking at model 2 (Table 4-4), a significant relationship was found between the number of hazards identified and the independent variables; young adults, adults, “too fast but I managed” questions and personal perception of knowledge. Incidence rate ratios were calculated by exponentiation of the coefficients. In all cases the number of hazard hits was positively influenced by the independent variables, for example, young adults and adults have an increased hazard hit score of 26-29%. Additionally with every unit increase of personal perception of knowledge hazard identification is increased by 10%.

The effect of characteristics on the identification of specific hazards was tested using logistic regression, again in a multivariable model. The same independent variables, listed above, were removed using a stepwise approach until all remaining variables were significant at p≤0.05 to produce a final model per hazard. The final models are
set out in Table 4-5. For example, the model finalised for the marinade included the independent variables of young adults, adults, children in the household, OB (Risk) and OB (Knowledge). The results can therefore be interpreted as; people who are either adults or young adults, have children in the household, believe that they are at less risk and have greater knowledge than an average person (with regard to food poisoning in the home) are more likely to identify the use of marinade containing raw chicken juices on a prepared salad as a hazard.
### Table 4-5 Multivariable associations between hazards and perceptions of risk, knowledge, control and demographic variables

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Fridge temperature</th>
<th>Washing chicken</th>
<th>Radio</th>
<th>Bottle</th>
<th>Poor handwashing</th>
<th>Wiping nose</th>
<th>Utensils</th>
<th>Marinade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (0 Male, 1 Female)</td>
<td>0.679 (2.33)*</td>
<td>0.583 (2.05)*</td>
<td>0.892 (2.08)*</td>
<td>2.162 (4.03)**</td>
<td>0.566 (2.11)*</td>
<td>1.024 (2.80)**</td>
<td>1.144 (3.01)**</td>
<td></td>
</tr>
<tr>
<td>Young adults</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adults</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mature</td>
<td>-1.564 (3.69)**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Children in household</td>
<td>-0.614 (2.12)*</td>
<td>0.781 (2.06)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Safety Qualifications</td>
<td>0.605 (2.45)*</td>
<td>0.667 (2.64)**</td>
<td>0.533 (2.10)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Poisoning in last 5 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.615 (2.04)*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Special diet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.692 (2.21)*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetarian</td>
<td>-1.184 (3.23)**</td>
<td>-0.803 (2.17)*</td>
<td>-0.809 (2.23)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OB (Risk) exhibited pre challenge</td>
<td>0.556 (2.00)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OB (Knowledge) pre challenge</td>
<td>0.940 (3.10)**</td>
<td>0.832 (2.71)**</td>
<td>1.02 (3.46)**</td>
<td>0.598 (2.13)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed question</td>
<td>&quot;Too fast but I managed&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>280</td>
<td>280</td>
<td>280</td>
<td>280</td>
<td>280</td>
<td>280</td>
<td>280</td>
<td>280</td>
</tr>
<tr>
<td>Coefficient (z score) * p&lt;0.05; ** p&lt;0.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Individuals that exhibit OB (Knowledge) are more likely to identify the following hazards; washing chicken \((p=0.002)\), touching the radio without washing hands \((p=0.007)\), touching the marinade bottle without washing hands \((p=0.001)\), use of marinade \((p<0.001)\) and poor hand washing \((p=0.033)\). Food safety qualifications as an independent variable was significant in the identification of the incorrect fridge temperature \((p=0.014)\), wiping of the nose \((p=0.008)\) and the use of raw utensils at the end of cooking \((p=0.036)\). Food poisoning in the last 5 years was also significantly associated with the use of utensils \((p=0.041)\), with people who have had food poisoning in the last 5 years less likely to identify the tongs as an issue. Gender was significant only for the identification of the radio and bottle cross contamination, with females more likely than males to identify the hazards. People who are vegetarian were less likely to identify three of the hazards; washing chicken, radio and bottle cross contamination.

### 4.4.5 Changes in perception

The attitudinal questions relating to risk, knowledge and control were asked both prior to the hazard perception challenge and then repeated afterwards, to establish if the participant wished to change their initial answers. A “change rating” was calculated to identify the movement in rating between the two survey occasions, pre and post hazard perception challenge. This change rating was generated for the individual personal perception questions for risk, control and knowledge and the level of change was tested for significance. This was also repeated for the respondents’ perception of risk, control and knowledge for the average person. Table 4-6 sets out the results highlighting the percentage of respondents that exhibited no change in rating, increased or reduced their rating and the significance of change.
Table 4-6 Percentage of respondents exhibiting change in ratings for perception of risk, control and knowledge in relation to personal perceptions for the average person and bias following the video perception challenge

<table>
<thead>
<tr>
<th></th>
<th>% No change</th>
<th>% Increased</th>
<th>% Reduced</th>
<th>Mann-Whitney significance of change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal</td>
<td>84.55</td>
<td>11.81</td>
<td>3.64</td>
<td>-5.113**</td>
</tr>
<tr>
<td>Average person</td>
<td>79.34</td>
<td>19.79</td>
<td>0.87</td>
<td>-10.010**</td>
</tr>
<tr>
<td>Bias rating</td>
<td>91.84</td>
<td>5.03</td>
<td>3.13</td>
<td>-1.605</td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal</td>
<td>91.15</td>
<td>4.86</td>
<td>3.99</td>
<td>-0.686</td>
</tr>
<tr>
<td>Average person</td>
<td>87.33</td>
<td>5.56</td>
<td>7.11</td>
<td>1.029</td>
</tr>
<tr>
<td>Bias rating</td>
<td>94.27</td>
<td>3.47</td>
<td>2.26</td>
<td>-1.219</td>
</tr>
<tr>
<td>Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal</td>
<td>84.38</td>
<td>10.07</td>
<td>5.55</td>
<td>2.739**</td>
</tr>
<tr>
<td>Average person</td>
<td>87.67</td>
<td>3.65</td>
<td>8.68</td>
<td>3.338**</td>
</tr>
<tr>
<td>Bias rating</td>
<td>94.1</td>
<td>3.3</td>
<td>2.6</td>
<td>0.686</td>
</tr>
</tbody>
</table>

* p<0.05, ** p<0.01

There was significant change to the ratings for the personal perception of knowledge and risk and perception of the average person’s knowledge and risk, following the completion of the video challenge. The results show that the ratings for perception of risk are significantly different to zero (no change) with both personal perception of risk and those for an average person, increased after the video challenge. However, with respect to knowledge, the results for personal perceptions show increased ratings whilst perceptions of the average person are reduced after the video challenge. For example, 84.38% of individuals retained their personal knowledge rating and 10.07% increased their rating following completion of the challenge. This is in contrast to 3.65% of individuals increasing the rating for their perception of the average person (for knowledge). Using chi-square, a significant relationship was found between food safety qualifications and the change rating for personal perception of knowledge ($\chi^2(1)=25.8639$, p=0.004). Fewer individuals changed their rating when categorised as having food safety qualifications or training.

The personal perception change ratings, perception of average person change ratings and OB change scores for risk and knowledge were tested to explain the reason and
degree of movement using ordinal logistic regression. A multivariable model (gender, food safety qualifications, young adults, adults, mature, missed hazard score) was initially used and reduced to a simple relationship of change in rating with the number of missed hazards. The results in Table 4-7 show that significance was found for this relationship with individuals changing their ratings with an increased number of missed hazards: OB (Knowledge) score (p=0.024), change in OB (Risk) score (p=0.050) and change in personal perception of knowledge (p=0.016) and risk (p=0.001).

Table 4-7 Ordinal regression highlighting relationship between change ratings (following the video perception challenge) for perceptions of knowledge and risk and performance (number of missed hazards)

<table>
<thead>
<tr>
<th>Missed hazards</th>
<th>Knowledge</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average person change rating</td>
<td>OB (Knowledge) Change</td>
</tr>
<tr>
<td>0.139 (2.42)*</td>
<td>-0.056 (0.90)</td>
<td>0.195 (2.26)*</td>
</tr>
</tbody>
</table>

| N  | 576 | 576 | 576 | 576 | 576 |
| LL | -402.176 | -315.797 | -149.94 | -390.738 | -455.109 | -192.137 |

Coefficient (z score) * p<0.05, ** p<0.01

4.5 Discussion

This study was initiated to assess the awareness of hazardous food behaviours in the domestic kitchen whilst testing a novel method of eliciting hazard perceptions. We sought to compare self-reported perceptions with performance in the challenge in addition to investigating influences in the identification of specific hazards. The hazard perception challenge seeks to reduce the bias identified with standard surveys, encourage the use of the cognitive process of System 1 thinking and allow less time for the respondent to consider what they should ‘do’ and act in accordance with their own behaviours or habits.
Understanding food preparation behaviours is important to target resources for education and identify hazardous food preparation habits that need to be corrected. However, gaining insights into these behaviours is challenging due to self-reported bias and an attitude-behaviour gap. The hope is that the use of this tool corresponds more closely to habitual behaviours by reducing these biases through time pressure, non-verbal responses and familiar setting.

The survey results demonstrate that hazards can be identified or not (as appropriate) using an interactive real time video challenge. For example, washing of chicken was not identified or regarded as a hazard by 37.86% which may be compared to the FSA ‘Food and You survey’ in 2010 which reported that 41% always wash poultry and red meat (FSA, 2010b). Whilst direct comparisons with survey data are difficult, some internal assessments can be considered further such as the comparison of hazards between films and the identifications made by people with food safety qualifications.

The use of two films presented an interesting comparison between the hazard of the incorrect fridge temperature of 8.9°C and a correct fridge temperature of 4.7°C. In film 1 where the incorrect temperature was shown, 159 (56.9%) participants identified the hazard in comparison to 141 (47.47%) participants who spotted the correct temperature shown in film 2. This would suggest that either the potential signposting may have caused individuals to consider the correct temperature as a hazard or that in fact these individuals did not know the temperature that a fridge should operate at and did not have time to consider their answer.

The fridge temperature can be used further in discussion as an example of a hazard that had an expected low ease of identification (see Table 4-2). When the hazard was tested, the identification of the incorrect fridge temperature was significantly associated with individuals that had food safety qualifications. The same was also found to be true for the hazard, wiping of the nose, also an expected low ease of identification. The hazard of using raw utensils at the end of cooking was categorised as of medium expected ease of identification but was also significantly associated with individuals that had food safety qualifications. This significance and the overall low percentage of identification (53%) suggest that this behaviour was miscategorised and in fact may be an important food safety behaviour that is overlooked. Whilst it may be
considered that the identification of the hazards; fridge temperature, wiping of the nose and using raw utensils at the end of cooking, was benefited by additional knowledge, an interesting alternative is that for five of the behaviours, the benefit of training and food safety qualifications did not provide any advantage in identification in comparison to members of the public without any food safety training.

A barrier to education can be an individual’s perception and the tendency to exhibit optimistic bias. Individuals significantly changed their ratings for risk and knowledge from both a personal perspective and for that of an average person. The change in personal perception of knowledge demonstrated that 10.07% changed their mind, deciding that they knew more than they first perceived whilst 5.56% possibly felt that they did not know as much as they first perceived. Further testing did not highlight a relationship with demographic variables but with that of the missed hazard score. This confirms that individuals changed their rating and therefore perceptions in line with performance in the hazard perception challenge.

This study confirmed that the sample exhibited optimistic bias for risk, control and knowledge of food poisoning in the home both prior to and after the completion of the challenge. Optimistic bias is a group effect and it is understood that an individual may have personal and perhaps valid reason for choosing their rating. For example, someone with food safety qualifications may well perceive that they have less risk of food poisoning than the average person, more control and more knowledge of food poisoning in the home. OB (Knowledge) was found to be important in the Poisson regression indicating a relationship with the number of hazard hits and therefore performance in the challenge. In addition, specific hazards (washing chicken, touching the radio without washing hands, touching the marinade bottle without washing hands, use of marinade and poor hand washing) were also linked to OB (Knowledge). This would suggest that whilst we have defined OB (Knowledge) as a form of optimistic bias where people perceive themselves to have more knowledge than the average person, the results suggest that this may in fact be the case. Considering this and the relationship identified between OB (knowledge) and food safety qualifications further highlights the role that education plays in food safety awareness. Interestingly, significantly fewer individuals with food safety qualifications changed their personal
perception ratings following the challenge and whilst this may well be due to good performance, the concern is the potential lack of acceptance of an initial inappropriate perception, thereby creating a barrier to education.

Further testing of the method is recommended between different groups of people in order to further examine characteristics and their effect on the number and type of hazards identified. For example, targeting specific groups of people, such as to highlight any age associated differences in awareness, may help to explain the increase in *Campylobacter* infection in older people (Gillespie et al., 2009). In the same manner, an interesting approach may be to investigate the frequency of cooking to highlight any differences in awareness or habits (good or bad). Additionally, it would be beneficial to attempt to establish the level of discrepancy between standard methods of food safety knowledge testing and the additional measurement that this interactive survey hopes to provide.

In conclusion, the interactive survey assesses the level of awareness of selected domestic food safety behaviours. The method provides a new approach to testing which hopes to provide a measurement that corresponds more closely to that of habitual behaviours in the household kitchen. Individuals that had food safety qualifications highlighted that knowledge improved the identification of the overall number of hazards as well as certain individual hazards such as the incorrect fridge temperature. This was further emphasised not only by the relationship between individuals with food safety qualifications and perception of knowledge but also those exhibiting so called OB (Knowledge). Whilst some individuals changed their perception ratings following completion of the challenge, fewer individuals with food safety qualifications made any change to their ratings suggesting that they performed well or did not accept that they needed to make a change.

**Acknowledgements**

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5 Investigating heterogeneity in food risk perceptions using Best-Worst Scaling

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5.1 Abstract

The psychometric paradigm has been the principle approach to analyse risk perceptions. In this paper we discuss some of the limitations associated with this method of risk perception elicitation before introducing a novel technique. We use Best-Worst Scaling (BWS) to elicit relative risk perceptions concerning domestic food behaviours. Heterogeneity in these risk perceptions are analysed using latent class modelling, demonstrating the influence of individual characteristics on class membership. We find that the relative risk perceptions of food safety experts and general public differed with food safety knowledge influencing latent class membership, defined in a 5-class model. This highlights the need to further understand the influence of risk perceptions in the domestic food safety setting, in order to target communication more effectively to reduce food-borne illness. The BWS method provides a practical approach to assessing relative risks whilst the choices made by the participants and subsequent analysis have a strong theoretical basis. It does so without the influence of scale bias, the cognitive burden of ranking a large number of items or issues of aggregation of data, often associated with the more commonly used psychometric paradigm. We contend that BWS, in conjunction with latent class modelling, provides a powerful method for eliciting risk rankings and identifying differences in these rankings in the population.
5.2 Introduction

Risk perceptions, and the means by which they are elicited, have been studied for many years. This paper proposes and tests the investigation of risk perceptions using a novel approach, Best-Worst Scaling (BWS), an intuitive choice-based approach to eliciting rankings. Heterogeneity in risk perception is explored both in terms of groups observed ex ante (experts / lay) and in terms of latent classes identified ex post on the basis of participants’ choices and their characteristics. We use the BWS approach with a sample comprising experts and lay individuals who rank domestic food safety behaviours. We contend that BWS, in conjunction with latent class modelling, provides a powerful method for eliciting risk rankings and identifying heterogeneity in these rankings.

This paper sets out the Best-Worst Scaling method before setting out the survey and associated model. The results are then presented with a discussion of the heterogeneity explored. In the next section we critically discuss the psychometric paradigm as the principle method of elicitation of risk perceptions.

5.2.1 The psychometric paradigm

Individuals evaluate hazards by the use of intuitive judgements with their risk assessments influenced by factors such as the risk posed to them personally, their knowledge of the risk, levels of trust and the newness of the hazard (Boholm, 1998). Much of the analysis of risk perceptions originates in psychological research. The psychometric paradigm, which dominates risk perception literature, conceptualises risk perceptions as multidimensional, with hazards characterised in terms of different dimensions of psychological risk. In seminal work, Fischhoff et al. (1978) undertook a study regarding thirty activities and technologies (e.g. mountain climbing, food preservatives, nuclear power) with study participants asked to respond to order and rate each of these with regard to a) perceived benefit to society; b) perceived risk and c) risk acceptability. In addition, respondents were asked to rate each of the thirty activities in terms of its position on nine dimensions of risk (voluntariness, immediacy, known to exposed, known to science, controllability, newness, chronic, common-dread, severity of consequence). Correlations in respondents’ ratings across the
dimensions of risk were identified using Principal Component Analysis (PCA). Two factors were identified as “technological risk” and “severity”, in terms of which all the activities featured could be characterised.

This method of the psychometric paradigm has been replicated and developed by many others (Feng et al., 2010, Fife-Schaw and Rowe, 1996, Sparks and Shepherd, 1994b) who identify different factors which characterise the risks considered. In some cases a third factor or dimension has been identified (Fife-Schaw and Rowe, 1996, Sparks and Shepherd, 1994b). Sparks and Shepherd (1994b) were the first to apply the psychometric approach of Slovic and Fischhoff to food related hazards finding that three factors explained 87% of the variance in risk perception, labelled ‘severity’, ‘unknown risks’ and ‘number of people exposed’. Fife-Schaw and Rowe (1996) went on to use this method with the aim of developing additional risk characteristics to define risk dimensions for food related hazards. In addition to hazards and characteristics used previously, they used new ones defined from focus group work, to ensure that they were meaningful to respondents. The results were structured similarly to that obtained previously, however new or little known hazards (e.g. Campylobacter) were found to be positioned in the factor of serious risk, which had not previously been highlighted.

A recurring issue in the use of psychometric approach has been the cognitive load associated with respondents providing multiple criteria Likert scale responses regarding large sets of activities. For example, in the original Fischhoff et al. study it was acknowledged that the respondents’ rating task (of 270 seven-point Likert scales) was arduous, so participants were asked to order and rate the 30 items with regard to its benefit to society or its perceived risk, not both. Similarly in Fife-Schaw and Rowe’s (1996) study they allocated respondents to one of 4 questionnaires so that each respondent had only to provide 110 Likert scale responses in comparison to the more cognitively challenging 270 Likert tasks in Fischhoff et al. (1978) and 575 in Sparks and Shepherd (1994b). We return to the issue of cognitive load when introducing the approach used in this study. We now consider another challenge to the psychometric approach: accommodating and analysing heterogeneity in risk perception.
5.2.2 Heterogeneity in risk perception

A major challenge to the psychometric paradigm is the aggregation of data and analysis of heterogeneity (Bronfman et al., 2007). This aggregation is the averaging of the participant responses prior to analysis, thereby developing an item × characteristic rating matrix. Bronfman et al. (2007) highlight that the variation between participants is masked using aggregate data, whilst at the same time increasing the explanatory power of the psychometric paradigm, perhaps artificially. There have been limited attempts, reported by Bronfman et al. to use the psychometric paradigm without averaging, which appear to further demonstrate that the explanatory power of the psychometric paradigm is reduced with disaggregate data. These methods are in turn criticised for changing the focus from the item differences to that of a participant approach, using a separate participant x characteristic rating matrix per item and therefore changing the research question (Bronfman et al., 2007).

To address this criticism, Bronfman et al. (2007) and Willis and DeKay (2007) combine the standard psychometric paradigm research with individual-difference measures, separating out the level of analysis (aggregate and disaggregate) and focus of analysis (item and participant). Bronfman et al. (2007) included 54 hazards (items) which participants were asked to rate each of them in terms of 19 characteristics. The questionnaire was blocked into 4 versions to ease the cognitive burden for participants so that either 216 or 270 ratings were required depending on the version received. The combined data were then analysed in four ways: aggregate hazard-focused, disaggregate hazard-focused, aggregate participant-focused, disaggregate participant-focused. They found that less variation can be explained with disaggregate data in comparison to aggregate data and that less variation can be explained when differences between participants are the focus of analysis rather than the items (Bronfman et al., 2007, Willis and DeKay, 2007).

Siegrist also addresses the difficulty of incorporating heterogeneity in the psychometric study of risk perceptions (Siegrist et al., 2005, Siegrist et al., 2006). He uses a three-way principal component analysis (PCA) to permit the individual differences to be reflected in the final results. Using a three way PCA allowed assessment of data interactions between items × rating scales × participants, rather
than condensing it to two interactions due to aggregation over people. However, this method has been criticised by Bronfman et al. due to the pre-processing of the data. This involved centralising data for each attribute and hazard combination in order to remove “neutral points” by subtracting from the item rating scale given by a participant, the average rating from each item and characteristic combination. It is as a result of this pre-processing that Bronfman et al. criticise the elimination of potential sources of variation (attribute and hazard interactions) prior to analysis (Bronfman et al., 2007).

5.2.3 Expert versus Lay comparisons
A number of studies have sought to compare risk perceptions between groups, such as between the public and experts (Hansen et al., 2003, van Kleef et al., 2006, Webster, 2010). Slovic notes that “lay people sometimes lack certain information about hazards. However, their basic conceptualisation of risk is much richer than that of experts and reflects legitimate concerns that are typically omitted from expert risk assessments” (Slovic, 1987:285). Rowe and Wright (2001) question the validity of lay and expert opinion comparisons. They argued that of the nine studies they evaluated, many were deficient in demonstrating any such gap between lay and experts due to experimental design faults or insufficient allowance for demographic factors that may have affected judgements of risk (Barke and Jenkins-Smith, 1993, Flynn et al., 1993, Gutteling and Kuttshreuter, 1999, Kraus et al., 1992, Lazo et al., 2000, McDaniels et al., 1997, Slovic, 1985, Slovic et al., 1995, Wright et al., 2000).

5.2.4 Food safety behaviours
There is a growing body of research regarding the perception of risk associated with food hazards (Fife-Schaw and Rowe, 1996, Frewer et al., 1994, Sparks and Shepherd, 1994b). Initial studies in the food sector investigated technological elements of food production such as genetic modification and irradiation, which at the time commanded a high profile in the media. Other research on perceptions of food related risks focussed specifically on risks arising from food production, such as the incidence of dioxin/PCB contamination (Hammitt, 1990, Kennedy et al., 2010) and those that consider more general food risks such as the use of irradiation in food preservation.
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(Fife-Schaw and Rowe, 1996, Frewer et al., 1994, Sparks and Shepherd, 1994b). Where risk perceptions concerning food poisoning have been considered it has been in very general terms, for example ‘food poisoning’ being listed as one of many food related risks within a set to be ranked or characterised (Frewer et al., 1994). To date there has been no research into individuals’ relative risk perceptions associated with food behaviours routinely undertaken.

In this paper we investigate risk perceptions of domestic food safety behaviours. The focus on behaviours is in contrast to past studies which have featured food poisoning in the abstract or particular pathogens (Salmonella, Listeria etc). It is motivated by an understanding that the general public tend not to think about specific pathogens but rather conceptualise food risks in terms of behaviours, for example the handling of raw chicken rather than Campylobacter per se.

Understanding perceptions of routine behaviours in relation to food may permit better designed and targeted food safety initiatives to reduce the social and economic disease burden (Redmond and Griffith, 2004b). Each year 11 million working days are lost in the UK due to the incidence of infectious intestinal disease which is estimated to cost the UK approximately £2 billion annually (FSA, 2010/2011). The Food Standards Agency (FSA), estimates that implementation of the UK Food-borne Disease Strategy will cost £20-25 million, with the benefits of reducing food-borne disease cases by 1% (which equates to 10,000 fewer instances of infection per year) estimated to generate economic savings of £15 million per year (FSA, 2001).

The FSA has identified improved domestic food safety as critical to reducing food-borne disease. It is thought that 11% of general food-borne pathogen outbreaks are associated with food prepared in the home for extended family or community events, whilst the source of individual or more sporadic cases in the home cannot be identified (FSA, 2001). In the food production industry there have been, and continue to be, food safety initiatives to tackle raw materials that pose a risk to consumer food safety, for example, work to reduce levels of Campylobacter in poultry through the supply chain (FSA, 2010/2011). In addition to such initiatives, the food industry is legislated, with monitoring and enforcement programmes in place to reduce food contamination. In contrast, domestic food preparation is unobserved and there is no requirement for
food safety training. Food that would be safe if handled, prepared and cooked properly can still present a significant risk to health because of its handling in the domestic kitchen.

In summary, knowledge of risk perceptions that influence domestic food safety is required to target communication in order to reduce food-borne illness. Whilst the psychometric paradigm has been the principle method of analysing risk perception, Frewer et al. report that there is a need to develop more innovative methods of research, including the use of conjoint analysis “in the assessment of the importance of different interrelated factors within a specific hazard domain” (Frewer et al., 1998:101). One of the substantive criticisms of the psychometric paradigm research is the aggregation issue previously highlighted. To make a contribution to this debate we test an alternative elicitation method, BWS. One advantage of this method is that there exist a set of models, for the analysis of such choice based data, which are designed specifically for the analysis of heterogeneity. As we discuss, the BWS approach has some other potential advantages in terms of the cognitive load for respondents and relative to other ranking and rating approaches, such as the use of Likert scales. We now introduce the Best-Worst Scaling technique.

5.3 Best-Worst Scaling

Best-Worst Scaling is a form of conjoint analysis (Finn and Louviere, 1992) developed as an extension to Method of Paired Comparison (MPC) (Thurstone, 1927). The importance of, or preference for, items such as products, services or risks is often elicited using ranking or rating techniques. Such techniques may include the individual or group ranking of a list of items (Florig et al., 2001, Morgan et al., 2001, Webster, 2010), or by asking the participant to assign a rating to each risk item, for example, via Likert scales used in the early stages of the psychometric paradigm, described in section 5.2.1. In comparison, the use of the BWS elicits importance via repeated choices within subsets of risk items.

Within a BWS study, each participant is shown a number of subsets (a subset of the full list of items). Each subset contains items and participants are asked to select the “best” and “worst” item in the subset. If, within a subset of four, the participant selects
“Item 1” as the best and “Item 2” as the worst, through transitive relations, it is known that item 1 is preferred to items 2, 3 and 4, items 2 and 3 are preferred to item 4. The only comparison that cannot be made is between items 2 and 3. A series of subsets of items, determined by an experimental design, are shown in sequence to each respondent. The resulting BW data can be analysed to provide a full, scaled, ranking of the items.

BWS is often used when there is a large set of items for which the researcher seeks to understand their relative importance to respondents. As the participant is not asked to rank the full list, BWS is argued to be less cognitively demanding for the respondent. Further, BWS is argued to have some advantages in comparison to more established forms of ranking and rating, including Likert scale approaches which are typically used in the psychometric studies, including:

- The requirement to make best/worst choices forces respondents to discriminate, preventing participants rating many items at equal importance by, for example, using the same response for many/all items on a Likert scale.

- As there is no scale, scale bias is avoided, such as that from differential interpretations of terms such as “quite likely” versus “very likely”, or “agree” versus “strongly agree”.

- Participants are better at judging items at extremes of preference or importance.

(Cross et al., 2011, Lusk, 2009, Sawtooth, 2007)

To conduct a BWS study one requires items to be ranked, their arrangement in repeated subsets and a criterion for ranking. Thus far the terms ‘best’ and ‘worst’ have been used which originate from the more typical use of BWS to assess preferences for product or service attributes. However the criteria can take many forms, in this study participants, experts and members of the public, were asked to select the food behaviours they perceived “most likely” and “least likely” to make someone ill with food poisoning. The selection of the items for ranking, study design and recruitment are now described before providing detail of the models estimated on the BWS data and the associated results.
5.4 Survey design and recruitment

In this study, fourteen behaviours relating to food safety (Table 5-I) were chosen for relative risk ranking. As the BWS survey was to be completed by both members of the general public and experts in food safety, it was important that the behaviours used in the BWS exercise were intuitive for all participants. The list of behaviours (Table 5-I) combined food safety issues that are well known (undercooking of chicken), that have had press coverage (the use of raw eggs), that are not so well known (reheating of rice which potentially has pre-formed Bacillus toxin) and issues that could cause concern to individuals but may not be associated with specific food related illness (using a washing-up cloth on the floor). It was intended that the behaviours be unambiguous, leaving little room for varied interpretation, whilst also being examples of routine behaviour.

Repeated subsets comprising four of these fourteen behaviours were provided (figure 5-1) and participants asked to select the one they perceived “most likely to make someone ill with food poisoning” and the one they perceived “least likely to make someone ill with food poisoning”. Nine subsets of four behaviours were shown to each participant. Research has indicated that a maximum number of 5 items should be presented within a subset, as above this, improvements in estimation have been shown to be small in comparison to the potential participant fatigue or confusion (Sawtooth, 2007). The experimental design\(^2\) of the BWS exercise used a programming based algorithm which generated an orthogonal design in which each item appeared the same number of times and there was positional balance of the items within the subsets. The design\(^12\) for this study comprised 20 different blocks, each with varying subset combinations. Participants were allocated at random to one block of nine BWS sets.

\(^{12}\) Created using Sawtooth Software’s MaxDiff design module.
### Table 5-1 Food Safety Behaviour Items

<table>
<thead>
<tr>
<th>Behaviours</th>
<th>Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Eating chicken that is not cooked through properly.</td>
<td>CHKN</td>
</tr>
<tr>
<td>Using the same knife for chopping up salad after cutting raw/uncooked chicken.</td>
<td>PREP</td>
</tr>
<tr>
<td>2. Storing raw/uncooked pork (on a plate) on the shelf above cooked ham in the refrigerator.</td>
<td>REFR</td>
</tr>
<tr>
<td>3. Cooking raw/uncooked frozen chicken. i.e. not defrosted before cooking.</td>
<td>FROZ</td>
</tr>
<tr>
<td>4. Eating chicken from a BBQ at a social event (party, sporting event etc) that has not been pre-cooked.</td>
<td>BBQ</td>
</tr>
<tr>
<td>5. Using the washing-up cloth to mop up a spillage (such as milk) on the floor.</td>
<td>CLOTH</td>
</tr>
<tr>
<td>6. Chilled foods not being put away in the refrigerator for 4 hours after finishing the shopping.</td>
<td>CHILL</td>
</tr>
<tr>
<td>7. Eating reheated (until piping hot) leftover rice after leaving it out of the fridge to cool overnight.</td>
<td>RICE</td>
</tr>
<tr>
<td>8. Not using antibacterial spray on surfaces after the preparation of raw/uncooked turkey</td>
<td>ANTI</td>
</tr>
<tr>
<td>9. Eating a beefburger that is pink in the middle.</td>
<td>BEEF</td>
</tr>
<tr>
<td>Eating a dessert that contains uncooked/unpasteurised egg such as a tiramisu or chocolate mousse.</td>
<td>EGG</td>
</tr>
<tr>
<td>10. Washing a chicken or turkey under the tap before cooking.</td>
<td>WASH</td>
</tr>
<tr>
<td>11. Eating cooked mussels in a restaurant.</td>
<td>MUSS</td>
</tr>
<tr>
<td>12. Leaving meat or fish from the freezer to defrost at room temperature.</td>
<td>DEFR</td>
</tr>
</tbody>
</table>
Demographic information was sought as was information regarding qualifications or experience at work that provided knowledge of food hazards. A copy of the survey is found in Appendix 8.13. The survey was completed online with recruitment concluded via snowball sampling. A recruitment seed email was generated and sent to personal, food industry and academic contacts. Individuals were asked to complete the survey and to pass it on to others. As there was a clear need to recruit food safety experts into the sample, seed emails were targeted to individuals that fitted this criteria, in the knowledge that they would in turn pass it on to colleagues. In fact this prompted the seed email being passed to experts that would not have otherwise been contacted. Thirty five seed emails generated 301 complete responses in four weeks.

5.5 Modelling BWS Data

We analyse BWS risk perception data by estimation of Conditional Logit (CL) random utility choice models (McFadden, 1974), which dominate the empirical analysis of discrete choice data. Typically CL models concern a person choosing a preferred product or service, that is, choosing the option with the highest utility. In this study
people choose items with highest (lowest) risk, so our exposition of the CL model reflects this. We define the level of risk $R_{imt}$ associated with food behaviour $m$ by individual $i$ on the $t$th choice occasion, as having a deterministic component $\eta_{m}$ and a stochastic element captured by the error term $\varepsilon$.

$$R_{imt} = \eta_{m} + \varepsilon_{imt}$$  \hspace{1cm} (1)

The response variable $y_{it}$ represents the food behaviour chosen by person $i$ in set $t$, with the probability that person $i$ selects food behaviour $m$ as the most risky modelled as a function of the food behaviours which compromise the set. The logit model for individual $i$'s probability of choosing food behaviour $m$ as most likely to cause food poisoning is given by:

$$P(y_{it} = m) = \frac{\exp(\eta_{m})}{\sum_{m=1}^{M} \exp(\eta_{m})}$$  \hspace{1cm} (2)

The exposition thus far concerns the choice of food behaviours most likely to cause food poisoning. However, the Best-Worst process also elicits the behaviours considered as least likely to cause food poisoning. The modelling of least likely choices requires a scale factor of -1 to be introduced so that the probability of person $i$ choosing food behaviour $m$ as least likely to cause food poisoning is given by:

$$P(y_{it} = m) = \frac{\exp(-1 \cdot \eta_{m})}{\sum_{m \in A_{it}} \exp(-1 \cdot \eta_{m})}$$ \hspace{1cm} (3)

if $m \in A_{it}$ and 0 if $m \not\in A_{it}$. Where $A_{it}$ denotes the possible alternatives at replication $t$ for person $i$.

In the selection of the best and worst choices (in this case most likely and least likely), we assume that the choices are sequential. As a result there is one less item to choose from when considering the worst choice and so the probability that the food behaviour already chosen as ‘most likely’ will be selected as ‘least likely’ is set to zero.

A particular motivation of the use of the BWS approach to elicit risk perceptions is the investigation in heterogeneity which, as discussed, has been identified as a challenge for the psychometric approach. We explore heterogeneity among the sample via an extension of the CL model in which the presence of latent classes, with differing risk
perceptions, is investigated. Incorporating latent classes, x, with differing risk perceptions, requires restating (2) as:

\[ P(y_i = m|x) = \frac{\exp(\eta_m|x)}{\sum_{m=1}^{M} \exp(\eta_m|x)} \]  

(4)

Where the probability that food behaviour m is chosen is as a function of the characteristics of the food behaviours that make up set t, given the class membership of person i. The latent class variable takes values \( 1 \leq x \leq K \), where K is the number of latent classes.

Class membership is modelled as a function of personal characteristics using a multinomial logit functional form (Rigby et al.), using a J x 1 vector of individual characteristics \( C_i \) and a set of parameters \( \phi = \{\phi_x\}_{x=1}^{K} \) to be estimated, where \( \phi_x = (\phi_{x0}, \phi_{x1}, \ldots, \phi_{xJ}) \) such that:

\[ P(x|C_i, \phi) = \frac{\exp(S_i|C_i, \phi_x)}{\sum_{x=1}^{K} \exp(S_x|C_i, \phi_x)} \]  

(5)

where:

\[ S_{x|C_i, \phi} = \phi_{x0} + \sum_{j=1}^{J} \phi_{xj} C_{ij} \]  

(6)

In summary, we model the risk perceptions probabilistically. We do so by estimating random utility models on respondents’ BW data. We allow for heterogeneity in risk perceptions via estimation of latent class models. Latent class membership is estimated as a function of individual characteristics. We now describe the results from the estimation of these models.14

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13 In this paper, class relates to the group or set of participants who exhibit similar discrete variables, observed through latent class analysis. Hence class membership relates to the composition of those latent classes and not a social definition of class.

14 All models were estimated in Latent Gold Choice version 4.5.
5.6 Results

Of the 301 people who completed the survey, 199 (66%) were female and 102 (34%) male and 31% of households had children under the age of 16. A quarter was between 25 and 34 years old, 30% between 45 and 64 years old and 7% over the age of 65.

Participants were asked “Do you have qualifications or experience at work that gives you knowledge of food hazards? (please do not be modest)”. They were presented with two options:

   No – I regard myself as a typical member of the public

   Yes – I have some knowledge regarding food hazards associated with my qualifications or employment

If they selected yes, they were provided with two further open-ended questions asking what experience and qualifications that gave them some knowledge of food safety. Responses to these open ended questions were used to ensure that the respondents were correctly allocated to one of two groups: “Public”, 59.5% - No knowledge and “Expert”, 40.5% - Academic knowledge or career in management of food safety.

5.6.1 Estimates of relative risk perception

The Best Worst Scaling data regarding the fourteen food behaviours was analysed using the models set out in Section 5.5. Table 5-2 shows the results of the Conditional Logit model (2) estimated on the entire sample. The coefficients are scaled to have a mean of zero and hence food behaviours with positive coefficients are interpretable as being perceived as above average risk, and those with negative coefficients are perceived as below average risk.

An advantage of the estimation of logistic models is that the coefficients may simply rescaled to ratio-scaled values via the transformation:

\[ e^{R_{pi}}/(e^{R_{pi}}+a-1) \]

where:

- \( R_{pi} \)=zero-centred logit score for behaviour i
- \( a \)=number of items shown per set (in this study, 4)
The resultant rescaled risk perception scores allow interpretation of a behaviour with a value of $2x$ as being perceived as twice as risky as one with a score of $x$, thereby aiding interpretation of the risk rankings (Sawtooth, 2007). These rescaled scores are shown in Figure 5-2.

### Table 5-2 Conditional Logit model results - Relative risk perceptions of food safety behaviours

<table>
<thead>
<tr>
<th>Behaviours</th>
<th>Coefficient</th>
<th>s.e.</th>
<th>z-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHKN</td>
<td>2.2600</td>
<td>0.0793</td>
<td>28.50</td>
</tr>
<tr>
<td>PREP</td>
<td>2.1941</td>
<td>0.0778</td>
<td>28.18</td>
</tr>
<tr>
<td>REFR</td>
<td>0.5557</td>
<td>0.0639</td>
<td>8.69</td>
</tr>
<tr>
<td>FROZ</td>
<td>0.5532</td>
<td>0.0634</td>
<td>8.72</td>
</tr>
<tr>
<td>BBQ</td>
<td>0.1064</td>
<td>0.0620</td>
<td>1.72</td>
</tr>
<tr>
<td>CLOTH</td>
<td>-1.1670</td>
<td>0.0621</td>
<td>-18.8051</td>
</tr>
<tr>
<td>CHILL</td>
<td>-0.2187</td>
<td>0.0615</td>
<td>-3.5553</td>
</tr>
<tr>
<td>RICE</td>
<td>-0.2431</td>
<td>0.0625</td>
<td>-3.8864</td>
</tr>
<tr>
<td>ANTI</td>
<td>-0.3080</td>
<td>0.0608</td>
<td>-5.06</td>
</tr>
<tr>
<td>BEEF</td>
<td>-0.4423</td>
<td>0.0621</td>
<td>-7.1277</td>
</tr>
<tr>
<td>EGG</td>
<td>-0.9301</td>
<td>0.0612</td>
<td>-15.21</td>
</tr>
<tr>
<td>WASH</td>
<td>-1.0332</td>
<td>0.0630</td>
<td>-16.41</td>
</tr>
<tr>
<td>MUSS</td>
<td>-1.1697</td>
<td>0.0619</td>
<td>-18.91</td>
</tr>
<tr>
<td>DEFR</td>
<td>-0.1574</td>
<td>0.0617</td>
<td>-2.5498</td>
</tr>
</tbody>
</table>

LL=-5291.03  N=301
The two behaviours that were identified as the highest risk were the undercooking of chicken (CHKN=19.33) and cross contamination of salad items with raw chicken (PREP=19.02). At the opposite end of the scale, the least risky behaviours were perceived to be the use of un-pasteurised egg (EGG=2.95), washing raw chicken (WASH=2.69), defrosting at room temperature (DEFR=2.38) and eating cooked mussels from a restaurant (MUSS=2.39). The undercooking of chicken was identified as at least six times more likely to make someone ill than these least risky behaviours.

The results presented thus far concern the sample as a whole. Latent class models of the form in (5) were estimated to explore heterogeneity. In the absence of a test for the number of classes to specify, models with increasing numbers of latent classes were estimated and information criteria used to identify a preferred model (Burton and Rigby, 2009). Both the Consistent Akaike Information Criterion (CAIC) and Bayesian Information Criterion (BIC) indicated a 5-class model was preferred. Results from this 5-class model are reported.

A series of personal characteristics were investigated as explanation of class membership (see (6)) and respondents’ level of food safety knowledge (‘lay’-‘expert’) was found to significantly affect class membership. Results from the estimation of the
5-class choice model, with ‘expert’ as a class membership term, are shown in Table 5-3. Figures 5-3 and 5-4 display the ratio-scaled logit scores for this model, the former organised by risk behaviour and the latter by latent class.

Of the 5 classes, the expert group are significantly more likely to be members of classes 3 and 5 and significantly less likely to be members of classes 2 and 4. The unconditional class membership probabilities for classes 3 and 5 are 0.19 and 0.10 respectively, while the conditional probabilities for an expert are 0.37 and 0.19 respectively.

The fact that the data support a 5-class specification indicates that there is very significant heterogeneity within the sample. The significance of the lay-expert term in explaining membership of the 5 classes indicates that this knowledge and training is a significant factor in explaining the heterogeneity. However, the results indicate that the expert-lay dichotomy is only part of the story. This is evident in the support for a 5 class model, and the fact that expert and lay public are equally likely to be members of class 1. We briefly summarise the risk perception profiles of the latent classes below. We report the more notable differences in risk perception, and both differences and similarities in the perceptions of experts and lay public, before discussing their possible causes and implications.
Table 5-3 A 5-class model of risk perceptions of food safety behaviours with expert as a factor

<table>
<thead>
<tr>
<th>Behaviours</th>
<th>Class1 (Coeff s.e.)</th>
<th>Class2 (Coeff s.e.)</th>
<th>Class3 (Coeff s.e.)</th>
<th>Class4 (Coeff s.e.)</th>
<th>Class5 (Coeff s.e.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHKN</td>
<td>2.68 (0.1787)</td>
<td>1.89 (0.1826)</td>
<td>3.76 (0.3373)</td>
<td>2.29 (0.2123)</td>
<td>2.46 (0.2908)</td>
</tr>
<tr>
<td>PREP</td>
<td>2.81 (0.1854)</td>
<td>1.41 (0.165)</td>
<td>3.87 (0.4431)</td>
<td>2.39 (0.2206)</td>
<td>2.57 (0.2915)</td>
</tr>
<tr>
<td>REFR</td>
<td>1.09 (0.1605)</td>
<td>-0.48 (0.1615)</td>
<td>0.51 (0.2198)</td>
<td>1.40 (0.1994)</td>
<td>1.21 (0.2609)</td>
</tr>
<tr>
<td>FROZ</td>
<td>1.27 (0.175)</td>
<td>0.80 (0.1612)</td>
<td>1.53 (0.2206)</td>
<td>-0.18 (0.1966)</td>
<td>-0.88 (0.2432)</td>
</tr>
<tr>
<td>BBQ</td>
<td>0.3368 (0.1558)</td>
<td>0.021 (0.1619)</td>
<td>0.7806 (0.2219)</td>
<td>0.0666 (0.193)</td>
<td>-1.2465 (0.2519)</td>
</tr>
<tr>
<td>CLOTH</td>
<td>-0.06 (0.1877)</td>
<td>0.27 (0.1674)</td>
<td>-1.44 (0.2121)</td>
<td>0.38 (0.197)</td>
<td>-0.93 (0.2834)</td>
</tr>
<tr>
<td>CHILL</td>
<td>-0.37 (0.1511)</td>
<td>0.42 (0.1695)</td>
<td>-1.19 (0.199)</td>
<td>-0.47 (0.1938)</td>
<td>-0.07 (0.2473)</td>
</tr>
<tr>
<td>RICE</td>
<td>1.33 (0.1751)</td>
<td>-0.74 (0.1979)</td>
<td>-1.40 (0.2012)</td>
<td>-1.54 (0.2176)</td>
<td>1.86 (0.2757)</td>
</tr>
<tr>
<td>ANTI</td>
<td>-0.40 (0.1551)</td>
<td>0.00 (0.1606)</td>
<td>-1.66 (0.205)</td>
<td>0.95 (0.1884)</td>
<td>-1.32 (0.2781)</td>
</tr>
<tr>
<td>BEEF</td>
<td>-1.90 (0.1724)</td>
<td>-0.41 (0.1993)</td>
<td>1.22 (0.2332)</td>
<td>-0.35 (0.2081)</td>
<td>0.54 (0.2868)</td>
</tr>
<tr>
<td>EGG</td>
<td>-1.97 (0.1602)</td>
<td>-0.12 (0.1586)</td>
<td>-0.78 (0.2209)</td>
<td>-1.85 (0.193)</td>
<td>-0.13 (0.2971)</td>
</tr>
<tr>
<td>WASH</td>
<td>-1.26 (0.1667)</td>
<td>-1.82 (0.1767)</td>
<td>-1.43 (0.1892)</td>
<td>-0.17 (0.2252)</td>
<td>-1.25 (0.2628)</td>
</tr>
<tr>
<td>MUSS</td>
<td>-1.89 (0.1591)</td>
<td>-0.54 (0.1562)</td>
<td>-1.72 (0.2236)</td>
<td>-1.52 (0.1879)</td>
<td>-1.57 (0.2499)</td>
</tr>
<tr>
<td>DEFR</td>
<td>-1.66 (0.1524)</td>
<td>-0.71 (0.1703)</td>
<td>-2.05 (0.1908)</td>
<td>-1.41 (0.1818)</td>
<td>-1.24 (0.2606)</td>
</tr>
</tbody>
</table>

Class Membership

<table>
<thead>
<tr>
<th>Model for Classes</th>
<th>Coeff (s.e.)</th>
<th>Coeff (s.e.)</th>
<th>Coeff (s.e.)</th>
<th>Coeff (s.e.)</th>
<th>Coeff (s.e.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.8312 (0.1776)</td>
<td>0.7032 (0.1875)</td>
<td>-0.7007 (0.3424)</td>
<td>0.4634 (0.1961)</td>
<td>-1.2971 (0.3655)</td>
</tr>
<tr>
<td>expert</td>
<td>-0.475 (0.2787)</td>
<td>-1.5342 (0.4123)</td>
<td>1.4501 (0.3681)</td>
<td>-0.8338 (0.3431)</td>
<td>1.3929 (0.4255)</td>
</tr>
</tbody>
</table>

LL = -4930.0572 N=301
Figure 5-3 Ratio-scaled relative risk perceptions, by food behaviour

Figure 5-4 Ratio-scaled relative risk perceptions of food safety behaviours, by class
Eating chicken that is not cooked properly (CHKN) and using the same knife for chopping salad after cutting uncooked chicken (PREP) are assigned the highest risk by all five classes. However there are significant differences in risk perceptions regarding the other behaviours, evident in Figures 5-3 and 5-4 with the latter including the pooled (1-class) estimates also to aid comparison between segments of the sample and the sample average results.

The classes more likely to contain the lay public (Classes 2 and 4) both regarded eating BBQ chicken without pre-cooking (BBQ), use of a washing-up cloth to wipe a spillage on the floor (CLOTH) and not using antibacterial spray (ANTI) to be of relatively high risk. However there are also notable differences in risk perception between the two ‘lay classes’ concerning, inter alia, the relative risk posed by not using antibacterial spray (ANTI), washing uncooked chicken (WASH), cross-contamination in the fridge (REFR) and eating unpasteurised egg (EGG). The ‘expert classes’ (3 and 5) both regard eating pink beef burgers (BEEF) as high risk, however there are significant differences between these groups. Notable differences include reheating rice cooled at room temperature (RICE), BBQ chicken without pre-cooking (BBQ), the temperature of chilled foods (CHILL) and cooking chicken from frozen (FROZ). Before discussing the heterogeneity in risk perceptions across the classes in more detail, we first introduce some additional information regarding the demographic profiles of those classes.

Latent class estimation allows ex post estimation of individual-level class membership probabilities. Based on these estimates we assign each respondent to a class, post-estimation. These results reveal that lay public respondents account for 88% and 75% of the membership of Classes 2 and 4 respectively, whereas experts account for 78% and 79% of the membership of Classes 3 and 5 respectively. Other differences in class profiles are evident, and since these are helpful in the intuitive rationalisation of differences in risk perceptions that now follows, we briefly summarise them. We find differences in the age profiles and whether there are children present in the household across the classes. In the ‘expert classes’ Class 3 has an older age profile

15 Kruskal-Wallis Ranksum tests; age: $\chi^2_{[4,0.05]} = 22.3$, prob=0.0002; children: $\chi^2_{[4,0.05]} = 10.6$, prob=0.0315
(mean age of 47.7 (9.6)) and its members are more likely to have children. Of the classes associated with the lay group, members of Class 2 tend to be older (mean age of 42.0 (16.8)) and those in Class 4 tend to be younger (mean age of 39.6 (13.9)). With this additional demographic information, a number of differences in risk perception profiles across the latent classes are notable.

5.6.2 Discussion of estimated relative risk perceptions

Classes 2 and 4 (lay) regard not using antibacterial spray (ANTI: 6.38, 10.92) and the use of the washing-up cloth on the floor (CLOTH: 7.76, 7.72) as relatively high risk in comparison to Classes 3 and 5 (ANTI: 1.35 and 1.90; CLOTH: 1.67 and 2.70). These are behaviours that could be regarded as having a prominence in the public consciousness greater than the health threat posed by them, evident by the far lower risk scores assigned to them by the experts.

Another factor in assessing the risk perceptions associated with not using antibacterial spray is that Class 4 (younger lay members) identifies not using antibacterial spray as a higher risk than their older lay counterparts in Class 2. This may imply a cohort effect with antibacterial sprays and products containing antibacterial agents having come on to the market more recently (Levy, 2001).

A cohort effect is possible also in relation to the risk perception of washing of uncooked poultry [WASH]. This is a practice which has become routine to many, who had associated it with good hygiene. The UK Food Standards Agency ran food safety campaigns against this practice on TV and radio in 2007—2009. Such washing was seen as most risky by members of Class 4 (younger, lay class). It may be the case that they were more influenced by such information campaigns or for them the washing of raw poultry had not become a habit before the public health message changed, perhaps unlike the older lay members of Class 2. A 2010 survey found that 63% of people wash poultry and red meat some of the time, with 41% of people always carrying out this practice (FSA, 2010b). In the same survey, it was found that 30% of 16-24 year olds always washed red meat and poultry in comparison to 47% of people in the age group 75+.
There may also be a media cohort effect in relation to the use of unpasteurised egg in an uncooked dessert (EGG). The public advice with regard to the use of raw eggs is that they should be avoided in uncooked dishes and that lightly cooked eggs should not be consumed by vulnerable groups. This has been the advice since 1988 when Edwina Currie (UK Government Junior Health Minister at the time) told reporters that "Most of the egg production in this country, sadly, is now affected with Salmonella," angering the egg industry, causing sales of shell eggs to fall significantly and costing Currie her job (BBC, 1988). Since 1998 the use of Salmonella vaccination for all British Lion Brand poultry flocks has seen the virtual elimination of Salmonella in British Lion marked eggs, alongside a comprehensive marketing campaign aimed at attempting to improve the reputation of the egg industry. However, not all eggs used in the UK are Salmonella free and non-UK eggs have been found to contain Salmonella (Little et al., 2006) and to be the source of a number of outbreaks. The class more associated with younger members of the public (Class 4) allocated a low risk to the use of unpasteurised egg in comparison to Class 2, the older lay group. It may be that the latter group were more likely to remember the food scare in the late 1980s, whilst their younger counterparts may not have been so influenced by the media reports of that period.

Changing tastes and responses to messages in the media also provide an interesting context in which to interpret the risk perceptions associated with eating beef burgers pink in the middle (BEEF). Perceptions of the risk from this follow the expert-lay dichotomy with the lay classes allocating it low risk (4.65 and 4.50) whereas Classes 3 and 5 (the expert groups) regard it as a much greater risk (12.09 and 8.47). An increasing preference for the eating of beef burgers which are pink in the middle may be linked to the increasing preference (over generations) for rarer cooking of steaks and joints of beef. In some restaurants the diner may well be asked as to how one would like one’s burger cooked (in the same way as one would be asked regarding a steak). This eating of pink ground or minced beef is highlighted by Taylor et al (2012) who found that that 18% of ground beef consumers ate it pink, and Phang and Bruhn (2011) who report 22% of their sample declared a burger cooked when it was at an unsafe temperature. This eating of rare minced beef has also been normalised in the mainstream media. For example celebrity chef Heston Blumenthal in a recent TV
programme cooked a burger suggesting that viewers should “cook to your liking or for medium rare, take the burger to 45ºC in the centre” (Blumenthal). The current advice from the UK Food Standards Agency is to cook beef burgers to 70ºC for 2 minutes or equivalent and that “If you are checking a burger... cut into the middle and check there is no pink meat left” (ACMSF, 2004, FSA). The expert Classes 3 and 5 seem to be less susceptible to the normalisation and cosmopolitanisation of the eating of pink minced beef with this behaviour regarded by both groups as being among the 5 most risky behaviours.

While the perception of the hazard posed by rare minced beef differs neatly across the lay-expert divide, this is not the case regarding the reheating of rice that has been cooled at ambient temperature overnight (RICE). This behaviour was included as a hazardous behaviour (because of the formation of Bacillus toxin through incorrect cooling of rice) as it was likely to be less well known to many. It was viewed as the 3rd highest risk by Class 5 (expert), however members of Class 3 (the other class more likely to contain experts) regarded it as very low relative risk (9th out of 14). This perception of low risk was shared with members of Class 2 and 4 (3.52 and 1.57 respectively). It is Class 1 (not associated with either the lay public or experts) that, like Class 5, regard RICE as high risk. This result again highlights that the expert-lay distinction is informative in understanding the differences in risk perception, but that those differences are more complex and nuanced than a simple 2 group classification.

5.7 Conclusions

This research proposes and tests the use of Best-Worst Scaling to elicit relative risk perceptions and to investigate differences in them. This is done for risk perceptions associated with domestic food safety behaviours. The combining of best worst risk perception data and latent class modelling provides a powerful and flexible method by which to investigate heterogeneity.

The latent class models estimated highlighted marked differences in relative risk perceptions among the sample regarding the fourteen food behaviours featured. This heterogeneity was shown to be significantly affected by the respondent’s level of knowledge and training regarding food safety. However, the differences in risk
perception revealed by the latent class results are far more subtle and nuanced than would be revealed by a comparison between groups identified *ex ante*, in this case between experts and the lay public.

Consumer food preparation behaviour in the kitchen is reliant on knowledge, control and an individual’s personal perception of the risk of food poisoning from behaviours (Redmond and Griffith, 2004b). The results reported here, further demonstrate that food safety knowledge plays a significant role in affecting risk perceptions. This method of BWS and Latent Class modelling is capable of providing a detailed understanding of food risk perceptions to target education and communication of food safety messages in order to reduce food-borne illness. To this end, the results from this study demonstrate that simply targeting communication or socialisation of good food safety habits to groups of people is insufficient. This method provides a useful means of segmenting the sample population such that more carefully targeted messages can be made, to better utilise resource.

The food safety behaviours in this study were selected to capture individuals’ attitudes with respect to food safety issues, including behaviour that may be habitual, for some people. It was designed so that individuals could relate to their own food handling behaviours rather than ask questions about risk perceptions of food-borne illness. However, comparing the relative risk perceptions of behaviours to a quantifiable measure would be a natural extension to the research. Whilst very little data is available to conduct a quantifiable comparison, aligning the focus to food safety behaviours associated with *Campylobacter*, and using appropriate risk factors as a comparison (Neimann et al., 2003, Rodrigues et al., 2001) may prove useful for the aims of the FSA food-borne disease strategy (FSA, 2001, FSA, 2011b).

As previously stated, risk perception is the way we evaluate hazards using intuitive judgements (Slovic, 1987). However, those responsible for food safety in the food industry are trained to use a formal method of risk analysis consisting of three components: risk assessment, risk management and risk communication (FAO/WHO, 1996). Whilst the sample population was chosen in order to test the Best-Worst Scaling method, between two groups of people, an interesting extension to the research would be to further classify the experts according to their practical
understanding and application of food safety for example as a risk assessor, manager or communicator – the detail from the open-ended questions on experience and training may assist in such a re-classification. The simple classification that was undertaken in this study, to identify individuals with knowledge of food safety, may not be interpreted as a true ‘expert’ status (Rowe and Wright, 2001). However, it is worth noting that this expert group, including a basic level of food safety knowledge was significant in the final model. This would tend to suggest that many of the food safety behaviours used in this exercise may be based more on a practical level of food safety.

In conclusion, Best-Worst Scaling can be used to elicit relative risk perceptions and can be adopted to investigate perceived risky food safety behaviours. In this study the relative risk perceptions of experts and general public were shown to differ with food safety knowledge influencing latent class membership. This exercise has shown that the BWS method provides a practical approach to assessing relative risks without the influence of scale bias, and without the cognitive burden of ranking a large number of items. The speed with which the data was collected (with no reward for participants), a low drop out rate and the absence of adverse comments in relation to the exercise are an indication that the BWS tasks were intuitive and not excessively cognitively challenging for the participants.

The choices made by the participants and subsequent analysis have a strong theoretical basis by the estimation of the Conditional Logit model, which is zero-centred and therefore provides an easily interpretable relative risk score based on an odds ratio. The study has also demonstrated differing risk perceptions can be identified, due to the influence of personal characteristics, across a group of people by interrogating the data to reveal latent classes and the membership of those classes by using an extension to the Conditional Logit model. This provides a strong theoretical basis to analyse risk perceptions, in addition to maintaining the data in a form that permits the detailed investigation of heterogeneity.
Acknowledgements

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6 Conclusions

The public health burden of food-borne illness is significant and whilst there have been efforts to reduce this, an increase in levels of some bacterial infections such as Campylobacter has overshadowed the significant steps taken in reducing levels of salmonellosis. Advances in reducing levels of Salmonella in the UK came from the introduction of a Salmonella Enteritidis vaccination programme for breeder and layer flocks, in addition to improvements in feed and general measures of biosecurity (Cogan and Humphrey, 2003). This demonstrated that decisive interventions are possible, which can have an impact on food poisoning incidence, if properly coordinated and applied. The Lion egg marking scheme is evidence of this. Whilst the controls (by vaccination) introduced in the early stages of the food chain appeared to be a success, in reducing the loading of Salmonella in households and catering establishments, there is little evidence that suggests any changes to food preparation behaviours in the later stages of the food chain assisted this reduction.

The significant public health burden of Campylobacter, is associated with sporadic infection and whilst the transmission mechanisms are not yet fully understood, interventions that have a similar dramatic effect as that for shell eggs are not yet available to reduce levels of Campylobacter in ingredients (for example poultry). Safe food preparation to avoid cross contamination and undercooking continue to be important in order to reduce levels of food-borne illness. Since consumer food preparation behaviour in the home is not regulated, food safety in the home is reliant on peoples’ knowledge of safe food preparation and handling behaviours and them being adopted so that they are routine or ‘second nature’.

In this chapter of the thesis, the outcomes of the research are revisited and discussed synoptically. The contributions of this thesis are documented along with limitations of the study and recommendations for future research.

This research explored the links between perceptions, attitudes and food preparation behaviours in the home for individuals and groups. The emphasis of the research was in relation to Campylobacter due to its sporadic nature of infection and therefore possible association with domestic food safety.
6.1 Summary of research findings

Influences of attitudes and behaviours were examined in the form of optimistic bias as well as introducing and testing novel methods of eliciting perceptions, attitudes and behaviours. As the research developed, it was evident that the links between perceptions, attitudes and food preparation behaviours could only be researched by trying to establish methods that provided results with a close comparison to habitual behaviours in the home. As a result, the use of two novel methods was introduced in the research (Clickin’ Tonight and Best Worst Scaling) in order to elicit perceptions attitudes and behaviours. Food safety behaviours were investigated to further understand differences that may be evident between groups of people such as experts and lay individuals and between people who had suffered *Campylobacter* infection in comparison to those who had not. Objectives were used with specific research questions being asked and answered in each of the individual papers. The objectives used were; to consider any differing food safety and hygiene behaviours between people who have and have not suffered food poisoning, investigate the level of awareness with regard to unsafe food preparation behaviours in a domestic setting, examine perception of food safety in the home (and factors influencing perceptions between individuals and groups of people) and assess the risk perception of unsafe food behaviours (and how they vary between individuals and groups of people).

As people tend to report differently to what their behaviour is, the first part of the study was intended to not only test for food safety behaviours and attitude differences between two groups of people, but to investigate behaviours further by examining respondents’ kitchen hygiene standards.

Whilst a similar study was conducted by Parry et al. (2005), this did not investigate people who had suffered campylobacteriosis, which is addressed in this research. A longitudinal element was also added to this study. The kitchen hygiene standards of people who had suffered campylobacteriosis in comparison to people who had not, proved inconclusive with little difference. It was disappointing to find an absence of *Campylobacter* on the dishcloths, considering their use in capturing any contamination from the kitchen surfaces. However, the inability to isolate *Campylobacter* may have
been due to its viable non culturable state (Rollins and Colwell, 1986) or more likely due to its rapid decline on surfaces (Cogan et al., 2002). This would suggest that *Campylobacter* is a source of transient infection, for example, via cross contamination. Its isolation after the event is therefore unlikely.

To further test the difference between the two groups of people, we asked a number of questions about kitchen behaviours to elicit self-reported practices. Significant differences between the cases and controls were highlighted. Interestingly cases responded more favourably to the behaviours, suggesting that their personal food preparation behaviours were of a better standard than those reported by the controls. Alternatively, following their food poisoning incident, social desirability bias may have affected the cases to answer more positively, rather than cast doubt on their own practices. There were two exceptions to the pattern, washing chicken and washing bagged salad leaves. The responses to these two questions suggested that cases do tend to wash chicken and salad leaves more than their control counterparts. These behaviours are incorrect and it would appear that either a) in their attempts to be seen to be ‘good’ and where there was no knowledge of the unsafe nature of these behaviours, the cases have chosen inappropriately or b) this is a truthful representation of their behaviour.

Perceptions of the cases and controls were examined, with optimistic bias evident in both. When tested again six months later, the bias remained. However, the level of optimistic bias increased for the group who had not had food poisoning, creating a significant difference between the two groups.

Changes in perception were also reported in chapter four, this time following the completion of the hazard perception challenge used to test awareness of food hazards. Chapter three and four set out and tested a method to assess hazard perception of domestic food behaviours.

The method, explained in chapter three, was developed to elicit hazard perceptions of unsafe or hazardous behaviours. Respondents were asked to watch a video clip of the preparation of a chicken salad and to click their computer mouse in real-time as they identified any hazards occurring. This method, combined with attitudinal and demographic questions was used in chapter four to test levels of awareness of unsafe
food behaviours, the effects of characteristics on the number of hazards identified and the probability of specific hazards being identified. Individuals’ perceptions of risk, control and knowledge of food safety in the home was also tested prior to and following the video hazard perception challenge and any change examined.

It was found that changes were made to perceptions of knowledge and risk of food poisoning in the home, particularly perceptions about oneself, following the challenge. The number of hazards that were missed during the challenge influenced this movement in perception, highlighting that the survey not only ‘collected’ data but in some instances prompted some individuals to re-evaluate their perceptions with regard to their levels of risk and knowledge. Whilst they may have accurately rated perceptions in the first instance, the concern is that people who did not change their perceptions may not have been influenced by the study, or believe that there was no need to re-evaluate their perceptions.

With respect to the level of hazard awareness among respondents, self-perceived knowledge was demonstrated to be an important factor. Individuals with formal food safety knowledge qualifications also identified some of the more difficult to spot hazards or those that required some knowledge such as the incorrect fridge temperature. People that exhibited optimistic bias with respect to knowledge were more likely to spot hazards of washing chicken, cross contamination of the radio and marinade bottle. In addition they were also more likely to spot the use of marinade (previously used on raw chicken) and poor hand washing. This suggests that perhaps their perception of knowledge is indeed correct, with 5 of 8 hazards identified. People who had food poisoning in the last 5 years were less likely to identify the use of tongs (used on raw followed by cooked chicken), a hazard identified by only 53% of respondents.

Formal food safety education was used to test differences in risk perception of food behaviours in comparison to members of the public. Whilst there was a difference between the two groups, the results of the BWS exercise and latent class modelling showed that it was not as simple as having two groups of differing risk perceptions. A five class model best fitted the data highlighting that neither experts nor the lay group were homogenous and their relative risk perceptions susceptible to influence.
Comparisons of perceptions of the relative risks of specific behaviours between the classes and across the groups showed a number of interesting patterns, including a possible cohort effect with regard to washing poultry, with the members of a lay class who were younger finding this practice most risky.

The BWS method provided a simple format for the respondents to follow, without a large cognitive burden seen from the psychometric paradigm, which dominates risk perception literature. It is hoped that from the method used and the investigation of behaviours, including behaviours that may be practised in their own kitchen, an individuals’ answers may reflect their own behaviours or attitudes to risk perception.

6.2 Conclusions

Four objectives were used to guide the research, to explore the links between perceptions, attitudes and food preparation behaviours of individuals and groups of people:

- To consider any differing food safety and hygiene behaviours between people who have and have not suffered food poisoning
- To investigate the level of awareness with regard to unsafe food preparation behaviours in a domestic setting
- To examine perception of food safety in the home and factors influencing perceptions between individuals and groups of people
- To assess the risk perception of unsafe food behaviours and how they vary between individuals and groups of people

In response to these objectives, the following findings can be concluded:

- No difference was observed in kitchen hygiene between people who have, and have not, suffered campylobacteriosis. Differences in self-reported kitchen behaviours were evident with people who had suffered campylobacteriosis responding more favourably, with the exception of two less well known unsafe practices (washing chicken and washing bagged salad leaves).
- Optimistic bias was evident in both the group who had campylobacteriosis and the group who had not had food poisoning. The level of optimistic bias increased after six months for the group who had not had food poisoning.

- Levels of hazard awareness were identified for a number of hazards using the intuitive hazard perception challenge. Knowledge was demonstrated to be an important factor in the identification of individual hazards and the total number of hazards identified.

- Changes were made to perceptions of knowledge and risk of food poisoning in the home, particularly personal perceptions, following the hazard challenge, with the number of hazards that were missed during the challenge influencing this movement in perception.

- Relative risk perceptions of food preparation behaviours vary between experts and lay individuals; however these differences are not clearly divided between the two groups.

The research outcomes confirm that behaviour is complex and whilst it would at first seem that formal education in food safety would reduce food-borne illness, the results suggest that this alone is not the case (Redmond and Griffith, 2005).

As can be seen by the relative risk perception work, there is no consensus on relative risks by people with formal food safety qualifications. In fact there were some quite marked differences demonstrated by the use of BWS and latent class modelling. Additionally, people with food safety qualifications were more likely to only identify 3 out of the 8 hazards in the hazard perception challenge, albeit hazards that were more difficult to identify. In the same hazard perception challenge, people who rated themselves with a higher perception of knowledge were able to perform better both in the number of hazards identified and with regard to specific hazards. This may well be due to more practical experience rather than formal food safety education.

The extent of practical experience may be as a result of a number of factors, for example, the responsibility for cooking or the frequency of cooking. In the hazard perception challenge it was interesting to note that vegetarians were less likely to identify certain chicken cross contaminated related hazards. Presumably this could be
explained by a lack of familiarity with meat preparation, although a simple study adapting the current video challenge to investigate this would be relatively straightforward.

Experience seemingly influenced optimistic bias in the case control study. Levels of optimistic bias diverged after six months elapsed, with the controls increasing their bias, presumably due to the lack of any food poisoning in that time. In contrast, the experience of missing hazards in the hazard perception challenge caused individuals to change ratings, further indicating that experience (good or bad) may lead to a change in perception.

Self-reported food preparation behaviours from the case control study appeared to have been affected by bias whereby the cases did not want to appear “bad”, or perhaps did not want to suggest that their own practises were in any way responsible for their food poisoning. This was counter intuitive for two behaviours but perhaps this was due to a gap in knowledge.

Establishing “true” behaviour is problematic and in itself creates a barrier to finding the individuals and groups that need some form of education. Education alone may not be sufficient to reach individuals with high personal perceptions of knowledge, or optimistic bias, that consider themselves to be immune from the messages. Interestingly, missing some hazards in the hazard perception challenge appeared to engage some individuals, causing them to re-evaluate their perceptions.

### 6.3 Contribution

This research makes a number of contributions both in the methods employed and results established. Whilst the contributions with regard to results have been stated in each paper, it is worth restating the contributions provided by the methods used.

A new method of eliciting hazard perceptions was developed and tested – An interactive survey method using video footage and real-time assessment of perceived hazards.
Best Worst Scaling is a novel method, used in conjunction with latent class analysis to elicit relative risks associated with a number of food safety behaviours. Heterogeneity was investigated to identify differences in ranking of the sample population.

Whilst there have been many kitchen sampling exercises, it is thought that this case control study was the first to investigate kitchen hygiene and food safety behaviour differences between people who had campylobacteriosis and those who had not, additionally introducing a longitudinal element.

### 6.4 Limitations

Limitations became apparent during the design of the study and on reflection undoubtedly some of the study design could have been improved upon. For example, a number of issues arose during the development of the case control research design and implementation of the programme, most of which were addressed at the time as part of the ethics approval process. As individuals were being contacted who had been ill with campylobacteriosis, it was necessary for the recruitment process to be approved by the North West branch of the National Health Service Research Ethics Committee. The process once approved yielded a low rate of recruitment and it was only when the HPA kindly stopped sending standard pro-formas (adopting the survey documents as an alternative), did the recruitment rate improve significantly.

Due to the requirement of the HPU managing the initial consent process it was necessary to use postal recruitment. Whilst this may in actual fact have lowered the response rate, reminders were issued as part of the administration of the survey and the final response rate was comparable to that expected by the HPU.

The overall design of the case control study was constrained by the resources available. For example, it may have been beneficial to have increased the sample size for the home visit for microbiological sampling however this was prevented by budget and the length of time taken to recruit individuals. Despite there being a small financial incentive, recruitment of individuals to take part in the home sampling visit proved challenging, with people reluctant to permit a researcher into their home.

Additionally the recruitment of control samples proved challenging, with the intended case nomination recruitment being ineffective. Again due to resource limitations the
more common recruitment of controls through GP surgeries, electoral register or telephone sampling was not possible. As a result the best option was to contact local groups and invite people to take part after delivering a topical talk or discussion, after receiving an amendment from the Research Ethics Committee.

It was initially intended to carry out a microbiological review of the kitchens after 6 months, however this element was removed after it became evident that the sample size would reduce further due to attrition and no significance was evident between initial and repeat visits after the first few were visited.

The home visit required arranging with prior notice for ethics reasons; this meant that the participant had opportunity to prepare for the visit. Whilst the participant did not know where the swabbing would take place or indeed that the dishcloth would be taken, it is appreciated that the advance notice of the visit could have influenced the results.

Snowball sampling was utilised for all aspects of the research, as it was decided that this method provided the quickest and cheapest solution for collecting data. This assumption was proven, especially with the use of an online system that was utilised for the Clickin’ Tonight study and the relative risk ranking survey. The use of this sampling method meant that access to both members of the public and people with food safety experience was possible. Whilst it was particularly desired to have people with food safety experience complete the study, this meant that comparison to Census or other survey data was not appropriate. Additionally, many participants chose not to provide income details making that section of data difficult to use in any social demographic comparison.

### 6.5 Recommendations for further research

The current research can be further extended, in part to address some of the shortcomings listed or indeed applied with an alternative strategy. The following section therefore divides these recommendations into an extension of the existing research and additional applications.
6.5.1 Extension of the existing research

Behaviours were selected for this research, particularly for the relative risk ranking exercise, to capture individuals’ perceptions with respect to food safety issues. This was aimed to include behaviour that may already be habitual for some people. Considering the focus of Campylobacter reduction through improved domestic food safety practices poses an interesting extension. Food safety behaviours particularly associated with Campylobacter could be incorporated more specifically, for example comparing the relative risk perceptions of behaviours to a quantifiable measure such as using risk factors from appropriate case-control studies.

The sample population for the relative risk ranking and for “Clickin’ Tonight” was chosen in order to test the Best-Worst Scaling and interactive survey methods. This included the comparison between people with food safety knowledge and members of the public. In order to further examine this, more detailed identification of the type of expert is suggested. The type of knowledge that individuals have, may highlight some important differences between practical understanding and application of food safety. For example, as a risk assessor, manager or communicator, food safety knowledge is applied very differently. Also by differentiating levels of knowledge, it may help to identify what aspects of knowledge are most important and may well help to identify the threshold of knowledge that is necessary to improve food safety in the home.

The level of discrepancy between standard methods of food safety knowledge testing and behaviour could be further examined in comparison to that provided by the interactive survey, to establish if this method provides any additional measure of behaviour.

As the research has shown a difference in perceptions, attitudes and knowledge between people with food safety qualifications and general public, further testing using the methods of BWS and the interactive survey is recommended targeting other specific groups of people. Target groups may include; people with differing time pressures in the kitchen, age differences, level of responsibility or frequency of food preparation. For example, people who do not have much responsibility in the kitchen, (or only prepare food from scratch infrequently) may have very different perceptions and attitudes, to people with habits that are established due to regular food...
preparation. Likewise, the age related incidence of campylobacteriosis may be in part due to a difference in food preparation habits which warrants greater investigation.

### 6.5.2 Additional applications of the research

The Clickin’ Tonight tool was extremely well received by stakeholders, researchers and independent parties who took part in the study. The use of the video footage and an alternative method of survey provided genuine interest among participants. As a result of this feedback, further consideration to develop this tool beyond the current video challenge should be made.

Researchers saw the advantages of not only gaining potential additional insights into habits and attitudes, but the opportunity to utilise a novel platform for data collection that provided interest for participants in the research.

The use of this application as part of an assessment process in education would again provide an interesting alternative to more routine tests of knowledge. For example, during, or at the end of a training exercise the tool could be used to establish knowledge recall in real-time rather than by use of questionnaires.

In both research and education, the findings that individuals changed their perceptions of knowledge and risk after completing the challenge are important. It suggests that the completion of the challenge may have had some influence, causing the participant to re-evaluate their perceptions.

### 6.6 Final conclusion

In conclusion, this research has extended the understanding of domestic food safety behaviour, risk perceptions. It has done so by developing and testing novel methods to elicit relative risk perceptions and hazard perception with regard to food safety behaviours.

As there are many influences on food preparation behaviour in the home, this research demonstrates that a segmentation approach is necessary to establish which group of individuals need to be targeted to better utilise resource. For example to target the older population without further differentiation would not pinpoint the population that was experiencing *Campylobacter* infection in increasing numbers.
Additionally, the research provides a means of assessing hazard perception which hopes to reduce self-reported bias and correspond more closely to habitual behaviours. It provides a practical tool for stakeholders, researchers, risk managers and communicators to use in research, communication and education.
7 References


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8 Appendices

8.1 Summary of Publications and Personal Professional Training

In addition to many internal policies, manuals and guidance documents, Caroline has written or co-authored publications for industry. These include:

- Chilled Food Association (CFA) Guidelines for the production of chilled foods
- Chilled Food Association (CFA) Microbiological testing and interpretation guidance

First editions of the following were written after a substantial number of audits and research in conjunction with the Marks and Spencer supply base (1995-2000):

- Marks and Spencer - Processing of Free Range Eggs
- Marks and Spencer - Eradication of Human Pathogens from Raw Poultry and Free Range eggs
- Marks and Spencer - Hatcheries
- Marks and Spencer - Poultry Feedstuffs and Feedmills

The following lists some of the training undertaken by Caroline during her career in the food industry and as a PhD researcher. The list is by no means exhaustive but hopes to convey personal professional development in addition to breadth of experience.

**General training**

Negotiation skills (ExI)  
Communication skills (ExI)  
“Powerful” presentations (ExI)  
Finance for non financial managers (Ex)  
Personal development planning (UoM)  
Speed Reading (UoM)  
Reactivating your writing skills (UoM)  
Academic writing (UoM)  
Critical writing (UoM)  
Intermediate Excel (ExI)  
Lotus notes (I)  
Creations (Ex)  
Endnote (UoM)  
Managing long documents for word (UoM)
Data Management

Intro to STATA (UoM)
Intro to SPSS (UoM)
Latent Factor Analysis (UoM)
Intro to data analysis (I&II) (UoM)
Intro to Quantitative Methods module (UoM)
Pre-session maths course (UoM)
Logistic Regression (UoM)
Introduction to Latent Class modelling (Ex)

Survey design and Research

Research Skills for Economists module (UoM)
Survey Research module (UoM)
Questionnaire design (UoM)
Cognitive interviewing methods for testing survey questions (UoM)
Standard multi-item scale development for surveys (UoM)

Food Specific Training

HACCP
- Leatherhead Food RA (Ex)
- Campden and Chorleywood Food RA (ExI)
BPCA Pest Control (Ex)
Internal Auditing (ExI)
Rapid Method Testing – Leatherhead Food RA (Ex)
ATP, rapid method testing (Ex)
Security and Biosecurity measures for the food industry. (Ex)
Food Legislation;
- Leatherhead Food RA (Ex)
- Internal update courses (I)
Nutrition (ExI)

Management of Corporate Social Responsibility (CSR) in the Supply chain (Ex)
An Introduction to CSR (ExI)

Ex I – External trainer running a course internally
Ex – External training course
I – Internally run training course
UoM – University of Manchester course
The following workshops were organised by Caroline. The content was wholly written and presented by Caroline or co-authored and co-presented.

Listeria Controls for the food industry.
Microbiology and Laboratory workshops
Hygiene
HACCP
Internal Audit
GMP
Pest Control
Basic microbiology for non technical personnel
Advanced microbiology for technical personnel
8.2 Case control study consent form

You and Your Food
Consent form

Please read the information sheet before completing this form. Please complete the form by initialling in the boxes before signing and dating at the bottom of the form.

1. I confirm that I have read and understand the information sheet (Version 6), for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected.

3. I agree to take part in the above study and am happy to complete the initial questionnaire. Please complete the questionnaire and return it with this form.

4. Please let us know if you wish to take part in some more of the study by initialing in one of the following boxes. I am happy to participate further in the study.
   a. Option 1 - Complete a repeat questionnaire in 6 months time (please provide a contact address or email address below)
   b. Option 2 - Have the researcher visit me at home soon (please provide a contact telephone number below)
   c. Option 3 - Have the researcher visit me at home soon and in 6 months time, as well as completing a repeat questionnaire in 6 months time (please provide a contact address or email address and telephone number below)

   I do not want to participate other than the initial questionnaire

Please Print clearly

Name: _____________________________________ Sign: ____________________________

Date:_____/_____/______

Please provide a contact address (inc. postcode) that we can send you a questionnaire in 6 months (if applicable):______________________________

Postcode____________________

Please provide a contact phone number so we can arrange a home visit (if applicable):

Landline No:_________________________

Mobile No:___________________________

Or an email address __________________________________________________________

☐ If you wish to have a copy of the summary results at the end of the study, please tick here.

Please return the top copy of this form in the enclosed envelope with the completed questionnaire. Thank you for helping with our research.

Even after completing and returning the consent form and questionnaire, you can leave the study at anytime.

When completed: 1 copy for participant; 1 copy for researcher
### 8.3 Case control study information sheet for case participants

#### YOU AND YOUR FOOD
Information Sheet

<table>
<thead>
<tr>
<th>What is the study about?</th>
</tr>
</thead>
<tbody>
<tr>
<td>This study is looking at the attitudes that people have to cooking and eating, and the habits and routines that they have regarding the food they eat. We will gather information about attitudes and habits from two groups of people: those that have had food poisoning and those that have not. We will then compare the attitudes and habits between these two groups of people.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How big is this study?</th>
</tr>
</thead>
<tbody>
<tr>
<td>We will be talking to several hundred people who have had food poisoning in the North West. We will also be approaching a similar number of people who have not had food poisoning.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Who is organising and paying for this study?</th>
</tr>
</thead>
<tbody>
<tr>
<td>This study is being organised by researchers in the Schools of Medicine and Social Sciences at the University of Manchester. We are working with the Greater Manchester Health Protection Unit. The Economic Social Research Council is funding the research.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Why have I been chosen and do I have to take part?</th>
</tr>
</thead>
<tbody>
<tr>
<td>You have recently had food poisoning, which has been confirmed, by your doctor. This is why we are inviting you to take part in this study. You will not be able to take part if you are under the age of 18. However, it is up to you to decide whether or not to take part. If you decide not to take part your health care will not be affected in any way.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What happens next if I agree to take part in this study?</th>
</tr>
</thead>
<tbody>
<tr>
<td>If you would like to take part in the study – you can choose to take part in one of the following ways:</td>
</tr>
<tr>
<td>1. Complete the questionnaire contained in this pack and in 6 months</td>
</tr>
</tbody>
</table>
2. Complete the questionnaire contained in this pack and have the researcher visit you at home soon.
3. Have the researcher visit you at home soon and in 6 months time, as well as completing the questionnaire contained in this pack and in 6 months time.

Or you can just complete the questionnaire contained in this pack. If that is all you would like to do then that is fine.

If you choose one of the options that requires Caroline, the researcher, to visit you at home – please let us have a suitable contact telephone number on the consent form, so that we can arrange the visit on a day and time that are convenient for you.
In all cases, we would like you to fill the Consent Form, also enclosed in the pack.

Have a look at the flowchart at the end of this leaflet - it will help you understand these stages and decide whether to be involved in some or all of the stages of the study.

<table>
<thead>
<tr>
<th>What kind of information will be collected about me in the questionnaire?</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the questionnaire we ask you about:</td>
</tr>
<tr>
<td>- your recent experience of food poisoning</td>
</tr>
<tr>
<td>- your attitudes and routines regarding food</td>
</tr>
<tr>
<td>- some basic information about you such as your occupation, education</td>
</tr>
<tr>
<td>and who else lives with you</td>
</tr>
<tr>
<td>You answer the questions by either ticking or circling different options, with only a few questions asking you to actually write something.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What will happen when you visit my home?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remember, you can take part by just completing a questionnaire.</td>
</tr>
<tr>
<td>If you have agreed to allow the researcher to visit you at home, she will want to look at your kitchen. During the visit the researcher will want to test some of the kitchen surfaces, so that they can be analysed in a scientific laboratory. The results will remain confidential.</td>
</tr>
<tr>
<td>If we do visit your home, we will compensate you for your time with a gift voucher for a major food retailer.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How will the information collected be kept confidential?</th>
</tr>
</thead>
<tbody>
<tr>
<td>The law called the Data Protection Act (1998) tells us how to keep your information secure.</td>
</tr>
</tbody>
</table>
We will store your information on a secure and password protected database. All information will be encrypted. Only members of the research team and those responsible for overseeing the study will have access to your information. We will not give your details to anyone else.

When we publish the results of the study we will group together all the information that we have collected from everyone taking part in the study and your name will be kept anonymous.

What are the benefits in taking part in this study?

This study will help understand better people’s attitudes and habits towards food and food poisoning. This will aid researchers and public health organisations shape food safety guidelines in the future.

Are there any risks in taking part in this study?

No. There are no risks in taking part in this study.

Do you have any friends that may be interested in taking part?

We are also interested in talking to people who have not had Food poisoning.

Do you know anyone that might wish to take part in the study?

If so, you could always give them a postcard. On the postcard is all the information that they need to register their interest in the study – they can do this by completing and sending the postcard back, going to the internet at http://tinyurl.com/uomfood or contacting the researcher by email or telephone.

You can show your friend(s) this leaflet but please keep hold of it, as we will send them their own copy.

After the study starts, can I change my mind?

Yes. You can change your mind and leave the Study at any time. If you do leave, the information you have given up to that time will still be helpful.

What if I have a problem?

If you have a concern about any aspect of this study, you should ask to speak to the researchers who will do their best to answer your questions. If they are unable to resolve your concern or you wish to make a complaint regarding the study, please contact a University Research Practice and
Governance Co-ordinator on 0161 2757583 or 0161 2758093 or by email to research-governance@manchester.ac.uk.

You can also do this through the NHS Complaints Procedure.

<table>
<thead>
<tr>
<th>What happens when the study finishes?</th>
</tr>
</thead>
<tbody>
<tr>
<td>The results will be published as a report, feature in published articles and will also be presented at conferences. Neither your name nor any information that can identify you will ever appear in any reports or articles. We are happy to send you a summary of the study’s results – just tick the box on the Consent Form if you would like us to do so. The results summary will be available after May 2011.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Who has checked the study?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before a study like this goes ahead it has to be checked by an NHS Ethics Committee. The North West NHS Research Ethics Committee has approved this study. Ref 10/H1010/44</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What if I have a question? Contact details</th>
</tr>
</thead>
<tbody>
<tr>
<td>If you have a question or are not sure about any aspect of this study you can speak to Caroline, the main researcher who will try to answer your questions: Caroline Millman Tel. 07505 957506 (she will phone you back to save your phone bill) or email: <a href="mailto:caroline.millman@postgrad.manchester.ac.uk">caroline.millman@postgrad.manchester.ac.uk</a> You are also welcome to contact her supervisor at the University of Manchester: Dr Dan Rigby, <a href="mailto:dan.rigby@manchester.ac.uk">dan.rigby@manchester.ac.uk</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Getting involved in research</th>
</tr>
</thead>
<tbody>
<tr>
<td>You can find out more about participating in NHS research from INVOLVE which supports public involvement in NHS research. You can find out more at their website. <a href="http://www.invo.org.uk/">http://www.invo.org.uk/</a> or by contacting them on 02380 651088 or at <a href="mailto:admin@invo.org.uk">admin@invo.org.uk</a></td>
</tr>
</tbody>
</table>
Perceptions and Risks: Food-borne Pathogens in the Domestic Environment
8.4 Questionnaire for case control study – Case questionnaire

Date posted to participant

Participant number

YOU AND YOUR FOOD

You will have received a letter, in the same envelope as this questionnaire, which explains why you have been approached to take part in this study. Please do read that letter first.

We hope you will be willing to take part in our study and complete this questionnaire. If so, please read each question carefully and try to complete all of the sections.

When you have completed the questionnaire, please return it with the consent form that you should complete and sign. Post it to us using the envelope provided – no stamp is required.

If you prefer to complete the questionnaire online, you can do so at:

http://tinyurl.com/foodill

You will need to enter your participant number (shown at top of this page).

If you are not sure about any aspect of this questionnaire or have a question for us please contact Caroline, the main researcher, who will be able to help you:

☐ Telephone 07505 957506
☐ Or email caroline.millman@postgrad.manchester.ac.uk

This information will be entered onto a computerised system and is covered by the Data Protection Act (1998). You have been assigned a unique participant number. This participant number will be used in the study instead of anything that can be identified to you. Your personal details will not be given to anyone else – your name will be kept anonymous.
Some of the questions we would like you to answer are about your opinions, some about what you do in your home and some are about your recent illness. These different sorts of questions are grouped together in boxes. Let’s begin by thinking about your recent illness…..

**YOUR ILLNESS**

We would like to ask you some questions about your recent case of food poisoning and how this affected you at the time.

1. Apart from your doctor, has anyone else been in contact with you to find out more about your food related illness?
   - Yes  ☐  No  ☐  If yes, please say who?

2. Did your illness prevent you going about your normal daily activities, like going to work, or looking after your family?
   - Yes  ☐  No  ☐  Not sure

   Were you admitted to hospital?
   - Yes  ☐  No  ☐  If yes, please say how long for

3. Do you remember the date when your symptoms started? Please give your best guess if you cannot remember exactly.
   
   _ _ / _ _ / _ _ _ 

4. We would like to ask you now about some of the symptoms that you had.

   Which of the following symptoms did you have? If you answer Yes to any of these, then we would be grateful if you could give, in your opinion, how severe they were and how many days they lasted?

   *Tick all appropriate boxes or mark a cross in the first column if you did not have the symptom. An example is given on how to enter if you had mild diarrhoea that lasted for 3 days.*

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Yes / No</th>
<th>Mild – I just didn’t feel right</th>
<th>Moderate – I felt lousy</th>
<th>Severe – I felt absolutely terrible</th>
<th>Total days</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Example – Diarrhoea</em></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Diarrhoea (i.e loose watery motions)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blood in motions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nausea (feeling sick)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vomiting (being sick)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abdominal (tummy) pain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other - please specify</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### SUSPECTED SOURCE OF ILLNESS

We would like to know your thoughts on where you think you may have got food poisoning from?

5. What do you think was responsible for your illness? (Please tell us what type of food, where it was cooked/prepared and purchased)


### CONTACT WITH ANIMALS

Some illnesses that people often associate with food can also be caused by contact with animals. So we would like to ask you some questions about any animals that you have, or may have been in contact with.

6. Do you have any pets?

☐ Yes ☐ No

If YES what type of pet(s) and how many do you have?
[e.g. 2 dogs, 3 parrots, 1 lizard, 1 goldfish etc]


7. Do you live on a farm or small holding?

☐ Yes ☐ No

8. Did you visit any farms, stables, zoos, petting corners etc in the 7 days before you became ill?

☐ Yes ☐ No

### TRAVEL HISTORY

9. Did you spend any nights outside the UK in the 7 days before you became ill?

☐ Yes ☐ No

If YES what country(ies) did you visit?


EATING OUT/TAKE AWAYS

We would like to know a bit more about where you tend to eat when you go out. We would also like to know a bit more about the week before you became ill.

10. In the 7 days before you started to feel ill, did you eat any meals out at a social function?
   [ ] Yes  [ ] No
   a. What sort of function was it? (e.g. wedding reception, birthday/ anniversary or dinner party, conference dinner)
   .................................................................................................................................
   b. Where was the function? (e.g. private house, restaurant, hotel, sports club)
   .................................................................................................................................

11. In the last 7 days, have you eaten any food (including take-aways and delivered foods) from, or in, any of the following?
   (Please tick all that apply.)
   [ ] Coffee shop or Café  [ ] Restaurant
   [ ] Takeaway e.g. Burger, Kebab [ ] Hotel
   [ ] Sandwich shop [ ] Pub
   [ ] Work canteen [ ] Mobile caterer
   [ ] Airport or Railway station/train [ ] Petrol station or Motorway servi
   [ ] Other

List name and town of premises visited
.................................................................................................................................
.................................................................................................................................

RESPONSIBILITY FOR FOOD PREPARATION

Who is the boss in the kitchen?

12. Are you the main person in the house responsible for shopping and food preparation?
   [ ] Yes  [ ] Shared pretty much equally  [ ] No

If you answered “No”, it would be useful to complete the rest of the questionnaire with the person who does most of the food shopping and cooking in the household – we will call them the house chef!
### YOU AND YOUR KITCHEN

Thinking about what you or the ‘house chef’ get up to in the kitchen...

13. Please answer the following questions, by circling the number which best indicates your response on the scale of 1 to 5

*Some questions have an * by them - Do not answer them if you do not buy or cook meat.*

<table>
<thead>
<tr>
<th>Question</th>
<th>Never</th>
<th>Sometimes</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>I use different chopping boards for the preparation of raw meat and nothing else.</em></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I smell leftover food to decide if it is still okay to use.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I would eat eggs even if the egg yolk was still very runny.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td><em>I would eat cooked meat a day after its “use by” date.</em></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I use the drying up cloth (or tea-towel) to dry my hands.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I defrost foods in the fridge rather than on the worksurface/worktop.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td><em>I wash chicken (whole bird, joints or pieces of) under the tap before cooking.</em></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I follow manufacturers’ cooking instructions on food packaging.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I clean the work surface after food preparation using an antibacterial spray.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td><em>I would eat a beef burger that was cooked to ‘medium’ (slightly pink in the middle).</em></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I wash salad leaves that are sold in a bag before eating them.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I leave hot foods out of the fridge to cool overnight.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

### FRIDGE TEMPERATURES

Thinking about your refrigerator....

14. Do you check the temperature of your fridge?

- [ ] No, never
- [ ] Yes, occasionally
- [ ] Yes, pretty regularly

If “yes”, can you tell me what the temperature of the fridge is now?  

\[\text{°C}\]

Do you know roughly what temperature it should be?  

\[\text{°C}\]
**FOOD AND LIFESTYLE**

A few questions to get you (or the house chef) thinking about food and the stresses of life. .. Please try to honest – we are very interested in what really happens rather than what you might like to happen.

### 15. Please answer the questions in the following four tables by circling the number which best indicates your response on the scale of 1 to 7.

Some questions have a * by them - Do not answer them if you live alone or shop and cook just for yourself.

<table>
<thead>
<tr>
<th>I choose easy, quick-to-prepare food for weekday evening meals</th>
<th>Completely disagree</th>
<th>Neither disagree nor agree</th>
<th>Completely agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I enjoy preparing meals from scratch</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I like to try out new recipes</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I prefer fresh products to canned or frozen products</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Shopping for food does not interest me at all</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>I am often rushing to get everything done</th>
<th>Completely disagree</th>
<th>Neither disagree nor agree</th>
<th>Completely agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Certain members of my family are choosy/picky in what they eat</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I compare prices between product variants (i.e. various brands of same product) in order to get the best value for money</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Before I go shopping for food I make a list of everything I need</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I find that I often have to throw away ingredients when cooking a meal from scratch</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Statement</td>
<td>Completely disagree</td>
<td>Neither disagree</td>
<td>Completely agree</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>---------------------</td>
<td>------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>I compare product information labels to decide which brand to buy</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I enjoy going to restaurants with my family and friends</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*My family helps with other mealtime chores, such as setting the table and doing the dishes</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Nowadays the responsibility for shopping and cooking ought to lie just as much with the husband as with the wife</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recently I have been unable to control the important things in my life</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I regularly use the microwave to cook my evening meal during the week</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I always plan what we are going to eat a couple of days in advance</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*It is difficult for us to have a family meal together</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I eat whenever I feel the slightest bit hungry</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I don’t usually prepare a proper meal when there’s just me</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SINCE YOUR ILLNESS

16. Since your illness, have you changed anything in relation to food purchase, hygiene, storage or preparation?

........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
FOOD SAFETY

We would like you to think now about the risk of getting food poisoning...

17. Please answer the following food questions, by circling the number which best indicates your response on the scale of 1 to 7

<table>
<thead>
<tr>
<th>Question</th>
<th>None at all</th>
<th>A moderate</th>
<th>A great deal</th>
</tr>
</thead>
<tbody>
<tr>
<td>How much risk do you think there is to you personally from getting food poisoning in your own home?</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>How much risk do you think there is to the average person from getting food poisoning in their own home?</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>How much control do you think you personally have over getting food poisoning in the home?</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>How much control do you think the average person has over getting food poisoning in the home?</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>How much knowledge do you think you personally have about the risk of getting food poisoning in the home?</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>How much knowledge do you think the average person has over the risk of getting food poisoning in the home?</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

DIETARY REQUIREMENTS

Some people follow specific diets....

18. Do you or others in your household have any special dietary requirements?
   ☐ Yes ☐ No

   If so, what are they? Please tick all that apply.
   ☐ Vegetarian ☐ Low cholesterol diet
   ☐ Vegan ☐ Dairy free diets
   ☐ Fruitarian ☐ Gluten free diet
   ☐ Diabetic ☐ Lactose intolerance
   ☐ Peanut/Nut allergy ☐ Low fat diet
   ☐ Shellfish/fish allergy
   ☐ Other (please specify)
FOOD POISONING RISKS

We would like you to now think about some of the ways in which people might become ill with food poisoning...

19. There are many different practices or behaviours that can create a risk of getting ill.

On the pages that follow we will show you groups of 4 such behaviours. In each case we would like you to indicate:

(i) the behaviour you think would be most likely to make someone ill with food poisoning
(ii) the behaviour you think would be least likely to make someone ill with food poisoning

Don’t think about how often someone (or you) is likely to do any of the things shown. Just think about, if someone did all these things once, which of them would pose the greatest chance of getting ill, and which would pose the lowest chance of getting ill.

An example is shown below:

<table>
<thead>
<tr>
<th>Most Likely to make someone ill</th>
<th>Least Likely to make someone ill</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

Tick the box next to the behaviour you think is most likely to make someone ill – only tick one

Tick the box next to the behaviour you think is least likely to make someone ill – only tick one

The sets that follow are a bit repetitive, but please do complete them. Don’t think about them too long, just give your first thoughts – we are just interested in your opinions.

Note: The following subsets are one example from the 10 versions of the BWS experimental design
<table>
<thead>
<tr>
<th>Only tick one behaviour that you believe is most likely to make someone ill</th>
<th>Only tick one behaviour that you believe is least likely to make someone ill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eating a beefburger that is pink in the middle.</td>
<td></td>
</tr>
<tr>
<td>Using the same knife for chopping up salad after cutting raw/uncooked chicken.</td>
<td></td>
</tr>
<tr>
<td>Eating cooked mussels in a restaurant.</td>
<td></td>
</tr>
<tr>
<td>Using the washing up cloth to mop up a spillage (such as milk) on the floor.</td>
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</tr>
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<th>Only tick one behaviour that you believe is least likely to make someone ill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using the same knife for chopping up salad after cutting raw/uncooked chicken.</td>
<td></td>
</tr>
<tr>
<td>Chilled foods not being put away in the refrigerator for 4 hours after finishing the shopping.</td>
<td></td>
</tr>
<tr>
<td>Washing a chicken or turkey under the tap before cooking.</td>
<td></td>
</tr>
<tr>
<td>Cooking raw/uncooked frozen chicken. i.e. not defrosted before cooking.</td>
<td></td>
</tr>
</tbody>
</table>

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</tr>
</thead>
<tbody>
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<td></td>
</tr>
<tr>
<td>Eating chicken that is not cooked through properly.</td>
<td></td>
</tr>
<tr>
<td>Not using antibacterial spray on surfaces after the preparation of raw/uncooked turkey</td>
<td></td>
</tr>
<tr>
<td>Eating a dessert that contains uncooked/unpasteurised egg such as a tiramisu or chocolate mousse.</td>
<td></td>
</tr>
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</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>☐ Not using antibacterial spray on surfaces after the preparation of raw/uncooked turkey</td>
<td>☐</td>
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<td>☐</td>
</tr>
<tr>
<td>☐ Storing raw/uncooked pork (on a plate) on the shelf above cooked ham in the refrigerator.</td>
<td>☐</td>
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<tr>
<td></td>
<td></td>
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<td>☐</td>
</tr>
<tr>
<td>☐ Eating reheated (until piping hot) leftover rice after leaving it out of the fridge to cool overnight.</td>
<td>☐</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
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</tr>
<tr>
<td>☐ Storing raw/uncooked pork (on a plate) on the shelf above cooked ham in the refrigerator.</td>
<td>☐</td>
</tr>
<tr>
<td>☐ Cooking raw/uncooked frozen chicken. i.e. not defrosted before cooking.</td>
<td>☐</td>
</tr>
<tr>
<td>☐ Leaving meat or fish from the freezer to defrost at room temperature.</td>
<td>☐</td>
</tr>
<tr>
<td>☐ Eating chicken from a BBQ at a social event (party, sporting event etc) that has not been pre-cooked.</td>
<td>☐</td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>Storing raw/uncooked pork (on a plate) on the shelf above cooked ham in the refrigerator.</td>
<td></td>
</tr>
</tbody>
</table>
20. What is your gender?

- Male
- Female

21. What is your year of birth?

___

22. How many adults aged 16 or older live in your household, including yourself?

___

23. Are there any children under the age of 16 living in the household?

- Yes
- No

If yes...

How many in each of the following age groups?

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 4 years of age</td>
<td></td>
</tr>
<tr>
<td>5 – 9 years of age</td>
<td></td>
</tr>
<tr>
<td>10 – 15 years of age</td>
<td></td>
</tr>
</tbody>
</table>

24. Which of these ethnic groups do you consider yourself to belong to?

- White - British
- White - Irish
- Other White
- Mixed - White & Black Caribbean
- Mixed - White & Black African
- Mixed - White & Asian
- Other Mixed
- Asian or Asian British - Indian
- Asian or Asian British - Pakistani
- Asian or Asian British - Bangladeshi
- Other Asian
- Black or Black British - Caribbean
- Black or Black British - African
- Other Black
- Chinese
- Other ethnic group
### ABOUT YOU (continued)

25. Which of these qualifications do you have? Tick all that apply or, if not specified, the nearest equivalent.

- [ ] No Qualifications  
- [ ] O levels/CSEs/GCSEs (any grades)  
- [ ] A levels/AS levels  
  - Higher School Certificate  
- [ ] First Degree (eg BA, BSc)  
- [ ] GNVQ  
- [ ] HNC, HND  
- [ ] Other qualifications (eg City and Guilds, RSA/OCR, BTEC/Edexcel)  
- [ ] Higher Degree (eg MA, PhD, PGCE, post-graduate certificates/diplomas)

26. Do you have any of the following professional qualifications?

- [ ] No professional qualifications  
- [ ] Qualified Teacher Status (for schools)  
- [ ] Qualified Medical Doctor  
- [ ] Qualified Dentist  
- [ ] Qualified Nurse, Midwife, Health Visitor  
- [ ] Other Professional Qualifications

### FOOD EDUCATION

Please try to remember any formal food education or training ....

27. When and where did you learn anything about cooking or food safety? If this was at school/college it might have been called ‘domestic science’, ‘home economics’ or ‘food technology’. Please tick all options that apply.

- [ ] Prior to age 14  
- [ ] Age 14 – 16  
- [ ] Age 16 – 18  
- [ ] Age 18+  
- [ ] Was not taught anything about food at school, college or work  
  - School  
  - At Catering college  
  - Job related training  
  - Other – please specify
ABOUT YOU AND YOUR WORK

28. Last week, were you doing any work:
   - as an employee, or on a Government sponsored training scheme?
   - as a self-employed/freelance, or in your own/family business?

☐ Yes   If ‘Yes’ go to question 30
☐ No    If ‘No’ go to question 29

29. Last week were you any of the following?
   ☐ Retired
   ☐ Student
   ☐ Looking after home/family
   ☐ Permanently sick/disabled
   ☐ None of the above

Answer questions 30 – 32 for the main job that you were doing last week, or if not working last week, your last main job.

30. Do (did) you work as an employee or are (were) you self-employed?
   ☐ Employee
   ☐ Self-employed with employees
   ☐ Self-employed/freelance without employees

31. How many people work (worked) at the place where you work (worked)?
   ☐ 1 – 9
   ☐ 10 - 24
   ☐ 25 – 499
   ☐ 500 or more

32. What is (was) the full title of your main job?

………………………………………………………………………………………….

INCOME

33. Which of these bands comes closest to the net income of the main income earner in your household – that is after deducting income tax, national insurance and contributions to pension schemes?
   (Tick the band that applies)

<table>
<thead>
<tr>
<th>Weekly</th>
<th>Monthly</th>
<th>Yearly</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ 1 Up to £74</td>
<td>Up to £299</td>
<td>Up to £3,499</td>
</tr>
<tr>
<td>☐ 2 £75 - £99</td>
<td>£300 - £399</td>
<td>£3,500 - £4,999</td>
</tr>
<tr>
<td>☐ 3 £100 - £249</td>
<td>£400 - £999</td>
<td>£5,000 - £11,999</td>
</tr>
<tr>
<td>☐ 4 £250 - £399</td>
<td>£1,000 - £1,699</td>
<td>£12,000 - £19,999</td>
</tr>
<tr>
<td>☐ 5 £400 - £619</td>
<td>£1,700 - £2,499</td>
<td>£20,000 - £29,999</td>
</tr>
<tr>
<td>☐ 6 £620 - £999</td>
<td>£2,500 - £4,199</td>
<td>£30,000 - £49,999</td>
</tr>
<tr>
<td>☐ 7 £1,000 - £1,499</td>
<td>£4,200 - £5,799</td>
<td>£50,000 - £69,999</td>
</tr>
<tr>
<td>☐ 8 £1,500+</td>
<td>£5,800+</td>
<td>£70,000+</td>
</tr>
</tbody>
</table>
34. Please note down in this box any further comments that you have regarding this survey or anything else that you think will be useful to our research.

Thank you for completing the questionnaire.

Please check that you have filled in all of the sections and return it as soon as possible to the Greater Manchester Health Protection Agency using the envelope provided – you do not need to put a stamp on it.
8.5 Case control study information sheet for control participants

YOU AND YOUR FOOD
Information Sheet

What is the study about?

This study is looking at the attitudes that people have to cooking and eating, and the habits and routines that they have regarding the food they eat.

We will gather information about attitudes and habits from two groups of people: those that have had food poisoning and those that have not. We will then compare the attitudes and habits between these two groups of people.

How big is this study?

We will be talking to several hundred people who have had food poisoning in the North West.
We will also be approaching a similar number of people who have not had food poisoning.

Who is organising and paying for this study?

This study is being organised by researchers in the Schools of Medicine and Social Sciences at the University of Manchester.
We are working with the Greater Manchester Health Protection Unit.
The Economic Social Research Council is funding the research.

Why have I been chosen and do I have to take part?

We are inviting you to take part in this study, as someone who we think has not had food poisoning.
You will not be able to take part:
- If your doctor has told you that you have been ill from Salmonella or Campylobacter food related illness at any time in the last 5 years, or
- You are under the age of 18

It is up to you to decide whether or not you want to take part.
If you decide not to take part your health care will not be affected in any way.

What happens next if I agree to take part in this study?

If you would like to take part in the study, then you will need to complete the questionnaire, contained in this pack.
If that is all you would like to do then that is fine.

However, you have the option of being further involved – you can choose to take part in one of the following ways:
4. Complete a repeat questionnaire in 6 months time
5. Have the researcher visit you at home soon
6. Have the researcher visit you at home soon and in 6 months time, as well as completing a repeat questionnaire in 6 months time

If you choose one of the options that requires Caroline, the researcher, to visit you at home – please let us have a suitable contact telephone number on the consent form, so that we can arrange the visit on a day and time that are convenient for you.

In all cases, we would like you to fill the Consent Form, also enclosed in the pack.

Have a look at the flowchart at the end of this leaflet - it will help you understand these stages and decide whether to be involved in some or all of the stages of the study.

<table>
<thead>
<tr>
<th>What kind of information will be collected about me in the questionnaire?</th>
</tr>
</thead>
</table>
| In the questionnaire we ask you about:
  - your attitudes and routines regarding food
  - some basic information about you such as your occupation, education and who else lives with you

You answer the questions by either ticking or circling different options, with only a few questions asking you to actually write something.

<table>
<thead>
<tr>
<th>What will happen when you visit my home?</th>
</tr>
</thead>
</table>
| Remember, you can take part by just completing a questionnaire.

If you have agreed to allow the researcher to visit you at home, she will want to look at your kitchen.

During the visit the researcher will want to test some of the kitchen surfaces, so that they can be analysed in a scientific laboratory. The results will remain confidential.

If we do visit your home, we will compensate you for your time with a gift voucher for a major food retailer.

<table>
<thead>
<tr>
<th>How will the information collected be kept confidential?</th>
</tr>
</thead>
</table>
| The law called the Data Protection Act (1998) tells us how to keep your information secure.
We will store your information on a secure and password protected database. All information will be encrypted. Only members of the research team and those responsible for overseeing the study will have access to your information. We will not give your details to anyone else.

When we publish the results of the study we will group together all the information that we have collected from everyone taking part in the study and your name will be kept anonymous.

### What are the benefits in taking part in this study?

This study will help understand better people’s attitudes and habits towards food and food poisoning. This will aid researchers and public health organisations shape food safety guidelines in the future.

### Are there any risks in taking part in this study?

No. There are no risks in taking part in this study.

### Do you have any friends that may be interested in taking part?

We are also interested in talking to people who have not had Food poisoning.

### Do you know anyone that might wish to take part in the study?

If so, you could always give them a postcard. On the postcard is all the information that they need to register their interest in the study – they can do this by completing and sending the postcard back, going to the internet at [http://tinyurl.com/uomfood](http://tinyurl.com/uomfood) or contacting the researcher by email or telephone. You can show your friend(s) this leaflet but please keep hold of it, as we will send them their own copy.

### After the study starts, can I change my mind?

Yes. You can change your mind and leave the Study at any time. If you do leave, the information you have given up to that time will still be helpful.

### What if I have a problem?

If you have a concern about any aspect of this study, you should ask to speak to the researchers who will do their best to answer your questions. If they are unable to resolve your concern or you wish to make a complaint regarding the study, please contact a University Research Practice and
Governance Co-ordinator on 0161 2757583 or 0161 2758093 or by email to research-governance@manchester.ac.uk.

You can also do this through the NHS Complaints Procedure.

### What happens when the study finishes?

The results will be published as a report, feature in published articles and will also be presented at conferences. Neither your name nor any information that can identify you will ever appear in any reports or articles.

We are happy to send you a summary of the study’s results – just tick the box on the Consent Form if you would like us to do so. The results summary will be available after May 2011.

### Who has checked the study?

Before a study like this goes ahead it has to be checked by an NHS Ethics Committee. The North West NHS Research Ethics Committee has approved this study. Ref. 10/H1010/44.

### What if I have a question? Contact details

If you have a question or are not sure about any aspect of this study you can speak to Caroline, the main researcher who will try to answer your questions:

Caroline Millman Tel. 07505 957506 (she will phone you back to save your phone bill)
or email: caroline.millman@postgrad.manchester.ac.uk

You are also welcome to contact her supervisor at the University of Manchester:
Dr Dan Rigby, dan.rigby@manchester.ac.uk

### Getting involved in research

You can find out more about participating in NHS research from INVOLVE which supports public involvement in NHS research.

You can find out more at their website. [http://www.invo.org.uk/](http://www.invo.org.uk/) or by contacting them on 02380 651088 or at admin@invo.org.uk
This flowchart helps explain how to take part in our study:

You are invited to take part in the study

After reading the information sheet – Are you interested in taking part?

Yes

Are you happy to be involved in additional parts of the study other than the initial questionnaire?

Yes

Option 1. Complete a repeat questionnaire in 6 months time

Option 2. Have the researcher visit you at home soon

Option 3. Have the researcher visit you at home soon and in 6 months time, as well as completing a repeat questionnaire in 6 months time

No

No. Thank you for taking the time to read this information.

No

Home visit

We will be in touch in 6 months time

Ensure that the consent form is completed.

Complete the questionnaire.

Return the questionnaire and consent form in the reply paid envelope provided.

Do you have any friends that would be interested in taking part in the study? If so, do not forget to complete the postcards or give the cards to them to complete.
8.6 Questionnaire for case control study – Control questionnaire

Date posted to participant

Participant number

YOU AND YOUR FOOD

You will have received a letter, in the same envelope as this questionnaire, which explains why you have been approached to take part in this study. Please do read that letter first.

We hope you will be willing to take part in our study and complete this questionnaire. If so, please read each question carefully and try to complete all of the sections.

When you have completed the questionnaire, please return it with the consent form that you should complete and sign. Post it to us using the envelope provided – no stamp is required.

If you prefer to complete the questionnaire online, you can do so at:

http://tinyurl.com/uomfood

You will need to enter your participant number (shown at top of this page).

If you are not sure about any aspect of this questionnaire or have a question for us please contact Caroline, the main researcher, who will be able to help you:

- Telephone 07505 957506
- Or email caroline.millman@postgrad.manchester.ac.uk

This information will be entered onto a computerised system and is covered by the Data Protection Act (1998). You have been assigned a unique participant number. This participant number will be used in the study instead of anything that can be identified to you. Your personal details will not be given to anyone else – your name will be kept anonymous.
Some of the questions we would like you to answer are about your opinions and some about what you do in your home. These different sorts of questions are grouped together in boxes. Let’s begin by thinking about food poisoning…..

### FOOD RELATED ILLNESS

We would like to ask you some questions about food poisoning.

1. Have you ever had a food related illness?
   - [ ] Yes
   - [ ] No

   If “Yes”, did you go to your doctor with the illness described?
   - [ ] Yes
   - [ ] No

   If you answered, “Yes”, did the doctor confirm it was food poisoning by carrying out any tests?
   - [ ] Yes
   - [ ] No
   - [ ] Not sure

   If you have answered yes and have had food poisoning confirmed by the doctor in the last 5 years, unfortunately we are unable to accept your questionnaire at this time.

### CONTACT WITH ANIMALS

Some illnesses that people often associate with food can also be caused by contact with animals. So we would like to ask you some questions about any animals that you have, or may have been in contact with.

2. Do you have any pets?
   - [ ] Yes
   - [ ] No

   If YES what type of pet(s) and how many do you have?
   [e.g 2 dogs, 3 parrots, 1 lizard, 1 goldfish etc]

   ……………………………………………………………………………………………………………………………………………………………

3. Do you live on a farm or small holding?
   - [ ] Yes
   - [ ] No

4. Have you visited any farms, stables, zoos, petting corners etc in the last 7 days?
   - [ ] Yes
   - [ ] No
EATING OUT/TAKE AWAYS

We would like to know a bit more about where you tend to eat when you go out.

5. In the last 7 days, did you eat any meals out at a social function?
   ☐ Yes  ☐ No
   
   a. What sort of function was it? (e.g. wedding reception, birthday/anniversary or dinner party, conference dinner)

   …………………………………………………………………………………………………………………………………………………………………………………

   …………………………………………………………………………………………………………………………………………………………………………………

   b. Where was the function? (e.g. private house, restaurant, hotel, sports club)

   …………………………………………………………………………………………………………………………………………………………………………………

   …………………………………………………………………………………………………………………………………………………………………………………

6. In the last 7 days, have you eaten any food (including take-aways and delivered foods) from, or in, any of the following? (Please tick all that apply.)

   ☐ Coffee shop or Café  ☐ Restaurant
   ☐ Takeaway e.g. Burger, Kebab  ☐ Hotel
   ☐ Sandwich shop  ☐ Pub
   ☐ Work canteen  ☐ Mobile caterer
   ☐ Airport or Railway station/train  ☐ Petrol station or Motorway service
   ☐ Other

RESPONSIBILITY FOR FOOD PREPARATION

Who is the boss in the kitchen?

7. Are you the main person in the house responsible for shopping and food preparation?
   ☐ Yes  ☐ Shared pretty much equally  ☐ No

   If you answered “No”, it would be useful to complete the rest of the questionnaire with the person who does most of the food shopping and cooking in the household – we will call them the house chef!
### YOU AND YOUR KITCHEN

Thinking about what you or the ‘house chef’ get up to in the kitchen...

8. Please answer the following questions, by circling the number which best indicates your response on the scale of 1 to 5

*Some questions have a * by them - Do not answer them if you do not buy or cook meat.

<table>
<thead>
<tr>
<th>Question</th>
<th>Never</th>
<th>Sometimes</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>*I use different chopping boards for the preparation of raw meat and nothing else.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I smell leftover food to decide if it is still okay to use.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I would eat eggs even if the egg yolk was still very runny.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>*I would eat cooked meat a day after its “use by” date.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I use the drying up cloth (or tea-towel) to dry my hands.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I defrost foods in the fridge rather than on the worksurface/worktop.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>*I wash chicken (whole bird, joints or pieces of) under the tap before cooking.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I follow manufacturers’ cooking instructions on food packaging.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I clean the work surface after food preparation using an antibacterial spray.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>*I would eat a beef burger that was cooked to ‘medium’ (slightly pink in the middle).</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I wash salad leaves that are sold in a bag before eating them.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I leave hot foods out of the fridge to cool overnight.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

### FRIDGE TEMPERATURES

Thinking about your refrigerator....

9. Do you check the temperature of your fridge?

- [ ] No, never  
- [ ] Yes, occasionally  
- [ ] Yes, pretty regularly

If “yes”, can you tell me what the temperature of the fridge is now?  

Do you know roughly what temperature it should be?
FOOD AND LIFESTYLE

A few questions to get you (or the house chef) thinking about food and the stresses of life. Please try to honest – we are very interested in what really happens rather than what you might like to happen.

10. Please answer the questions in the following four tables by circling the number which best indicates your response on the scale of 1 to 7. Some questions have a * by them - Do not answer them if you live alone or shop and cook just for yourself.

<table>
<thead>
<tr>
<th></th>
<th>Completely disagree</th>
<th>Neither disagree nor agree</th>
<th>Completely agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I choose easy, quick-to-prepare food for weekday evening meals</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I enjoy preparing meals from scratch</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I like to try out new recipes</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I prefer fresh products to canned or frozen products</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Shopping for food does not interest me at all</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Completely disagree</th>
<th>Neither disagree nor agree</th>
<th>Completely agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am often rushing to get everything done</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>*Certain members of my family are choosy/picky in what they eat</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I compare prices between product variants (i.e. various brands of same product) in order to get the best value for money</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Before I go shopping for food I make a list of everything I need</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I find that I often have to throw away ingredients when cooking a meal from scratch</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
### Perceptions and Risks: Food-borne Pathogens in the Domestic Environment

#### Table 1: Perceptions of Food Safety Practices

<table>
<thead>
<tr>
<th>Statement</th>
<th>Completely disagree</th>
<th>Neither disagree</th>
<th>Completely agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I compare product information labels to decide which brand to buy</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I enjoy going to restaurants with my family and friends</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>My family helps with other mealtime chores, such as setting the table and doing the dishes</em></td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Nowadays the responsibility for shopping and cooking ought to lie just as much with the husband as with the wife</em></td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recently I have been unable to control the important things in my life</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Statement</th>
<th>Completely disagree</th>
<th>Neither disagree</th>
<th>Completely agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I regularly use the microwave to cook my evening meal during the week</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I always plan what we are going to eat a couple of days in advance</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>It is difficult for us to have a family meal together</em></td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I eat whenever I feel the slightest bit hungry</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I don’t usually prepare a proper meal when there’s just me</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
DIETARY REQUIREMENTS

Some people follow specific diets....

11. Do you or others in your household have any special dietary requirements?
☐ Yes    ☐ No
If so, what are they? Please tick all that apply.
☐ Vegetarian    ☐ Wheat free
☐ Vegan    ☐ Low cholesterol diet
☐ Fruitarian    ☐ Dairy free diets
☐ Diabetic    ☐ Gluten free diet
☐ Peanut/Nut allergy    ☐ Lactose intolerance
☐ Shellfish/fish allergy    ☐ Low fat diet
☐ Other (please specify)

FOOD SAFETY

We would like you to think now about the risk of getting food poisoning...

12. Please answer the following food questions, by circling the number which best indicates your response on the scale of 1 to 7

<table>
<thead>
<tr>
<th></th>
<th>None at all</th>
<th>A moderate amount</th>
<th>A great deal</th>
</tr>
</thead>
<tbody>
<tr>
<td>How much risk do you think there is to you personally from getting food poisoning in your own home?</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How much risk do you think there is to the average person from getting food poisoning in their own home?</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How much control do you think you personally have over getting food poisoning in the home?</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How much control do you think the average person has over getting food poisoning in the home?</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How much knowledge do you think you personally have about the risk of getting food poisoning in the home?</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How much knowledge do you think the average person has over the risk of getting food poisoning in the home?</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## FOOD EDUCATION

**Please try to remember any formal food education or training....**

13. When and where did you learn anything about cooking or food safety? If this was at school/college it might have been called ‘domestic science’, ‘home economics’ or ‘food technology’. *Please tick all options that apply.*

<table>
<thead>
<tr>
<th>Prior to age 14</th>
<th>School</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 14 – 16</td>
<td>At Catering college</td>
</tr>
<tr>
<td>Age 16 – 18</td>
<td>Job related training</td>
</tr>
<tr>
<td>Age 18+</td>
<td>Other – please specify</td>
</tr>
</tbody>
</table>

☐ Was not taught anything about food at school, college or work
FOOD POISONING RISKS

We would like you to now think about some of the ways in which people might become ill with food poisoning...

14. There are many different practices or behaviours that can create a risk of getting ill. On the pages that follow we will show you groups of 4 such behaviours. In each case we would like you to indicate:

(i) the behaviour you think would be **most likely** to make someone ill with food poisoning
(ii) the behaviour you think would be **least likely** to make someone ill with food poisoning

**Don’t think about how often** someone (or you) is likely to do any of the things shown. Just think about, if someone did all these things once, which of them would pose the greatest chance of getting ill, and which would pose the lowest chance of getting ill.

An example is shown below:

<table>
<thead>
<tr>
<th>Most Likely to make someone ill</th>
<th>Least Likely to make someone ill</th>
</tr>
</thead>
<tbody>
<tr>
<td>[   ] Behaviour 1</td>
<td>[   ] Behaviour 1</td>
</tr>
<tr>
<td>[   ] Behaviour 2</td>
<td>[   ] Behaviour 2</td>
</tr>
<tr>
<td>[   ] Behaviour 3</td>
<td>[   ] Behaviour 3</td>
</tr>
<tr>
<td>[   ] Behaviour 4</td>
<td>[   ] Behaviour 4</td>
</tr>
</tbody>
</table>

Tick the box next to the behaviour you think is **most likely** to make someone ill

Tick the box next to the behaviour you think is **least likely** to make someone ill

The sets that follow are a bit repetitive, but please do complete them. Don’t think about them too long, just give your first thoughts – we are just interested in your opinions.

**Note:** The following subsets are one example from the 10 versions of the BWS experimental design
<table>
<thead>
<tr>
<th>Most Likely to make someone ill</th>
<th>Least Likely to make someone ill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not washing your hands before preparing food.</td>
<td>🅺</td>
</tr>
<tr>
<td>Eating chicken from a BBQ that has not been pre-cooked</td>
<td>🅺</td>
</tr>
<tr>
<td>Eating a dessert that contains uncooked/unpasteurised egg such as a tiramisu or chocolate mousse.</td>
<td>🅺</td>
</tr>
<tr>
<td>Eating reheated (until piping hot) leftover rice after leaving it out of the fridge to cool overnight.</td>
<td>🅺</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Most Likely to make someone ill</th>
<th>Least Likely to make someone ill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storing raw/uncooked pork (on a plate) on the shelf above cooked ham in the refrigerator.</td>
<td>🅺</td>
</tr>
<tr>
<td>Not washing your hands before preparing food.</td>
<td>🅺</td>
</tr>
<tr>
<td>Using the washing up cloth to mop up a spillage (such as milk) on the floor.</td>
<td>🅺</td>
</tr>
<tr>
<td>Eating a beefburger that is pink in the middle.</td>
<td>🅺</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Most Likely to make someone ill</th>
<th>Least Likely to make someone ill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not using antibacterial spray on surfaces after the preparation of raw/uncooked turkey</td>
<td>🅺</td>
</tr>
<tr>
<td>Eating a beefburger that is pink in the middle.</td>
<td>🅺</td>
</tr>
<tr>
<td>Eating chicken that is not cooked through properly.</td>
<td>🅺</td>
</tr>
<tr>
<td>Cooking raw/uncooked frozen chicken. i.e. not defrosted before cooking.</td>
<td>🅺</td>
</tr>
<tr>
<td>Most Likely to make someone ill</td>
<td>Least Likely to make someone ill</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>Eating chicken that is not cooked through properly.</td>
<td></td>
</tr>
<tr>
<td>Chilled foods not being put away in the refrigerator for 4 hours after finishing the shopping.</td>
<td></td>
</tr>
<tr>
<td>Eating chicken from a BBQ that has not been pre-cooked.</td>
<td></td>
</tr>
<tr>
<td>Using the same knife for chopping up salad after cutting raw/uncooked chicken.</td>
<td></td>
</tr>
<tr>
<td>Eating a dessert that contains uncooked/unpasteurised egg such as a tiramisu or chocolate mousse.</td>
<td></td>
</tr>
<tr>
<td>Washing a chicken or turkey under the tap before cooking.</td>
<td></td>
</tr>
<tr>
<td>Not using antibacterial spray on surfaces after the preparation of raw/uncooked turkey.</td>
<td></td>
</tr>
<tr>
<td>Pets walking on the kitchen worktops/work surfaces.</td>
<td></td>
</tr>
<tr>
<td>Pets walking on the kitchen worktops/work surfaces.</td>
<td></td>
</tr>
<tr>
<td>Storing raw/uncooked pork (on a plate) on the shelf above cooked ham in the refrigerator.</td>
<td></td>
</tr>
<tr>
<td>Chilled foods not being put away in the refrigerator for 4 hours after finishing the shopping.</td>
<td></td>
</tr>
<tr>
<td>Leaving meat or fish from the freezer to defrost at room temperature.</td>
<td></td>
</tr>
</tbody>
</table>
### Most Likely to make someone ill

<table>
<thead>
<tr>
<th></th>
<th>Eating reheated (until piping hot) leftover rice after leaving it out of the fridge to cool overnight.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cooking raw/uncooked frozen chicken. i.e. not defrosted before cooking.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Leaving meat or fish from the freezer to defrost at room temperature.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Eating cooked mussels in a restaurant.</td>
<td></td>
</tr>
</tbody>
</table>

### Least Likely to make someone ill

<table>
<thead>
<tr>
<th></th>
<th>Washing a chicken or turkey under the tap before cooking.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Using the same knife for chopping up salad after cutting raw/uncooked chicken.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Eating cooked mussels in a restaurant.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Using the washing up cloth to mop up a spillage (such as milk) on the floor.</td>
<td></td>
</tr>
</tbody>
</table>
## ABOUT YOU

Finally, there are some questions about you and your household to complete.

15. What is your gender?

- [ ] Male
- [ ] Female

16. What is your year of birth?

[ ]

17. How many adults aged 16 or older live in your household, including yourself?

[ ]

18. Are there any children under the age of 16 living in the household?

- [ ] Yes
- [ ] No

If yes…

How many in each of the following age groups?

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 4 years of age</td>
<td></td>
</tr>
<tr>
<td>5 – 9 years of age</td>
<td></td>
</tr>
<tr>
<td>10 – 15 years of age</td>
<td></td>
</tr>
</tbody>
</table>

19. Which of these ethnic groups do you consider yourself to belong to?

- [ ] White - British
- [ ] White - Irish
- [ ] Other White
- [ ] Mixed - White & Black Caribbean
- [ ] Mixed - White & Black African
- [ ] Mixed - White & Asian
- [ ] Other Mixed
- [ ] Asian or Asian British - Indian
- [ ] Asian or Asian British - Pakistani
- [ ] Asian or Asian British - Bangladeshi
- [ ] Other Asian
- [ ] Black or Black British - Caribbean
- [ ] Black or Black British - African
- [ ] Other Black
- [ ] Chinese
- [ ] Other ethnic group
### ABOUT YOU (continued)

20. Which of these qualifications do you have? Tick all that apply or, if not specified, the nearest equivalent.

- [ ] No Qualifications
- [ ] O levels/CSEs/GCSEs (any grades)
- [ ] A levels/AS levels
  - Higher School Certificate
- [ ] First Degree (eg BA, BSc)
- [ ] No professional qualifications
- [ ] Qualified Teacher Status (for schools)
- [ ] Qualified Medical Doctor
- [ ] GNVQ
- [ ] HNC, HND
- [ ] Other qualifications (eg City and Guilds RSA/OCR, BTEC/Edexcel)
- [ ] Higher Degree (eg MA, PhD, PGCE, post-graduate certificates/diplomas)

21. Do you have any of the following professional qualifications?

- [ ] No professional qualifications
- [ ] Qualified Teacher Status (for schools)
- [ ] Qualified Dentist
- [ ] Qualified Nurse, Midwife, Health Visitor
- [ ] Other Professional Qualifications

### ABOUT YOU AND YOUR WORK

22. Last week, were you doing any work:
- [ ] as an employee, or on a Government sponsored training scheme?
- [ ] as a self-employed/freelance, or in your own/family business?

- [ ] Yes If ‘Yes’ go to question 24
- [ ] No If ‘No’ go to question 23

23. Last week were you any of the following?
- [ ] Retired
- [ ] Student
- [ ] Looking after home/family
- [ ] Permanently sick/disabled
- [ ] None of the above

Answer questions 24 – 26 for the main job that you were doing last week, or if not working last week, your last main job.

24. Do (did) you work as an employee or are (were) you self-employed?

- [ ] Employee
- [ ] Self-employed with employees
- [ ] Self-employed/freelance without employees

25. How many people work (worked) at the place where you work (worked)?

- [ ] 1 – 9
- [ ] 10 - 24
- [ ] 25 – 499
- [ ] 500 or more

26. What is (was) the full title of your main job?

………………………………………………………………………………………….
INCOME

27. Which of these bands comes closest to the net income of the main income earner in your household – that is after deducting income tax, national insurance and contributions to pension schemes? (Tick the band that applies)

<table>
<thead>
<tr>
<th>Weekly</th>
<th>Monthly</th>
<th>Yearly</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Up to £74</td>
<td>Up to £299</td>
<td>Up to £3,499</td>
</tr>
<tr>
<td>2 £75 - £99</td>
<td>£300 - £399</td>
<td>£3,500 - £4,999</td>
</tr>
<tr>
<td>3 £100 - £249</td>
<td>£400 - £999</td>
<td>£5,000 - £11,999</td>
</tr>
<tr>
<td>4 £250 - £399</td>
<td>£1000 - £1,699</td>
<td>£12,000 - £19,999</td>
</tr>
<tr>
<td>5 £400 - £619</td>
<td>£1,700 - £2,499</td>
<td>£20,000 - £29,999</td>
</tr>
<tr>
<td>6 £620 - £999</td>
<td>£2,500 - £4,199</td>
<td>£30,000 - £49,999</td>
</tr>
<tr>
<td>7 £1,000 - £1,499</td>
<td>£4,200 - £5,799</td>
<td>£50,000 - £69,999</td>
</tr>
<tr>
<td>8 £1,500+</td>
<td>£5,800+</td>
<td>£70,000+</td>
</tr>
</tbody>
</table>

COMMENTS

28. Please note down in this box any further comments that you have regarding this survey or anything else that you think will be useful to our research.

Thank you for completing the questionnaire.

Please check that you have filled in all of the sections and return it as soon as possible using the envelope provided – you do not need to put a stamp on this.
8.7 Questionnaire for case control study – Case questionnaire after six months

Date posted to participant

Participant number

YOU AND YOUR FOOD

Thank you for taking the time to complete this questionnaire.

Please read each question carefully and try to complete all of the sections.

When you have completed the questionnaire, please return it to us using the envelope provided – no stamp is required.

If you prefer to complete the questionnaire online, you can do so at:

http://tinyurl.com/foodill-6

You will need to enter your participant number (shown at top of this page).

If you are not sure about any aspect of this questionnaire or have a question for us please contact Caroline, the main researcher, who will be able to help you:

- Telephone 07505 957506
- Or email caroline.millman@postgrad.manchester.ac.uk

This information will be entered onto a computerised system and is covered by the Data Protection Act (1998). You have been assigned a unique participant number. This participant number will be used in the study instead of anything that can be identified to you. Your personal details will not be given to anyone else – your name will be kept anonymous.
Some of the questions we would like you to answer are about your opinions and some about what you do in your home. These different sorts of questions are grouped together in boxes. Let’s begin by thinking about food poisoning again…..

### YOUR ILLNESS

We would like to ask you some questions about food poisoning.

1. Since the last questionnaire and your incident of food poisoning, have you had another food related illness?
   - [ ] Yes
   - [x] No

   If “Yes” did you go to your doctor with the illness?
   - [ ] Yes
   - [ ] No

   If “Yes” did your illness, described, prevent you going about your normal daily activities, like going to work, or looking after your family?
   - [ ] Yes
   - [ ] No
   - [ ] Not sure

### EATING OUT/TAKE AWAYS

We would again, like to know a bit more about where you tend to eat when you go out.

2. In the last 7 days, did you eat any meals out at a social function?
   - [ ] Yes
   - [ ] No

   a. What sort of function was it? (e.g. wedding reception, birthday/anniversary or dinner party, conference dinner)

3. In the last 7 days, have you eaten any food (including take-aways and delivered foods) from, or in, any of the following?
   (Please tick all that apply.)

   - [ ] Coffee shop or Café
   - [x] Restaurant
   - [x] Takeaway e.g. Burger, Kebab
   - [ ] Hotel
   - [ ] Sandwich shop
   - [ ] Pub
   - [ ] Work canteen
   - [ ] Mobile caterer
   - [ ] Airport or Railway station/train
   - [ ] Petrol station or Motorway service
   - [ ] Other

---

Perceptions and Risks: Food-borne Pathogens in the Domestic Environment
RESPONSIBILITY FOR FOOD PREPARATION

Has the responsibility for food preparation changed in the last 6 months?

4. Are you the main person in the house responsible for shopping and food preparation?

☐ Yes
☐ Shared pretty much equally
☐ No

If you answered “No”, it would be useful to complete the rest of the questionnaire with the person who does most of the food shopping and cooking in the household – we will call them the **house chef**!

COOKING WITH MEAT

We would like to ask you some questions about how often you (or the house chef) buy, cook and eat meat?

5. Please answer the following questions by circling the number which best indicates your response. *Do not answer the following questions if you do not buy or cook meat.*

<table>
<thead>
<tr>
<th>How frequently do you…..</th>
<th>Never</th>
<th>Sometimes – e.g. every month</th>
<th>Very regularly – e.g. at least weekly</th>
</tr>
</thead>
<tbody>
<tr>
<td>…eat meat?</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>…buy meat from the butcher or butchers counter in the supermarket?</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>…buy meat ready packaged in the supermarket?</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>…cut or butcher meat before cooking?</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>…marinate or soak meat?</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>… cook the giblets or make a stock with the bones?</td>
<td>1</td>
<td>2</td>
<td>3</td>
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YOU AND YOUR KITCHEN

Thinking about what you or the 'house chef' get up to in the kitchen... Have you changed what you do?

6. Please answer the following questions, by circling the number which best indicates your response on the scale of 1 to 5.

Some questions have a * by them - Do not answer them if you do not buy or cook meat.

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### SINCE YOUR ILLNESS

7. Since your illness, **in the last six months**, have you changed anything in relation to food purchase, hygiene, storage or preparation?

---

### DIETARY REQUIREMENTS

Some people follow specific diets.... Has anything changed in the last 6 months?

8. Do you or others in your household have any special dietary requirements?

- [ ] Yes
- [ ] No

If so, what are they? Please tick all that apply.

- [ ] Vegetarian
- [ ] Vegan
- [ ] Fruitarian
- [ ] Diabetic
- [ ] Peanut/Nut allergy
- [ ] Shellfish/fish allergy
- [ ] Other (please specify)

- [ ] Wheat free
- [ ] Low cholesterol diet
- [ ] Dairy free diets
- [ ] Gluten free diet
- [ ] Lactose intolerance
- [ ] Low fat diet
**FOOD SAFETY**

**We would like you to think now about the risk of food poisoning...**

9. Please answer the following food questions, by circling the number which best indicates your response on the scale of 1 to 7

<table>
<thead>
<tr>
<th>Question</th>
<th>None at all</th>
<th>A moderate</th>
<th>A great deal</th>
</tr>
</thead>
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### ABOUT YOU

Finally, there are some questions about you and your household to complete, to make sure your circumstances have not changed.

10. How many adults aged 16 or older live in your household, including yourself? □

11. Are there any children under the age of 16 living in the household?

□ Yes □ No

If yes…

How many in each of the following age groups?

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 4 years of age</td>
<td></td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>10 – 15 years of age</td>
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</table>

### ABOUT YOU AND YOUR WORK

12. Last week, were you doing any work:
   - as an employee, or on a Government sponsored training scheme,
   - as a self-employed/freelance, or in your own/family business?

□ Yes If ‘Yes’ go to question 14
□ No   If ‘No’ go to question 13

13. Last week were you any of the following?

□ Retired
□ Student
□ Looking after home/family
□ Permanently sick/disabled
□ Looking for work
□ None of the above

*Answer questions 14 – 16 for the main job that you were doing last week, or if not working last week, your last main job.*

14. Do (did) you work as an employee or are (were) you self-employed?

□ Employee
□ Self-employed with employees
□ Self-employed/freelance without employees

15. How many people work (worked) at the place where you work (worked)?

□ 1 – 9 □ 10 - 24
□ 25 – 499 □ 500 or more

16. What is (was) the full title of your main job?

...........................................................................................................................................
INCOME

17. Which of these bands comes closest to the net income of the main income earner in your household – that is after deducting income tax, national insurance and contributions to pension schemes?
(Tick the band that applies)

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<th>Monthly</th>
<th>Yearly</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Up to £74</td>
<td>Up to £299</td>
<td>Up to £3,499</td>
</tr>
<tr>
<td>2</td>
<td>£75 - £99</td>
<td>£300 - £399</td>
<td>£3,500 - £4,999</td>
</tr>
<tr>
<td>3</td>
<td>£100 - £249</td>
<td>£400 - £999</td>
<td>£5,000 - £11,999</td>
</tr>
<tr>
<td>4</td>
<td>£250 - £399</td>
<td>£1000 - £1,699</td>
<td>£12,000 - £19,999</td>
</tr>
<tr>
<td>5</td>
<td>£400 - £619</td>
<td>£1,700 - £2,499</td>
<td>£20,000 - £29,999</td>
</tr>
<tr>
<td>6</td>
<td>£620 - £999</td>
<td>£2,500 - £4,199</td>
<td>£30,000 - £49,999</td>
</tr>
<tr>
<td>7</td>
<td>£1,000 - £1,499</td>
<td>£4,200 - £5,799</td>
<td>£50,000 - £69,999</td>
</tr>
<tr>
<td>8</td>
<td>£1,500+</td>
<td>£5,800+</td>
<td>£70,000+</td>
</tr>
</tbody>
</table>

COMMENTS

18. Please note down in this box any further comments that you have regarding this survey or anything else that you think will be useful to our research.

Thank you for completing the questionnaire.

Please check that you have filled in all of the sections and return it as soon as possible using the envelope provided – you do not need to put a stamp on this.
8.8 Questionnaire for case control study – Control questionnaire after six months

Thank you for taking the time to complete this questionnaire.

Please read each question carefully and try to complete all of the sections.

When you have completed the questionnaire, please return it to us using the envelope provided – no stamp is required.

If you prefer to complete the questionnaire online, you can do so at:

http://tinyurl.com/uomfood-6

You will need to enter your participant number (shown at top of this page).

If you are not sure about any aspect of this questionnaire or have a question for us please contact Caroline, the main researcher, who will be able to help you:

- Telephone 07505 957506
- Or email caroline.millman@postgrad.manchester.ac.uk

This information will be entered onto a computerised system and is covered by the Data Protection Act (1998). You have been assigned a unique participant number. This participant number will be used in the study instead of anything that can be identified to you. Your personal details will not be given to anyone else – your name will be kept anonymous.
As with the previous questionnaire some of the questions we would like you to answer are about your opinions and some about what you do in your home. These different sorts of questions are grouped together in boxes. Let’s begin by thinking about food poisoning again…..

### FOOD RELATED ILLNESS

We would like to ask you some questions about food poisoning.

1. Since the last questionnaire, have you had a food related illness?
   - [ ] Yes  
   - [ ] No  
   If “Yes” did you go to your doctor with the illness?
     - [ ] Yes  
     - [ ] No  
   If “Yes” did your illness, described, prevent you going about your normal daily activities, like going to work, or looking after your family?
     - [ ] Yes  
     - [ ] No  
     - [ ] Not sure

### EATING OUT/TAKE AWAYS

We would again, like to know a bit more about where you tend to eat when you go out.

2. In the last 7 days, did you eat any meals out at a social function?
   - [ ] Yes  
   - [ ] No  
   a. What sort of function was it? (e.g. wedding reception, birthday/anniversary or dinner party, conference dinner)
   
   ..............................
   ..............................
   b. Where was the function? (e.g. private house, hotel, sports club)
   
   ..............................
   ..............................

3. In the last 7 days, have you eaten any food (including take-aways and delivered foods) from, or in, any of the following?
   (Please tick all that apply.)
   - [ ] Coffee shop or Café
   - [ ] Takeaway e.g. Burger, Kebab
   - [ ] Sandwich shop
   - [ ] Work canteen
   - [ ] Airport or Railway station/train
   - [ ] Other
   - [ ] Restaurant
   - [ ] Hotel
   - [ ] Pub
   - [ ] Mobile caterer
   - [ ] Petrol station or Motorway service
RESPONSIBILITY FOR FOOD PREPARATION

Has the responsibility for food preparation changed in the last 6 months?

4. Are you the main person in the house responsible for shopping and food preparation?

☐ Yes
☐ Shared pretty much equally
☐ No

If you answered “No”, it would be useful to complete the rest of the questionnaire with the person who does most of the food shopping and cooking in the household – we will call them the house chef!

COOKING WITH MEAT

We would like to ask you some questions about how often you (or the house chef) buy, cook and eat meat?

5. Please answer the following questions by circling the number which best indicates your response.

Do not answer the following questions if you do not buy or cook meat.

<table>
<thead>
<tr>
<th>How frequently do you…..</th>
<th>Never</th>
<th>Sometimes – e.g. every month</th>
<th>Very regularly – e.g. At least weekly</th>
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<tr>
<td>…eat meat?</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>…buy meat from the butcher or butchers counter in the supermarket?</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>…buy meat ready packaged in the supermarket?</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>…cut or butcher meat before cooking?</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>…marinate or soak meat?</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<td>… cook the giblets or make a stock with the bones?</td>
<td>1</td>
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Thinking about what you or the ‘house chef’ get up to in the kitchen... Have you changed what you do?

6. Please answer the following questions, by circling the number which best indicates your response on the scale of 1 to 5  
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If so, what are they? Please tick all that apply.

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- ☐ Vegan
- ☐ Fruitarian
- ☐ Diabetic
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- ☐ Shellfish/fish allergy
- ☐ Other (please specify)
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- ☐ Low cholesterol diet
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- ☐ Low fat diet

### FOOD SAFETY

We would like you to think now about the risk of food poisoning...

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**ABOUT YOU**

Finally, there are some questions about you and your household to complete, to make sure your circumstances have not changed.

9. How many adults aged 16 or older live in your household, including yourself?  

10. Are there any children under the age of 16 living in the household?  
   - [ ] Yes  
   - [ ] No  
   
   If yes…  
   How many in each of the following age groups?  
   
   0 – 4 years of age  
   5 – 9 years of age  
   10 – 15 years of age

**ABOUT YOU AND YOUR WORK**

11. Last week, were you doing any work:  
   - [ ] as an employee, or on a Government sponsored training scheme,  
   - [ ] as a self-employed/freelance, or in your own/family business?  
   
   - [ ] Yes If ‘Yes’ go to question 13  
   - [ ] No   If ‘No’ go to question 12  

12. Last week were you any of the following?  
   - [ ] Retired  
   - [ ] Student  
   - [ ] Looking after home/family  
   - [ ] Permanently sick/disabled  
   - [ ] None of the above

   Answer questions 13 – 15 for the main job that you were doing last week, or if not working last week, your last main job.

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   - [ ] 10 – 24  
   - [ ] 25 – 499  
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15. What is (was) the full title of your main job?  

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16. Which of these bands comes closest to the net income of the main income earner in your household – that is after deducting income tax, national insurance and contributions to pension schemes?
(Tick the band that applies)

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<td>£12,000 - £19,999</td>
</tr>
<tr>
<td>5  £400 - £619</td>
<td>£1,700 - £2,499</td>
<td>£20,000 - £29,999</td>
</tr>
<tr>
<td>6  £620 - £999</td>
<td>£2,500 - £4,199</td>
<td>£30,000 - £49,999</td>
</tr>
<tr>
<td>7  £1,000 - £1,499</td>
<td>£4,200 - £5,799</td>
<td>£50,000 - £69,999</td>
</tr>
<tr>
<td>8  £1,500+</td>
<td>£5,800+</td>
<td>£70,000+</td>
</tr>
</tbody>
</table>

COMMENTS

17. Please note down in this box any further comments that you have regarding this survey or anything else that you think will be useful to our research.

Thank you for completing the questionnaire.

Please check that you have filled in all of the sections and return it as soon as possible using the envelope provided – you do not need to put a stamp on this.
8.9 Case control study - Researcher information for home visits

YOU AND YOUR FOOD – Home Visit Schedule

1. Researcher is to make the “buddy” call before entering the property, so that their whereabouts are known.

2. Introductions are to be made and identification is to be shown.

3. Recap on the study that they have consented to be part of and ensure that the participant is still happy to proceed.

4. General chat about the study and a bit more detail of what it is about.

5. Ask to go to the kitchen and explain how the swabs are to be taken, showing the swab. Explain that the results are not instantly available but it takes a few days in the laboratory.

6. Ask if they have any questions about the process.

7. As the swabbing is taking place, ask........
   a. When was the kitchen was last used for cooking and what was cooked i.e. snack or a full meal?
   b. How do they clean the kitchen surfaces – see equipment (cloths and chemical? used)?
   c. When did they last clean the kitchen work surfaces?
   d. Is a dishwasher used?

   Explain that this may be useful when looking at the results that are received from the laboratory.

8. The following observations are to be made when conducting the swabbing – to again inform the results.
   a. Visual cleanliness of the swabbed surfaces (Scale of 0 – 5)
   b. Type of chopping board (e.g. wood, glass, melamine)
   c. Fridge temperature (if a thermometer is in use)
   d. Assessment of fridge contents (arrangement of contents, fullness)

9. The type of washing up cloth/brush is to be looked at and a decision made as to whether to ask for it in return for a new one. For example if it will not be possible to process it in the laboratory or it is clearly new from the packet, an exchange will not be made. If a swap is required, ensure that a suitable new cloth is supplied and the participant is happy with the exchange.

10. Ask if they have any questions about the sampling or the study and conclude the visit including providing the participant with their gift voucher.
11. If questions about food safety are asked, information provided by the Food Standards Agency is to be offered on the second visit – refer to the FSA leaflets (Germwatch, some bugs like it hot, listeria, beat the BBQ bug). No advice on food safety is to be provided.

12. Thank the participant for their time. If it is the first visit, check contact arrangements for future if they have agreed to a second visit in 6 months time.

13. On exit, call “buddy” to re-establish contact.
8.10 ‘Clickin’ Tonight information sheet for participants

Awareness Of Food Safety Risks
Information Sheet

What is the study about?
This study is looking at the awareness of food safety risks in the home.

Who is organising and paying for this study?
This study is being organised by researchers in the School of Social Sciences at the University of Manchester.
The Economic Social Research Council is funding the research.

Why have I been chosen and do I have to take part?
We are inviting you to take part in this study, as someone who we think would be able to provide us with some valuable opinions about food, food preparation and risks of food poisoning.
It is up to you to decide whether or not you want to take part.

What happens next if I agree to take part in this study?
You will need to complete the questionnaire online. This will take no more than 10 minutes.
You can choose at the end of the questionnaire if you want to provide your name and email address – you do not need to.

What kind of information will be collected about me in the questionnaire?
In the questionnaire we ask you:
• some information about you (your occupation, education, etc)
• to identify hazards with regard to food safety and food hygiene in the home

How will the information collected be kept confidential?
The law called the Data Protection Act (1998) tells us how to keep your information secure.
If you have decided to provide your name and email address, it will remain confidential and we will not give your details to anyone else. All of the data will be analysed and published anonymously.
<table>
<thead>
<tr>
<th>What are the benefits in taking part in this study?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unfortunately there is no payment for taking part in this short piece of research. This study will help understand better people's perceptions and awareness towards food and food poisoning. This will aid researchers and public health organisations shape food safety guidelines in the future.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Are there any risks in taking part in this study?</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. There are no risks in taking part in this study.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Do you have any friends that may be interested in taking part?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you know anyone that might wish to take part in the study?</td>
</tr>
<tr>
<td>If so, please forward the invitation email to them.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>After the study starts, can I change my mind?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes. You can change your mind and leave the study at any time – just close down your internet browser to break the link to the questionnaire.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What if I have a problem?</th>
</tr>
</thead>
<tbody>
<tr>
<td>If you have a concern about any aspect of this study, you should ask to speak to the researchers who will do their best to answer your questions. If they are unable to resolve your concern or you wish to make a complaint regarding the study, please contact the Head of the Research Office, Christie Building, University of Manchester, Oxford Road, Manchester, M13 9PL.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What happens when the study finishes?</th>
</tr>
</thead>
<tbody>
<tr>
<td>The results will be published as a report, feature in published articles and will also be presented at conferences. Neither your name nor any information that can identify you will ever appear in any reports or articles.</td>
</tr>
<tr>
<td>We are happy to send you a summary of the study’s results – just select the appropriate option in the questionnaire if you would like us to do so. The results summary will be available after August 2011.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What if I have a question? Contact details</th>
</tr>
</thead>
<tbody>
<tr>
<td>If you have a question or are not sure about any aspect of this study you can speak to Caroline, the main researcher who will try to answer your questions:</td>
</tr>
<tr>
<td>Caroline Millman Tel. 07505 957506 (she will phone you back to save your phone bill)</td>
</tr>
<tr>
<td>or email: <a href="mailto:caroline.millman@postgrad.manchester.ac.uk">caroline.millman@postgrad.manchester.ac.uk</a></td>
</tr>
<tr>
<td>You are also welcome to contact her supervisor at the University of Manchester:</td>
</tr>
<tr>
<td>Dr Dan Rigby, <a href="mailto:dan.rigby@manchester.ac.uk">dan.rigby@manchester.ac.uk</a></td>
</tr>
</tbody>
</table>
8.11 ‘Clickin’ Tonight’ survey, within which the hazard perception challenge is embedded

<table>
<thead>
<tr>
<th>Clickin’ Tonight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thanks for taking the time to complete this food safety video challenge - it should take you no more than 10 minutes. We will be asking you some questions about food safety and you will take part in the food safety video challenge. Finally there are a few questions about you. All of the information you provide will be analysed anonymously.</td>
</tr>
</tbody>
</table>

Before proceeding with this questionnaire, please read the Information Sheet that was supplied with your invitation email. If you do not have it you can download a copy [here](#). If you do not wish to take part in this study please navigate away from this page, or close your web browser at any time.

[Continue]

If you would like to speak to someone about the survey then please contact

Caroline Millman: caroline.millman@postgrad.manchester.ac.uk (tell: 075356-50350)

or her supervisor

Prof. Dan Rigby, in the Economics Department of the University of Manchester: dan.rigby@manchester.ac.uk (tell: 0161-275-4868)

This research has been approved by the University of Manchester Research Ethics Committee (Ref 10225).
**Clickin’ Tonight**

**Food Poisoning**

We would like you to think now about the chance of getting food poisoning.

Please answer the questions below and select the button that best shows your view.

**How much risk do you think there is to you personally from getting food poisoning in your own home?**

| None at all | ☐ | ☐ | ☐ | ☐ | ☐ | A great deal | ☐ | ☐ | ☐ | ☐ | ☐ |

**How much risk do you think there is to the average person from getting food poisoning in their own home?**

| None at all | ☐ | ☐ | ☐ | ☐ | ☐ | A great deal | ☐ | ☐ | ☐ | ☐ | ☐ |

**How much control do you think you personally have over getting food poisoning in the home?**

| None at all | ☐ | ☐ | ☐ | ☐ | ☐ | A great deal | ☐ | ☐ | ☐ | ☐ | ☐ |

**How much control do you think the average person has over getting food poisoning in the home?**

| None at all | ☐ | ☐ | ☐ | ☐ | ☐ | A great deal | ☐ | ☐ | ☐ | ☐ | ☐ |

**How much knowledge do you think you personally have about the risk of getting food poisoning in the home?**

| None at all | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**How much knowledge do you think the average person has over the risk of getting food poisoning in the home?**

| None at all | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
Clickin' Tonight

Food Safety Video Challenge

The following food safety challenge is set in a domestic kitchen in which...

- at the start of the film the surfaces, utensils and clothes are clean and safe to use.
- the food purchased is all within its ‘use by’ date.

During the course of the short film you identify hazards that may cause food poisoning. You do this by clicking the left mouse button in the approximate location of any hazard, as you see it happen.

The film plays all the way through. You click as you see each hazard, so you will need to be quite quick.

If it goes wrong, or you are interrupted, there is a RESET button so you can start again.

Don’t worry if the hazard or object has just left the screen! Click anyway. We’ll know what you mean.

Hint: There is more than one hazard

Are you ready?

Yes, I'm ready
How did you do?

The film showed a number of hazards that may cause food poisoning. The way we store, prepare and cook food can help harmful bacteria (e.g. Salmonella and Campylobacter) to be passed on to people. We call these “hazards”. Some hazards were more difficult to spot than others - the main ones are listed below.

Raw meat and poultry contain harmful bacteria that can spread very easily to surfaces that they touch. The chicken was stored at the top of the fridge where the juices could drip onto the products below that may not be cooked.

Raw meat and poultry contain harmful bacteria that can spread very easily to surfaces that they touch. Hands that are not washed after handling chicken can spread these bacteria.

The film showed Caroline touching many things after handling the raw chicken:

* The radio (when it was turned on)
* Cupboard doors and handles

The chopping board and knife were just wiped down and not washed in soapy water or a dishwasher before being used to cut up salad ingredients. Alternatively, the salad should have been prepared first or entirely separate utensils and board used instead.

The same utensils were used to put the raw chicken into the pan and to remove the cooked chicken from the pan. This means that the harmful bacteria could have contaminated the cooked chicken.

The chilli marinade that the raw chicken had been sitting in was drizzled on to the salad at the end. This contaminated the meal with uncooked (and therefore harmful) bacteria.
Hopefully you spotted some of these hazards. Have you seen some more? If so and you have time to tell us about them, please jot them down below.

If you want to read more food safety advice, visit www.eatwell.gov.uk/keepingfoodsafe
How much control do you think the average person has over getting food poisoning in the home?

- None at all
- A moderate amount
- A great deal

How much knowledge do you think you personally have about the risk of getting food poisoning in the home?

- None at all
- A moderate amount
- A great deal

How much knowledge do you think the average person has over the risk of getting food poisoning in the home?

- None at all
- A moderate amount
- A great deal

---

**Clickin’ Tonight**

Food Related Illness

We would like to ask you some questions about food poisoning.

Have you had food poisoning in the last 5 years?
- Yes
- No

If so, did you go to your doctor when you had food poisoning?
- Yes
- No

---

Perceptions and Risks: Food-borne Pathogens in the Domestic Environment
Clickin' Tonight

Did the doctor confirm it was food poisoning by carrying out any tests?
- Yes
- No
- Not sure

How long ago was this food poisoning?

What did the doctor say the illness was?

Do you know how you got the food poisoning?
- Yes
- No

If yes, can you please provide some brief details of how you think that you got food poisoning?

Continue

Clickin' Tonight

About you

What is your gender?
- Male
- Female

What is your year of birth?

Which of these ethnic groups do you consider yourself to belong to?

Do you have any special dietary requirements? Please select all that apply.
- No special dietary requirements
- Vegetarian
- Vegan
- Fructarian
- Diabetic
- Nut allergy
- Shellfish/fish allergy
- Wheat free
- Dairy free
- Gluten free
- Lactose intolerance

Perceptions and Risks: Food-borne Pathogens in the Domestic Environment
Perceptions and Risks: Food-borne Pathogens in the Domestic Environment

Clickin' Tonight

Your household

How many adults aged 16 or older live in your household, including yourself?
1

Are there any children under the age of 16 living in the household?

Yes  No

Continue

Clickin' Tonight

Children in your household

0-4 years of age
0

5-9 years of age
0

10-15 years of age
0

Continue

Clickin' Tonight

Qualifications

Do you have any of the following qualification levels? Please tick all that apply.

- No Qualifications
- GCSE
- O levels/CSEs/GCSEs (any grades)
- HNC, HND
- A levels/AS levels/Higher School Certificate
- Other qualifications (e.g., City and Guilds, RSA/OCR, BTEC/Edexcel)
- First Degree (e.g., BA, BSc)
- Higher Degree (e.g., MA, PhD, PGCE, post-graduate certificates/diplomas)

Do you have any of the following professional qualifications? Please tick all that apply.

- Qualified Teacher Status (for schools)
- Qualified Medical Doctor
- Qualified Dentist
- Qualified Nurse, Midwife, Health Visitor

Continue
Clickin’ Tonight

Employment status

What do you do? Are you...

Employed

Continue

Clickin’ Tonight

Employment details

What is (was) the full title of your current or last main job?

If you work outside of the UK on a full time basis, please tell us where you work.

Do you have qualifications or experience at work that gives you knowledge of food safety risks? (Please do not be modest)

- No - I regard myself as a typical member of the public
- I have some knowledge regarding food hazards associated with my qualifications or employment

Continue

Clickin’ Tonight

Food Safety Qualifications and Experience

Can you tell us (briefly) the qualifications that you have with regard to food safety?

Can you tell us something about your experience at work that provides you with knowledge of food safety risks?

Continue
# Food poisoning risks information sheet for participants

## YOU AND YOUR FOOD

### Information Sheet

<table>
<thead>
<tr>
<th>What is the study about?</th>
</tr>
</thead>
<tbody>
<tr>
<td>This study is looking at the attitudes that people have to cooking and eating, the routines that they have regarding the food they eat and their views on the risk of food poisoning. We will gather information from members of the general public and food scientists and then will compare their attitudes.</td>
</tr>
</tbody>
</table>

<table>
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<th>Who is organising and paying for this study?</th>
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</thead>
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<th>Why have I been chosen and do I have to take part?</th>
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</thead>
<tbody>
<tr>
<td>We are inviting you to take part in this study, as someone who we think would be able to provide us with some valuable opinions about food, food preparation and risks of food poisoning. <strong>It is up to you to decide</strong> whether or not you want to take part.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What happens next if I agree to take part in this study?</th>
</tr>
</thead>
<tbody>
<tr>
<td>You will need to complete the questionnaire online. This will take no more than 20 minutes. At the start of the questionnaire we would like you to complete some Consent questions, which is done by selecting answers that you think is appropriate. You can choose at the end of the questionnaire if you want to provide your name and email address – you do not need to.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What kind of information will be collected about me in the questionnaire?</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the questionnaire we ask you about:</td>
</tr>
<tr>
<td>• your attitudes regarding food and risks of food poisoning</td>
</tr>
<tr>
<td>• your routines with regard to food</td>
</tr>
<tr>
<td>• some information about you (your occupation, education, etc)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How will the information collected be kept confidential?</th>
</tr>
</thead>
<tbody>
<tr>
<td>The law called the Data Protection Act (1998) tells us how to keep your information secure. If you have decided to provide your name and email address, it will remain confidential and we will not give your details to anyone else. All of the data will be analysed and published anonymously.</td>
</tr>
</tbody>
</table>
What are the benefits in taking part in this study?

Unfortunately there is no payment for taking part in this short piece of research.

This study will help understand better people’s attitudes towards food and food poisoning. This will aid researchers and public health organisations shape food safety guidelines in the future.

Are there any risks in taking part in this study?

No. There are no risks in taking part in this study.

Do you have any friends that may be interested in taking part?

Do you know anyone that might wish to take part in the study?

If so, please forward the invitation email to them.

After the study starts, can I change my mind?

Yes. You can change your mind and leave the study at any time – just close down your internet browser to break the link to the questionnaire.

What if I have a problem?

If you have a concern about any aspect of this study, you should ask to speak to the researchers who will do their best to answer your questions. If they are unable to resolve your concern or you wish to make a complaint regarding the study, please contact the Head of the Research Office, Christie Building, University of Manchester, Oxford Road, Manchester, M13 9PL.

What happens when the study finishes?

The results will be published as a report, feature in published articles and will also be presented at conferences. Neither your name nor any information that can identify you will ever appear in any reports or articles.

We are happy to send you a summary of the study’s results – just select the appropriate option in the questionnaire if you would like us to do so. The results summary will be available after May 2011.

What if I have a question? Contact details

If you have a question or are not sure about any aspect of this study you can speak to Caroline, the main researcher who will try to answer your questions:

Caroline Millman Tel. 07505 957506 (she will phone you back to save your phone bill)
or email: caroline.millman@postgrad.manchester.ac.uk

You are also welcome to contact her supervisor at the University of Manchester: Dr Dan Rigby, dan.rigby@manchester.ac.uk
8.13 Food poisoning risks – Online survey to elicit relative risk perceptions of food behaviours
The following takes you through some consent questions to make sure that you are happy to proceed with this questionnaire.

Please read the Information Sheet that was supplied with your invitation email before progressing. If you do not have the Information Sheet with you, you can download a copy here.

Please complete the following questions.
Please note that you will be unable to progress to the online version of the questionnaire until you have provided consent.

Have you received enough information about the study?
Yes
No

Do you understand that you do not need to take part in the study and if you do enter you are free to withdraw at any time, without having to give a reason for withdrawing, and without detriment to you?
Yes
No

Do you agree to take part in this study?
Yes
No

If you agree to take part, please click the "Next" button below. If you do not wish to take part in this study please navigate away from this page, or close your web browser now.

---

You & Your Food - Food Poisoning Risks

Some of the questions we would like you to answer are about your opinions and some about what you do in your home. These different sorts of questions are grouped together.

We would like to start by asking you a few questions about food and lifestyle.

Food and Lifestyle

Please try to be honest - we are very interested in what really happens rather than what you might like to happen. If you do not get involved with the cooking in your household, we would like you to ask the person who does, to fill this section in with you.

---
### Food and Lifestyle 1

Please answer the questions in the following table by selecting the answer which best indicates your response on the scale. Some questions have a * by them - do not answer them if you live alone or shop and cook just for yourself.

<table>
<thead>
<tr>
<th></th>
<th>Completely Disagree</th>
<th>Neither Disagree</th>
<th>Completely Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I choose easy, quick-to-prepare food for weekday evening meals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I enjoy preparing meals from scratch</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I like to try out new recipes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I prefer fresh products to canned or frozen products</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shopping for food does not interest me at all</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Food and Lifestyle 2

Please answer the questions in the following table by selecting the answer which best indicates your response on the scale. Some questions have a * by them - do not answer them if you live alone or shop and cook just for yourself.

<table>
<thead>
<tr>
<th></th>
<th>Completely Disagree</th>
<th>Neither Disagree</th>
<th>Completely Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am often rushing to get everything done</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certain members of my family are choosy/picky in what they eat</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I compare prices between product variants (i.e. various brands of the same product) in order to get the best value for money</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before I go shopping for food, I make a list of everything I need</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I find that I often have to throw away ingredients when cooking a meal from scratch</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

20% 100%
### Food and Lifestyle 3

Please answer the questions in the following table by selecting the answer which best indicates your response on the scale. Some questions have a * by them - do not answer them if you live alone or shop and cook just for yourself.

<table>
<thead>
<tr>
<th></th>
<th>Completely disagree</th>
<th>Neither disagree nor agree</th>
<th>Completely agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I compare product information labels to decide which brand to buy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I enjoy going to restaurants with my family and friends</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My family helps with other meal time chores, such as setting the table and doing the dishes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>“I don’t have the responsibility for shopping and cooking ought to lie just as much with the husband as with the wife”</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recently I have been unable to control the important things in my life</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Next

---

### Food and Lifestyle 4

Please answer the questions in the following table by selecting the answer which best indicates your response on the scale. Some questions have a * by them - do not answer them if you live alone or shop and cook just for yourself.

<table>
<thead>
<tr>
<th></th>
<th>Completely disagree</th>
<th>Neither disagree nor agree</th>
<th>Completely agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I frequently use the microwave to cook my evening meal during the week</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I always plan what we are going to eat a couple of days in advance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>“It is difficult for us to have a family meal together”</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I eat whenever I feel the slightest bit hungry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I don’t usually prepare a proper meal when there’s just me</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Next

---

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### Food and Lifestyle

Thank you very much for your responses.

Is there anything else that you would like to say about the questions we have asked or the issues we have raised?

---

### Food Safety

We would like you to think now about the risk of getting food poisoning. Please answer the questions below, by selecting the answer which best indicates your response on the scale.

<table>
<thead>
<tr>
<th>Question</th>
<th>None at all</th>
<th>A moderate amount</th>
<th>A great deal</th>
</tr>
</thead>
<tbody>
<tr>
<td>How much risk do you think there is to you personally from getting food poisoning in your own home?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How much risk do you think there is to the average person from getting food poisoning in their own home?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How much control do you think you personally have over getting food poisoning in the home?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How much control do you think the average person has over getting food poisoning in the home?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How much knowledge do you think you personally have about the risk of getting food poisoning in the home?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How much knowledge do you think the average person has about the risk of getting food poisoning in the home?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Note: The following subsets are one example from the 20 versions of the BWS experimental design.
Please consider the 4 behaviours shown below.
Considering only these 4 behaviours, which do you think is the Most Likely AND the Least Likely to make someone ill with food poisoning?

<table>
<thead>
<tr>
<th>Most Likely to make someone ill</th>
<th>Least Likely to make someone ill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eating a dessert that contains uncooked eggs such as tiramisu or chocolate mousse.</td>
<td>Washing a chicken or turkey under the tap before cooking.</td>
</tr>
<tr>
<td>Not using antibacterial spray after the preparation of raw/uncoked turkey.</td>
<td>Allowing dirt on the kitchen worktop, work surfaces.</td>
</tr>
</tbody>
</table>

Click the 'Next' button to continue...

[Next]

- [ ] 4% 100%
Please consider the 4 behaviours shown below.
Considering only these 4 behaviours, which do you think is the Most Likely AND the Least Likely to make someone ill with food poisoning?

<table>
<thead>
<tr>
<th>Most Likely to make someone ill</th>
<th>Least Likely to make someone ill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not using antibacterial spray after the preparation of raw/uncooked turkey</td>
<td>[ ]</td>
</tr>
<tr>
<td>Eating a beef burger that is pink in the middle.</td>
<td>[ ]</td>
</tr>
<tr>
<td>Eating chicken that is not cooked through properly.</td>
<td>[ ]</td>
</tr>
<tr>
<td>Cooking raw/uncooked frozen chicken, i.e. not defrosted before cooking.</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

Click the 'Next' button to continue...

[Next]

---

Please consider the 4 behaviours shown below.
Considering only these 4 behaviours, which do you think is the Most Likely AND the Least Likely to make someone ill with food poisoning?

<table>
<thead>
<tr>
<th>Most Likely to make someone ill</th>
<th>Least Likely to make someone ill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eating chicken that is not cooked through properly.</td>
<td>[ ]</td>
</tr>
<tr>
<td>Chilled foods not being put away in the refrigerator for 4 hours after finishing the shopping</td>
<td>[ ]</td>
</tr>
<tr>
<td>Eating chicken that had been only cooked on a BBQ</td>
<td>[ ]</td>
</tr>
<tr>
<td>Using the same knife for chopping unpeeled after cutting raw/uncooked chicken.</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

Click the 'Next' button to continue...

[Next]
### Perceptions and Risks: Food-borne Pathogens in the Domestic Environment

#### Please consider the 4 behaviours shown below.

Considering only these 4 behaviours, which do you think is the **Most Likely** AND the **Least Likely** to make someone ill with food poisoning?

<table>
<thead>
<tr>
<th>Most Likely to make someone III</th>
<th>Least Likely to make someone III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allowing_aes on the kitchen worktop/work surfaces.</td>
<td></td>
</tr>
<tr>
<td>Storing raw/uncoked pork (on a plate) on the shelf above cooked ham in the refrigerator.</td>
<td></td>
</tr>
<tr>
<td>Chilled foods not being put away in the refrigerator for 4 hours after finishing the shopping.</td>
<td></td>
</tr>
<tr>
<td>Leaving foods from the freezer to defrost at room temperature.</td>
<td></td>
</tr>
</tbody>
</table>

Click the 'Next' button to continue...

Next

84% 100%
Please consider the 4 behaviours shown below.
Considering only these 4 behaviours, which do you think is the Most Likely AND the Least Likely to make someone ill with food poisoning?

<table>
<thead>
<tr>
<th>Most Likely to make someone ill</th>
<th>Least Likely to make someone ill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washing a chicken or turkey under the tap before cooking.</td>
<td>Using the washing up cloth to mop up a spillage on the floor.</td>
</tr>
<tr>
<td>Using the same knife for chopping up salad after cutting raw/uncooked chicken.</td>
<td>Eating shellfish (eg mussels, oysters).</td>
</tr>
</tbody>
</table>

Click the ‘Next’ button to continue...

Food Poisoning Risk
Thank you very much for your responses.
Please add any comments that you would like to make regarding food risks and the questions that we have asked yourself with:

Food Related Illness
We would like to ask you some questions about food poisoning.

Have you ever had a food related illness?
Yes
No
Did you go to your doctor with the illness described?
Yes
No

Did the doctor confirm it was food poisoning by carrying out any tests?
Yes
No
Not sure

How long ago was the confirmed case of food poisoning?

Do you know how you got the food poisoning?
Yes
No

If yes, can you please provide some brief details of how you think you got food poisoning?
About You

Finally, we would like to ask you some questions about you and your household.

What is your gender?
- Male
- Female

What is your year of birth?

Next

How many adults aged 16 or older live in your household, including yourself?

Yes
No

Are there any children under the age of 16 living in the household?

Next
How many children are there in each of the following age groups?

0-4 years of age

5-9 years of age

10-15 years of age

Which of these ethnic groups do you consider yourself to belong to?

- White (British)
- White (Irish)
- Other White
- Mixed (White & Black Caribbean)
- Mixed (White & Black African)
- Mixed (White & Asian)
- Other Mixed
- Asian or Asian British - Indian/Asian
- Asian British - Pakistani/Indian or Asian British - Bangladeshi
- Other Asian
- Black or Black British - Caribbean
- Black or Black British - African
- Other Black
- Chinese
- Other ethnic group
Which of these qualifications do you have? Please select all that apply.

- No Qualifications
- A Level/AS Level/Higher School Certificate
- Other Qualifications (eg City and Guilds, RSA/OCR, BTEC/Edexcel)
- HNC, HND
- First Degree (eg BA, BSc)
- Higher Degree (eg MA, PhD, PGCE, postgraduate certificates/diplomas)

Do you have any of the following professional qualifications?

- Qualified Teacher Status (for schools)
- Qualified Medical Doctor
- Qualified Dentist
- Qualified Nurse, Midwife, Health Visitor
- Other Professional Qualifications

What do you do? Are you...

- Employed
- Self-employed
- An Employer
- Not working/Looking for work
- Retired
- A Student
- Looking after home/family
- Permanently sick/disabled
- Other
Please add any comments that you may have with regard to the questionnaire or anything else that you wish to mention.

Thank you very much for your thoughts.

Can we contact you to follow up on any comments that you make?
- Yes - I'll provide my details below
- No - I'd prefer not to be contacted

Would you like a summary of the results to be emailed to you?
- Yes - I'll provide my details below
- No - I don't want a summary of results

Name:

Email address:
Thank you for completing the questionnaire and for your comments.

Please click on the NEXT button to submit your information.

And do not forget...
If there is anyone that you know who might be prepared to take part, please feel free to forward the original email onto them.