



**Food safety behaviours in the home
Final Report for the Food Standards Agency**

CL2351 R4 V6 FCA

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Food safety behaviours in the home

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Key findings

Food safety behaviours of the general population

For the general population, the evidence review and consultation with experts strongly indicated frequent failure¹ to follow recommended food hygiene practices. Broadly the evidence suggests:

- People have a low level of awareness of recommended good practice with respect to cooking (correct final cooked temperature), storing raw meat on the bottom shelf (to avoid cross-contamination), and chilling (correct fridge temperatures);
- People may fail to follow recommended personal hygiene (hand washing), cleaning, thawing (in refrigerators) and cross-contamination practices despite being aware of recommended practice in these areas;
- There is limited use and comprehension of food safety parts of labels, such as ‘use by’ dates and storage instructions.

Again broadly the evidence review indicated that certain recommended behaviours were rarely reported, whilst higher levels of awareness and performance were reported for other important behaviours.

Association between knowledge and behaviour

Whilst there was moderate evidence that knowledge of food safety was associated with ‘better’ food safety behaviour, this was not a perfect relationship. The review consistently found that the relationship between knowledge and behaviours was influenced by risk awareness, perceptions of risk and ‘optimism bias’ (namely when people wrongly believe that they are not vulnerable to foodborne illness). An increase in knowledge of risks and how specific behaviours are associated with foodborne risks was associated with ‘better’ food safety behaviours. Awareness of risk was needed to counter ‘optimism bias’.

Socio-demographic factors and food safety behaviour

There was also some evidence of associations between age, gender, household type, education, income and household status with food safety attitudes and behaviours. Broadly, men, elderly people, people with a lower income and more educated people were reported as displaying either poorer knowledge or behaviours. These factors coincided with risk awareness, for example men having lower levels of food safety knowledge. Indeed, some studies found that education in food safety was a stronger factor than, for example, being male. Higher levels of education were found by some studies to be associated with poorer food safety behaviours. Some studies indicated that this was due to ‘optimism bias’ amongst highly educated people.

Impact of advice

The review found a low level of evidence that the provision of advice can influence attitudes and behaviours, and a moderate level of evidence that behaviour is related (imperfectly) to knowledge of risks and safe handling practices. A general finding from the evidence review and from expert interviews was that advice should be specific to each

¹ It should be noted that we have faithfully used the terminology adopted in the reviewed articles, which tend to refer to “failure” to follow recommended practices, non-compliance and violation. The use of this language is consistent with the reviewed research and not intended to imply “judgement” of people’s behaviour.

target group, address their particular attitudes and be presented in a way that they can identify with. The contemporary approach advocated by the Department of Health to public health communication is represented by targeted social marketing tactics which advocate assessing the views and needs of specific target groups. Whilst there is minimal research into social marketing in the context of food safety, it was suggested by some of the reviewed studies that the principles of social marketing are adopted for future food safety in the home interventions.

However, it was also noted that if people perceive that the information is directed at other people, perhaps a vulnerable group of people, they may not perceive it to apply to them and it may reinforce their own 'optimism bias'. Thus, whilst personalised information is advocated by researchers, this may lead to a 'narrow' impact. The expert interviews suggested that targeted approaches should be complimented by general advertising through media such as television, to ensure that targeted messages do not lead other people to believe they are not at risk.

Food safety behaviour and the rise in listeriosis

A key issue concerns the reasons for a rise in listeriosis in the 2000s amongst elderly patients. Whilst there was evidence of societal trends influencing food safety risks, these did not account for the rise in listeriosis amongst elderly persons. The small number of studies (mostly in the US) regarding food safety behaviour and knowledge of elderly patients indicated that:

- Whilst they were aware of their vulnerability, they were not aware of the link between specific food safety behaviours and the risk of food poisoning; and
- They consume high risk foods.

Research (including UK studies) into elderly persons found that, despite relatively good knowledge of food safety and concern about their health, they were more likely to eat food beyond its 'use by' date and store high risk food uncovered in the refrigerator. Thus, elderly persons and elderly patients were reported to exhibit food safety and consumption behaviours that increase their risk of listeriosis.

Recommended targeted intervention for patients who are immunocompromised

In the absence of a behavioural explanation for the rise in listeriosis, the review briefly examined a small number of clinical studies. The studies indicated that the rise in listeriosis coincided with changes in chemotherapy treatment of elderly persons. This led to the authors of this report suggesting 1) a fuller review of the evidence regarding changes in chemotherapy and listeriosis in elderly persons and 2) a targeted intervention of elderly patients via healthcare professionals. Notwithstanding the small number of studies, the reviewed studies noted that healthcare professionals were a trusted source of food safety advice. A targeted intervention would also match the point that *Listeria Monocytogenes* (*L. Monocytogenes*) is a particular risk for a specific high risk group, namely patients who are immunocompromised. The authors of this report suggested that the evidence indicates that the intervention could focus on:

- Raising patient awareness of the risk of listeriosis during treatment and avoiding high risk foods during periods of treatment/pregnancy. A strategy of avoiding high risk foods would be consistent with the point that chemotherapy patients are immunocompromised.
- Management of high risk foods during periods of treatment, e.g. consumption

before expiration of 'use by' date, correct refrigeration temperatures.

As part of a targeted intervention, it was suggested by the authors of this report that:

- Dietary advice for these high risk groups is developed, particularly for elderly cancer patients – possibly by a collaboration between dieticians, oncologists and listeriosis experts;
- Advice is communicated to cancer patients by those healthcare professionals that care for cancer patients, such as oncologists, dieticians, oncology centres and chemotherapy units;
- Advice is communicated to pregnant women by those healthcare professionals that care for pregnant women, such as midwives, GPs and health visitors;
- Consideration is given to working with organisations such as the Oncology Section of the Royal Society of Medicine and the NHS Cancer Programme.

There are examples of food safety advice for patients from the USA. Whilst the review did not identify evaluations of these, they exemplify the type of advice that could be offered. Further research could usefully develop and evaluate UK versions of such guidance. In addition, further research could explore the extent to which UK healthcare professionals advise elderly chemotherapy patients of *L. Monocytogenes* risks and awareness of these risks amongst UK cancer patients. The review did not identify any such research in the UK.

The review did not identify a behavioural segmentation of elderly people. However, it is pertinent to note that elderly patients are the group most at risk.

Executive summary

Background

One of the Food Standards Agency's (FSA or the Agency) priorities within its Strategic Plan for 2010-2015 is to reduce foodborne disease, using a targeted approach on those pathogens that cause the severest and largest number of cases, such as *Campylobacter* and *Listeria Monocytogenes* (*L. Monocytogenes*). The domestic sector is a key element of this strategy. In order to help reduce cases of foodborne disease, the FSA is currently identifying and prioritising its evidence needs throughout the food chain (from farm to fork). One area identified is for the FSA to better understand the role of public behaviours in minimising the risks of foodborne disease, particularly in the home.

Whilst foodborne disease can affect anyone, particular groups within the population are more susceptible to food poisoning. This can include older people (usually defined as those aged over 60), those who have an immune suppressive disease, those who are taking immune suppressive medication, those who are pregnant and children aged under 5. How best to reach these persons is a key issue, as well as evidence on whether these persons are already receiving food safety advice. Moreover, there has been an unexplained increase in listeriosis amongst persons over 60. Understanding why this is occurring and developing better methods for disseminating food safety advice to persons over 60, perhaps through health professionals, are key issues.

The overall aim of the review was to determine what is known about the public's food storage and handling behaviours in the home relating to food safety, identify any relevant work which is in progress and help develop future analysis and/or primary research in this area. The interviews with experts did not identify any relevant work in progress.

Methodology

The review applied the principles of the Rapid Evidence Assessment toolkit² developed by the Government Social Research Unit, including:

- Being question led, with clear and answerable questions – both what is known about how to disseminate advice and what is known about food safety behaviours;
- Applying a conceptual framework, e.g. inclusion criteria, search terms and an analysis framework;
- A search method (with sources, what is being searched for, search terms);
- Screening (e.g. reading abstracts) and selecting studies;
- Describing studies using evidence tables and coding schemes;
- Appraising studies using a 'Weight of Evidence' framework; and
- Synthesis, including meta-review and relating findings to FSA questions.

A sample of experts and FSA staff were also consulted in order to acquire feedback on:

- Key elements of current knowledge; e.g. who is vulnerable, key behaviour factors;
- Evidence regarding how best to advise and influence people, especially over 60s;

² <http://www.civilservice.gov.uk/my-civil-service/networks/professional/gsr/resources/gsr-rapid-evidence-assessment-toolkit.aspx>

- Main gaps in current evidence and future research priorities;
- Research methodology.

Further details on the methodology are provided in Annex A.

Results: Level and weight of evidence

Table E.1 shows the number of documents included in the review categorised by the type of study and weight of evidence score. The weight of evidence was scored from 0 to 5, where 5 was the highest standard of evidence and 0³ was the lowest. As shown in the table, there were 371 included documents, mostly research with about 20% being evaluations of interventions. 393 other documents were excluded from the review on the grounds of lack of relevance, being completed prior to 1990, country of study or (34) because the full article could not be acquired.

Table E.1: Number of document by type of study

Type of study	Count of weight of evidence (0-5)						Total
	0	1	2	3	4	5	
Evaluation studies	5	18	31	8	2	3	67
Qualitative research and theories	3	38	45	30	11	5	132
Surveys and quantitative research	1	17	64	50	27	13	172
Total	9	73	140	88	40	21	371

Some key points regarding the level of evidence include:

- Less than 20% of the studies address specific vulnerable types of people, mostly the elderly and pregnant women. However, it is important to note that most studies on elderly persons did not specifically consider elderly patients, who are the group most vulnerable to *L. Monocytogenes*.
- Most studies regarding interventions concerned mass education interventions such as TV and schools based education, with few concerning methods such as advice via healthcare professionals, labelling or product design. Evaluations of interventions were often assigned low to moderate weight of evidence scores.

Food safety behaviour: general population

There were significant gaps in people's knowledge of safe food handling practices, such as correct fridge temperatures, as well as a weak relationship between knowledge and behaviours. The association between knowledge and behaviour might be influenced by awareness and perceptions of risk. The evidence indicated that the perception and awareness of risks influenced the extent to which knowledge of food handling practices was associated with behaviour. Whilst knowing about recommended practices may be a pre-requisite, people who display 'optimism bias' or have a low awareness of the risk may be less likely to apply their knowledge of food safety. In turn, it could be suggested that if an increase in knowledge leads to an increase in risk perception, this may lead to a change in behaviour.

Food safety behaviour of vulnerable people

Some key findings include:

³ A score of zero was awarded to articles where no clear method was described in the article. No studies scored as zero were included in the narrative.

- A low level of awareness of the risk posed by listeriosis to elderly persons, particularly elderly cancer patients;
- Examples of high risk behaviours amongst the elderly such as ‘using up’ food and keeping food for longer in refrigerators.

The research in this area advocated that health professionals give advice to pregnant women and other vulnerable groups, with healthcare professionals cited as one of the most trusted and preferred sources of food safety advice. However, no studies were found regarding the extent to which UK health professionals advise vulnerable groups about food safety, nor were there any evaluations of the impact of such advice.

Interventions

Whilst the weight of evidence was low, it indicated that:

- The provision of advice and information can influence attitudes, knowledge and behaviours, although this is not a perfect relationship;
- Strategies should be based on knowledge of the attitudes, actual behaviours and receptivity to advice of each segment of people;
- Strategies need to address perceptions and awareness of risk;
- The source of information is a key factor in whether people trust information.

Research priorities

The main gaps include evidence regarding:

- Attitudes, knowledge and behaviours of vulnerable groups;
- How to segment older persons (other than by health status, gender and living alone)
- The extent to which vulnerable groups in the UK receive advice and information about food safety risks and how to minimise them.

It was also noticeable that few interventions have been evaluated to a high standard, with most relying on before and after knowledge questionnaires. Accordingly, this review concluded that the higher priorities for future research were:

- Understanding observed behaviour, especially of vulnerable people;
- Developing and robustly assessing methods for advising and influencing people.

Theoretical issues, research methods and connections between food safety and other topics were rated as lower priorities.

Some specific options for further work suggested by the evidence review included to:

- Address the Advisory Committee on the Microbiological Safety of Food (ACMSF) recommendation to review evidence of the link between the rise in listeriosis and chemotherapy, as we were unable to identify behavioural, social or demographic causes of the trends;
- Explore the food safety attitudes and behaviours of chemotherapy patients, pregnant women and other patients in the UK who are immunocompromised;
- Survey the extent to which healthcare professionals in the UK that have contact with elderly cancer patients, pregnant women and immunocompromised people

provide advice on food safety, and how to reduce the risk of listeriosis, to these groups.

More generally future research could:

- Explore the relationships between attitudes, knowledge, risk perceptions/awareness and actual behaviours, for example explore how knowledge of the risks interacts with knowledge of recommended practices to influence behaviour. Ideally this work would also map out how attitudes and behaviours vary by factors such as age, household type and so forth.
- Evaluate the impact of interventions, using rigorous research design such as randomised control groups, measure of changes in observed behaviour and longer follow up periods.

1 INTRODUCTION

1.1 Background

One of the Food Standards Agency's (FSA or the Agency) priorities within its Strategic Plan⁴ for 2010-2015 is to reduce foodborne disease, using a targeted approach on those pathogens that cause the severest and largest number of cases, such as *Campylobacter* and *Listeria Monocytogenes* (*L. Monocytogenes*). The domestic sector is a key element of this strategy. The Agency already carries out a series of food hygiene campaigns to help meet these objectives. Initiatives in the domestic sector strand of the Foodborne Disease Strategy focus on:

- A targeted approach focused on vulnerable groups and the severest pathogens;
- Increasing consumer understanding of food safety issues and their use of food safety messages;
- Reducing the level of foodborne illness caused by unhygienic consumer practices during the storage, preparation and cooking of food.

In order to help reduce cases of foodborne disease, the FSA is currently identifying and prioritising its evidence needs throughout the food chain (from farm to fork). One area identified is for the FSA to better understand the role of public behaviours in minimising the risks of foodborne disease, particularly in the home. This includes such behaviours as described by the FSA's 4 Cs: Cleaning, Cooking, (avoiding) Cross-contamination and Chilling⁵.

Persons over 60, *L. Monocytogenes* and reaching vulnerable groups

Whilst foodborne disease can affect anyone, particular groups within the population are more susceptible to food poisoning. This can include older people (usually defined as those aged over 60), those who have an immune suppressive disease, those who are taking immune suppressive medication, those who are pregnant and children aged under five. How best to reach these persons is a key issue, as well as evidence on whether these persons are already receiving food safety advice.

The Advisory Committee on the Microbiological Safety of Food (ACMSF) noted that there has been an increase in listeriosis since 2000 in the UK (a threefold increase when you compare the mid 2000s with the mid 1990s) and other European countries and that this has occurred almost exclusively in patients aged over 60 years. The ACMSF excluded certain explanations for this increase, including an increase in detection, or an increase in microbial contamination in foodstuffs, or an increase in the number of elderly people. They did note that there has been a trend for older patients to be treated more aggressively with chemotherapy, often with agents that have only become available in the past 10 years. One agent, Rituximab, was reported as being widely used in elderly patients and has been associated with listeriosis. The ACMSF also recommended that work is undertaken to investigate the management of underlying conditions amongst elderly people.

Understanding why this unexplained increase is occurring and developing better methods for disseminating food safety advice to persons over 60, perhaps through health professionals, are key issues. This should build on the work of the ACMSF and Social Science Research Committee (SSRC). As part of this, the over 60s may need to be

⁴ <http://www.food.gov.uk/multimedia/pdfs/publication/sciencestrat0210.pdf>

⁵ For more information on the 4C's please see: <http://www.eatwell.gov.uk/keepingfoodsaf/germwatch/>

disaggregated.

Moreover, in recent years, there has been an unexplained increase in the number of cases of listeriosis in those aged over 60. The Advisory Committee on the Microbiological Safety of Food (ACMSF)⁶ have investigated possible reasons behind the increase in cases of listeriosis, a very serious disease, and have highlighted a number of potential contributing factors⁷. One hypothesis is that the behaviours of this age group could be increasing their risk of contracting listeriosis. Behaviours such as the types of foods they are buying (*L. Monocytogenes* is most often found in chilled, ready to eat foods), storing foods incorrectly (at too high a temperature or not following storage instructions once a packet is open), eating foods that are past their 'use by' date or eating leftovers after two days (or after failing to store them correctly). The SSRC⁸ were asked in November 2008 to consider this hypothesis and identify what further research, if any, would be required to explore this area. A working group was established and an advice paper was presented to the ACMSF in September 2009.

The SSRC working group considered a range of existing evidence and concluded that there was insufficient historical data against which current behaviours could be compared, that would help explain the increase in listeriosis. However, they recommended new primary research that could help explain how the current behaviours of this group could be putting them at risk of listeriosis. The recommendations are applicable to other foodborne diseases, such as *Campylobacter* and *Salmonella*, rather than just focusing on *L. Monocytogenes*⁹. They also recommended that work be undertaken to explore how food safety advice is, or could be, disseminated via health professionals.

Some points included:

- The need to disaggregate the over 60s. A lack of definition, and attempts to further define this potentially diverse group, was a problem encountered in the literature uncovered.
- That it was not clear currently to what extent, if at all, food safety advice is disseminated to vulnerable groups and what would be the best mechanisms for this in the future.

This study was commissioned to fulfil the ACMSF requirement for a full review of existing evidence and to help identify further research needs.

1.2 Aims and scope of this review

1.2.1 Aims

The overall aim of the review was to determine what is known about the public's food storage and handling behaviours in the home relating to food safety, identify any relevant work which is in progress and help develop future analysis and/or primary research in this

⁶The ACMSF provides expert advice to Government on questions relating to microbiological issues and food. For further details please see: <http://acmsf.food.gov.uk/>

⁷ For full details of the ACMSF report please see:
<http://www.food.gov.uk/news/newsarchive/2009/sep/acmsflisteria>

⁸ The SSRC is another of the FSA's scientific committees. It provides advice to the Agency about how it gathers and uses social science evidence. For further details please see: <http://ssrc.food.gov.uk/>

⁹ For full details of the SSRC advice paper please see:
<http://www.food.gov.uk/multimedia/pdfs/committee/acm954ssrcrep.pdf>

area. Seventeen specific questions were cited by the Agency, as noted in Table 1.

Table 1: 17 questions posed by the Agency

1. What is already known about food storage and handling behaviours relating to food safety in the home in both the general population and in vulnerable groups?
2. What factors are associated with food storage and handling behaviours in the home? (for example, socio demographic factors including age, ethnicity and income, illness, accommodation, kitchen facilities, etc)
3. Is there a relationship between food safety knowledge, beliefs and actual behaviours?
4. What, if any, factors encourage the adoption of safe food storage/handling practices and how can change in practices be encouraged?
5. What, if any, factors inhibit the adoption of safe food storage/handling practices and how can these be overcome?
6. What is known about influencing safe food storage/handling behaviours?
7. How, if at all, does existing literature on food safety behaviours fit with the literature on food and kitchen practices and behaviour more broadly?
8. What are the theoretical approaches that have been adopted to explore and explain food storage/handling behaviours?
9. What research techniques have been used in the past for exploring these behaviours, including how to measure actual rather than stated behaviours?
10. What is known about how food safety advice is disseminated to vulnerable groups via health professionals, carers or care organisations? Who, if any one, is responsible?
11. What, if anything, is known about how to disseminate food safety advice to particular groups of the population?
12. What educational campaigns have been undertaken to provide the general public with information about food safety in the home, how have these been evaluated and what has been learnt?
13. What research is underway in this area?
14. What are the main gaps in the existing evidence base and how could these best be filled by future FSA work? What techniques might the FSA consider using for these areas?
15. How can the broader literature on kitchen practices and behaviour help inform directions for further research?
16. What analysis should the FSA consider for Food and You Survey?
17. What specific secondary analysis could be undertaken of the data sets identified by the SSRC working group on listeriosis and are there any other data sets that should be considered?

1.2.2 Scope of review

The review:

- Drew on literature from the full range of social science disciplines and included a broad range of related topic areas;
- Covered the full range of literature, including journal articles, government and NGO research, industry research and trade publications (for example, publications for environmental health officers), health and social care publications etc;
- Was limited to non-institutional settings (i.e. excluding those living in hospitals, prisons, care homes etc).

1.2.3 Overview of method

The review applied the principles of the Rapid Evidence Assessment toolkit developed by

the Government Social Research Unit¹⁰, including:

- Being question led, with clear and answerable questions – both what is known about how to disseminate advice and what is known about food safety behaviours;
- Applying a conceptual framework, e.g. inclusion criteria, search terms and an analysis framework;
- Involving the users (the Agency) of the REA in developing the method;
- Having an ‘a priori’ review protocol with scope to be iterated as the work proceeded;
- A search method (with sources, what is being searched for, search terms);
- Screening (e.g. reading abstracts) against criteria such as relevance, availability of full article and date (since 1990) and selecting studies;
- Describing studies using evidence tables and coding schemes;
- Appraising studies using a ‘Weight of Evidence’ framework; and
- Synthesis, including meta-review and relating findings to FSA questions.

A sample of experts was also consulted in order to acquire feedback on:

- Key elements of current knowledge; e.g. who are vulnerable, key behaviour factors;
- Evidence regarding how best to advise and influence people, especially over 60s;
- Main gaps in current evidence and future research priorities;
- Research methodology.

A full summary of the method is given in section 4 of this report.

¹⁰ <http://www.civilservice.gov.uk/my-civil-service/networks/professional/gsr/resources/gsr-rapid-evidence-assessment-toolkit.aspx>

2 SUMMARY OF EVIDENCE

2.1 Introduction

This section of the report provides a narrative summary of research findings along with the points raised and opinions expressed by those experts interviewed in this work. As a rapid evidence review, the summary draws out the main findings and themes, aligning these to the Agency's questions. It does not cite and summarise every included study. It gives emphasis to those studies that addressed the Agency's questions and which were assigned a higher (2 to 5) weight of evidence (WOE) score. The weight of evidence was scored from 0 to 5, where 5 was the highest standard of evidence and 0¹¹ was the lowest. Studies with lower WOE scores (1 or 2) have been cited but clearly stated as having lower WOE, typically where they express opinions or where the articles lacked detail on methods.

Table 2 shows the number of documents included in the review categorised by the type of study and weight of evidence score. As shown in the table, there were 371 included documents, mostly research with about 20% being evaluations of interventions. 393 other documents were excluded from the review. Only 149 studies were rated as 3 to 5 which is the standard commonly required for systematic evidence reviews. Only 13 studies that evaluated interventions were rated as 3 to 5.

Section 6 provides ratings of evidence for each of the Agency's 17 questions and other subdivisions of the evidence.

Table 2: Number of document by type of study

Type of study	Count of Weight of evidence (0-5)						Total
	0	1	2	3	4	5	
Evaluation studies	5	18	31	8	2	3	67
Qualitative research and theories	3	38	45	30	11	5	132
Surveys and quantitative research	1	17	64	50	27	13	172
Total	9	73	140	88	40	21	371

Key findings per study were provided as part of the evidence tables, supplied separately from this report¹². Key points raised by experts and during the FSA focus group are cited where pertinent, although the expert interviews and FSA focus group tended to match the findings from the evidence review.

Where the phrase 'this review' is used, this refers to the review reported in this document. The phrase 'the researchers' refers to the authors of this document. It should also be noted that we have faithfully used the terminology adopted in the reviewed articles, which tend to refer to "failure" to follow recommended practices, non-compliance and violation.

¹¹ A score of zero was awarded to articles where no clear method was described in the article. No studies scored as zero were included in the narrative.

¹² Available on request to the FSA

2.2 Peoples' behaviours: general population

2.2.1 Overview

The Agency posed a series of questions regarding what is known about food safety behaviours, what are the barriers to safe behaviour; how can 'recommended behaviours' be encouraged and what is the association between knowledge and behaviour. The evidence has been summarised around these questions. However, there is a common set of findings that cut across these questions. As elaborated in the following sections, the key findings that cut across these questions are:

- A lack of knowledge is associated with failure to follow some of the recommended practice, whilst other recommended food safety practices are not followed due to factors such as inaccurate risk perception;
- The main barriers to improved food safety behaviour include lack of knowledge of recommended practices (in some cases) and (in other cases) inaccurate risk perceptions, inappropriate behavioural norms as well as age and income related barriers – with improved knowledge and risk perceptions helping to overcome these barriers and encourage adoption of safer behaviour.

Section 2.2.4 provides an overview of theoretical approaches to health promotion. They help to 'pull together' these findings by suggesting how these factors interact.

As there is one body of evidence cutting across a number of the Agency's questions, the review has provided a single summary of evidence regarding the relationship between knowledge and behaviour along with the barriers to safe behaviour and how to overcome them. This is preceded by a summary of the evidence regarding the extent to which recommended food safety practices are adopted by the general population. The summary of behaviours identifies the main reason for failing to follow types of recommended practices. This connects to the subsequent discussion of related factors in that, as noted above, some unsafe behaviours are reported to be related to lack of knowledge and others due to risk perceptions and other behavioural factors.

2.2.2 What is known about their behaviour?

What is already known about food storage and handling behaviours relating to food safety in the home in both the general population?

There is strong evidence of frequent failure to follow recommended food safety practices with 162 studies addressing food safety behaviour of the general population of which 73 had a WOE score of 3 to 5. The evidence includes some observational studies, where people's actual food safety behaviour was observed, tests of the presence of pathogens in cooked foods, fridges and surfaces were conducted, as well as an exploration of self-reported behaviours and knowledge. Whilst the exact results vary between studies, they all report frequent unsafe behaviours. The expert interviews broadly agreed with the evidence review.

Main themes

As elaborated below, the main themes cited in studies included:

- Significant gaps in people's knowledge of food safety practices, particularly with respect to:
 - Correct cooking temperatures;
 - Correct refrigeration temperatures and use of fridge thermometers;
 - Thawing practices, namely to thaw foods in refrigerators rather than at room

- temperature;
- Interpretation of food labels (e.g. not understanding ‘best before’ versus ‘use by’ dates).
 - There were relatively higher reported levels of awareness of the need to use different chopping boards and utensils for uncooked meat, storing uncooked meat on lower shelves of the fridge;
 - There are deviations from all recommended food handling practices, despite relatively high levels of reported knowledge;
 - There was very limited use of labels ('use by' dates and cooking instructions) and consumption of food after 'use by' date;
 - People's self rated level of their understanding of food safety was higher than that found when observed by researchers;
 - Whilst many people think they are informed about food safety, they actually lack knowledge of many aspects of food safety and awareness of the risks (see Redmond and Griffiths 2003 for a summary).

The feedback from the experts and the FSA focus group concurred with the evidence review, namely that there was a mixed awareness of adequate food safety behaviours, confusion about issues such as appropriate refrigerator temperatures and gaps in knowledge. They went on to also say that many people may think they have a good understanding of food safety when in reality they do not. The expert interviews also highlighted the risk posed by storing 'leftovers' and transporting food shopping home without using cool bags.

Thus, food safety behaviours and knowledge varied between issues, with better adherence to recommendations on cleaning and avoidance of cross-contamination than on chilling and cooking recommendations.

The results regarding the prevalence of unsafe food safety behaviours are summarised in Table 3. Redmond and Griffith (2003) completed a meta-review of evidence covering 88 studies which provides an overview of findings to that date. Results from recent UK studies, as cited in Table 3 indicate that the types of issues cited by Redmond and Griffith (2003) remain relevant. Some of the UK studies provide microbiological evidence of unsafe behaviour.

Some studies have reported food safety behaviours as a whole. These tend to show that most people commit at least one unsafe food safety behaviour. For example:

- In a survey of 153 US young adults at university, less than half of respondents stated that they engaged in the recommended food handling practices. In addition only two thirds of respondents correctly answered food safety knowledge questions (Abbot et al, 2009);
- Daniels et al, (2000) in the US Home Food Safety report found from auditing food handling practices 74% of respondents (n=106) had at least one “violation” (such as not washing hands) that could by itself lead to illness.

As regards the weight of this evidence:

- Some studies are based on self reported behaviours and therefore are relatively less robust (as people may not accurately self-report their actual behaviour);
- Some evidence includes observational studies and some studies using microbiological samples, which are relatively more robust as they provide objective

evidence of actual behaviour.

For example the study by Harrison et al (2001) and Kennedy et al (2005) used microbiological samples of BBQ chicken and stir fry chicken in 30 homes, finding that 75% had *Campylobacter* and 20% had *Salmonella*.

On the other hand, the survey of 485 Irish beef consumers (Mahon et al, 2006) relied on self reported behaviours and the Agency's 2008 survey (TNS, 2008) of consumer attitudes to food safety used self reported behaviours.

It can be noted that whilst the observational studies had the advantage of 'verified' measures, they had smaller samples than the surveys using self reported behaviours. The results were consistent, in so much that they all report inappropriate food safety behaviours. The consistency in the findings from the two types of studies increases the level of confidence that can be placed in them.

The findings presented in Table 3 were considered to potentially be out of date for the UK. Therefore, whilst the findings indicate the pattern of behaviours, they might not provide an up to date view of behaviours in the UK. It should be noted that the 2010 Food and You Survey, completed by the Agency, should provide an up to date view of food safety (self reported) behaviours in the UK.

Table 3: Summary of evidence regarding prevalence of inappropriate food safety behaviours

Behaviour	UK study	Overseas study
Cooking	<p>Most people knew that inadequate cooking was a risk factor, but few knew the right cooked temperature for meat (Redmond and Griffith (2003)).</p> <p>Harrison et al (2001) reported from an observational study that 15% of stir fry chicken was inadequately cooked, 20% of surfaces had <i>Campylobacter</i> and 8% of cooked chicken had <i>Campylobacter</i> (0% had <i>Salmonella</i>).</p>	<p>Abbot et al, (2009) in a survey of 153 US young adults at university found that 28% checked final cooking temperatures for chicken with a thermometer.</p> <p>Anderson et al, (2000) also found that a third of 92 women and 7 men knew the correct internal final cooking temperature for chicken</p> <p>In a study of Irish beef consumers, it was found that 32% did not cook beef mince for a recommended 25 minutes or more, and only 3% used a thermometer to check cooked temperature once cooked. (Mahon et al, 2006)</p>
Cleaning	<p>Redmond and Griffith (2003) found that most people are aware of the need to wash hands (although other studies tend to report variable levels of actual hand washing).</p> <p>Eves et al (2006) report in a survey of UK children aged 4 to 14 that of 4 to 7 year olds, 96% knew it was important to wash hands before handling food with 64% saying they 'always did'. Most recognised foods that needed washing, of 7 to 11 year olds, 67% or more knew about washing food and 92% of 11 to 14 year olds knew of hand washing, i.e. they reported good levels of food safety knowledge amongst children.</p>	<p>In a survey of 153 US young adults at university 50% washed hands correctly (Abbot et al, 2009).</p> <p>The majority of 92 women and 7 men failed to wash hands correctly (Anderson et al, 2000).</p> <p>Mahon et al, (2006) in a study of Irish beef consumers found that 2% of respondents reported not washing hands prior to preparing beef mince. .</p>

Behaviour	UK study	Overseas study
Cooling	<p>Most people know that cooling cooked food at room temperature is a risk but only a few knew the right refrigerator temperature. (Redmond and Griffith, 2003).</p>	<p>Abbot et al, (2009) found that 40% of respondents (n=153) refrigerated a pre-cooked meal correctly, only 8% had a thermometer in their fridge with a mean fridge temperature at the recommended level of 40°F. .</p> <p>International studies commonly report very low use of fridge thermometers and common 'violation' of recommended fridge temperatures such as Gilbert et al (2007) in a survey of 316 New Zealanders.</p> <p>5% of 92 women and 7 men had a fridge thermometer (Anderson et al, 2000).</p> <p>In a study of Irish beef consumers 44% of consumers failed to store cooked beef on the bottom shelf, 4% left cooked beef in the fridge for 3 days or more, over half of consumers (58%) defrosted beef on the worktop and the majority who took over 2 hours to return home did not use a cooler bag (Mahon et al, 2006).</p> <p>Kennedy et al (2005) tested 900 swabs in Ireland for bacterial contamination in refrigerators and found <i>Staphylococcus aureus</i> (41%), <i>E.coli</i> (6%), <i>Salmonella</i> (7%) and <i>L. Monocytogenes</i> (6%). 59% of fridges were found to operate at temperatures above the recommended 5°C.</p>

Behaviour	UK study	Overseas study
Cross-contamination	<p>Redmond & Griffith (2003) stated that most people were unaware of the risk of storing raw meat on upper shelves and the risk of raw meat contaminating cooked foods but were aware of the importance of using separate chopping boards/utensils. .</p> <p>Using a self report survey, the 2005 evaluation of the Agency's food hygiene TV adverts (COI, 2005) reported that the vast majority of adults washed chopping boards, surfaces and utensils <i>after</i> preparing raw chicken, with most aware of the need to avoid cross-contamination.</p>	<p>Abbot et al, (2009).found 67% (n=153) of young adults at University followed cross-contamination practices correctly.</p> <p>Nearly all of 92 women and 7 men handled food in a manner that caused cross-contamination (Anderson et al 2000).</p> <p>In a study of Irish beef consumers 58% had two chopping boards (one for uncooked meat and one for other foods) (Mahon et al, 2006).</p>
Awareness of foodborne illnesses	Most people could name <i>Salmonella</i> , <i>L. Monocytogenes</i> and <i>Campylobacter</i> and could cite some of the high risk foods (Redmond and Griffith, 2003).	
Use of labels	<p>The Agency's 2008 survey (TNS, 2008) of consumer attitudes to food safety reported that:</p> <ul style="list-style-type: none"> • 16% of consumers reported that they looked at 'best before' or 'use by' date on products they buy for the first time (in a prompted question); • 6% of consumers said they looked for cooking instructions; • 42% of consumers reported they had difficulty in reading the print size of labels; • There was confusion over the meaning of 'use by' dates with 32% (increased from 28% previously) of consumers believing that this indicated that food would be at its best quality before this date but not necessarily unsafe. 55% correctly interpreted the 'use by' definition. Men were less likely than women to give the correct answer for 'use by' dates but more likely for the 'best 	<p>In a study of Irish beef consumers 11% sometimes or never checked 'use by' dates. (Mahon et al, 2006)</p>

Behaviour	UK study	Overseas study
Use of labels (cont.)	<p>'before' date;</p> <ul style="list-style-type: none">There was greater confusion for the 'best before' date, with half the UK sample (51%) giving the correct interpretation, but with 36% saying that 'it should not be eaten past this date'. <p>Hudson & Hartwell (2002) in a focus group study of older people found 'Use by' dates were understood but not always followed as older people had difficulty in reading the dates. In addition it was also reported that even when consumers knew they should dispose of foods that had past their consume-by date, they often kept these foods for up to a month before consumption</p>	

2.2.3 Knowledge versus behaviour, barriers and overcoming barriers

Is there a relationship between food safety knowledge, beliefs and actual behaviours?

What, if any, factors encourage the adoption of safe food storage/handling practices and how can change in practices be encouraged?

What, if any, factors inhibit the adoption of safe food storage/handling practices and how can these be overcome?

These questions are addressed together as the evidence is common to them all. There were 100 studies covering relationships between knowledge and actual behaviours (38 with a WOE of 3 to 5), 59 covering factors that inhibit adoption of safe behaviour (27 with WOE of 3 to 5) and 42 that covered how to encourage safer behaviours (22 with WOE 3 to 5). Therefore, the level of evidence for these questions was considered to be moderate.

The key points are that:

- The evidence is mixed (see Table 4 for a summary of some studies) in that some studies report a disparity between knowledge and behaviour whilst others report an association between knowledge and food safety behaviours. The FSA focus group and the experts were unanimous in agreeing that there was a disparity between expressed knowledge and observed behaviour. For example, research has found:
 - Lack of knowledge being associated with not using fridge thermometers and failure to apply correct cooking temperatures;
 - People instructed in food safety having better cleaning and chilling behaviours;
 - Actual practice regarding cleaning utensils and hands being poorer than reported knowledge.
- Other studies indicate that factors such as risk awareness and risk perceptions also influence behaviour.
- Self reported levels of knowledge do not correspond to assessed levels of knowledge, some studies report underestimation of risks and some report low levels of awareness of pathogens.
- The expert interviews stated that people often do not understand the reasoning behind advice and do not think that they will suffer foodborne illness, and consequently do not apply known good practices.

This review strongly suggests that, when the evidence is considered as a whole, that the perception and awareness of risk may be an influence on the extent to which improved knowledge affects food handling practices and actual behaviour. Knowing about recommended practices may be a pre-requisite to adopting such behaviour. However, people display ‘optimism bias’ (namely when people wrongly believe that they are not vulnerable to foodborne illness) or have a low awareness of the risk and may be less likely to apply their knowledge of food safety. This leads on to the view that if an increase in ‘knowledge’ (of the hazards and potential consequences) leads to an increase in risk perception; this may lead to a change in behaviour. This view was also expressed by the experts who stated that food safety behaviours can improve when people understand the risks associated with specific behaviours and the benefit of recommended behaviours. However, if the increase in knowledge is limited to recommended food safety behaviours, this may have less impact. In addition, increased knowledge (of risks and/or recommended

practices) may not have an impact if there are social or other barriers, such as attitude.

Some studies have identified factors that may help explain the association between knowledge and behaviour.

- In a survey of 153 young adults at university in the US (Abbot et al, 2009), it was found that one of the most powerful predictors of food handling behaviours was knowledge of who is at greatest risk of foodborne illness;
- Studies such as Redmond & Griffith (2003) reported low levels of awareness of foodborne risks – such as being unaware of which foods are associated with pathogens, the risks of (for example) not washing some foods etc;
- It has also been suggested that habit is a factor, described as when “performance of a particular behaviour is no longer based on reason, but is elicited automatically based on certain ...cues or contexts” (Mullan 2010, p31). Mullan goes on to cite research that found that habit explained (just) 4.9% of variance in food hygiene behaviour.

Some studies report that the role of knowledge, awareness and motivation varies between types of food safety behaviours. For example, Daniels et al (2000) report from a US behavioural observation study using 115 home audits stated that:

- ‘Education’ (“Participant had never heard of the principle”, p6) was the most common cause of ‘violations’ for ‘improper leftover handling’, ‘cross-contamination’ and ‘thermometer use’;
- ‘Awareness’ (“...not thinking of the principle at that the time”, p6) was the main cause of ‘violations’ of ‘personal practice’, cooking at low temperatures and ‘inventory control’, and;
- Lack of motivation (“...consciously chose to ignore principle”, p6) to follow recommended practice was an equal first cause of ‘improper food preparation’.

Nieto-Montenegro, Brown and LaBordehas (2006¹³) mention a variation on the Health Action Model which had 5 types of factors, 1) knowledge, 2) norms, 3) motivation, 4) belief and 5) physical conditions, which influence action. This would be consistent with the idea that there is a range of factors that interact in their influence on food safety behaviour. The model would suggest that there is not a direct association between knowledge and behaviour. Instead, behaviour is influenced by a combination of factors, such that (for example) norms (e.g. previous behaviours) may inhibit application of new knowledge.

This leads to a final point, namely that the debate about the link between knowledge and behaviour needs to recognise that the term ‘knowledge’ has been used to refer to a variety of points, such as knowledge of food handling practices versus knowledge of the risks. The differences in studies may be explained in part by the possibility that some studies have explored the association between knowledge of *risks* and behaviour, whilst others have explored the relationships between knowledge of recommended practices and behaviour. Those studies that have suggested there is a disparity between knowledge and behaviour also say that risk perceptions influence behaviour. Thus, there is possibly a higher level of agreement between the studies once the difference in the use of terms is recognised.

¹³ This study was additional to the evidence review and was not weighted as it serves purpose of illustrating the Health Action Model only.

Table 4: Examples of studies covering relationship between knowledge and behaviour

Studies indicating an association between knowledge and behaviour	Studies indicating a disparity between knowledge and behaviour
<p>Some studies report that education in food safety was associated with behaviours, for example:</p> <ul style="list-style-type: none"> • Meer and Misner (2000) in a US survey of 229 consumers (mostly women), found a small positive effect of food safety knowledge on “food safety practice scores” (i.e. questionnaire responses); • Brennan et al (2007) in an Irish survey of 1000 high risk consumers found that completing a home economics course was the significant factor for food safety behaviour; • Abbot et al (2009) in a survey of 153 US young adults at University found that: <ul style="list-style-type: none"> ○ Prior food safety instruction predicted actual cleaning and chilling behaviours; but ○ Respondents were observed performing 25% of the recommended hand washing practices, despite self reporting they perform half of these and three quarters answering hand washing questions correctly. <p>Some studies report an association between knowledge and behaviour, such as:</p> <ul style="list-style-type: none"> • In a survey of 1020 Irish consumers Kennedy et al (2005) reported that knowledge of how to avoid cross-contamination and how to cook food thoroughly were the distinguishing factors between people with higher and lower levels of fridge contamination. 	<ul style="list-style-type: none"> • Redmond and Griffith (2003) reported from meta reviews that “knowledge, attitudes, intentions and self reported practices did not correspond to observed behaviours” (p130), e.g. 89% report correct use of utensils but only 47% did when observed; • Redmond and Griffith (2003) in their review of evidence argued that failure to apply appropriate food handling practices that people were familiar with lead to many cases of illness as oppose to a lack of knowledge. However whilst some other studies also indicate that provision of knowledge does not always translate into practice, they do report improved knowledge can enhance the motivation to change behaviour. • Patil, Cates and Morales (2005) reported from a meta-review of 20 studies that knowledge of safe handling practices did not correspond with reported practices. In most cases, knowledge exceeded practice. However, they also found: <ul style="list-style-type: none"> ○ Knowledge diverged from practice most amongst people with more than a high school education; ○ Food handling practice were superior to knowledge amongst people without a high school education, who also had better hygiene practices; ○ Men and younger adults were more likely to have a large difference between knowledge and practice; and people who have knowledge but poor practices may be displaying an ‘optimism bias’ i.e. perceiving that the negative effects of unsafe behaviour are unlikely.

Barriers and factors encouraging safe behaviours

These findings suggest that the barriers to adoption of recommended food safety behaviours include:

- ‘Knowledge’ – lacking correct knowledge of food handling practices;
- ‘Risk awareness’, ‘level of concern’ – failing to understand the risk posed by unsafe food handling practices, underestimating the risk of harm and how specific food handling practices may cause food poisoning;
- ‘Optimism bias’ – being over optimistic in one’s knowledge of correct food safety practices and resilience to illness;
- Age related ‘impairments’ – factors such as impaired vision limiting ability to read labels;
- Income related factors – affordability of aids such as fridge thermometers.

The research suggests a combined approach is needed that addresses all of these factors in a targeted way, such as:

- Addressing misconceptions about food safety risks, raising awareness of the vulnerability of specific types of people and how food poisoning can be caused by unsafe practices;
- Providing advice on specific recommended food handling practices.

Potential interventions are discussed further in section 2.4 of this report.

2.2.4 Theoretical approaches

A summary of theoretical approaches to health and safety behaviour is given below. It should be noted though that this summary is equally relevant to the latter questions about barriers and the association between knowledge and behaviour, in that they provide an explanation of this association. The weight of evidence could be said to be low as most of the studies describe a theoretical approach. However, the authors of this report suggest that they are moderately robust because 1) they are based, if implicitly, on research and 2) they all identify social and psychological factors that influence the relationship between knowledge and behaviour.

What are the theoretical approaches that have been adopted to explore and explain food storage/handling behaviours?

A small number of studies have considered theoretical aspects of food safety behaviours. Most studies have focused on reporting behaviours and attitudes, rather than theoretical explanations of these. Social cognition models, such as the Theory of Planned Behaviour have been advocated as a way of understanding the disparity between knowledge and behaviour and as a basis for designing educational initiatives that target attitudes and beliefs, as well as knowledge. Social cognition refers to the process of learning and thinking (cognition). The ‘social’ aspect refers to the influence of watching other peoples’ behaviours and their opinions on your own thoughts and behaviours. The models also recognise that individuals also learn from their own experience.

Key aspects of these approaches are noted below. Mullan (2010¹⁴) provides an extensive summary of three social cognition models, namely health belief, the theory of planned behaviour and health action model, and their application to food safety behaviour. These

¹⁴ The article has been used as it serves the purpose of describing models as opposed to a critique of them.

models have been developed and applied to health behaviour in general and are not unique to food safety. Indeed, social cognition models have only been applied to a few food safety studies. However, they are still considered helpful in understanding what can at first appear to be conflicting results of different food safety behaviour studies. In particular, the models indicate that the application of knowledge of recommended food handling practices would be influenced by an individual's observation of how other people behave, other peoples' attitudes and their own experience of food safety.

As noted above, this review concluded that each of these approaches has value in that they help to explain elements of food safety behavioural research. The research reviewed in section 2.2 has identified that food safety behaviour is influenced by a combination of knowledge of recommended food handling practices, awareness of the risk, social pressure, normative values, and motivation. Risk perception work builds on these models by helping to explain how people perceive risks and how these risk perceptions may be influenced. These models provide a 'framework' for explaining how these factors may interact and how to influence these behaviours. The models therefore inform the answer to the Agency's questions about barriers and how to encourage food safety. For example, in aggregate the models would suggest that it is important to:

- Help people recognise unsafe behaviours and their consequences;
- Recognise if people feel they are not susceptible and raise the profile of (underestimated) risks;
- Address any misconceptions of risks and behaviours, as well as social pressures and norms;
- Demonstrate the benefits of changing behaviours, as well as the severity of harm if they do not;
- Ensure people feel confident and able to implement the suggested behaviours;
- Cite credible behaviours when trying to change behaviours; and
- Ensure the source of advice is credible.

Health belief model

The health belief model (Rosenstock, 1974), originally developed in the 1950s, consists of six central 'constructs', 'perceived susceptibility', 'severity', 'benefits', 'barriers', 'self efficacy' (a person's belief about their capabilities) and 'cues to action'. It is argued that people make rational choices and decisions based on their view of these constructs. For example, if they believe they are susceptible and the consequences are severe, then the costs (such as time and effort) of engaging in a behaviour are outweighed by the benefits. Cues to action may include advertising alerting people to a risk. Mullan (2010) reports that the model has been applied "with some success" (p18) to food hygiene behaviour, i.e. it does help to explain food hygiene behaviour. However, Mullan (2010) also reports a number of flaws in the application of this model, including failure to establish the validity of measures (i.e. do the measures actually measure what they claim to measure?) and whether the model includes a social element to account for the role of social influences on behaviour. In addition, normative influences were cited as a key social influence and are included within the Theory of Planned Behaviour.

Theory of planned behaviour

The Theory of Planned Behaviour is one of the most widely used models in health psychology, and was derived from the theory of reasoned action. It assumes that behaviour is rational. Decision making is influenced by motivation and in turn by social

norms and beliefs. Beliefs may include perceptions of the risk. Norms may include the influence of how 'significant others' view an activity. It also introduces the idea of 'perceived behavioural control', i.e. does the individual believe they have control over the issue and are capable of the behaviour. It was reported by Mullan (2010) to have successfully explained food safety behaviour in some studies, accounting for about 41% of variance in intention; and has been used to design a food hygiene intervention (Mullan and Wong, 2010). However, it has been criticised for predicting intention more accurately than actual behaviour.

Health action model

The health action model was developed as a combination of the Health Belief Model and the Theory of Reasoned Action. This model cites social pressure as an influence on behavioural intention. Previous research (Nieto-Montenegro, Brown and LaBordehas, 2006) found the five constructs of the model effective for identifying influential factors when designing a food handling educational intervention, in this case for Hispanic workers in the mushroom industry. The five constructs are:

1. 'Motivation and volition'. The first principle suggests that one should divide the health behaviour change process into two phases - the motivation phase in which people develop their intentions and then the volition phase.
2. 'Two volitional phases'. There are two groups of individuals: those who have not yet translated their intentions into action, and those who have.
3. 'Post-intentional planning'. People are motivated to change, but need to plan a strategy and may need to acquire the right skills to translate their intention into action.
4. 'Two kinds of mental simulation'. Planning can be divided into action planning and coping planning. Action planning pertains to the 'when, where, and how' of intended action. Coping planning includes the anticipation of barriers and the design of alternative actions that help to attain one's goals in spite of any impediments.
5. 'Phase-specific self-efficacy'. Perceived self-efficacy (self belief in one's capabilities) is required throughout the entire process.

Nieto-Montenegro et al (2006) stated that when explaining why someone may or may not engage in the specific behaviour, the model had the advantage of incorporating wider social and environmental considerations to behaviour in addition to characteristics of the individual.

Elaboration Likelihood Model

Petty and Cacioppo (1986¹⁵) propose the Elaboration Likelihood Model. This theory attempts to explain how 'persuasive messages' are processed thus leading to changes in attitude and behaviour by suggesting that those with an active interest in the area of promotion will have the motivation to consider the 'central' content of any promotional activity including the detail of the message being promoted, their existing thoughts of the topic and those of people close to them. By contrast individuals who lack interest or experience in the area will more likely encode the 'peripheral' cues of the message and will therefore lack motivation to give consideration to the message itself and instead will be swayed by wider cues such as celebrity endorsement and social approval. Hence, the model suggests that persuasion will differ from person to person and in different situations.

¹⁵ Not assessed in the evidence review as it describes the model only.

In a survey of 160 individuals exploring risk perception, Frewer et al (1997) examined the use of the Elaboration Likelihood Model in the context of food risks. The research found that low 'credibility of the source of advice' was an important factor in reduction of risk perceptions. 'Persuasive content' and 'hazard type' were also said to be important in determining whether people paid attention to the message. They concluded that:

"Optimistic bias may represent one of the biggest barriers to the impact of effective risk communication - if people believe that the information is directed towards a vulnerable other person, rather than the self, they are unlikely to pay attention to the risk information" (p768).

Transtheoretical model

This presents behaviour change as a set of stages (see Armitage et al, 2004 for a discussion in the context of food choices). The stages are:

- 'Pre-contemplation' - people are not intending to take action in the foreseeable future, usually measured as the next 6 months;
- 'Contemplation' – raising consciousness and awareness of the issue, with consideration to take action in the future;
- 'Preparation' – self evaluation and advanced planning in order to take action in the near future;
- 'Action' – people are making changes to behaviours;
- 'Maintenance' – continuing behavioural changes made and working to prevent relapse;
- 'Termination' – complete behavioural change whereby individuals are sure they will not return to their old behaviours.

For an individual to move from the pre-contemplation stage to the contemplation stage, they must first become aware of the issue. As with other models such as the Health Action Model, it says that people will make decisions on behaviours by balancing pros and cons, and these decisions will be influenced by their self confidence. It is suggested that people with more self confidence are more likely to adopt recommended behaviours. It also includes processes of change which are strategies people use to progress from one stage to another. The model was used to help explain use of food labels (Coulson, 2000) by 165 students, using self report questionnaires. With regards to the percentage of participants classified into each stage, Coulson reported the following: 30% pre-contemplation, 4.5% contemplation, 16.4% action and 49.1% maintenance. The consumption of fruit and fatty foods was reported to be associated with the stage of change, such as contemplation stage versus action stage.

We did not identify other applications to food safety in the home. The model has however received criticism due to its capacity allow for relapse at any stage, yet without offering explanation for why this may happen.

Risk awareness and perception

The perception and awareness of risk has been cited as an important factor in many food safety studies, such as Clayton, Griffith and Price (2003) who interviewed 100 consumers about their behaviours and observed behaviours in 40 of them. This leads onto the question of how to characterise risk perceptions, such as what factors distinguish and influence perceptions of different food safety risks. There have been many studies

regarding public risk perceptions, some of which are summarised in Fife-Shaw and Rowe (1996¹⁶) in the context of food safety. Some key points are that people do not comprehend risk according to fatality estimates. They have more elaborate conceptualisations that include considerations such as immediacy of effect, voluntariness of risk, control over risk, newness and others. Risks that are perceived as 'old', that you have control over and are not severe, are regarded as lower risk, for example. Awareness of risks is important as this would influence perceived severity. It goes on to suggest that issues such as trustworthiness and credibility of sources of information also influence the impact of risk communication.

Howard and Wignarajah (2008) in a summary of previous work cited one study from 1987 that had mapped out how people perceive the risk posed by foodborne illness (from all sources). They found that foodborne illness was perceived as high probability but which provoked low 'outrage', attributing this to perceived 'controllability', 'voluntariness' and 'familiarity'. They also quote a survey of 120 people reporting that perceptions of food risks were explained by their perceived severity, familiarity and number of people exposed. Finally, they cite the idea of 'optimism bias', where people underestimate the probability of an adverse event, which Howard and Wignarajah (2008) report has been found to apply to food safety. In a survey of 100 consumers, Redmond and Griffith (2004) found that 90% of respondents demonstrated 'optimism bias', 'illusion of control' and 'perceived invulnerability' to food poisoning from self prepared foods. In other words, consumers often perceive themselves to be at less risk than others and consequently take no action to change their own behaviours.

Socio demographic factors

A number of studies have explored the relationship between socio-demographic factors and food safety behaviours, such as the association between income and behaviour. However, we were able to identify very limited theoretical work regarding socio-demographic factors and food behaviour, such as sociological models. Some of the studies, as per section 2.2.3, indicate that knowledge or education can influence the extent to which there is an association between socio-demographic factors and behaviour. No studies were identified that took these findings forward to develop a sociological theory about how factors such as education, income, ethnicity and other social factors interact to influence food safety behaviour. Whilst research has identified some social factors related to food safety, the review did not identify a theoretical explanation of these factors in the context of food safety behaviour.

2.3 Food safety versus kitchen practices and other behaviours

How, if at all, does existing literature on food safety behaviours fit with the literature on food and kitchen practices and behaviour more broadly?

Research regarding wider kitchen and food practices was considered by the researchers to be of relevance in a number of respects including:

- Indicating trends in consumption that could influence consumer exposure to foodborne pathogens;
- Indicating trends in cooking skills and practices that could influence food handling risks.

¹⁶ Not assessed in the evidence review as it describes the model only.

An understanding of the social trends that may influence food safety behaviours may inform the design of interventions, such as by targeting the reasons for spending less time cooking.

In addition, some studies have reported a coincidence of attitudes towards food safety and towards other aspects of cooking, diet and kitchen consumptions. If behaviours form a pattern this may suggest they have common underlying factors and that education should adopt a holistic approach to diet, cooking skills and hygiene. The expert interviews indicated that people with an 'external locus' (i.e. they do not feel that they control events that affect them) of control tend to be less health conscious and less likely to follow food safety advice than health conscious people who have an 'internal locus' of control (i.e. they feel that they do control events that affect them).

The weight of evidence for this question was moderate, with 65 studies in total and 35 rated as 3 to 5. In addition, they consistently reported some trends, such as less time being spent cooking. As many of these studies examine trends in cooking and kitchen behaviours generally, the association of these trends with food safety behaviour in the home has not been assessed to any great extent.

As summarised in the studies below, some key trends that may increase food safety risks in the home include:

- A trend towards consumption of pre-prepared foods
- A reduction in time spent cooking;
- Reduction in cooking skills;
- A trend towards single person households who are associated with simpler cooking, such as less use of raw ingredients;
- More bulk buying.

The findings were:

- Buckley, Cowan and McCarthy (2007) identified four consumer segments from a survey of 1000 consumers, which are paraphrased below:
 - the 'food connoisseurs' (26%) – they are least likely to snack or eat convenience foods, less likely to eat alone, check food prices and less likely to seek convenient cooking methods;
 - the 'home meal preparers' (25%) – they are least inclined to purchase convenience foods or seek ways to save time in cooking, freshness is important to them and they are more likely to involve the whole family in meal preparation;
 - the 'convenience-seeking grazers' (33%) – have a higher intake of convenience foods, willing to forego freshness for convenience, time pressured, use microwaves and snack. Convenience seeking grazers also have high levels of Socio Economic Status (SES) and were more likely to be 25- 34 and 45-54. These people were less likely to prepare food properly and plan their meals;
 - 'Kitchen evaders' (16%) are individuals who are most inclined to choose convenience foods to ensure their lives are easier, are most time pressured and eat alone. They are more likely to be 16-24 and the lowest SES.

- Williamson et al (2004) expressed the view, based on their interpretation of research findings, that changes in lifestyle have an impact on food safety behaviour, in particular more women in employment, less commitment to food preparation, and a greater number of single heads of households;
- Warde et al (2007) reported from the use of diary data from the early 1970s to 1990s that “There are some common patterns across countries (*France, UK, USA, Norway and Holland*), notably a decline in the amount of time devoted to food preparation”;
- There has been an increase in single person households (ONS, 2009) who are associated with ‘simpler’ cooking (see section 2.6);
- Knabel (1995) noted that failure of adults to learn basic principles of food safety and preparation could be attributed to societal changes such as changes in family structure, increased use of convenience food and decline in the levels of training that individuals receive in proper food handling.;
- Mullan (2010) cites some social trends that could influence food safety in the home, as paraphrased below:
 - A reduction in cooking skills passed to children and young people as a result of the increase in the proportion of women working. Less time for cooking and an increase in the use of convenience foods also has an effect;
 - Fewer people shopping on a daily basis, with movement towards bulk buying and convenience foods – this in turn leads to concerns about storage of foods by consumers;
 - Removal of preservatives from foods in response to consumer demand, reducing the safe life of foods at home.

The feedback from experts and the FSA focus group also cited the following trends; a reduction in cooking skills; less cooking education in schools; less food preparation in the home (more pre-packaged meals); more eating out; more cooking food ‘lightly’; more eating raw foods (e.g. salads); more barbeques. All of these trends may increase food safety risks. The FSA focus group also cited the use of cleaning products and discussed whether this has led to less cleaning by people, and whether the use of vacuum packed cold meats require different handling methods (once opened) than before.

Thus, a trend towards convenience foods, fewer preservatives and bulk buying may increase pathogen risks (i.e. consumers may store foods with less preservative for longer), whilst a reduction in cooking skills and time may reduce standards of food handling, with these trends possibly coinciding for some groups.

2.4 Interventions

2.4.1 How to influence behaviours

What is known about influencing safe food storage/handling behaviours?

The weight of evidence

The evidence review and the feedback from experts indicated that there have been few high grade evaluations of interventions. Only 19 evaluations of interventions had WOE scores of 3 to 5. As noted in section 6.4 most studies rely on reported change in attitudes or knowledge in a subject group, without using control groups or assessing observed behaviour, i.e. the weight of evidence was commonly moderate. Milton and Mullan (2010)

in a meta-review of 10 consumer food safety education studies found that there were many gaps in the research and that there were methodological flaws in many studies, such as relying on self report questionnaires. They recommended longer follow up, use of randomised control trials and more rigorous intervention design. In addition, the FSA focus group noted that it is difficult to isolate the impact of campaigns from other events such as food poisoning outbreaks and related media attention.

Many of the recommendations on how to influence people are based on researchers' interpretation of studies into peoples' behaviour rather than evaluations of the impact of interventions. Therefore, this review recommended that more rigorous approaches are adopted in the evaluation of future interventions, as discussed in section 3.2 of this report. The low weight of evidence regarding interventions also implies that there is a limited evidence base for deciding on future intervention.

Key findings

The key recommendations from previous research are consistent with the research into the factors influencing behaviour, namely that behaviour is influenced by a combination of knowledge, risk perceptions and behavioural norms.

Notwithstanding the low weight of evidence about interventions, overall the evidence regarding factors that influence behaviour (as per section 2.2) and on the impact of interventions (as summarised below) are consistent with the opinions of researchers including:

- The provision of advice and information can influence attitudes, knowledge and behaviours, although this is not a perfect relationship, for example:
 - Milton and Mullan (2010) report that all 10 studies of consumer food safety education reported "...some significant evidence of an increase in food safety behaviours post intervention" (p45);
 - Cates et al (2007) report in a study involving 8 focus groups of older people (typically 60 and over) recommended practices were not adopted despite individuals being exposed to 'educational materials';
 - After education, using a sample of 107 before and 45 after questionnaires, Roseman and Hayek (2005) reported "an increased percentage of elderly believed older people were more likely to get food poisoning (from 66% to 76%); increased eating prepared meals right after delivery (from 45% to 57%); increased thawing food in refrigerator (from 28% to 40%); and decreased thawing at room temperature (from 15% to 10%).
- Redmond and Griffith (2005) noted that strategies should be based on knowledge of the attitudes, actual behaviours and receptivity to advice of each population segment.
- Strategies need to address perceptions and awareness of risk as well as provide knowledge, as per section 2.2.3 of this report;
- The intervention needs to be targeted at and specific to the target group (Redmond and Griffith 2004);
- The source of information is a key factor in whether people trust the food risk information (Redmond and Griffith 2005). This is reflected by the finding from a survey of 586 pregnant women who reported that they were more likely to trust advice from healthcare professionals but less likely to trust advice from friends and family (Bondarianzadeh, Yeatman and Condon-Paoloni, 2007). Redmond and

Griffith (2005) found that environmental health offices and health professionals were the top trusted sources.

Redmond et al (2006) go on to argue that “Despite the vast quantity of food safety information ... available or provided to UK consumers, this study has identified a widespread lack of familiarity and failure to recall ... UK intervention materials from national and local food safety initiatives” (p18). This was said to suggest that “previous and current placement, promotion and distribution strategies are ineffective and require reviewing” (p18). They argue that inaccurate beliefs about ‘adequate’ behaviours and failure to associate personal relevance to food safety education efforts may significantly impede intervention effectiveness.

Redmond and Griffith (2005) go on to highlight ‘social marketing’ as the contemporary approach to behaviour change and cite studies saying that it is the most developed approach to public health communication. Social marketing is advocated by the Department of Health for public health promotion. It is a consumer oriented approach that targets audiences’ needs, wants, attitudes and perceptions. Whilst it involves dissemination of knowledge and advice, this is developed and provided through a social marketing approach. The principles of social marketing are consistent with the themes cited above.

2.4.2 Disseminating advice

What, if anything, is known about how to disseminate food safety advice to particular groups of the population?

A consistent finding from the evidence review and from expert interviews was that advice should be specific to each target group, address their particular attitudes and be presented in a way that they can identify with. As previously noted, these findings are based on a low weight of evidence. Some specific findings include:

- It has been recommended that advice for patients and pregnant women should come from healthcare professionals;
- Schools based education has been recommended for children and young people and found to improve knowledge (See section 2.4.3);
- For the general population, mass media channels such as the TV are cited as common sources, for example Redmond and Griffiths (2005). In addition Redmond et al (2005) noted that food safety television campaigns have reported recall rate of 61%.
- Policastro et al (2007) reported from focus groups that young adults want campaigns to “focus on a few behaviours, be personalised, provide concrete examples for improving behaviours, and be serious but light-hearted in tone”. They identified “information overload”, ‘time constraints’, and ‘apathy’ as major barriers to receptiveness to food safety messages.
- In the case of older persons:
 - Gettings and Kiernan (2001) in a US focus group study of 74 senior citizens reported that ‘senior citizens’ expressed limited support for computer based advice, preferring flyers and television adverts.
 - Darnton (2005) found in a desk research review that older people tend to prefer receiving information face to face, particularly more excluded subgroups. Whilst older people watch more television, they do so in a ‘passive way’ and become less interested and less receptive to advertising.

- Roberts et al (2009) reported that from a survey of older adults ($n = 103$), just over a third of respondents used computers and email to obtain information. In addition 64.9% used personal interactions and newsletters/papers (62.5%).
- Also, when they asked which types of technology they used, the most common responses included television (99%) and over half (52.4%) mobile phones. In addition 41.7% used a computer and 35% used the internet."

It should also be noted (as per this evidence review and the expert interviews) that if people perceive that the information is directed at another, perhaps vulnerable group of people, they may not perceive it to apply to them and may indeed reinforce their own 'optimism bias' (as per the Likelihood Expectation Model, see section 2.2.4). Thus, whilst personalised information is advocated by researchers, this may lead to a 'narrow' impact. The expert interviews suggested that targeted approaches should be complimented by general advertising through media such as television, to ensure that targeted messages do not lead other people to believe they are not at risk.

2.4.3 Educational campaigns

What educational campaigns have been undertaken to provide the general public with information about food safety in the home, how have these been evaluated and what has been learnt?

The main interventions in the UK and elsewhere have included:

- Television, newspaper and internet based campaigns/advice about foodborne risks and how to manage them;
- Advertising in doctors' surgeries and pharmacies, such as regarding foodborne illness risks and the need to (for example) use separate chopping boards for fresh meat versus other products;
- Labelling of products with information such as recommended cooking times and safe storage instructions;
- Schools based education involving practical lessons or computer based exercises regarding recommended food handling practices.

As previously stated, we were unable to identify from the included research any examples of educational campaigns in the UK via healthcare professionals, other than advice on the NHS Direct website.

The evidence found is summarised below. Given the small number of evaluations and their moderate WOE scores, the confidence in the evidence was low. Many studies relied on before and after tests of knowledge without checking changes in behaviour or the level of knowledge sustained at later dates.

The key findings were that:

- **Mass media (including in doctors' surgeries etc):** The evaluations report that mass media interventions are associated with increased food safety knowledge and influenced behaviours.

The evaluations have tended to rely on before and after self reported changes in attitudes and behaviours, without using matched control groups of people (people who were not exposed to the media campaign); and general trends in reported behaviour. Such studies are rated as only moderate (2) by our weight of evidence criteria. Therefore, this finding has only moderate strength. In addition, it is not possible to attribute a cause and effect relationship between mass media

intervention and changes in attitudes/ behaviours due to the broad range of other potential influences on people's attitudes and behaviours;

- **Local Authorities:** Whilst many Local Authorities use leaflets, the impact of these leaflets did not appear to have been evaluated;
- **Schools based education:** Whilst schools based education was consistently reported to be effective, studies focused on the impact of school based education on knowledge, rather than changes to actual behaviour. In addition, most of these studies had a moderate weight of evidence, again limiting the extent to which firm conclusions can be drawn;
- **Labelling:** Few studies have evaluated the impact of labels on food safety behaviour. Studies have focused on the reported use of labels rather than the impact of labels on observed or self reported food safety behaviour. They tend to report low levels of use of labels for food safety purposes.

Mass media interventions and advertising in surgeries etc

The Agency has led many of the UK campaigns including:

- Mass media campaigns, for example, the 4 Cs campaign;
- Advertising in doctors' surgeries and pharmacies;
- The Agency has also completed some targeted campaigns for older persons, such as Food Safety Week 2009.

Many of these campaigns were holistic, covering healthy eating and food safety. The Agency's review of subjective feedback (Giles, 2009) on campaigns led by the Agency or partners across the UK cited positive stakeholder feedback but did not evaluate impact in terms such as change in attitudes or behaviours. Other findings are noted below:

- The 2005 pre and post evaluation of the Agency's TV based food hygiene campaign (COI, 2005), which focused on the preparation of raw chicken, provided mixed results;
 - Unprompted awareness of the campaign rose amongst adults from 17% before to 24% after, i.e. a rise of only 7%, and when prompted, recall was 41% of adults. 86% said they already knew the information;
 - However, there was a rise in awareness of some of the key behaviours, such as washing hands after handling chicken (rising from 38% to 45%) and using different boards for raw chicken and other foods (rising from 21% to 27%).
- COI Communications (2003) and COI Communications (2004) reported that there were high levels of consumer awareness, recall and retention of the Christmas Turkey advertising campaign message;
- A US report noted (Daniels et al, 2001) that there had been a decrease in 'violations' (failures to follow recommended practices that may cause illness) from 96% to 74% between 1997 and 2000. They attributed this by judgement to media attention of food safety, as respondents identified the media as their main source of food safety information. In addition the study also found that cross contamination was no longer the most frequent violation. Lack of hand washing and incorrect food preparation was reported as becoming the most frequent type of violation;
- When assessing self reported food safety practices before and after intervention, 176 women who were provided with information via interactive multimedia self-reported significantly greater improvement than those receiving information via a

- pamphlet (Trepka, 2008);
- Griffith et al (1994) reported the view that mass media can have a positive effect in health education and also provide individuals with 'cues to action' in order to improve food hygiene in a domestic environment. This follows on from the point that for any health education campaign to succeed it is important that people perceive there is a need for the information, as well as trusting the source of information. They went on to argue, after consulting people about sources of information, that magazines, cookery books and television programmes were effective means of disseminating food safety information;
 - Darnton (2005) from a review of research that the principles for TV advertising should include a clear 'narrative', 'transparent messages' which highlight benefits, as well as reinforcing the overall message through 'mnemonic techniques'.

The feedback from experts was more mixed. They stated that many people obtain their food safety knowledge from television cookery shows. However, the shows do not always follow correct food safety practices and so may contribute to a distorted view of appropriate food safety behaviour.

UK Local authorities

Redmond et al (2006) reported from a survey of Local Authorities (LAs) that:

- The majority of LAs (93%) provide 'consumer food safety advice' via leaflets;
- The most common issues which LAs reported as being addressed in 'hygiene initiatives' included hand-washing (87%), cross-contamination (85%) and cooking (77%);
- Evaluation of the effectiveness of food hygiene advice was uncommon with only less than a third of LAs undertaking this;
- Local Authorities reported an increase in the use of internet and a reduction in 'traditional formats' when sharing and disseminating information.

Findings suggest a relative lack of coordination of consumer food safety activities in the UK (particularly in England, Wales and Scotland). Furthermore, large numbers of LAs 'reinvent the wheel' with unique interventions that many consumers do not rate highly. In addition, the effectiveness of initiatives in the UK is rarely evaluated.

Schools based education

Studies focused on the impact of school based education on knowledge rather than changes to actual behaviour. Most of these studies had a moderate weight of evidence, again limiting the extent to which firm conclusions can be drawn. The main findings were that:

- Schools based education was regarded as effective (in raising knowledge);
- There is evidence of inconsistent teaching practice across schools in the UK.

The number of studies regarding alternative teaching methods was insufficient to confidently draw out any themes.

Studies on schools based education consistently report that education at schools is associated with improved knowledge and increased understanding of food safety behaviours (Pivarnik, Patnoad and Giddings, 1994; Edwards et al, 2005; Richards et al, 2008). These studies tend to rely on before and after comparisons of knowledge.

The evidence regarding practice included:

- Bielby et al (2006) in a UK survey of 875 primary schools found that topics such as personal hygiene and hand washing (and food hygiene in general) are taught in a number of areas. It was however noted that limitations were found in terms of teaching the topic due to a lack of space and time within the curriculum.

As regards teaching techniques, there are (as noted above) varied results, including:

- In a survey of 756 teachers in primary and secondary schools, Egan et al (2008) concluded that practical demonstrations and activities were most effective in educating children and young people;
- Youatt et al (1996) in a US study of students aged 8 to 11, found from post session questionnaires that computer based games were easy to use and resulted in a positive change in knowledge on food safety;
- Thompson et al (2007) report that self-paced internet modules were as effective as traditional classroom teaching for food safety education in secondary schools. Groups taught with either of the two methods had significant changes in post teaching test scores. Internet teaching was found to be most successful for students with higher education levels.

Labelling products

Labelling of products includes 'use by' and 'best before' dates, as well as storage and cooking instructions. Few studies have evaluated the impact of labels on food safety behaviour. Studies have focused on the reported use of labels rather than the impact of labels on observed or self reported food safety behaviour. As summarised in section 2.2 of this report, the use of labels is reported to be low with people often misinterpreting labels.

The few studies on the role of labelling in promoting food safety in the home were moderately rated; mostly using surveys of self reported use of labels, and have provided mixed findings. For example:

- Yang, Angulo and Altekruse (2000) reported from a US survey of 14,262 consumers that there was a higher level of awareness of label awareness and risky food-handling behaviours amongst people with higher education and income. They also reported that food handling labels had a limited impact on cooking practices although they did discourage cross contamination.
- In a pilot study, food packaging was reported by college students to be the most convenient means of receiving food safety education (Burney, Richards and Draughon, 2009);
- Carter-Young et al (2003) report finding in focus group discussions that people do not generally look for 'Safe Handling Information' labelling to determine if a product requires cooking for safety; although some said it is helpful, especially for new cooks. About half look for preparation instructions and use instructions to dictate the cooking method. They also reported that participants were confused by the inconsistency in cooking requirements on labels ;
- Carter-Young et al (2003) reported that participants suggest the use of colour coded logos and standardised cooking phrases, such as 'cook thoroughly'.

2.4.4 Fridge thermometers

Despite the common finding that few people use fridge thermometers and that fridge temperatures are often above recommended levels, there were no studies exploring the possibility of mandating or encouraging the installation of fridge thermometers by manufacturers. Nor was any research found to encourage the use of refrigerator

thermometers amongst consumers.

2.4.5 Outreach and community interventions

There have been very few studies regarding the nature and impact of community based schemes. Two studies, summarised below, suggested that community based approaches were feasible and improved knowledge:

- Stevenson and Duval (2003) piloted a community-based food hygiene initiative in the Toxteth–Granby area of Liverpool between December 2001 and March 2002. The project aimed to raise awareness of poor food purchases as well as storage and handling practices. The study involved community members in ‘home-based peer-facilitated training’. It concluded that the pilot demonstrated the feasibility of this approach.
- Byrd-Bredbenner, Schaffner and Maurer Abbot (2010) reported from a pilot that the use of a self directed home audit check increased participants’ (self reported) realisation that the cleanliness of their kitchens and their behaviours were putting them at risk of foodborne illness. Additionally, participants indicated that the check-up increased their food safety knowledge and the likelihood that they would improve their food safety behaviours.

However, both studies were pilots and have a low weight of evidence.

2.5 People’s behaviours: vulnerable persons and *L. Monocytogenes*

2.5.1 What is known about their behaviour

What is already known about food storage and handling behaviours relating to food safety in the home ... in vulnerable groups?

This section of the report first considers evidence regarding possible explanations of the rise in listeriosis amongst elderly patients and then summarises evidence regarding the food safety behaviours of elderly patients and elderly people more generally and then other vulnerable groups. As elaborated below, whilst there was no evidence of a behavioural reason for the rise in listeriosis, there was evidence of unsafe food safety behaviours amongst elderly patients, elderly people and other vulnerable persons. Therefore, whilst the rise in listeriosis may not be associated with a change in behaviour, there is a moderate level of evidence that listeriosis is associated with patient food behaviour, particularly consumption of high risk foods and unsafe food handling practices.

Trends associated with the rise in listeriosis

The review did not identify any study that sought to evaluate whether changes in behaviour or socio-economic factors are associated with the rise in listeriosis amongst elderly patients. Therefore, this review rapidly considered socio-demographic trends in the period before and after 2000. The rapid review did not identify any *change* in trends coinciding with the increase in listeriosis in the 2000s. For example:

- The number of single elderly people (lone pensioners) rose from 3.6m in 1991 to 3.8m in 2008 (ONS, Pension Trends 2010); i.e. the start of this trend predates the rise in listeriosis in the 2000s;
- Pension income rose from 1977 to 2005/06 whilst the percentage of pensioners living in households with less than 60% of median household income declined between 1994/95 and 2006/07 (ONS, Pension Trends 2010); i.e. the rise in listeriosis does not coincide with a fall in pensioner income;
- The trend in the level of care provided to elderly persons and a switch from

- communal living to independent living predates 2000 (DoH, 2000);
- Our review of family spending surveys (see section 9.2 of this report) found that there was no apparent major change in food expenditure on meats between 1999-2000 and 2008, except a decline in expenditure on beef.

Research into the food safety behaviour of elderly people does identify ‘unsafe’ behaviours, such as leaving cold meat uncovered in refrigerators. However, few if any studies have tracked the consumption patterns of elderly people over the past few decades or changes in food safety behaviour in the home. Thus, there was no evidence about trends in elderly patients’ food safety behaviours that coincide with the increase in listeriosis nor could this review identify any socio demographic, economic or expenditure pattern trend that coincided with or could explain the three fold increase in listeriosis amongst the elderly since 2000.

This review did not aim to assess clinical research. However, a very small number of studies were identified by a very rapid internet search and were *briefly* considered to determine if there might be non-behavioural reasons for the trend in listeriosis. This did not constitute or aspire to be a systematic clinical evidence review. The reviewed studies use data on treatment practices and rates of diagnosed listeriosis and so provide objective evidence of these trends. It was noted that:

- There was a threefold increase in the use of chemotherapy in the 12 year period 1995 to 2006 reported by a review of oesophagogastric cancer¹⁷ patients in the East of England (Lyratzopoulos et al 2009);
- Increases in listeriosis were also reported in Belgium, Denmark, Finland, France and Switzerland in the mid 2000s, most pronounced in older patients diagnosed with bloodstream infections (Gerner-Smidt and Whichard, 2008), as well as Austria, Spain and Norway (Allerberger and Wagner, 2009), again mostly in elderly persons with underlying disease. Clusters of cases due to sporadic outbreaks did not account for these trends;
- There was a marked increase in listeriosis in Israel in 1998, with a fivefold increase between 1996 and 1998. They also report from a review of worldwide cases that 74% of persons affected were immunocompromised patients with malignancies¹⁸ (Siegman-Igra et al, 2002);
- 1.7% of chronic lymphocytic leukaemia patients treated with fludarabine¹⁹ developed listeriosis compared to 0% of those treated with conventional chemotherapy (Anaissie et al, 2007);
- The use of chemotherapy increased from approximately 28% in 1997 to 36% of elderly patients diagnosed in 2002 in the United States (Lang et al, 2009).

It was also stated that tumour cells (in cancer patients) will genetically resist cytostatic²⁰ drugs, including antibiotics; i.e. cancer patients with listeriosis may be resistant to antibiotics (Hof et al, 1997).

¹⁷ Cancer of the throat and stomach.

¹⁸ Progressive worsening of their condition.

¹⁹ A chemotherapy drug

²⁰ The word 'cytotoxic' means toxic to cells, or cell-killing. Chemotherapy is formally called 'cytotoxic therapy'.

Therefore, there does appear to be value in a further exploration of the evidence for a relationship between the increase in listeriosis amongst elderly persons and what appears to be an increased use of chemotherapy. In addition, the increase in listeriosis does not appear to be unique to the UK. In the absence of evidence pointing to a sudden change in food safety behaviours or socio-demographics in a range of countries, the increased use of chemotherapy is a possible reason for the rise in listeriosis.

There were only 10 studies that this review identified relating to immunocompromised people, with six of these rated as 1 or 2, i.e. poor weight of evidence ratings. If there is a trend in listeriosis due to changes in cancer treatment, there would (in the opinion of the authors of this report) be value in further research into patient behaviour in order to help develop interventions. Therefore, it was suggested by this review that there was a need for further research into the role of cancer treatment and the behaviour of patients.

Elderly patients' food safety behaviour

There was very limited research into the food safety behaviours of chemotherapy patients and other patients who are immune compromised, with only 10 studies identified in total. This constitutes a low weight of evidence. The work that has been completed consistently indicates that there is limited awareness amongst elderly patients of their susceptibility to listeriosis or of the high risk foods to be avoided, and that many do engage in high risk behaviours. In addition, the expert interviews did not offer any additional insights into elderly patient behaviour, whilst the FSA focus group highlighted the view that some elderly people are less able to care for themselves and that this increases their risk.

Some specific findings from the evidence review include:

- Medeiros et al (2008) report on a multi stage qualitative research project involving discussions with 31 cancer patients. They found that American cancer patients were aware that they were vulnerable to infection and had 'basic' knowledge of food safety. However, the patients did not link their vulnerability to infection with their food handling practices. Two groups of foods associated with listeriosis (such as cold meats) were consumed by half of their respondents, with over 30% eating eggs with runny yolks. Few had changed their consumption behaviour since being diagnosed with respect to avoiding foodborne illness. They also found that patients were sceptical of information about specific 'high risk foods' due to their food preferences, disbelieving the risk and inadequate information on how to implement the recommendation.
- There was awareness amongst cancer patients consulted in focus groups regarding their increased susceptibility to foodborne illness from chemotherapy. Information sources were predominantly health professionals (physicians, nurses and dieticians). The importance of hand washing and washing of fruit and vegetables, in addition to adequate cooking of food products were known, as well as their need to generally avoid raw food products. Patients were not generally aware of the high risk foods that they should avoid while in an immune compromised state (Medeiros et al, 2003).

Elderly persons' food safety behaviour

Forty six studies were identified regarding elderly people as a whole. The work (mostly surveys, interviews and focus groups) on older persons reinforces the findings for cancer patients in that it also consistently reports 'unsafe' behaviours amongst elderly persons. 27 of the studies had a weight of evidence score of 3 to 5 which indicates a moderate weight of evidence overall for the behaviour of elderly people. Whilst it cannot be assumed that the findings for elderly people directly apply to elderly patients, they do highlight the risk of

elderly peoples' behaviour putting them at risk in the event they become chemotherapy patients. In addition, elderly persons may tend to have less robust immune systems, making research into elderly people relevant in its own right. Some key findings include:

- The FSA 2009 qualitative review of feedback on FSA engagement activities (Giles, 2009) noted that older people:
 - Tend to be more likely to rinse cutting boards and separate raw animal products from fresh produce;
 - Tend not to dispose of food items adequately, such as not disposing of perishable foods when past their 'use by' dates;
 - Consume foods beyond their 'use by' date;
 - Are unlikely to have a fridge thermometer or check their fridge's temperature;
 - Store 'high risk food' incorrectly;
 - Find it difficult to understand 'use by' dates on food labels or put information on labels into practice.

They also noted that older people:

- Can have difficulty preparing meals due to limited hand mobility and reduced cognitive functioning;
- Fail to fully understand the risk posed by consuming unsafe foods, underestimate the likelihood of food poisoning and the risk posed by unsafe food practices;
- May resist advice due to a wish to retain a sense of independence;
- (Single older persons) are less likely to consume hot meals and have less support networks.
- Redmond et al (2004) reported from observation in model kitchens of a small sample ($n = 10$) of adults aged 60 to 75 years that they tended to fail to implement hand washing, safe chopping board/knife usage and cross-contamination management;
- Cates et al (2009) reported from a quantitative survey of 1,140 people, that older persons considered themselves to be knowledgeable about food safety, although this differed by the type of pathogen. Key findings included:
 - 97% had heard of *E. Coli* and *Salmonella*, 40% *L. Monocytogenes* and 8% *Campylobacter*,
 - 60% of respondents agreed with the statement that they could 'do more' in relation to food safety in the home;
 - 59% agreed that they were more susceptible to foodborne illness due to their age;
 - 68% were concerned about contracting foodborne illness from outside the home compared with 32% who expressed concern for food prepared within their own home.

- Focus groups with older persons found that participants were unaware of listeriosis and recommendations on how to prevent listeriosis. In addition self reported adoption of the recommended practices was not widespread despite exposure to educational materials. Participants also believed that older adults have safer, less risky food handling and consumption practices than younger adults, thereby reducing older adults' risk of contracting foodborne illness (Cates et al, 2007).
- Cates et al (2006) report from their survey of 1,212 US adults over 60 that they were less aware of listeriosis and were less likely to follow food storage guidelines or identify foods that are more prone to *L. Monocytogenes*. In addition, many stored open packs of deli meats for longer than recommended (less than 5 days).
- Gettings and Kiernan (2001) in a US focus group study reported that 'senior citizens' rely on the "distant past for knowledge", and display unsafe behaviours such as using sight to check if chicken is cooked (after cutting it open), putting hot food into fridges and leaving food on counters for too long (more than 2 hours).
- Terpstra et al (2005) reported that over half of over 60s respondents stored sliced cold meats unclosed in the refrigerator. Whilst the study included physical measures, such as temperature, the article lacked detail on the method and so had a low WOE.
- Johnson et al (1998) in a US survey using face to face interviews, refrigerator measurements and dietary diaries of 809 elderly people found that 70% of fridges were too warm (equal to or over 6 Celsius), 45% reported difficulty reading labels but 90% understood the term 'use by' and 79% understood the term 'sell by'. People living alone and on lower incomes were more likely to store food inappropriately.

Pregnant women

Research (20 studies) regarding pregnant women also reports limited and variable levels of knowledge and avoidance of high risk foods, as elaborated below. The weight of evidence was low for this area because there were only 10 of these studies rated as 3 to 5. Most studies used questionnaires as opposed to observed behaviour and at least three were conducted overseas rather than with UK people.

An Australian study (Bondarianzadeh et al, 2007) using a survey to investigate listeria awareness among 586 pregnant women attending an antenatal clinic or class in 2006, found that:

- Nearly half had received some kind of information on listeriosis prevention, mostly from a women's social network, 42% had received listeriosis advice from health care providers and 27% from leaflets;
- 57% had incomplete knowledge of foods with a high *L. Monocytogenes* risk – only 13% identified all high risk foods;
- 25% continued consumption of foods with a high *L. Monocytogenes* risk with relatively high frequency, such as cold deli meats;
- There was a strong association between women's knowledge and practice, those with higher knowledge were more likely to avoid high risk foods;
- Low income and education, not speaking English and unplanned pregnancy were associated with incomplete knowledge and more frequent consumption of at risk foods.

In a US focus group study (FSIS, 2001) pregnant women were reported to be unaware of

Campylobacter, L. Monocytogenes or listeriosis or that pregnant women are high-risk. They expressed confidence in their food handling practices but very few actually engaged in correct practices.

Jevsnik et al (2008) reported from a survey of 291 Slovenian pregnant and non pregnant women that there were differences in self reported behaviour. For example pregnant women were more likely to defrost food at room temperature; and are more likely to check 'best before' dates (which refer to quality rather than safety). By contrast they are less likely to eat foods at high risk of infection (e.g. raw eggs) (but many still did). They reported that during pregnancy women are more motivated to take care of their own health.

Immunocompromised people

As previously noted, there were very few (10) studies regarding immunocompromised people with only two rated as 3 to 5. The most relevant findings were from Samuel et al (2007) who compared the consumption of high risk foods amongst adults with HIV, AIDS, cancer, immunosuppressive drugs and those who were not immunocompromised through interviews with 12,755 people in the US. Key findings included:

- Gender, age and immune status were associated with consumption of risky foods, such as runny eggs, Alfalfa sprouts and pink hamburgers/chicken;
- Males, under 65 years of age and those with immunosuppressive conditions were more likely to eat risky foods;
- Elderly persons with immunosuppressive conditions were more likely to eat risky foods than other elderly persons, with 32% of over 65 year olds taking an immunosuppressive drug eating runny eggs.

2.5.2 Communicating via healthcare professionals

This section summarises the evidence regarding communicating via health care professionals. This question is addressed here because it is of particular relevance to patients. A further summary of evidence about interventions and how to influence people (including vulnerable groups) was provided in section 2.4 of this report.

What is known about how food safety advice is disseminated to vulnerable groups via health professionals, carers or care organisations? Who, if any one, is responsible?

The main themes are:

- Researchers in this area advocate that health professionals give advice to pregnant women and other vulnerable groups, with healthcare professionals cited as one of the most trusted and preferred sources of food safety advice;
- However, no studies could be found regarding the extent to which UK health professionals advise vulnerable groups about food safety;
- No evaluations of the impact of food safety advice to patients could be identified;
- Overseas studies show mixed practice in the USA and Australia, with few healthcare professionals providing food safety advice.

Thus, whilst it was strongly recommended by previous studies that health professionals give advice; this recommendation is not necessarily based on evidence regarding the effectiveness of food safety advice from healthcare professionals.

Ohio State University series of studies

Medeiros et al (2008) completed a series of studies in the USA. As one of the few studies

on communicating about food safety with cancer patients, it is summarised below.

Medeiros et al (2008) reported that they were unaware of any study regarding cancer patients' compliance with food safety guidance. They report that an International Food Information Council Foundation focus group study of physicians working with patients at high risk of foodborne illness found that physicians, including oncologists, were not discussing food safety with patients. Food safety was said by the physicians to be of less importance than other topics such as heart health and smoking. Medeiros et al (2008) also report that five out of six focus groups of American cancer patients had not received any food safety advice from healthcare professionals.

Medeiros et al's (2008) work went on to develop and test three educational resource prototypes for cancer patients. This included statistics on foodborne illness, symptoms, guidance on food safety (at home and when eating out), and foods to avoid. In addition the reaction to food safety advice was tested by a small sample of cancer patients in two focus groups and interviews.

They found that 'scientific proof' was the top motivator for following 8 out of 10 risk reduction recommendations, with fear of foodborne illness also being important. Lack of awareness of which foods were 'dangerous' was also a barrier to risk reduction. The patients also said that they wanted advice that was specific to them as cancer patients, for the advice to be scientifically based and to be available at the treatment centre from physicians or nurses, in a format such as leaflets. In contrast to this, none of the 18 healthcare staff they interviewed had received any training in food safety.

Despite their scepticism, the prototype educational resource was received positively by cancer patients. In addition, patients were also expressed willingness to follow the food safety recommendations which were cited in the educational materials. Finally the research reported the suggestion from 'health care providers' that dieticians, nurses, and physicians should provide food safety information although physicians reported that time constraints would limit their ability to provide information.

In a later report (Buffer et al, 2009), a survey of US dieticians ($n = \text{unknown}$) found that they 'sometimes' convey food safety messages to at-risk groups. Buffer also reports that for pregnant women, food safety advice was provided 50% of the time, for elderly 60% of the time and for the immunocompromised (i.e. patients with HIV/AIDS) 55% of the time.

Other studies regarding vulnerable groups

There were two themes in other studies, namely that healthcare professionals are advocated as a source of food safety advice but that they do not consistently perform this role. These themes are elaborated below.

The impact of healthcare professionals' dietary advice on observed behaviour has not been evaluated. Healthcare professionals have been identified as an effective source of advice and information based on subjective feedback from patients and researchers, but the weight of evidence is low. For example:

- Huffling (2006) expressed the opinion that midwives could take a greater role in education and informing about risk foods and behaviours to reduce risk.
- Cates et al (2004) found from focus groups with 63 pregnant women that they were unaware of the risks of listeriosis, were not taking sufficient precautions to prevent it and were unaware that they were a high risk group. It was suggested that information be delivered as part of the prenatal package of information at the first prenatal care visit.

- FSIS (2001) reported that participants agreed that the best way to inform pregnant women about listeriosis is through obstetricians or through prenatal magazines, books or websites.
- Wallner et al (2007) found from a before and after knowledge test of 106 dietitians that online education courses enhanced their knowledge of food safety issues of high-risk populations.
- A 1993 survey of the general population in the UK found that the most popular sources of education reported were the environmental health department (86%) and their doctor or health centre (54%) (Simpson, 1993).

A few overseas studies have explored the provision of advice using surveys and interviews. There was a variable level of advice regarding food safety offered by healthcare professionals to vulnerable groups, for example:

- An Australian interview based study of midwives ($n = 10$) found that they were more likely to provide advice on the type of foods they thought women should avoid, while food-handling practices were less often discussed or totally ignored during the consultation. *L. Monocytogenes* education was usually given in antenatal sessions and usually in the context of dietary advice. Midwives generally did not think food safety issues were of great importance (Bondarianzadeh et al, 2007).
- From a survey of 79 clinics, 72% of US health professionals reported that they provided advice to 20% (or more) of their clients on a daily basis. 90% identified the food safety knowledge of their 'Women with Infants or Children' (WICs) clients to be 'fair to very poor'. They also reported that there is a demand for 'food safety handouts' which are targeted towards WIC clients – this was identified by 27% of the respondents (Scheule, 2004).
- In a US study using interviews, only eight of the twenty three health care professionals interviewed said they currently provided food safety information to their pregnant clients, nine occasionally provided such information, and five did not provide information on food safety to their clients (Morales et al, 2004).

As noted, no survey of current practice by healthcare professionals advising patients on food safety in the UK could be identified.

2.6 Segmenting the population

What factors are associated with food storage and handling behaviours in the home? (For example, socio demographic factors including age, ethnicity and income, illness, accommodation, kitchen facilities, etc)

Public health and safety interventions are commonly targeted onto specific groups of people. The review of evidence indicated that there are at least three ways of segmenting people, namely:

- According to vulnerability;
- Socio-demographics;
- Attitudes and behaviours.

No single form of segmentation is necessarily superior. An approach that targets people according to their vulnerability (which may be related to socio-demographics) and that addresses the attitudes and behaviours of sub-sets of people within each vulnerable group is consistent with the principles of social marketing and risk based interventions.

The review identified 15 studies that segmented people by their food safety behaviours, with 7 of these rated as WOE 3 to 5. Many of the studies were either conducted overseas or were small scale. No current segmentation work for UK consumers, with respect to food hygiene behaviours, was identified. Therefore, the weight of evidence was low, even though the findings were broadly consistent between studies. It should be noted that the analysis of the Agency's 2010 'Food and You' includes exploration of the relationships between demographics and people's self reported food safety behaviours.²¹

By vulnerability

An obvious segmentation by vulnerability is between patients and non-patients, particularly elderly cancer patients (having chemotherapy), pregnant women and other immunocompromised people, versus other people. There are many examples of interventions that target particular vulnerable groups, aiming to make them aware of their particular vulnerability and actions they should take, although few have been assessed in the area of food safety.

We were unable to identify studies that specifically segmented elderly people according to their food safety behaviours.

Socio demographics

There have been a series of studies that mapped out behaviours by age, gender, class and ethnicity. These studies have found significant differences in attitudes and behaviours according to:

- Age;
- Household type, such as being single;
- Income;
- Gender;
- Education.

Some care must be exercised in interpreting these findings. For example, some studies have noted that men may have poorer food safety knowledge. However, men with home economics training have better food safety knowledge. Therefore, whilst there may be an association between (say) age or gender with food safety behaviours, the underlying factor may be knowledge or education. For example, in an Irish survey of 1000 high risk consumers, Brennan et al (2006) found that whilst men and people in part time work had lower (poorer) knowledge, completing a home economics course was the significant factor (improving knowledge). Indeed, a number of studies have indicated that knowledge is a key factor and of more importance than socio-demographic factors. This would suggest that neither gender nor age are the determining factors. Rather the level of education in 'home economics' is the key factor. Whilst men may tend to have less knowledge this is not an inherent trait, rather it is due to men tending to have less education in home economics.

Some key findings include:

- Elderly persons tend to (ACMSF and Giles 2009):
 - Be more concerned about health and have different eating habits, such as eating more chilled foods and fresh meat;

²¹ This report was drafted prior to the analysis of the 2010 wave of the Food and You survey

- Have difficulty reading labels;
- Buy end of life food;
- Keep food longer in the refrigerator and;
- Cite ‘using up’ food as it has come to its ‘use by’ date more often.

Meer and Misner (2000) found, in a US questionnaire survey of 229 consumers, that people over the age of 50 had higher food safety practice scores, as did white people and women.

Thus, the evidence suggests that older persons tend to express more concern about health and diet. It also suggest that they display some higher risk consumption behaviours that may be related to elderly person’s life styles, such as buying end of life food to save money.

The FSA focus group suggested splitting older persons into those that still prepare their own food and those that cannot (who are more likely to be vulnerable due to reduced immune functioning).

- Men are reported to have less knowledge of food safety, poorer hygiene and poorer food handling practices, for example:
 - Research indicates that men are less knowledgeable and more likely to adopt unsafe food handling behaviours (e.g. Redmond and Griffith 2003, Kennedy et al, 2005);
 - Patil, Cates and Morales (2005) in a meta review noted that men report more consumption of undercooked foods and poorer hygiene;
 - Brennan et al (2007) in an Irish survey of 1000 high risk consumers found that older men had poor scores;
 - Byrd-Bredbenner et al (2007) reported, from an observational study of 154 people in test kitchens, found unsafe food handling practices particularly in young adults and males, in areas such as cleanliness and the use of refrigerator temperatures. They scored people on scales they had developed representing unsafe versus safe food safety behaviour. Scores ranged from 29% on the cook scale²² to 67% on their scales, where 100% is best.
- Household type

Some types of households are more likely to simplify meal preparation (especially single person households) whilst others (such as families) are more likely to adopt recommended food safety practices, as below:

- Single person households: Gustafsson and Sidenvall (2002) in a Swedish qualitative study using in depth interviews found that single older women tended to simplify cooking and eating, with fewer cooked meals. Kullberg et al (2006) in a Swedish interview study of 61 elderly people (aged 64 to 88) found that single older men suffering from an illness (e.g. Parkinson’s) had fewer cooked meals from raw ingredients.

²² The cook scale was a check-list used to directly observe and record food-handling practices. The check-list had four criterion-referenced scales based on food safety recommendations (e.g. clean, cook, separate, chill). Each recommended behaviour performed earned one point. Scale scores were calculated by summing points earned and could range from zero to the maximum (100%) of observed behaviours on the scale.

- Fischer, Frewer and Nauta (2006) in a Dutch survey of 1044 consumers identified five types of households related to differences in food safety behaviours. These were:
 - 'Traditional family' (primary cook is female and rarely employed);
 - 'Average traditional family' (primary cook is female and less often employed);
 - 'Average family' (primary cook is female and often employed);
 - 'Average modern family' (primary cook is female, employed & highly educated); and
 - 'Single male' (employed and highly educated).

Behaviours range from safer to less safe as you move from traditional families to single men.

- Redmond et al (2004) reported from an observational study in a model kitchen that mothers with at least one child aged under 10 were less likely to fail to implement an assortment of food safety behaviours than single men or adults aged 60 to 75.
- Income
 - Patil, Cates and Morales (2005) in a meta-review noted people with high incomes reported a greater consumption of raw foods as well poorer awareness and knowledge of hygiene and cross contamination practices.
- Education
 - A number of studies have found that individuals with higher levels of education are more likely to engage in risky behaviours such as improper storage of foods (e.g. leaving food unwrapped) and consumption beyond 'use by' dates, including Cates et al (2006) in a survey of 1212 people, Fischer, Frewer and Nauta (2006) in their survey of 1044 people and Patil, Cates and Morales (2005).
 - Mahon et al (2006) found from a survey of 485 Irish beef consumers that people with higher levels of education reported better handling of beef mince, such as following defrosting guidelines, putting mince away within 2 hours of purchase and storing on bottom shelves of the fridge.

It can be noted that the findings regarding the link between education and food safety behaviours are mixed. Some studies cite higher risk behaviours for persons with more education, and others cite safer behaviour amongst persons with more education. One possible explanation for this, is that the influence of education depends on whether it covers food safety risks or whether higher education levels are associated with 'optimism bias', i.e. where people believe they are safer than they are. 'Optimism bias' has been cited as a key factor that influences behaviour such that people disregard safety in the false belief that they are less vulnerable. Other studies have found that raising risk perceptions through education is associated with safer behaviour.

The ACMSF cited a need to better segment older persons. The research reviewed here would distinguish between older men and women, and being single or living together. However, we would also refer back to the vulnerability segmentation and distinguish older persons with cancer or other immune compromised condition versus others as a critical distinction.

Attitudinal

A number of studies and the FSA focus group have segmented people by their attitude. Some of these have related attitudes to behaviours and exposure to pathogens. Some examples include:

- People who are very concerned about food safety are less likely to have *Staphylococcus aureus* (*S. aureus*) on their hands (Dharod et al, 2004). Dharod et al (2004) in a US study of 500 Latino consumers, found that: older people, poorer people, those with high school education, Spanish speakers and people born in the US had higher (worse) bacteria counts. However, once these factors were controlled, bacteria counts were associated with the level of expressed concern.
- Kennedy et al (2005) developed an attitudinal segmentation from 1020 Irish home food preparers, namely:
 - 'Cavalier' (25.4%)
 - With worst levels of contamination in fridges;
 - Who were high risk and tended to be young, male, from urban areas and with formal education, and under estimate the risk;
 - With lowest level of knowledge of food safety and bacteria.
 - 'Careful' (53.3%)
 - With mid level of contamination;
 - Who were familiar with food handling practices but less likely to know about unfamiliar bacteria.
 - 'Conscientious' (21%)
 - With lowest level of fridge contamination and highest level of knowledge.

The level of contamination in fridges was assessed and related to their food safety knowledge. There were close associations between knowledge and contamination levels. Knowledge of how to avoid cross-contamination and how to cook food thoroughly were the distinguishing factors between the three groups of respondents.

It is important to note that 'cavalier' persons tended to be young, compared to the point that vulnerable people tend to be elderly, pregnant or be immunocompromised. Thus, whilst attitudinal segmentation is important for targeting messages, this should in our opinion be crossed with vulnerability segmentation.

McCarthy et al (2005) developed a similar attitudinal segmentation of Irish people. McCarthy et al (2007) also completed an attitudinal segmentation in Ireland, using a survey of 1025 consumers that focused on perceptions of vulnerability. They found that in many cases (13%) people regard less than ideal food handling practices as safe, particularly amongst the young (18–24) or older men (65+) with a limited education and were unlikely to have completed any sort of home economics course. This example of work shows how attitudinal segmentation can also be matched to socio-demographic segmentation.

2.7 Research techniques

What research techniques have been used in the past for exploring these behaviours, including how to measure actual rather than stated behaviours?

This review found that the most common method used in reviewed studies involved the use of self reported attitudes, knowledge and behaviours, with fewer studies using observed behaviour or in depth interviews. A small number of studies included in this review have explicitly critiqued research methods. We noted that:

- These critiques tend to be qualitative comparisons of the results of studies using different types of research methods;
- Studies have generally not applied self reported questionnaires and then observed behaviour within the same study to cross validate results or evaluate the methods.

In addition, some studies that advocate the use of observational data instead of self reported behaviour have not necessarily cited the limits of observational studies. As such we concluded that the weight of evidence regarding how to assess behaviour is low.

The validity (do they accurately measure what they claim to) of different research techniques has been considered within reviewed studies, such as Redmond and Griffith (2003). It has been stated that this is an important issue due to the disparity between self reported and observed behaviours, i.e. people report they wash their hands when in fact they do not. Accordingly, it has been argued that research which relies on self reported behaviours cannot be relied on to provide a measure of actual behaviour. This has led to a series of observational studies that have involved either 'audits' of food handling behaviours in the home or observation of simulated tasks in a 'laboratory'. These studies tend to also involve exploring the knowledge of people (by asking them 'test' questions) and how their knowledge relates to observed behaviour. Some examples of these studies include:

- Audits International (2000) conduct of home visits to audit observed behaviours and practices using a checklist of recommended practices;
- Harrison, Griffith and Tennant (2001) completion of an observational study of people making stir fry chicken.

However, whilst observational work may provide more confident behaviour measures, the studies tend to be limited to relatively small numbers of participants. Redmond and Griffith (2003) reported an average of 83 consumers per observational study. This limits (but does not prevent) their ability to explore relationships between behaviours and factors, such as income and age. Some observational studies have grouped people into types based on factors such as household type. However, as they tend to involve relatively small sample sizes, their statistical power is low.

The feedback from expert interviews noted that many observation studies use controlled settings that may not capture true behaviours. They highlighted the option of home observation and video ethnographic studies²³ within people's own homes but also recognised the time and cost of such research.

There have been many questionnaire based studies that have used larger samples to explore the relationship between self reported attitudes, behaviours and factors, such as age and household type. Redmond and Griffith (2003) reported an average of 1809 consumers per face to face interview study. The reliability of these studies has been mixed, with many studies rated low in our own review (as per Table 8). Typical concerns include:

- Unrepresentative sample frames;

²³ Data gathered through participant observation within their natural environment.

- Potential for socially desirable responses;
- Different questionnaires being used with little validation or testing of repeat measures reliability.

Notwithstanding these concerns, some survey based studies have provided statistically powerful measures of relationships between attitudes/behaviour and factors such as education level and age, for example Kennedy et al's (2005) attitudinal segmentation of 1020 Irish home food preparers. Whilst the measures of behaviour may not be reliable, they have indicated the nature of relationships between attitudes and socio-demographic factors.

In addition, in depth qualitative research techniques such as interviews and focus groups and observational exercises have been used to explore motivations, attitudes and behaviours, and to develop 'models' of how people think about food safety, such as, Fischer, Frewer and Nauta's (2006) study of Dutch households. Redmond and Griffith (2003) reported an average of 67 to 84 consumers per focus group study. Observation of behaviour is inherently limited to just that, observing behaviour, rather than explaining behaviour. Techniques that ask people to declare attitudes and their thinking have been used to help explain behaviour, whilst obviously relying on self-expressed thoughts.

The latter review of research methods indicates that each approach has advantages for certain research purposes and disadvantages. Whilst observational work can provide robust measures of actual behaviour, the costs tend to limit the sample size. Whilst surveys using self reported attitudes and behaviours provide a less robust measure of behaviour, they do provide a means of quantitatively exploring associations between attitudes and social factors. Neither observation studies nor surveys provide an in depth understanding of people's thinking, compared with focus groups and in depth interviews. Therefore, it is suggested by this review that the selection of research methods should be guided by the purpose of the work, as well as consideration of good practice in experimental, statistical and research design. For example:

- Observational methods – for measuring actual behaviour and in depth understanding of people's behaviours;
- Questionnaire surveys – for exploring relationships between socio-demographic, economic and other factors with food safety attitudes and behaviours;
- Qualitative methods – to develop in depth understanding of people's attitudes, motivation, perceptions and behaviours.

In each case, the study should match good research methodology, in respect of issues such as stratification of samples, validity of questions/exercises (i.e. they should provide accurate and truthful measures of attitudes and behaviours) and replicability of studies.

The review of papers discussing research methods did not identify other categories of research methods. The only additional options suggested by this review were to also:

- Explore the extent to which food safety behaviours are associated with other consumption and health behaviours – on the grounds that if food behaviours (diet, hygiene etc) are related then a more holistic intervention may be required rather than one that focuses on any one issue;
- Draw on theoretical approaches to promoting behavioural change, to help explain and pull together findings and to help provide a comprehensive understanding of behaviours and how to change them.

3 CONCLUSIONS AND PROPOSALS

3.1 Conclusions

3.1.1 Weight and level of evidence

Overall, whilst there were a substantial number of references (371 included in this review):

- The majority were rated as 2 or 3 with respect to weight of evidence, which indicates a moderate level of confidence in most studies;
- The studies were skewed towards behaviour amongst the general population;
- There were relatively few studies for the areas of particular concern, namely vulnerable persons and how best to influence their attitudes and behaviours.

Therefore, overall there is clear scope to improve the level of evidence through further research.

3.1.2 Key attitudes and behaviours

General population

For the general population, both the evidence review and the consultation with experts consistently indicated frequent failure to follow recommended food hygiene practices. Broadly the evidence strongly suggests:

- People have a low level of awareness of recommended good practice with respect to cooking (correct final cooked temperature), storing raw meat on the bottom shelf (to avoid cross-contamination), and chilling (correct fridge temperatures);
- People may fail to follow recommended personal hygiene (hand washing), cleaning, thawing (in refrigerators) and cross-contamination practices despite being aware of recommended practice in these areas;
- There is limited use and comprehension of food safety parts of labels, such as 'use by' dates and storage instructions.

Again, broadly the evidence review consistently indicated that certain recommended behaviours were rarely reported, including use of fridge or meat thermometers, checking fridge temperatures, using food labels, storing raw meat on lower fridge shelves. Higher levels of awareness and performance were generally reported for rinsing cutting boards and separating raw animal products from other products.

Whilst there was moderate evidence that knowledge of food safety was associated with 'better' food safety behaviour, this was not a perfect relationship. The review found many studies that indicated that the relationship between knowledge and behaviours was influenced by risk awareness, perceptions of risk and 'optimism bias'. An increase in knowledge of risks and how specific behaviours are associated with foodborne risks was commonly reported to be associated with 'better' food safety behaviours. Awareness of risk was stated by some key research studies to be needed to counter 'optimism bias', namely when people wrongly believe that they are not vulnerable to foodborne illness.

There was also some moderately rated evidence of associations between age, gender, household type, education, income and household status with food safety attitudes and behaviours. Broadly the evidence indicated that men, elderly people, those with a lower income and more educated people were reported as displaying either poorer knowledge or behaviours. These factors coincided with risk awareness, such as men having lower levels of food safety knowledge and lower awareness of risk. Indeed, a few studies found that education in food safety was a stronger factor than, for example, being male. Higher levels

of education were found by some studies to be associated with poorer food safety behaviours. The studies suggested that this was due to 'optimism bias' amongst highly educated people.

Listeriosis amongst the elderly

Whilst there was some evidence of societal trends influencing food safety risks, these did not account for the rise in listeriosis amongst elderly persons. The small number of studies (mostly in the US) regarding food safety behaviour and knowledge of elderly patients indicated that:

- Whilst they were aware of their vulnerability, they were not aware of the link between specific food safety behaviours and the risk of food poisoning;
- They consume high risk foods.

A moderate number of research studies (including UK studies) into elderly persons found that, despite relatively good knowledge of food safety and concern about their health, they were more likely to eat food beyond its 'use by' date and store high risk food uncovered in the refrigerator. Thus, elderly persons and elderly patients were reported to exhibit food safety and consumption behaviours that increase their risk of listeriosis.

3.1.3 Interventions

General

The review found a relatively small amount of moderately rated evidence that the provision of advice can influence attitudes and behaviours, as well as evidence that behaviour is related (imperfectly) to knowledge of risks and safe handling practices. A general recommendation from the reviewed studies and from expert interviews was that advice should be specific to each target group, address their particular attitudes and be presented in a way that they can identify with. The contemporary approach to public health communication advocated by the Department for Health is represented by targeted social marketing tactics which advocates assessing views and needs of specific target groups. Whilst there was minimal research into social marketing in the context of food safety, it was suggested in some of the reviewed studies that the principles of social marketing are adopted for future food safety in the home interventions. The FSA focus group also suggested exploring whether increasing people's knowledge of pathogens such as *E. Coli* and *Campylobacter* would affect behaviour.

However, it was also noted by at least one study that if people perceive that the information is directed at another, perhaps a vulnerable group of people, they may not perceive it to apply to them and this may indeed reinforce their own 'optimism bias'. Thus, whilst personalised information was advocated by researchers, this may lead to a 'narrow' impact. The expert interviews suggested that targeted approaches should be complimented by general advertising through media such as television, to ensure that targeted messages do not lead other people to believe they are not at risk.

Interventions regarding *L. Monocytogenes* amongst vulnerable people

The very rapid review of a few clinical studies indicated that the rise in listeriosis may have coincided with changes in chemotherapy treatment of elderly persons. As noted above, there were a small number of studies of elderly patients, all of which reported they consume high risk foods and do not follow recommended food safety practices. These points led to the authors of this report suggesting 1) a fuller review of the evidence regarding changes in chemotherapy and listeriosis in elderly persons and 2) a targeted intervention of elderly patients via healthcare professionals. Notwithstanding the small number of studies about interventions, it was noted that healthcare professionals were a

trusted source of food safety advice. A targeted intervention would also match the point that *L. Monocytogenes* is a particular risk for a specific high risk group, namely patients who are immunocompromised. In addition, the feedback from the expert interviews was that a targeted social marketing approach, involving face to face advice from health professionals such as home healthcare nurses, was needed that identifies foods that pose a risk.

The intervention could, in the opinion of the researchers, focus on:

- Raising patient awareness of the risk of listeriosis during treatment; and whilst immunocompromised, and raising awareness of high risk foods;
- Avoiding high risk foods during periods of treatment/pregnancy;
- Management of high risk foods during periods of treatment, e.g. consumption before expiration of 'use by' date, correct refrigeration temperatures.

It was also suggested by the researchers that:

- Dietary advice for these high risk groups is developed, particularly for elderly cancer patients – possibly by a collaboration between dieticians²⁴, oncologists and listeriosis experts;
- This advice is communicated to cancer patients by those healthcare professionals that care for cancer patients, such as oncologists, dieticians, oncology centres and chemotherapy units;
- This advice is communicated to pregnant women by those healthcare professionals that care for pregnant women, such as midwives, GPs and health visitors;
- Consideration is given to working with organisations such as NICE, the Oncology Section of the Royal Society of Medicine, NHS Cancer Programme and the Association of Cancer Physicians, to produce and disseminate dietary advice for cancer patients and immunocompromised people.

As healthcare professionals may not regard food safety to be a priority, as per the expert interview feedback, it may be particularly important to involve health professional organisations in developing and disseminating guidance.

The expert interviews also mentioned supportive agencies such as 'meals on wheels' as potential partners in this whilst the FSA focus group cited the potential use of celebrity chefs, although they sometimes apply incorrect procedures.

There are previous examples of dietary advice being given to cancer patients for the sake of food safety. For example²⁵, advice about neutropenic diet²⁶ has been given to prevent infection in patients with acute myeloid leukaemia (AML) (Gardner et al, 2008). Nearly all US healthcare institutions surveyed in the 2000s recommended a neutropenic diet to their neutropenic patients, and the most common recommendation was to avoid uncooked fruits and vegetables (Smith and Besser, 2000).

It was suggested by the researchers that the advice should be informed by a rapid review of the clinical aspects of listeriosis, in respect of 1) the evidence of patient vulnerability to

²⁴ Dieticians are the health care providers typically responsible for teaching patients and their caregivers about diet, nutrition, safe food handling and appropriate food choices.

²⁵ These studies are outside of the evidence review and are cited as examples of guidance only.

²⁶ Low risk diet for people with low white blood cell counts (neutropenic), who are vulnerable to infection.

listeriosis and 2) whether better food management can significantly reduce exposure to listeriosis. Such work may give weight to the dissemination of guidance by healthcare professionals and indicate whether guidance should focus on avoiding high risk foods rather than just changing food hygiene practices.

A US study of immunocompromised people (Samuel et al 2007), involving the US Centre for Disease Control and Prevention and Emerging Infections Program, recommended that messages should describe specific foods to avoid. Indeed, a range of guides were identified regarding food safety for patients in the US, including:

- The Ohio State University provide free online fact sheets²⁷ regarding food safety for patients and carers that could be drawn on for this purpose;
- United States Department of Agriculture: Food Safety for People with Cancer.²⁸

They would need to be amended to be specific to the UK. In addition, this review did not identify any evaluations of these guides or their impact on patients. Therefore, whilst they provide examples of advice and evidence that such advice can be developed, further research could usefully develop, pilot and evaluate UK versions of such guidance.

3.1.4 Gaps in evidence

What are the main gaps in the existing evidence base?

The main gaps include evidence regarding:

- Attitudes, knowledge and behaviours of vulnerable groups particularly those who are immunocompromised;
- How to segment older persons (other than by health status, gender and living alone);
- The extent to which vulnerable groups in the UK receive advice and information about food safety risks and how to minimise them.

It is also noticeable that few interventions have been evaluated to a high standard, with most relying on before and after knowledge questionnaires.

3.2 Proposed future research and analysis

3.2.1 Future research priorities

The Agency feedback on the importance of each topic was cross referenced (see section 4.4.3 for an explanation) to the assessed level and weight of evidence to produce a matrix of priorities, as per Figure 1. Topics with the least (poorest) evidence and most importance are ranked highest in respect of future research priorities, in the top right hand corner of the matrix. Some topics had moderate levels of evidence and high importance, particularly understanding behaviour of vulnerable people. Overall the higher priorities were:

- Understanding actual (as opposed to self reported) behaviour, especially of vulnerable people;
- Developing and assessing methods for advising and influencing people.

Theoretical issues, research methods and connections between food safety and other topics were rated as lower priorities.

²⁷ These can be found at <http://foodsafety.osu.edu/health-professionals/fact-sheets/cancer-transplant/>

²⁸ United States Department of Agriculture: Food Safety for People with Cancer. Available at: http://www.fsis.usda.gov/PDF/Food_Safety_for_People_with_Cancer.pdf

Figure 1: Matrix of research priorities

Importance of topics	High (3)	Food safety behaviour (general population)	Food safety behaviour (vulnerable people)		
		Relationships between food safety knowledge, beliefs and behaviour	Knowledge vs. behaviour		
		Factors associated with behaviours			
	Medium (2)			Knowledge about influencing behaviour How to communicate via health professionals	
	Low (1)			Theoretical approaches	
	Greatest (1)	Moderate (2)	Poorest (3)		
Extent of evidence					

Suggestions on further research into the higher priority topics are given below.

3.2.2 Further research regarding listeriosis amongst vulnerable persons

In the opinion of the authors of this report and based on this evidence review, further research could usefully:

- Address the ACMSF recommendation to review evidence of the link between the rise in listeriosis and chemotherapy. As we are unable to identify behavioural, social or demographic causes of the rising trend in listeriosis, this does appear to be the most appropriate area for further causal research;

Whilst we cannot exclude (due to the lack of data) the possibility of a change in elderly patients' diet or food safety behaviour, we judge that it is unlikely that this could explain a rising trend in listeriosis across many EU countries and Israel.

Therefore, we do not expect that research into food safety/consumption trends amongst elderly patients would serve any purpose other than to exclude this as an explanation.

- Explore the food safety attitudes and behaviours of chemotherapy patients, pregnant women and other patients in the UK who are immunocompromised;
- Survey the extent to which healthcare professionals in the UK that have contact with elderly cancer patients, pregnant women and immunocompromised people provide advice to these groups.

The NHS Direct website identifies high risk food for listeriosis and that people with weakened immune systems are at particular risk, and provides food safety and (some limited) food avoidance advice. It also provides advice for pregnant women on foods to avoid due to the risk of listeriosis. However, the review did not identify any study regarding the extent to which UK healthcare professionals provide food safety advice to cancer patients or the impact of the NHS Direct website on food safety awareness of cancer patients.

In addition, a consultation could be held with the Department of Health and other healthcare representatives to:

- Identify those parts of the healthcare services that have most contact with chemotherapy patients and other patients who are immunocompromised, such as: NHS Cancer Programme, oncology departments; NHS cancer networks; the Association of Cancer Physicians;
- Develop dietary advice protocols and food hygiene advice for chemotherapy patients and other patients who are immunocompromised.

This would help verify which healthcare professionals could usefully be involved in an intervention and secure their engagement in the intervention.

What techniques might the FSA consider using for these areas?

Previous quantitative surveys and qualitative fieldwork (focus groups and in depth interviews) have provided insights into the attitudes, behaviours and knowledge of people, and these techniques could usefully fill some of the gaps in the evidence base. It was also suggested by the researchers that a survey of current practice with regard to the provision of advice and information by healthcare professions could be useful. As regards to assessing the impact of a targeted intervention, previous research would indicate that the most reliable study could involve:

- Providing advice and information to a group of cancer patients (or other vulnerable group);
- Not providing advice and information to a matched sample of cancer patients (or other vulnerable group);
- Completing before and after questionnaire surveys of attitudes, knowledge and behaviour, boosted with some observation of before and after behaviours.

It was suggested by the researchers that the sample of participants in such research should match the profile of people at risk. All research involving patients is likely to require research ethics approval, as this is the case for all NHS research involving patients. Therefore, the ethical aspects of a controlled test of guidance would need to be identified and addressed before embarking on such a study.

How can the broader literature on kitchen practices and behaviour help inform directions for further research?

The broader literature suggests that there are trends in kitchen practices and skills which indicate the need to compensate for declining kitchen skills through targeted advice to vulnerable groups, such as the use of 'use by' dates for pre-prepared meals (that are being consumed more) and advice on cold meats. Thus, the broader literature does help to identify trends in behaviours that could increase food safety risk and which might need to be countered by advice or other interventions.

3.2.3 Further research regarding other people and pathogens

It was suggested by the researchers that further research could usefully explore the relationships between attitudes, knowledge, risk perceptions/awareness and behaviours. This would help map out the relationship between these factors. As the relationships may differ between types of food safety behaviours, the work could usefully segment results by type of food safety practice.

Ideally this work would also map out how attitudes and behaviours vary by factors such as age, household type and so forth. Whilst observational studies may provide the most reliable measure of behaviour, it may not be practical to carry out a large scale observational study unless this involves (for example) home 'audits'. An option is to use a survey based approach to map out relationships with some observational work to 'boost' and validate findings.

As previously noted, few evaluations of interventions have been completed and many have methodological flaws. Therefore, further work could usefully evaluate the impact of interventions, using rigorous research design such as randomised control groups, measuring changes in observed behaviour and incorporating longer follow up periods.

As there is only moderate evidence regarding interventions, there may be some value in piloting new interventions. However, as piloting tends to be carried out on a small scale, it may not improve on the weight of evidence achieved by previous studies. Piloting tends to perform the role of testing concepts rather than assessing impacts and outcomes.

3.2.4 Analysis of "Food and You" Survey and other databases

What specific secondary analysis could be undertaken of the data sets identified by the SSRC working group on listeriosis and are there any other data sets that should be considered?

A number of other data sources were reviewed to explore whether further secondary analysis would help explain food safety behaviours in the home. Our review of existing surveys in Appendix E (section 8.2.1) did not identify any that has mapped food safety attitudes and behaviours of people vulnerable to listeriosis (i.e. patients), or their consumption habits.

Overall, these data sets did not appear to offer scope to help explain trends in food poisoning. Whilst the TNS Worldpanel would track purchasing of older persons over the decades, as noted by the ACMSF, it does not appear to identify health status of people and so cannot assess consumption of food for people vulnerable to listeriosis. Of course, patient diet might not differ from non-patient diet and so the TNS Worldpanel may offer value. Therefore, if it was assumed that older persons' consumption habits are unaffected by serious illness, they would provide insight into their general behaviours. Obviously they would not indicate if patients are aware of the risk from *L. Monocytogenes* or how to manage this risk whilst ill or undergoing treatment.

The TNS Worldpanel would allow assessment of purchasing over a number of decades. No other data sets were identified as offering significant additional insights.

What analysis should the FSA consider for Food and You?

The Agency's planned analysis of the Food and You survey²⁹ would inform understanding of attitudes, knowledge and behaviours of each demographic group. This could inform

²⁹ At the time of writing Food and You survey preliminary analyses were underway. The findings from these analyses are now available: <http://www.food.gov.uk/science/socsci/surveys/foodandyou/foodyou10>

targeting of interventions for other types of foodborne diseases, such as *Campylobacter* and *Salmonella*, particularly for behaviours such as undercooking meats, storage and cross-contamination from uncooked meat³⁰. The Food and You survey would also allow mapping of food safety behaviours of older persons but cannot yet indicate trends over time as the survey has only been applied once so far.

An option suggested by the researchers is to extend the analysis of Food and You to explore, by factor analysis for example, whether food safety behaviours correlate with other surveyed attitudes and behaviours. This would help ascertain whether food safety behaviours are part of a wider attitudinal / behavioural pattern or not.

A factor or cluster analysis could be completed of the entire questionnaire. This could help “discover” how best to segment people into groups of similar food related behaviours, for example whether people who are “health conscious” tend to cook for themselves, eat 5 portions of fresh fruit or vegetables a day and adopt hygienic food preparation practices.³¹ An alternative to a factor or cluster analysis would be to test relationships between each of the Food Safety questions and questions that relate to issues identified in previous research. A sample of questions from the Food and You survey that relates to issues cited in previous research reviewed in this report has been identified and is listed below:

- Attitude to and extent of cooking
 - Attitude to food (Q2.2), e.g. whether cooking is a hobby as opposed to “food is just fuel to live”;
 - Frequency of cooking for yourself or others (Q2.3 and Q2.4).
- Frequency of shopping (Q3.7) and usual place for household shopping (Q3.3/3.4);
- Diet
 - Extent to which people consume fresh fruit and vegetables (Q2.11, 2.12, 2.13);
 - Knowledge of recommended number of portions of fresh fruit and vegetables’ (Q2.9), balanced diets (Q2.17, Q2.18), calories per day (Q2.25/2.26), fat intake per day (Q2.27/2.28), salt per day (Q2.30/2.31);
 - Frequency of eating each food category (Q2.14);
 - Beliefs regarding healthy diets (Q2.16).
- Eating out
 - Awareness of food hygiene in restaurants etc (Q2.37);
 - Frequency of eating out at each type of outlet (Q2.33), e.g. fast food versus restaurants.

The Food and You survey does ask (Q6.2) whether you have a long term disability or illness. Whilst this is not specific to immunocompromised conditions, there may be some value in exploring if there is a relationship between food safety behaviours and health status.

³⁰ The planned analysis includes assessing what factors are associated with the 4 C’s which should cover part 1 household information (e.g. gender, age, living arrangements, working status) and part 7 demographics (e.g. income and ethnicity).

³¹ A further Food and You survey report that looks at segmenting people into groups based on similar food related attitudes and behaviours will be published Summer 2011

4 APPENDIX A: METHOD

4.1 Search method

4.1.1 Inclusion/exclusion criteria

Inclusion/exclusion criteria were used to specify the parameters of evidence to be included for the evidence review and to ensure the search would be repeatable.

The inclusion/exclusion criteria for evidence was based upon the date of evidence, the country evidence was from, type of evidence and availability, subject and topic area, and setting etc. All inclusion/exclusion criteria were discussed and agreed with the FSA with evidence to be included in the review being based upon the following inclusion criteria being met:

- Period: Since 1990;
- Countries: UK, North America, Australia, New Zealand, Scandinavia and continental Europe;
- English language studies with the inclusion of other languages where the abstract indicated the article was of clear relevance;
- Type of material/research method: Journals, FSA, government and NGO research, conference articles, industry research and publications;
- Full article or research paper/report if available;
- Nature of subject matter: Matched topics covered by scope of review;
- All foodborne diseases;
- Multidisciplinary: e.g. including economics, sociology, psychology, public health etc; to build up a 'mosaic' of different perspectives or points of view with no one perspective being taken to be more important than another; and
- Setting: Behaviours in the home (including sheltered accommodation).

Repetitions of articles were excluded, as was any research regarding institutional or business settings as this was outside the scope of the evidence review.

4.1.2 Topics

We searched for material covering:

- Food safety behaviour in the home – general research, research on specific pathogens/behaviours;
- Segmentation of people according to food safety behaviour;
- Evaluations of food safety promotion;
- Evaluations of food safety education interventions;
- Current practice in promotion of food safety amongst health and social care professionals;
- Current practice in the education of food safety;
- Trends in cooking behaviours;
- Trends in eating/consumption behaviours (e.g. increased consumption of ready meals);
- Trends in kitchen practices that might relate to and explain trends in foodborne

disease;

- Social trends such as ageing population, independent living, single person households, etc. that might relate to and explain trends in foodborne disease;
- Segmentation of people according to other safety, diet and consumption behaviours as well as age, education, past experience, ethnicity etc;
- Theory of health and safety behaviours (with respect to diet, alcohol, food safety, nutrition, smoking, etc) and how these might relate to or explain food safety behaviour;
- Behavioural research into perceptions, knowledge and understanding of food safety behaviour that might suggest issues, factors or explanations of food safety behaviour;
- Evaluations of promotion and education interventions for other topics (diet etc).

4.1.3 Key words and search terms

Initially key words around food safety and associated areas were used such as

Food safety and:

Behaviour, knowledge, foodborne disease, preparation, cross contamination, cooling, storage, handling, cooking; cleaning, hygiene, labelling, consumption, trends, segmentation, at risk groups.

However, as the search progressed, especially within the databases it was necessary to filter the number of records being returned to ensure that the most relevant and pertinent evidence would be sourced. Search terms were placed in quotations and Boolean operators AND, OR and NOT were also used with other terms as appropriate e.g. "food safety" AND intervention AND domestic exc reference work or "food safety" promotion AND "current practice" (1990 - present). Structuring the search this way enabled us to capture the most relevant items of evidence and specifically identify evidence related to the domestic environment.

The key words and the way they were used for the search to find evidence is shown below and should be reviewed in conjunction with the evidence review spreadsheet which provides details on what key words were used for each source reviewed:³²

Alcohol; Cigarette; smoking

Cooking; cooking (Advanced Search in keywords and limiting to 1990-2010); cooking theory (1990-2010); cooking research (1990-2010); cooking evidence; cooking evidence (1990-2010); cooking stud* (1990-2010); Cooking intervention; "cooking interventions"; Cooking research; Cooking review; Cooking studies; Cooking theory; Diet theory; kitchen practice (1990-2010); Kitchen practice,

Food safety; Food Safety behaviour; Food safety knowledge; food safety and consumer knowledge; "food safety" and consumer knowledge (1990-2010); "food safety" preparation -jobs; "food safety" "cross contamination" -jobs (Fewer shopping sites); "food safety" cooling -jobs (Fewer shopping sites)"food safety" cooking -jobs (Fewer shopping sites);

³² The type of person (e.g. pregnant women) was not added as this would reduce the scope of the search. Instead all relevant articles on food safety were screened and the type of person was categorised.

"food safety intervention" (1990-2010); "food safety" education AND "current practice" (1990-present); "food safety" education AND evaluation (1990-present); "food safety" education AND assessment (1990-present); "food safety" education AND assessment* (1990-present); "food safety" education AND review (1990-present); "food safety" education AND review (1990-present); "food safety education" and school (1990-2010); "food safety" education AND "best practice" (1990-present); "food safety" education AND healthcare (1990-present).

Food Safety advice (1990-2010); "food safety" advice AND "social care" (1990-present); "food safety" advice AND "best practice" (1990-present); "food safety" advice AND healthcare (1990-present); "food safety" advice AND school (1990-present); "food safety" advice AND evaluation (1990-present); "food safety" advice AND intervention (1990-present); "food safety" advice AND assessment (1990-present); "food safety" advice AND review (1990-present); "food safety" advice AND "current practice" (1990-present).

"food safety" promotion AND evaluation (1990-present); "food safety" promotion AND intervention (1990-present); "food safety" promotion AND "current practice" (1990-present); "food safety" promotion AND assessment (1990-present); "food safety" promotion AND review (1990-present); "food safety" promotion AND "best practice" (1990-present); "food safety" promotion AND school (1990-present); "food safety" promotion AND healthcare (1990-present); "food safety" promotion AND social care (1990-present)

"food safety" intervention AND "current practice" (1990-present); "food safety" intervention AND assessment (1990-present); "food safety" intervention AND "best practice" (1990-present); "food safety" intervention AND review (1990-present); "food safety" intervention AND social care (1990-present); "food safety" intervention AND evaluation (1990-present); "food safety" intervention AND healthcare (1990-present); "food safety" intervention AND school (1990-present)

"food safety" AND review AND domestic exc references; "food safety" AND "cross contamination" and domestic exc reference work; "food safety" AND hygiene and domestic exc reference work; "food safety" AND segmentation and domestic exc reference work; "food safety" and "at risk group" (1990-2010); "food safety" AND cooling and domestic exc reference work; "food safety" AND storage and domestic exc reference work; "food safety" AND preparation and domestic exc reference work; "food safety" AND handling and domestic exc reference work; "food safety" AND cooking and domestic exc reference work;

"food safety" AND foodborne disease AND domestic; "food safety" AND consumption and domestic exc reference work; "food safety" AND cleaning and domestic exc reference work; "food safety" and labelling and consumer (1990-2010); "food safety" AND labelling and domestic exc reference work; "food safety" AND at risk groups and domestic exc reference work.

"food safety" and "foodborne disease" (1990-2010); "food safety" and cleaning (1990-2010); "food safety" and hygiene (1990-2010); "food safety" and "cross contamination" (1990-2010); "food safety" and cooling (1990-2010); "food safety" and storage (1990-2010);

"food safety" and consumption (1990-2010); "food safety" and home cook* (1990-2010); "food safety" and home cook* (1990-2010); "food safety" and trend (1990-2010); "food safety" and preparation (1990-2010)

"food safety" and "food handling" (1990-2010); "food safety" AND review AND domestic exc references; "food safety" AND handling and domestic exc reference work; "food safety" AND trends and domestic exc reference work; "food safety" and segmentation

(1990-2010); "food safety" AND segmentation and domestic exc reference work

"food safety behav*"; "food safety behav*" and research (1990-2010); food safety behav* and theory (1990-2010); "food safety behav*" and evidence (1990-2010); "food safety behav*" and stud* (1990-2010); "food safety behav*" and review (1990-2010); "food safety behav*" and evaluation (1990-2010) "food safety behav*" and trend (1990-2010); "food safety behav*" and factors (1990-2010);

"food safety behaviour" AND factors exc reference work; "food safety behaviour" AND research (1990-present); "food safety behaviour" AND evidence (1990-2010); "food safety behaviour" AND evidence (1990-2010); "food safety behaviour" AND stud* (1990-2010).

"food safety education" AND evaluation* (1990-2010); "food safety education" AND assessment* (1990-2010); "food safety education" AND review* (1990-2010); "food safety education" AND "best practice" (1990-2010); "food safety education" AND best practice* (1990-2010); "food safety education" AND "bst practice" (1990-2010); "food safety education" AND healthcare* (1990-2010); "food safety education" AND advice (1990-2010); "food safety education" AND advice exc reference work;

"food safety education" AND intervention AND domestic exc reference work; "food safety education" AND behaviour - jobs; "food safety education" AND promotion exc reference work; "food safety education" AND current practice (1990-2010); "food safety education" AND foodborne disease – jobs;

"food safety promotion" (1990-2010); "food safety intervention" (1990-2010); "food safety behaviour" AND trend (1990-present); "food safety behaviour" AND factors exc reference work.

Public advice; Public education; public intervention; public health; public promotion; public health and safety advice; Public Health and Safety Education; public health and safety intervention; public health and safety promotion; "public health and safety education"; "public health and safety advice";

"public health and safety promotion"; "public health and safety intervention"; "public health education" intervention; "public health education" "current practice"; "public health education" "best practice"; "public health education"; "public health education" evaluation (1990-2010).

4.1.4 Sources

The search was partly purposive and partly responsive to the discovery of material.

Purposive elements involved:

- Reviewing the reference list from key publications that had been identified and the references cited;
- Publications/materials "expert interviewees" had produced or referenced;
- A key word search of selected journals (see below);
- A search of selected organisations and individuals, as noted above;
- A search of online databases namely Wiley Interscience, ScienceDirect, Emerald and Web of Science;
- An online key word search using Google of the first two pages of results as a minimum;
- A search of FSA reports.

Exploratory aspect included extending the search to cover journals, organisations and

individuals discovered by the purposive search. In all cases we recorded the key words used and the sources used (see evidence review spreadsheet).

Sources used to initiate the search are noted below.

1. Journals

Journal of Food Safety; Comprehensive Reviews in Food Science and Food Safety; British Food Journal, and American *Journal of Public Health*. It should be noted that within ScienceDirect and Wiley InterScience databases, research evidence that was found had been published in a variety of journals, which included the above publication titles as well as other key journals such as *Journal of Nutrition Education and Behaviour*, and *Journal of Food Protection*.

2. Online Databases

We completed searches using the following databases; Wiley Interscience, ScienceDirect, Emerald and Web of Science. Emerald and Web of Science were also used for a few of the key words. The evidence review spreadsheet details how the keywords were searched within the databases and how searches were structured through the use of Boolean operators to identify the most relevant research. For each key word that was searched the first 50 to 100 records were reviewed, depending on the number of duplicates that the searches were returning. As the search progressed references that had already been sourced started to appear and so after the first 50 records if the search was continuing to yield duplicate references the next search term was used.

3. Food Standards Agency research, including work by the ACMSF, SSRC and Food and You scoping study.

We acquired copies of:

- Work completed by or on behalf of the SSRC, including:
 - ACMSF Report on the Increased Incidence of Listeriosis in the UK³³;
 - Report of the SSRC Working Group on L. Monocytogenes and the food storage and food handling practices of the over 60s at home, September 2009.³⁴
- Work completed by or on behalf of the Microbiological Safety of Food Funders Group (MSFFG), including:
 - A search of the MSFFG database; and
 - “UK publicly funded research relating to food preparation practices and behaviour in relation to the microbiological safety of food research between 1992 and 2007. Report from the Microbiological Safety of Food Funders Group. September 2008.”³⁵
 - Other research commissioned or completed by the FSA such as “B20004 - Review of past and on-going research into consumer practices, focusing on cross-contamination during food preparation”³⁶, the 25 studies cited by the Food and You

³³ <http://www.food.gov.uk/news/newsarchive/2009/sep/acmslisteria>

³⁴ <http://www.food.gov.uk/multimedia/pdfs/committee/acm954ssrcrep.pdf>

³⁵ <http://www.food.gov.uk/multimedia/pdfs/09finalreportmsffg>

³⁶

<http://www.food.gov.uk/science/research/researchinfo/foodborneillness/domestichygieneresearch/b20programme/projlist/b20004/>

scoping study and “Older people and food: a synthesis of evidence”³⁷.

4. Key word online search

We completed an online search using Google with key words reviewing the first two pages of each search. Again, the evidence review spreadsheet details the search terms and how they were used.

5. Selected organisations and individuals

We searched the websites and more generally for work completed by:

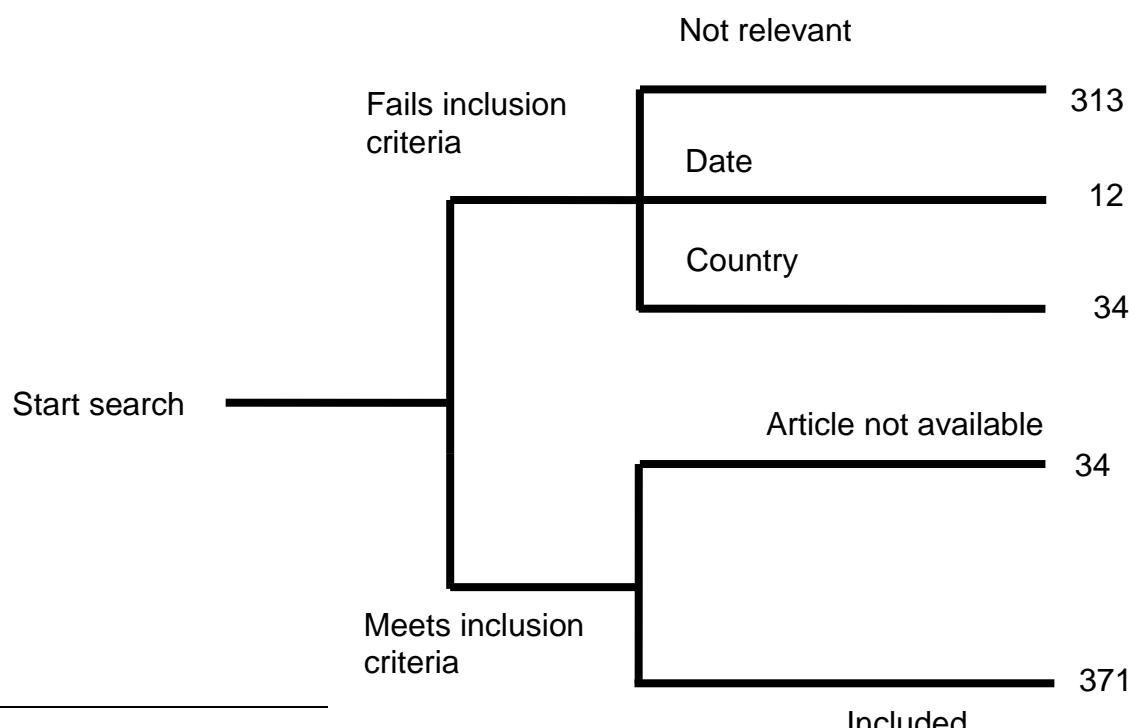
- US Department for Health and Social Services - Centers for Disease Control and Prevention;
- UK ESRC; Department of Health; NICE etc;
- Institute of Food Research;
- University of Wales Institute, Cardiff;
- (Irish) Food Safety Promotion Board;
- Food Standards Australia New Zealand;
- New Zealand Food Safety Authority.

Again the results of these searches are documented in the evidence review spreadsheet for relevant information that was found.

4.1.5 Screening

All articles were screened against the inclusion/exclusion criteria. Most exclusions were due to lack of relevance and duplications. All items that have been excluded have been placed within the evidence review spreadsheet with the reason for their exclusion detailed. 34 articles could not be obtained within the timescale of this project. These were mostly a mixture of conference proceedings, thesis and government / university reports.

Figure 2: Flow diagram of how the final number of included articles was reached



³⁷ <http://www.food.gov.uk/multimedia/pdfs/synthesisofevidence.pdf>

4.1.6 Evidence tables

All articles were reviewed and entered into an evidence table. A spreadsheet containing the evidence is available separately to this report.

Categories

For each study we:

- Produced a summary;
- Noted if the study was relevant to each of the Agency's 17 questions;
- Noted if it was specific to any vulnerable group, age or other demographic group;
- Noted which topic it related to (where evidence logged fell into two topic areas both of these have been listed);
- Assigned a weight of evidence score from 0 to 5;
- Full reference.

Table 5: Example evidence table (the example is split over series of tables)

Keyword	Search location	Source (database)	Type of material (B chapter, J article)	Full citation (reference)	Title	Year	Link
(Food safety and hygiene)	Direct	Foodbase (FSA)	Research Report	Eves, A., Adams, M., Bielby, G., Egan, B., Winchester and Eastleigh Healthcare Trust. & Raats, M. (2006). Getting food hygiene messages into schools. <i>Foodbase</i> . B20002	Getting food safety and hygiene messages into schools	2006	http://www.foodbase.org.uk/admin/tools/reportdocuments/403-1-709_B20002_final_report.pdf

Abstract (copied) Exec summary	Key findings	Type of evidence (observational study)	Weight of evidence scale used	Weight of evidence (1-5)	Justification of weight
<p>The FSA has committed itself to reducing the number of cases of food poisoning by 20% by 2006. One strategy to achieve this is to improve domestic food preparation practices. Children educated in an effective way at school will, hopefully, become adults who observe good hygiene practices.</p> <p>The project aimed to:</p> <ul style="list-style-type: none"> • Identify gaps in current provision of food hygiene education at Key Stages 1 - 3 or Equivalents. • Identify effective ways of influencing the attitudes and behaviour of young people. • Determine barriers to performing appropriate hygiene-related behaviours. • Identify practical actions that the Agency can take to improve the knowledge of young people, and bring about desired changes in behaviour. 	<p>There are few non web-based activities relating to food hygiene, and few up-to-date videos or CD-ROMs for primary children. CD-ROMs for secondary pupils are often more suitable for examination courses. There are few resources of any sort to support the teaching of the youngest children.</p> <p>Food hygiene is covered in many subjects at primary level (KS1 & 2), but much of the teaching and learning occurs when children engage in food preparation.</p> <p>Overall food hygiene knowledge in children was good. Most learned about food hygiene at school and some had adults at home who taught them.</p>	Review and evaluation	Surveys and quantitative research	3	Above 500 sample, reasonable discussion of survey sampling, no further stratification of sample, some discussion of analysis techniques

Topic/ subject matter	Other	Risky Behaviours (4 Cs)	Intervention type	Food storage and handling behaviours in the home (general population)	Food storage and handling behaviours in the home (vulnerable groups)	Relationship between food safety knowledge beliefs and actual behaviours	Factors associated with food storage and handling behaviours in the home	Factors to encourage adoption of safe food storage/handling practices	Factors which inhibit the adoption of safe food storage/handling practices	What is known about influencing safe food storage/ handling behaviour
EducFS	N/A	General	Mass education	yes	no	no	no	no	no	no

Does existing literature on food safety behaviours fit with literature on food in kitchen practices and behaviour more broadly (trends)	What are the theoretical approaches adopted to explore and explain food storage/handling behaviours	Research techniques used for exploring behaviours (Measuring actual rather than stated behaviours)	How food safety advice is disseminated to vulnerable groups (by health practitioners and care organisations)	How to disseminate food safety advice to particular groups in the population	Educational campaigns undertaken to provide the general population with information on food safety in the home and how these have been evaluated
no	no	no	no	yes	no

Pathogen 1	Pathogen 2	Pathogen 3	Population	Vulnerable group	Vulnerable group	Health status of the sample (N/K, immune suppression)	Population Age (N/K = Not Known)	Population gender	Population Country
Non-specific	N/A	N/A	teachers of children and children	N/A	N/A	N/K	N/A	N/A	UK (Wales, NI, Scotland)

4.2 Critical review

4.2.1 Weight of evidence criteria

Overview

The Maryland Scale of Scientific Methods (MSSM)³⁸ is a recognised five-point scale for classifying the strength of methodologies for intervention studies and has been applied in social science research. Features used to assess the quality of research include the pre- and post testing of the impact of interventions, the use of controlled groups and randomisation.

Our review of Weight of Evidence methods cited by the Government Social Research (GSR) Unit suggested that whilst the Maryland scale was applicable to impact and evaluation studies, the cited methods did not support rating of research studies, qualitative and theoretical work, and other forms of evidence covered in this review. Therefore two additional scales were developed for:

- Surveys and quantitative research; and
- Qualitative research and theories.

Using the 5 levels of The Maryland scale, each bespoke scale contained criteria based upon research design, sample, and data collection as primary considerations and criteria around analysis and reporting as secondary considerations to assess the weights of evidence.

For survey and quantitative research evidence, criteria used to distinguish the quality of research was based upon the methodology adopted (self report or observation, research instruments used), sample size, and constructs of reliability, validity and generalisability were used. Criteria used to inform evidence rated as qualitative research and theories were informed by the GSR resource “Quality in Qualitative Evaluation: A framework for assessing research evidence” (Spencer et al, 2003)³⁹, where criteria indicators are based upon the credibility, rigour and relevance of individual qualitative research studies.

The two bespoke scales were drafted and piloted on a sample of studies to test their relevance and discriminatory ability and adapted accordingly and then piloted again. The Researchers also reviewed evidence to be assessed using The Maryland scale for inter-rater reliability.

Weight of evidence criteria

The weight of evidence criteria are shown in Table 6.

³⁸ <http://www.civilservice.gov.uk/my-civil-service/networks/professional/gsr/resources/REA-how-to-resources-for-appraising-studies.aspx>

³⁹ Spencer, L., Ritchie, J., Lewis, J., Dillon, L., Quality in Qualitative Evaluation: A framework for assessing research evidence” (2003). Government Chief Social Researcher’s Office.

Table 6: Weight of evidence criteria

Weight of evidence	Evaluation Studies	Surveys and quantitative research	Qualitative research and theories
Examples of studies	Evaluations of interventions.	Questionnaires, surveys, meta-analysis ⁴⁰	Literature reviews, meta-reviews, rapid evidence review, systematic reviews, case studies, observational studies, qualitative interviews.
Zero	No intervention is formally used or described to enable a rating to be assigned.	Not enough information provided for a rating. Research design, sample size, and data collection does not fit criteria to enable a rating of one.	Not enough information provided for a rating. Research design, sample size, and data collection does not fit criteria to enable a rating of one.
One	Observed correlation between an intervention and outcomes at a single point in time. A study that only measured the impact of the service using a questionnaire at the end of the intervention would fall into this level.	Research design, sample and data collection: Small convenience sample (n= less than 100). No sample frame. No piloting of research instruments, lack of standardised procedures followed for data collection. Methodology risks socially desirable responses, e.g. self reported behaviours without reference to specific occasions.	Research design, sample and data collection ⁴¹ : Anecdotal evidence/ poor or no use of qualitative methodology, no justification or rationale for selection of cases/evidence, data collection or analysis. Secondary considerations Analysis and reporting: Poor/no links between data, interpretation and conclusions.

⁴⁰ Meta-analysis, literature reviews, meta-reviews, rapid evidence reviews, and systematic reviews, were weighted based on how well the evidence reviewed fits the various criteria indicators, but especially the research methods implemented, details on the inclusion and exclusion criteria of studies/research included, how the findings are discussed (e.g. if any weights of evidence criteria have been used) and not just on the number of studies reviewed.

⁴¹ Research design, sample and data collection (i.e. the robustness and appropriateness of the methods employed) will take priority over the method statement and critique of study/studies or discussions on analysis.

Weight of evidence	Evaluation Studies	Surveys and quantitative research	Qualitative research and theories
		<p>Secondary considerations</p> <p>Generalisability: None or very limited.</p> <p>Analysis and reporting: No discussion of analysis techniques used. Inappropriate statistical tests used. No discussion of findings and links to previous work.</p>	<p>Reference to research and theory: Does not theory build or extend knowledge/understanding. Use of anecdotal/subjective evidence.</p>
Two	<p>Temporal sequence between the intervention and the outcome clearly observed; or the presence of a comparison group that cannot be demonstrated to be comparable.</p> <p>A study that measured the outcomes of people who used a service before it was set up and after it finished would fit into this level.</p>	<p>Research design, sample and data collection: Sample is 100 to 400 individuals Piloting of research instruments, and use of standardised procedures for data collection. Surveyed behaviours are linked to previous research but do risk socially desirable response due to self reported behaviours.</p> <p>Secondary considerations</p> <p>Generalisability: Could apply to other behaviours within the surveyed population.</p> <p>Analysis and reporting: Appropriate use of statistical tests. Limited discussion of analysis, findings and reference to reliability and validity.</p>	<p>Research design, sample and data collection: Limited use of qualitative methodology, limited/no details for rationale of study, selection of cases, data collection and analysis. Study design has no scope to draw any wider inferences.</p> <p>Secondary considerations</p> <p>Analysis and reporting: Limited evidence to support findings. Does not critically evaluate research. No discussions around future research.</p> <p>Reference to research and theory Does not extend knowledge or understanding and lack of robust evidence.</p>

Weight of evidence	Evaluation Studies	Surveys and quantitative research	Qualitative research and theories
Three	A comparison between two or more comparable units of analysis, one with and one without the intervention. A matched-area design using two locations in the UK would fit into this category if the individuals in the research and the areas themselves were comparable.	<p>Research design, sample and data collection: Sample is 400 to 600 individuals 95% Confidence interval of about 5%</p> <p>A sample frame representative of the population or target population to be studied with an appropriate sampling strategy (e.g. quota or stratified sampling).</p> <p>Piloting of research instruments, and use of standardised procedures for data collection.</p> <p>Methodology avoids socially desirable responses, e.g. self reported behaviours on specified occasions.</p> <p>Secondary considerations</p> <p>Generalisability: Can apply findings to more than one population.</p> <p>Analysis: Appropriate use of statistical tests and justification.</p> <p>Discussion of analysis techniques used, reliability, validity and significance of findings is considered.</p>	<p>Research design, sample and data collection: Appropriate use of methods e.g. interviews, observations, focus groups with questions linked to previous research/theory.</p> <p>Some justification for case selection, data collection procedures, and analytical approach.</p> <p>Case selection (numbers and variety) enables some applicability to other settings.</p> <p>While there is detail on methods no formal evaluation criteria is used (or weighting of evidence criteria for a meta-review/rapid evidence review).</p> <p>Secondary considerations</p> <p>Analysis and reporting: details provided on analysis and categorising of data. Links between data, interpretation and conclusions supported by evidence.</p> <p>Discussion of how assessments of effectiveness/evaluative judgements have been reached.</p> <p>Reference to research and theory: Some detail of the contexts in which the study was conducted to enable applicability to other settings /contextual generalities to be assessed and build theory/extend knowledge.</p>

Weight of evidence	Evaluation Studies	Surveys and quantitative research	Qualitative research and theories
Four	Comparison between multiple units with and without the intervention, controlling for other factors or using comparison units that evidence only minor differences. A method such as propensity score matching, that used statistical techniques to ensure that the programme and comparison groups were similar would fall into this category.	<p>Research design, sample and data collection: Stratified sample groups (e.g. sample is segmented into subgroups age, gender, ethnicity etc with approx 400 to 600 participants in each sub group).</p> <p>Consideration given to survey weighting.</p> <p>Sample size provides 95% confidence interval of <5%.</p> <p>Power of 80% per segment.</p> <p>Piloting of research instruments, and use of standardised procedures for data collection.</p> <p>Methodology avoids socially desirable responses. Use of validated measures of behaviours.</p> <p>Secondary considerations</p> <p>Generalisability:</p> <p>Findings are generalisable to other settings and groups e.g. “external validity” (e.g. potential to explain other food safety behaviours).</p> <p>Analysis:</p> <p>Comprehensive discussion of findings and their reliability and validity. Use and justification of appropriate statistical tests.</p>	<p>Research design, sample and data collection: Appropriate use of methods e.g. interviews, observations, focus groups with questions/topic guides linked to previous research/theory.</p> <p>Justification for case selection, data collection procedures, and analytical approach.</p> <p>Case selection criteria (e.g. numbers of cases and key features of cases / representativeness) provides some scope for drawing wider inferences from research/theory.</p> <p>Use of formalised appraisal criteria/indicators that have been used (e.g. weights of evidence. A rapid evidence review following GSR protocols would fit here potentially).</p> <p>Secondary considerations</p> <p>Analysis and reporting:</p> <p>Detailed analysis and reference to construction of analytical categories and their application.</p> <p>Findings/ conclusions supported by data/study evidence.</p> <p>Findings discuss appraisal criteria and alternative viewpoints.</p>

Weight of evidence	Evaluation Studies	Surveys and quantitative research	Qualitative research and theories
			<p>Limitations of research/theory discussed and their influence.</p> <p>Reference to research and theory:</p> <p>Underlying assumptions/theoretical perspectives discussed.</p> <p>Discussion on what can be generalised to wider population from which case selection has been made.</p>
Five	<p>Random assignment and analysis of comparable units to intervention and control groups. A well conducted Randomised Controlled Trial fits into this category.</p>	<p>Research design, sample and data collection:</p> <p>Stratified sampling with groups further segmented (e.g. sample is segmented into subgroups age, gender, ethnicity etc. with approx 600+ in each group).</p> <p>Sample size provides 95% confidence interval of up to 2%.</p> <p>Power of 90% per segment.</p> <p>Piloting of research instruments, and use of standardised procedures for data collection.</p> <p>More than one survey used. Methodology uses observational measures of behaviour or other measures that confirm true behaviours which are reliable.</p> <p>Secondary considerations</p> <p>Generalisability: Can extrapolate from this population to others and/or explain other</p>	<p>Research design, sample and data collection:</p> <p>Analytical approach links sample design, case selection, data collection with full justification and where appropriate research tools/materials included.</p> <p>Description of formalised appraisal criteria and weights of evidence used to assess findings (e.g. a meta-review with weighted evidence or a systematic review would fit in here).</p> <p>Case selection and numbers enables research to be generalised to a wider sample and other contexts and theory built.</p> <p>Secondary considerations</p> <p>Analysis and reporting:</p> <p>Transparency for analysis and construction of analytical categories and their</p>

Weight of evidence	Evaluation Studies	Surveys and quantitative research	Qualitative research and theories
		<p>food safety behaviours.</p> <p>Analysis:</p> <p>Appropriate use and justification of statistical tests.</p> <p>Comprehensive review of research findings and validity and reliability of measures used and significance of findings.</p> <p>Discussion of methodological limitations with directions for future research identified and appropriate methods for investigation.</p>	<p>application.</p> <p>Findings/ conclusions supported by evidence to enable analysis and interpretations to be distinguished.</p> <p>Discussion of any missing coverage in cases selected and any implications for study evidence.</p> <p>Further research areas identified and potential methodological approaches suggested.</p> <p>Findings discuss alternative viewpoints and atypical cases.</p> <p>Limitations of research/theory discussed and their influence and how these could be addressed in the future.</p> <p>Reference to research and theory:</p> <p>Findings/ conclusions supported by evidence and are linked to previous research.</p> <p>Extends knowledge on food safety/models of behaviour further.</p> <p>Discussion of any assumptions of theoretical perspectives and what can be generalised to wider population from which case selection has been made.</p>

4.2.2 Checklists for gap analysis

A number of checklists were drafted to help identify gaps in the evidence. For example, during the synthesis of research we compared the range of interventions cited in the research to those listed here, and we also compared the coverage of vulnerable groups against those listed here.

The checklists are shown below.

Checklist 1: Interventions

There are many ways to segment interventions. One split of interventions is provided below to act as a checklist.

1. Outreach style interventions

The recognition that a minority of people may be both most at risk and hard to reach has led to a variety of outreach type of interventions. These interventions aim to “go out” to people and provide direct support based on their individual needs, rather than expecting people to “come to you” or respond to mass communications. Some examples of guidance include the Department of Health guide “Addressing inequalities - reaching the hard-to-reach groups - National Service Frameworks: a practical aid to implementation in primary care, 12 August 2002.”⁴²

Community advocates, networks and champions

- Cooking clubs;
- Presentations and talks in community centres;
- Community events.

Local promotional work by the lead agency

- Stands at community events, high street etc;
- Presentations and talks in community centres.

Needs assessments

- Where one or more agency completes an assessment of the needs of the individual and either arranges or refers them on for advice and assistance. Examples include:
 - Home safety checks;
 - Sure Start Children Centres (outreach assessment);
 - Single point assessments by social services of needs of individuals.

Special needs assessments

- E.g. assess special needs of children and then refer to a specialist support agency provided by local authority or third sector organisation, e.g. social service referral of disabled children for respite short break services;
- E.g. assess needs of patients and then provide ongoing advice and support in the home. For example, cardiac heart failure specialist nursing.

⁴²

http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_4065397.pdf

Screening and referral

- Medical screening and checks – leading to referrals to special support, e.g. screen pregnant women for smoking and refer to smoking cessation service.

Partner referrals of vulnerable people

- Where the prime agency seek agreement of other agencies to refer over to them clients who meet certain criteria. Examples include:
 - Age Concern refer elderly persons for fire safety advice;
 - Fire service referring people to social services for heating or home help services.

Advice via existing services

- Via healthcare professions and third sector organisations. Where practitioners agree to identify people in need, complete some form of assessment and then provide advice and assistance to them. Examples include:
 - Health visitors;
 - Midwives;
 - Nurses at local GPs;
 - GPs;
 - Other medical and support staff (e.g. for patients suffering or undergoing cancer treatment).

One to one counselling

- Individuals receive one to one advice and counselling to support them, change their behaviours/attitudes or overcome problems.

2. Environmental changes and enabling interventions

Community development work acknowledges that health is as affected by the social conditions of people's lives such as damp housing, unemployment, or poor access to facilities, as it is by lifestyle choices. Major policy documents including Our National Health⁴³ (2000) highlight the importance of considering life circumstances alongside lifestyle choices and disease in promoting health and wellbeing. This leads to 'Enabling' interventions that provide a supportive environment: Examples include providing free eye tests, free phone advice, extending opening hours for health services and locating services close to deprived persons.

3. Product oriented interventions

Labelling of products and accompanying information

- Information and advice is contained on product labelling.

Provision of products that enable health and safety

⁴³ NHS Scotland. (2000) Our National Health. Published online by Scottish Executive.

<http://scotland.gov.uk/Resource/Doc/158732/0043081.pdf>

- New standards on equipment to make them inherently safer, e.g. thermostatically controlled deep fat fryers, RCDs to cut off electricity supply;
- Encourage innovation of products, e.g. home safety devices.

4. Mass education and communication interventions

Schools based education

- Inclusion within national curriculum and initiatives by bodies promoting food based education for hygiene or healthy eating e.g. Schools Food Trust.

Adult education and training

- Where, for example, courses are offered to develop life skills.

Advice and information via industry

- Industry works in partnership with the government to provide advice and information through mass media, in shop information and product labelling/leaflets.

Workplace as a venue for education and promotion.

Mass media

- Government funded adverts and advertorials via TV, radio and magazines;
- Website based advice and information.

Social marketing

Recently social marketing has been receiving more attention⁴⁴. This is defined⁴⁵ as “Social marketing is concerned with the application of marketing knowledge, concepts and techniques to enhance social, as well as economic ends. It is also concerned with analysis of the social consequences of marketing policies, decisions and activities”. It aims to develop an understanding of the barriers to people taking up a service or changing their behaviours, and then developing an intervention that meets their specific needs. Social marketing is more of an approach to developing interventions, than a form of intervention in its own right.

The following six features and concepts underpin social marketing:

- Consumer orientation: gaining deep insight and understanding about the consumer, their knowledge, attitudes and beliefs, and the social context in which they live and work.
- Behaviour and behavioural goals: understanding existing behaviour and key influences on it in order to enable the development of clear behavioural goals. These goals should be divided into actionable and measurable steps or stages, phased over time.

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http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_090348

Ambitions for health: a strategic framework for maximising the potential of social marketing and health-related behaviour, 10 July 2008

⁴⁵ Lazer W. and Kelley E. (1973), Social Marketing: Perspectives and Viewpoints. Homewood, IL: Richard D. Irwin, p. ix.

- ‘Intervention mix’ and ‘marketing mix’: using a range of different interventions or methods to achieve a particular behavioural goal. When used at the strategic level, this is commonly referred to as the ‘intervention mix’: when used operationally it is described as the ‘marketing mix’ or ‘social marketing mix’.
- Audience segmentation: making use of audience segmentation in order to target effectively.
- ‘Exchange’: using and applying the exchange concept (what people must give up or pay in order to receive the benefit). Understanding the real cost to the customer will enable a more effective exchange, whereby the potential benefit can be optimised and the ‘cost’ to the customer minimised.
- ‘Competition’: understanding all the factors that compete for people’s attention and willingness to adopt a desired behaviour (e.g. the influence of other people or organisations, or the internal drivers of pleasure, habit or addiction).

Checklist 2: Segmentation of people

A rapid review of previous studies into health and safety behaviours identified the following segmentations of people.

Socio-economic

- Socio-economic class, income, employment status.

Educational

- Educational attainment level – what is their highest educational attainment.

Demographic

- Age, gender, ethnicity, household type (single adult, lone parent, 2 adults and children, lone pensioner etc), language, marital status.

Housing type

- Houses, flats, bedsits etc

Cohort- generational

- 1st, 2nd generation etc

Consumer type categories

Attitudinal and behavioural

- Consumption habits;
- Safety attitudes and beliefs.

Lifestyle

Regional

Health

- Health status (physical and mental)

Checklist 3: Who is at risk

A number of studies have explored which groups of people have higher rates of foodborne disease. A key study⁴⁶ was completed on the increased incidence of listeriosis in September 2009 by the Advisory Committee On The Microbiological Safety Of Food (ACMSF) Ad Hoc Group on Vulnerable Groups. Whilst *Campylobacter* is the most common form of food poisoning, followed by *Salmonella* and *Escherichia coli*, listeriosis (whilst relatively infrequent) causes most deaths. As stated by the ACMSF "Listeriosis is a rare but severe foodborne disease caused by the opportunistic pathogen *L. Monocytogenes*. Primarily affecting the unborn, the newly delivered, the immunocompromised and the elderly Listeriosis is estimated to be the most common cause of food-related deaths in the United Kingdom."

The key groups of people identified as at risk, to date, are noted below along with key findings from previous work. It should be noted that this list is limited to those groups cited in previous research and is not considered to be a comprehensive list of vulnerable groups, i.e. research into who is most at risk is assumed to be incomplete.

1. Pregnant women

L. Monocytogenes which can cause miscarriage [miscarriage, premature delivery or stillbirth] during pregnancy;

Pregnant women and people with weakened immune systems are also at risk from *Toxoplasma gondii*- a parasite that causes toxoplasmosis, with typical sources such as raw or undercooked pork.

2. Ethnicity

The ACMSF reported (from HPA studies⁴⁷) that the proportion of pregnancy-associated listeriosis cases classed as ethnic increased from 16.7% to 57.9% from 2001 to 2008, whereas this trend was not observed for non pregnancy-associated cases. Thus ethnicity has also been identified as a factor, although the cited work did not identify which ethnic groups may be at greater risk.

3. Unborns and newborns

They are at greater risk due to their reduced immunity.

4. Elderly (over 60)

The ACMSF reported that the incidence of listeriosis in those aged ≥60 years reported during 2008 and 2009 (10.53 cases per million people) far exceeded that observed in younger cases (1.62 cases per million people) and increased with increasing age 7.67, 11.07 and 16.16 case per million for 60-69, 70-79 and ≥80 year olds.

5. Adults with a weakened immune system

The ACMSF study notes that:

- Cancer patients had an almost fivefold increased risk of listeriosis and, within this group; cancers of the blood had the greatest impact.

⁴⁶ <http://www.food.gov.uk/multimedia/pdfs/committee/acm979listeriosis.pdf>

⁴⁷ <http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=19610>

- Other high risk/impact conditions include diabetes mellitus, alcoholism, certain diseases of the circulatory system and the musculoskeletal/connective tissue system, non-infective enteritis/colitis, as well as diseases of the liver and kidneys.

Persons on immune suppressive medication or with immune suppression disorders are also at greater risk.

6. People with liver diseases are especially at high risk from *Vibrio vulnificus*, which can cause gastroenteritis, wound infection, and severe bloodstream infections. Sources: raw or undercooked seafood, particularly shellfish.

7. Deprivation

The ACMSF report noted that:

- “Compared to the most affluent areas, disease incidence was higher in the most deprived areas of the country (RR 1.38 CI95 1.16-1.65). This effect was observed in patients aged ≥60 years (RR 1.36 CI95 1.09-1.71) and was more marked for pregnancy-associated cases (RR2.20 CI95 1.18-4.08). Cases were more likely to purchase foods from convenience stores or from local services (bakers, butchers, fishmongers and greengrocers) than the general population, and their risk profile changed with increasing deprivation”.

Checklist 4: Risky behaviours

A list of the types of behaviours that are associated with foodborne disease, segmented under the Food Standards Agency's four Cs.

1. Cooling (chilling)

Unsafe behaviours include:

- Failing to check food labels and ensure refrigeration of those items that require chilling;
- Leaving food out in an environment where temperature is not controlled, especially foods that need to be kept cool, including foods which have been cooked or prepared, or food with a “use by” date (e.g. salads; dips, milk, cream and yoghurt; deserts and cream cakes; sandwiches, ham and other cooked meats; and cooked rice) and leaving these out for too long at room temperature, e.g.:
 - Leaving food out for more than four hours;
 - Failure to use cool box or bag for foods taken out doors;
- Failing to store foods properly after opening packaging, such as failing to reseal packaging;
- Overloading a fridge such that it no longer maintains adequate refrigeration;
- Failing to check the temperature of the refrigeration appliance (0 to 5°C);
- Eating leftovers more than two days afterwards.

2. Cross-contamination

Unsafe behaviours include:

- Using same surfaces for cooked and uncooked meat;
- Using same utensils for uncooked and cooked meat;

- Placing uncooked meats close to other ready to eat foods;
- Failing to store uncooked meats in sealed containers or wrappings;
- Storing uncooked meats above other foods in a refrigerator (= not storing raw meat covered and at the bottom of the fridge);
- Failure to wash hands thoroughly or frequently during food preparation will also lead to cross-contamination (see cleaning).

3. Cooking

Unsafe behaviours include:

- Not cooking foods long enough or at high enough temperatures, especially:
 - Raw and undercooked eggs, undercooked poultry and meat, fresh fruits and vegetables, and unpasteurized dairy products – risk of *Salmonella*;
 - Undercooked beef – with risk of *E. Coli*;
 - *Campylobacter* - from undercooked chicken (poultry), meat.
- Reheating foods more than once;
- Not reheating to a high enough temperature (until steaming hot);
- Consuming foods after their 'use by' dates.

Especially eating unpasteurized dairy products, including soft cheeses; sliced deli meats; smoked fish; hot dogs; pate'; and deli-prepared salads (i.e. egg, ham, seafood, and chicken salads) after use by dates.

4. Cleaning

Unsafe behaviours include:

- Failing to wash hands after using the toilet;
- Failing to wash hands after handling foods, especially uncooked meat, creating risk of cross-contamination between uncooked and cooked food;
- Failing to clean surfaces and utensils, creating risk of cross-contamination;
- Failing to change dish cloths and tea towels, allowing germs to breed;
- Failing to wash hands before handling food when you are suffering from food poisoning symptoms (diarrhoea and/or sickness) (e.g. whether viral or bacterial). Poor hygiene practise by such people causes bacteria or viruses to be easily passed from person to person and from infected individuals to food items. Typical sources include: salads and any food handled by someone who is infected. Contamination by infected food handlers is a common source of viral foodborne illness.

4.3 Expert interviews

4.3.1 Aims of expert interviews

To inform the findings of the evidence review and explore key trends around food storage and handling behaviours in the home, consumer awareness of food safety knowledge, how to promote and encourage food safety behaviours, and to identify any relevant work in progress and areas of further research.

The expert interviews aimed to provide feedback on:

- Key elements of current knowledge; e.g. who is vulnerable, key behaviour factors;
- Evidence regarding how best to advise and influence people, especially over 60s;
- Main gaps in current evidence;
- Future research priorities;
- Research methodology.

4.3.2 Selection criteria and identification of experts

Experts to be consulted as part of the review were agreed in conjunction with the FSA. It was felt by the FSA that it would be beneficial to consult with FSA staff working within policy and communications within England, Scotland, Wales and Northern Ireland, with the FSA identifying suitable colleagues who were able to participate in a focus group to inform the review. In addition a series of interviews with experts within the UK and from overseas (Australia, United States, and the Netherlands) were conducted. Experts for this part of the review were identified by reviewing the literature and identifying key researchers, practitioners and individuals who work within the field of consumer food safety, as well as from any recommendations from interviewees. Decisions on whom to interview were based upon the research interests and areas of work individuals were involved in, which could benefit the review such as experience and knowledge of researching the topics/groups of interest (e.g. the elderly, pregnant women, and the use and application of different types of methodologies).

Interviewees came from a range of backgrounds and disciplines and included researchers, academics, public health nutritionists, microbiologists, practitioners working in the field of food safety and individuals who were involved with disseminating advice and promoting food safety materials from food safety organisations.

4.3.3 Interview Procedure

Interviewees were initially sent an approach letter from the FSA (which had been drafted by Greenstreet Berman Ltd and the FSA) introducing the evidence review and asking for their participation in an interview (see Appendix C). Individuals were notified in the letter that a member of the research team at Greenstreet Berman would contact them to enquire if they would be happy to participate and to accordingly arrange a convenient time and date for an interview. All individuals were also provided with the email and phone details for a contact from the FSA for any further queries or questions individuals may have about the evidence review and the interviews. All individuals who agreed to participate in the review were provided with an information sheet which provided some further details about the interviews including the key themes that would be explored and a consent form which they were asked to sign. Interviews on average lasted an hour and after which participants were informed that a summary of the interview would be provided for them to review and add any further comments.

These interview summaries were then used to produce a synthesis of the key themes from the various interviews (see Appendix D).

4.3.4 Topic guides for the interviews

We produced two topic guides with the FSA (one for the focus group with FSA policy and communications staff, and one for the expert interviews). Each topic guide included questions to explore the following topic areas:

- Expert's background;
- Key trends and behaviours regarding food safety;

- Vulnerable groups;
- Promoting food safety and education - how best to advise and influence people;
- Research Methodology;
- Gaps in current evidence/ future research priorities.

4.4 Synthesis

4.4.1 Synthesis by FSA question

We provided the findings for all 17 of the FSA questions, one by one (existing evidence, additional questions of secondary importance and identifying evidence gaps).

4.4.2 Meta evidence tables

We produced meta-evidence review tables to support the gap analysis. The tables serve the purpose of summarising the extent of evidence. This was supported by a narrative review of the extent and quality of evidence on each topic, taking account of the expert interviews. A judgement was offered regarding whether the extent of evidence means there is or is not a “gap”.

4.4.3 Research priority grid

We produced a matrix of 1) weighting each topic or sub-topic (such as behaviour of over 60s) and 2) extent of evidence available, as in Figure 3, taking account of the expert interviews.

Figure 3: Rating of future research needs

Importance of topics	High (3)			Top priority
	Medium (2)		Moderate priority	
	Low (1)	Lowest priority		
		Greatest (1)	Moderate (2)	Poorest (3)
Extent of evidence				

The importance of each topic area was based upon a priority rating exercise which formed part of a focus group attended by FSA staff working within policy or communications. Prior to the focus group each participant was provided with a list of topic areas which the evidence review was exploring and were asked to assign a high, medium, or low rating based upon how important they felt it was to investigate the topic area. Individuals were asked to discuss their ratings in the focus group and then group members were asked to agree on a high, medium, or low rating for each topic (see Appendix D section 8.2.4).

The priority awarded by the FSA focus group was rated as 3 for High, 2 for Medium and 1 for Low.

The extent of evidence was rated as 1 for Greatest, 2 for Medium and 3 for Poorest as follows:

- Producing a weighted level of evidence by multiplying the number of references by their weight of evidence rating. For example, 2 references rated as zero and 18 articles weighted as 1 would give a weighted overall score of $(0 \times 2) + (18 \times 1) = 18$.

- The overall weighted score was graded as 3, 2, 1 according to the following guideline:

>200	Greatest	1
100 to 200	Medium	2
<100	Poorest	3

The results are shown in Figure 4.

Figure 4: Calculation of research priority scores

FSA question	Weight of evidence							Weighted level of evidence	Level of evidence	FSA importance score	Overall score
	0	1	2	3	4	5	All				
Food storage and handling behaviours in the home (vulnerable groups)	1	14	22	14	10	9	69	185	2	3	6
Factors which inhibit the adoption of safe food storage/handling practices	2	11	21	18	7	2	59	145	2	3	6
What is known about influencing safe food storage/ handling behaviour	2	5	16	12	3	2	38	95	3	2	6
How food safety advice is disseminated to vulnerable groups (by health practitioners and care organisations)	3	11	8	6	2	0	27	53	3	2	6
Research techniques used for exploring behaviours (Measuring actual rather than stated behaviours)	1	10	13	16	4	1	44	105	2	2	4
Factors to encourage adoption of safe food storage/handling practices	2	4	16	13	8	1	42	112	2	2	4
Food storage and handling behaviours in the home (general population)	2	30	59	41	25	7	162	406	1	3	3
Factors associated with food storage and handling behaviours in the home	2	18	29	31	17	3	98	252	1	3	3
Relationship between food safety knowledge beliefs and actual behaviours	1	17	45	29	6	3	100	233	1	3	3
What are the theoretical approaches adopted to explore and explain food storage/handling behaviours	0	9	17	11	3	0	40	88	3	1	3

FSA question	Weight of evidence							Weighted level of evidence	Level of evidence	FSA importance score	Overall score
	0	1	2	3	4	5	All				
Does existing literature on food safety behaviours fit with literature on food in kitchen practices and behaviour more broadly (trends)	1	17	13	19	10	6	65	170	2	1	2
How to disseminate food safety advice to particular groups in the population	2	15	28	17	4	1	65	143	2	1	2

5 APPENDIX B: INCLUDED REFERENCES

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Elaboration likelihood model

The following two articles were added to the review to provide a complete review of theoretical approaches to behaviour change. This model had not been identified in the search but was known to the researchers.

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Health belief model

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Neutrogenic diet advice

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6 APPENDIX C: CRITICAL REVIEW

6.1 Number of references per topic

The search was guided by a list of topics. Table 7 shows the number of studies by topic by weight of evidence score. The median score was 2 on a scale of 0 to 5, with studies skewed towards understanding behaviours and fewer covering interventions.

Table 7: Number of documents by main topic

Topic	Weight of evidence						
	0	1	2	3	4	5	Total
Food Safety behaviour in the home	3	23	37	26	13	3	105
Perceptions, knowledge and understanding of food safety behaviour	0	5	23	14	5	0	47
Evaluations of food safety schools education interventions	1	11	25	5	3	0	45
Diet/Eating/consumption/purchasing behaviours	0	3	6	9	5	2	25
Other evaluations of promotions/education interventions	1	2	12	6	1	2	24
Social trends/demographics	0	4	1	4	5	9	23
Evaluations of food safety promotion	1	2	8	6	2	1	20
Kitchen Practices	0	6	6	4	1	1	18
Segmentation of people according to food safety behaviours	0	4	4	5	1	1	15
Current practice in schools education of food safety	0	5	3	5	0	0	13
Current practice in promotion of food safety	3	2	4	2	0	1	12
Theory of health and safety behaviours	0	3	5	1	1	1	11
Segmentation of people according to diets	0	1	5	0	2	0	8
Trends in cooking behaviours	0	2	1	1	1	0	5
Grand Total	9	73	140	88	40	21	371

6.2 Weight and level of evidence per FSA question

The Agency cited a set of questions to be addressed by this review. Table 8 shows the number of studies per FSA question along with their weight of evidence score. It can be noted that:

- Most studies cover food safety behaviours in the general population;
- There are fewer studies regarding how to influence people;
- A minority address vulnerable groups;
- The key question of “How food safety advice is disseminated to vulnerable groups (by health practitioners and care organisations)” has the fewest studies.

Table 8: Number of studies by weight of evidence per FSA question

FSA question	Weight of evidence						
	0	1	2	3	4	5	All
Food storage and handling behaviours in the home (general population)	2	30	59	41	25	7	162
Relationship between food safety knowledge beliefs and actual behaviours	1	17	45	29	6	3	100
Factors associated with food storage and handling behaviours in the home	2	18	29	31	17	3	98
Food storage and handling behaviours in the home (vulnerable groups)	1	14	22	14	10	9	69
Does existing literature on food safety behaviours fit with literature on food in kitchen practices and behaviour more broadly (trends)	1	17	13	19	10	6	65
How to disseminate food safety advice to particular groups in the population	2	15	28	17	4	1	65
Factors which inhibit the adoption of safe food storage/handling practices	2	11	21	18	7	2	59
Research techniques used for exploring behaviours (Measuring actual rather than stated behaviours)	1	10	13	16	4	1	44
Factors to encourage adoption of safe food storage/handling practices	2	4	16	13	8	1	42
What are the theoretical approaches adopted to explore and explain food storage/handling behaviours	0	9	17	11	3	0	40
What is known about influencing safe food storage/handling behaviour	2	5	16	12	3	2	38
How food safety advice is disseminated to vulnerable groups (by health practitioners and care organisations)	3	11	8	6	2	0	27
Total	19	161	287	227	99	35	809

Note: The totals exceed 371 as each study could be coded more than once.

6.3 Weight and level of evidence per at risk group

Table 9 shows the number of studies that cited a specific vulnerable group. Some studies may have cited more than one. The studies are skewed towards the elderly and pregnant women, which are both recognised vulnerable groups. However, it is important to note that most studies on elderly persons did not specifically consider elderly *patients*, who are the group particularly vulnerable to listeriosis.

Table 9: Number of studies citing a specific vulnerable group(s)

Vulnerable group	Weight						
	0	1	2	3	4	5	All
Elderly	1	6	13	9	13	5	46
Pregnant	1	2	7	7	3	0	19
Immunocompromised or suppressed	0	4	2	1	3	0	10
Infants	0	3	3	3	0	0	9
Pregnant (Deprived)	0	0	1	2	0	0	3
Pregnant (Ethnic minorities)	0	0	0	0	1	0	1
Total	2	14	26	22	18	5	84

Note: Each study could be coded more than once.

Table 10 shows the number of studies that cited a specific pathogen. Clearly this was a minority of all studies, namely about one fifth of the total.

Table 10: Number of studies specific to a pathogen

Pathogen	Weight							Total
	0	1	2	3	4	5		
<i>L. Monocytogenes</i>	0	3	5	7	6	4		25
<i>Campylobacter</i>	0	5	6	5	6	1		23
<i>Salmonella</i>	1	4	7	4	1	0		17
<i>E. Coli</i>	0	0	2	1	0	0		3
Total	1	12	20	17	13	5		68

Note: Each study could be coded more than once.

6.4 Weight and level of evidence per intervention

Table 11 shows the number of studies that evaluate a type of intervention. As some studies cite more than one intervention, the count may exceed the number of documents. It can be noted that:

- Most studies address education interventions. These were mostly school based education interventions and mass media;
- Only one study evaluated product oriented interventions and 3 covered environmental options such as provision of hand washing facilities in schools;
- There were some evaluations of outreach work.

This can be contrasted with the expert interviews that cited the potential benefit of the installation of thermostats / temperature gauges in refrigerators and with the Agency's interest in communicating with vulnerable groups via healthcare professionals. The option of communicating food safety advice via healthcare professions has been subject to relatively little research.

It can also be noted that most evaluation studies were rated as 2 or 3. Common concerns with evaluation studies included the use of self reported change in attitudes, knowledge and behaviour and the reliance on before and after measures without the use of control groups. Only a small minority were assigned a higher rating.

Table 11: Number of studies by weight of evidence per type of intervention

Type of intervention	Weight of evidence							All
	0	1	2	3	4	5		
Mass education	5	14	28	8	3	1		59
Outreach	0	3	4	6	1	0		14
Environment/Enabling	0	2	1	0	0	0		3
Product oriented	0	1	0	0	0	0		1
Total	5	20	33	14	4	1		77

Note: Each study could be coded more than once.

6.5 Weight and level of evidence per behaviour

Table 12 shows the number of studies that addressed each of the 4 Cs. It can be noted that most studies were not specific to any one food safety behaviour. They tended to cover all types of food safety behaviours or were not specific to any type.

Table 12: Number and weight of evidence per behaviour

Type of behaviour	Weight of evidence						
	0	1	2	3	4	5	All
General	4	28	68	41	14	5	160
Cooking	0	2	5	4	1	0	12
Chilling	0	2	3	2	2	1	10
Cleaning	2	2	2	2	1	0	9
Cross-contamination	0	4	1	1	0	0	6
Grand Total	6	38	79	50	18	5	197

Note: Each study could be coded more than once.

7 APPENDIX D: EXPERT INTERVIEW TOPIC GUIDE AND ASSOCIATED MATERIALS

7.1 Approach letter sent to experts

INVITATION TO PARTICIPATE IN FSA FOOD SAFETY IN THE HOME RESEARCH

The Food Standards Agency has appointed Greenstreet Berman to undertake an evidence review on food safety behaviours in the home. The research includes a small number of interviews with individuals who have relevant expertise on food safety behaviour and we would very much appreciate your participation in this research project.

The interviews will last up to one hour and will cover a number of topics including key trends around food storage and handling behaviours in the home, evidence on how to promote and encourage food safety behaviours, research methodologies to explore food safety and future research priorities. You will be provided with a full list of topics prior to the interview.

The names of interviewees will be included in the report, however all interviews will be confidential and your comments seen only by members of the research team at Greenstreet Berman. You will be provided with a summary note of your interview to comment upon to ensure it is a true and accurate reflection of the interview. Key themes will be included in the final report to the Food Standards Agency; however all comments will be anonymised and will be not attributed to individuals. All personal details and summary notes of interviews will be kept confidential, held securely and not used for any purpose beyond this specific project and will be destroyed upon completion of the project.

A member from the research team at Greenstreet Berman (Reena Masrani, Rebecca Williams, or Tom Barry) will contact you over the next few weeks to ask if you are able to help with this project and if so to arrange a convenient time to conduct the interview. If you have any questions in the meantime, please do not hesitate to contact me via the details below.

I do hope you can help us with this important project.

Yours sincerely

Danielle De Feo

Social Science Research Unit

Analysis and Research Division

020 7276 8499

danielle.defeo@foodstandards.gsi.gov.uk

7.2 Information sheet for participants

Title of study: An evidence review on food safety behaviours in the home

Thank you very much for agreeing to this interview which Greenstreet Berman are completing on behalf of The Food Standards Agency to feed into an evidence review on people's food safety behaviours in the home.

It is important for you to understand why the research is being done and what your participation will involve. Please take time to read the following information carefully and discuss it with others if you wish. Please ask us if there is anything that is not clear or if you would like more information.

Why have I been selected?

The evidence review is exploring food safety behaviours in the home covering all age groups and pathogens, with a particular focus on vulnerable groups and listeriosis. Interviews with experts in the field within the UK and overseas are being conducted to complement the review of literature and we have been advised that you would be a key person to speak to within this field.

Aims of the interviews and how results will be used

Interviews will last for a maximum of one hour and will be conducted over the telephone at a time convenient to you. In this interview we would like to gather your opinions on:

- Key trends around food storage and handling behaviours in the home;
- Groups who are most vulnerable to the effects of food safety;
- How to promote and encourage food safety behaviours;
- Research methodologies which have been used to explore food safety;
- Future research priorities in food safety research.

Your data will be stored anonymously and securely with only researchers working on the project having access. A summary of the interview will be written up for you to review that it is a true and accurate reflection of the discussion and to add any additional comments if you wish. The key themes from all interviews will be synthesised into a summary. While the names of interviewees will be included in the report, all interviews will be confidential and no comments you make will be personally attributed to you. All personal details and interview summaries will be destroyed upon completion of the project.

We would appreciate if you could sign and return a copy of the consent form attached to Reena Masrani before your interview commences at:

Greenstreet Berman Ltd, 161 Drury Lane, Covent Garden, London, WC2B 5PN

reena.masrani@greenstreet.co.uk

If you have any questions about the research please contact:

Danielle De Feo (Food Standards Agency) or Reena Masrani (Greenstreet
Berman)

Danielle.DeFeo@foodstandards.gsi.gov.uk reena.masrani@greenstreet.co.uk
020-7276- 8499 020-3102-2120

Consent form for participants

Title of study: An evidence review on food safety behaviours in the home

Please complete this form after you have read the Information Sheet and/or listened to an explanation about the research.

Please tick box

- I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions.
- I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my legal rights being affected.
- I understand that although my name will appear in the report as an interviewee no comments will be attributed to me.
- I agree to take part in the above study.

Your name

Date

Signature

7.3 Expert topic guide

Evidence Review on food safety behaviours in the home

Interview Pro-forma

Introductions

Thank you very much for your time and agreeing to take part in this interview for Greenstreet Berman Ltd on behalf of the Food Standards Agency.

(Check that interviewee has read the information sheet, signed consent form, and if they have any questions etc)

Expert's background

- What is your area of expertise/research focus within the area of food safety?
- What research within food safety and behaviours have you been involved in / are you currently involved with?

Key trends and behaviours regarding food safety

- What factors are associated with food storage/handling practices? (E.g. cooking, cleaning, cross-contamination, cooling?)

(Which of these areas require more research - explore reasons and why?)

(What factors encourage/inhibit safe practices?)

- How aware do you think individuals are of safe handling of food and cooking practices?
- What could be done to ensure individuals know how to store food properly, for example correct fridge temperatures?
- In your view what are the reasons consumers implement unsafe food handling practices?
- How can a change in practices be encouraged? How can behaviour be influenced?
(What theoretical approaches have been used in research?) - for academic researchers only
- What do you think is the relationship between food safety knowledge, beliefs and actual behaviours?
- Do you think food and safety is related to other behaviours/social trends?
(Explore issues around wider behaviours e.g. Diet and exercise/health lifestyle, segmentation of individuals into groups)
- How have cooking trends had any effects on food safety?

Vulnerable groups

- Are there certain individuals or groups of people that you think are particularly vulnerable to foodborne disease?
- Why are these individuals/groups vulnerable?
(Explore any particular characteristics of groups which make them vulnerable)
- What can be done to help reduce the number of cases of listeriosis in the over 60s?
How can the over 60s be made more aware of the risks of Listeriosis?

Promoting Food safety and education - regarding how best to advise and influence people

- In what ways can food safety advice/education be disseminated to the public?
- Are there any strategies which would be particularly effective to engage vulnerable groups/individuals?

(Explore the role of health professionals, particular tools, resources etc)

- What campaigns have been used to promote food safety (in your country)?
- How effective do you think food safety campaigns are?

(Can campaigns be effective in getting messages to the over 60s? Explore why, either way?)

- What do you think makes a good food safety campaign?

(Why have campaigns been successful/unsuccessful? How have they been evaluated?)

- How do you think food safety awareness and education is in this country/your country in comparison to other countries?

Research methodology

- Can you comment on any issues around the methodologies that have been used in research studies?
- Are there any alternative methodologies that may be more appropriate?

Gaps in current evidence/ Future research priorities

- What gaps in evidence do you think there are in research around food safety in the home?
- How could these be addressed?
- What areas of food safety require further research?

(Explore how much of a priority may be placed upon other areas) Are you aware of any upcoming research?

- What aspects of food safety research are you interested in exploring in the future?
- Is there any secondary analysis that could be undertaken on existing data sets within the field?
- Do you have any other comments or would like to mention any key issues/points of interest within the topic of food safety in the home which we have not touched upon in this interview?
(Explore any areas identified)

Thank interviewee for their time, recap key points of discussion, ask them if there is anything which they wish to add at all, or any comments regarding the telephone interview. Inform them that should they have any thoughts later or comments which they wish to add they can email reena.masrani@greenstreet.co.uk

Remind interviewees that they will be sent a summary write up of their interview in a few weeks time to review the content.

7.4 FSA focus group topic guide

7.4.1 Topic guide

Evidence Review on food safety behaviours in the home

Focus Group Pro-forma

Introductions (5)

Thank you very much for your time and agreeing to take part in this focus group. I amfrom Greenstreet Berman where we are carrying out an evidence review for the FSA to determine what is known about the publics' food storage and handling behaviours in the home, and impact on food safety, which will feed into the Foodborne Disease Strategy and *L. Monocytogenes/Campylobacter* research management programmes. (The review is looking at all pathogens across all age groups with *L. Monocytogenes* being a particular area of interest).

As part of the review a small number of interviews are being carried out with relevant experts. The purpose of this focus group is to gain insights from policy makers and communication colleagues from the FSA on:

- Key trends and behaviours in food safety behaviours in the home;
- Vulnerable groups at risk;
- How to promote food safety and education and the use of campaigns to encourage safe food practices and;
- Determining future research priorities and additional areas of research to inform the review.

Check that participants are all happy for the session to be recorded, to enable us to recheck any points with our notes of the session. Remind all interviewees that they will be sent a summary write up of the key themes from the discussion to review.

Participant Introductions

Each participant to introduce themselves (e.g. their role and area and aspects of food and safety they are involved with – specific areas of expertise)

Key trends and behaviours regarding food safety (10-15)

Aims:

To understand and explore consumers' understanding of food safety and the relation to the 4c's and factors that influence behaviours to understand how food safety can be encouraged.

- In discussions around food safety in the home the 4Cs are mentioned (cooking, cleaning, cross-contamination and cooling) which of these do you feel is more of a concern?

(Explore reasons why and where more research may be needed)

(Explore how any trends around cooking and types of foods being consumed link into the 4Cs)

- What do you think is the relationship between food safety knowledge, beliefs and actual behaviours?
- In your view what are the reasons consumers implement unsafe food handling practices?

(Explore any issues around: - awareness and understanding of hygiene practices, 'use by', 'sell by' and display dates - instructions re: cooking and storage e.g. ease of understanding and clarity)

- Do you think food safety is related to other behaviours/social trends?

(Explore issues around wider behaviours e.g. Diet and exercise/health lifestyle, segmentation of individuals into groups)

Vulnerable groups (20)

Aims:

To explore what can be done to reduce the risks of foodborne disease for vulnerable individuals and the key characteristics of what makes a group vulnerable and what can be done to protect them.

Whilst foodborne disease can affect anyone, particular groups within the population are more susceptible to food poisoning.

Vulnerable groups identified include older people (e.g. over 60s), those who have an immune suppressive disease, those who are taking immune suppressive medication, those who are pregnant and children aged under five.

- What are the particular characteristics of these groups which make them vulnerable?
- What can be done to reduce/protect vulnerable groups from food poisoning?
- What are the issues around *Campylobacter* and how can the public be made more aware?
(General population and vulnerable groups)
- What are the issues around listeriosis?
(General population and vulnerable groups)
- What is the FSA doing to help reduce the number of cases of listeriosis in the over 60s? (and other groups)
- How can the over 60s be made more aware of the risks of *L. Monocytogenes*?
(Explore how any of the approaches mentioned may link into the other vulnerable groups)

Promoting food safety and education - How to best advice and influence people (45)

Aims:

To understand how policy and communication staff are working to encourage and promote safe food handling and storage, identifying what makes a campaign effective exploring the different approaches, and how to target and successfully engage with particular groups regarding food safety.

- What are the different approaches that have been used to provide food safety advice/education to the public?
- What campaigns have been used to promote food safety?
(Explore local and national campaigns)
- What do you think makes an effective food safety campaigns?
(Why have campaigns been successful/unsuccessful? How have they been evaluated?)
- Have campaigns focused on all 4Cs or have particular Cs been “more of a priority”?
- What groups do you particularly want to engage with on issues around food safety?
(Explore which populations/groups are decided to be at risk and why and how this links in to any marketing and targeted approaches)
- Are there any strategies which have been found to be particularly effective to engage vulnerable groups/individuals?

(Explore different media methods and how these may relate to different groups and any challenges for disseminating advice e.g. cooking programmes)

(Explore what approaches may be used to get messages to the over 60s and the appropriateness)

(How can the over 60s be best segmented for targeting food safety advice? - explore any challenges with engaging with this group)

(Explore the role of health professionals or other key individuals, particular tools, resources etc)

- How do you think food safety awareness and education is managed in the UK in comparison to other countries?

(Explore any models of good practice or successful campaigns which could be adopted)

Rating exercise for future research priorities and gaps in research (35)

Aims:

To determine priority ratings for the topic areas the review is covering and to identify any gaps in understanding and policy areas.

We will discuss the ratings interviewees have given each of the areas and what gaps in evidence there are thought to be in these areas. Participants will be asked to discuss the reasons for the ratings they have provided and together the group will be asked to agree a set of high, medium or low priority weightings.

- What other gaps in evidence/research do you think exist around food safety in the home?

(Explore any topic areas which have not been listed in the rating exercise)

- How could these be addressed?

(Explore how much of a priority may be placed upon other areas)

Summary (5)

- Do you have any other comments or would like to mention any key issues/points of interest within the topic of food safety in the home which we have not touched upon in this interview?

(Explore any areas identified)

Provide a recap of key points of discussion; ask interviewees if they have any comments or questions. Inform all of the group that should they have any thoughts later or comments which they wish to add they can email reena.masrani@greenstreet.co.uk and that the notes from the focus group session will be written up and sent to them to review and check that the points accurately reflect their views.

Close and Thanks

7.4.2 Determining future research priorities

The overall aim of the evidence review on food safety behaviours in the home is to determine what is known about the public's food storage and handling behaviours in the home, and to help inform further work in the foodborne disease strategy, and potentially help the FSA in providing advice to at risk groups.

In order to help the FSA going forward, we will be looking for gaps in the evidence base and areas for future research. Below are some of the areas which the review will be exploring. For each of these areas please indicate the level of priority that you would give the area for further investigation.

Please can you bring this with you for focus group 2.30 to 4.30pm Wednesday 22nd September 2010

	High Priority	Medium Priority	Low Priority
Knowledge about food storage and handling behaviours relating to food safety in the home for: The general population. Vulnerable groups.			
Factors associated with food storage and handling behaviours in the home. (e.g. socio demographic factors including age, ethnicity and income, illness, accommodation, kitchen facilities, etc)			
The relationship between food safety knowledge, beliefs and actual behaviours.			
Factors which encourage the adoption of safe food storage/handling practices and how can change in practices be encouraged.			
Factors which inhibit the adoption of safe food storage/handling practices and how can these be overcome.			
Knowledge about influencing safe food storage/handling behaviours.			
How existing literature on food safety behaviours fit with the literature on food and kitchen practices and behaviour more broadly.			
Theoretical approaches that have been adopted to explore and explain food storage/handling behaviours.			
Research techniques which have been used in the past for exploring food storage/handling behaviours, including how to measure actual rather than stated behaviours.			

	High Priority	Medium Priority	Low Priority
Knowledge about how food safety advice is disseminated to vulnerable groups via health professionals, carers, or care organisations			
Knowledge about how to disseminate food safety advice to particular groups of the population.			
Educational campaigns that have been undertaken to provide the general public with information about food safety in the home, how these have been evaluated and what has been learnt.			

8 APPENDIX E: SUMMARY OF EXPERT INTERVIEWS AND FSA FOCUS GROUP

8.1 Expert interviews

This section of the report provides a summary of the opinions and information expressed by the sample of experts interviewed as part of this evidence review. Their opinions have been summarised without any critical review or validation by the authors of this report.

8.1.1 Key trends and behaviours regarding food safety

Food storage/handling practices of consumers, and the 4Cs

When exploring factors associated with food storage and handling practices, aspects of the 4Cs (behaviours related to cooking, cleaning, cross-contamination, and cooling) were discussed alongside the types of foods being consumed, purchasing behaviours, and consumers' awareness and attitudes towards food safety. For each of the 4Cs it was felt that individuals had a mixed awareness and understanding of the necessary behaviours.

Cooking

It was thought that while individuals understood that foods needed to be cooked properly there was confusion about the correct temperature for cooking foods, and it was emphasised that meat was often undercooked. Likewise with many consumers using microwaves to reheat convenience foods, another issue raised was recognising that cooking instructions provided were a guide and may need to be adjusted depending on the power and wattage of the microwave.

Cross-contamination and cleaning

It was noted that consumers had an awareness of cleaning kitchen surfaces and separating raw and cooked food, and may follow certain behaviours to keep safe; but then without thinking undo their efforts. For example, consumers may take some chicken out of a marinade and cook it, but then place the chicken back into the raw marinade. Another example given was that "*people know that they should wash chopping boards and knives after preparing raw meat, but they do not seem to realise that putting bags that have sat on the floor and elsewhere (e.g. ladies purses that had been set on various surfaces) on kitchen counter tops is also a risk behaviour for cross-contamination.*" It was also mentioned that sometimes people may not always be aware of when they needed to wash their hands and that with large increases in cleaning products with antibacterial properties they may believe that this compensated for poor food hygiene behaviours.

Chilling

It was noted that consumers were often not aware of how long leftovers could be stored for and consumers were not aware of correct fridge temperatures and how to check that their fridge was at the optimum temperature. Individuals were also believed to leave foods for too long in the fridge and this was thought to be related to consumer confusion over the differences between 'use by', 'sell by' and 'best before' dates. It was also noted that in countries with hot climates, care needed to be taken when transporting chilled foods from the supermarket to the home, to collect these items at the end of their shopping trip and to use cool bags/cool boxes to transport foods to their home.

8.1.2 Consumer awareness of the safe handling of food and cooking practices

It was highlighted that while the public may appear to have a good understanding and awareness of appropriate behaviours when handling food, in reality this was often not the case. A vast majority of research on consumers' interactions with food and food safety had

used self report measures and although the findings appeared to be positive and indicate a good level of knowledge by consumers, observational studies had highlighted the disparities between people's self reported behaviours and actual behaviours. It was also suggested that in self reported studies individuals often overstated the frequency of their own safe food handling behaviours. Therefore, while consumers may know about certain behaviours in reality these were not practiced and interviewees spoke of consumers having a "*lack of knowledge about what to do and how to do it.*" It was implied that individuals did not fully appreciate or understand the science behind certain actions and what purpose specific behaviours served in reducing risk.

When exploring how people learnt about food safety it was noted that over time there had been a decline in cooking skills and knowledge and that "*children no longer learn at school.*" It was suggested that previously people would have learnt about food safety in school, watching their grandparents/parents prepare meals, and more meals would have been prepared in the home using a range of ingredients. However, changes in cooking practices had seen individuals less involved in food preparation than before, an increase in the reheating of prepared meals, more use of pre-packaged mixed items, people were not eating together in the kitchen and eating out more in restaurants. Consequently certain behaviours and actions that previously would have been employed on a regular basis were no longer the norm.

Interviewees explored the possibility that some individuals were not engaged or did not pay attention to key messages around food safety, believing these were not relevant to them. Yet food safety behaviours improved when individuals were aware of risks and could identify with how messages related to them. For example, research with pregnant women found "*once they understood the risks and knew what they should be doing they were very willing to make changes*" and likewise mothers wanted to protect the health of their children. It was emphasised by interviewees that to ensure individuals knew how to handle and store food properly information needed to be seen as relevant and important by consumers, so that messages would be absorbed and acknowledged. There were suggestions that "*targeted information has to be provided through appropriate channels*" and that consumers "*need to understand why foods should be stored properly and the risks [of not doing so]*". One interviewee made an interesting point that the public needed to be aware that food was not benign and that consumers needed to have accurate perceptions of the various risks at different stages in their lives.

It was thought that the majority of consumers obtained their food safety knowledge from cookery shows with celebrity chefs. However, it was thought that the correct food safety behaviours were not always followed on such programmes, and it was felt that this had contributed to the public developing a distorted view of what constituted appropriate food safety behaviour.

Throughout the interviews, the routine practices, short cuts and unconscious habits that individuals followed were discussed. It was suggested that it is important to change these habits and make the public more aware of their kitchen practices. An important point was that consumers needed to appreciate the reasons why certain behaviours and practices were being recommended to ensure that they were followed. It was suggested that education which illustrated the potential susceptibility and severity of foodborne illness combined with strategies to improve consumers' self confidence and perceptions of the value in engaging in recommended food handling practices would be beneficial. On a practical level it was suggested that raising awareness of correct cooking temperatures and chilling temperatures would help to improve food safety.

8.1.3 Relationship between food safety knowledge, beliefs and behaviour

There was unanimous agreement that while individuals may appear to have a good awareness and knowledge of appropriate behaviours (e.g. from self reported studies) this was not translated into corresponding behaviours or practices as evidenced from various observational studies. It was emphasised that while people may be aware of food safety and could tell you the key behaviours to keep them safe, they did not understand the science and reasoning behind advice. Consequently, individuals had difficulties applying knowledge practically within the context of their kitchens and knowing when to implement particular behaviours. An interviewee gave an example of how hands are to be washed after handling a raw chicken. While many individuals do this, it may be after they have touched and already contaminated other work surfaces and items (e.g. answering the phone). The interviewee also recalled studies which had found a positive correlation between education and food safety knowledge, but with an inverse trend between subsequent knowledge and actual behaviour. It was suggested that the poor relationship between knowledge and behaviour among the highly educated could possibly be due to their lack of exposure and direct experience of food handling.

Across all interviews a reoccurring theme was that consumers often did not practise safe food practices, and took short cuts. Likewise people were often “optimistically biased” and underestimated potential risks including the severity of food poisoning, their susceptibility, or any long term consequences which could occur. Interviewees explained how individuals believed foodborne illness was something which happened to other people and not to them, and that they did not need to change their behaviours because they had never experienced food poisoning. Furthermore, in the event that they did suffer from foodborne illness, it would be attributed to external sources/causes, (e.g. a recent takeaway meal, rather than their own kitchen practices). It was thought that these consumers also perceived food safety campaigns to be directed at other people and not at them, especially as they did not identify how any of their kitchen practices were placing them at risk of harm.

It was noted by interviewees that over recent years there had been an explosion of cookery focused shows with celebrity chefs and cooking challenges, which attracted large audiences who were then likely to emulate behaviour seen on TV. However, as correct food safety procedures were not always followed on such programmes individuals were receiving mixed messages and could develop a distorted view of what constituted appropriate behaviours and practices when handling food.

8.1.4 Cooking trends and practices

It was emphasized that there had been a move away from individual ingredients being used to prepare meals to using packaged foods and an increase in the reheating of prepared meals and eating out. Other trends included cooking food lightly (e.g. when preparing stir fries) which may result in food not being thoroughly cooked and not all pathogens killed, and people eating more raw foods and preparing salads whereby ingredients may not always be thoroughly washed and can still contain traces of dirt. The popularity of barbeques and cooking food outside was also identified as practices which posed risks within a less controlled environment with greater opportunities for cross-contamination to occur.

While certain trends could influence the relationship between food safety knowledge and practices adopted, such as living a healthy lifestyle, it was not certain that health behaviours such as diet and exercise were positively linked with observing food safety. There was a view that individuals who were conscientious about their health in general are

more likely to possess an internal locus of control (as noted before, they feel they control events that affect them), and comparatively those who need to be targeted are more likely to possess an external locus of control as they perceive food hygiene and health in general to be outside of their control. Individuals who were health orientated may be expected to take notice of campaigns and messages distributed and follow advice given, in contrast to those who were not health orientated and did not prioritise health or food safety. However, as one interviewee explained a subsection of the population could be classed as 'healthy optimists' and include "*people who think they are doing the right thing but in reality they are not*".

8.1.5 Vulnerable groups

Vulnerable groups at risk

Key vulnerable groups identified were the over 60s, pregnant women, and individuals who were immunocompromised or had suppressed immune systems.

Other groups identified as also being potentially at risk included men who were thought to engage in more risky food safety behaviours than women (especially newly single men), individuals with food intolerances and allergies, new families and individuals living away from home for the first time, such as students. It was also noted that potentially all individuals could be at risk if they were run down and had a weakened immune system and were involved in unsafe food behaviours.

Overall, individuals from the key vulnerable groups were at greater risk due to weakened or less developed immune systems and poor infection resistance. It was recognised that whilst being a member of a vulnerable group may put you at risk it was important to recognise that within each group there were differences. For example, there was scope for segmenting the over 60s as they were not a homogeneous group, and there may be different behaviours between 65 and 80 year olds, as well as other characteristics such as an individual's health and wellbeing, differences between those who were independent and able to prepare their meals in comparison to those who were dependant on others.

Engaging with vulnerable and at risk groups

A common thread along all interviews was the importance for individuals to recognise they were at risk and the role that their kitchen practices may play, and how changes in their behaviours would benefit them.

Social marketing and a targeted approach were believed to be the best way to engage 'vulnerable/at risk' groups in food safety education, and to identify foods which may pose potential risks to them. For example, for the over 60s it was thought that more education and awareness on deli meat safety would be beneficial.

Taking advantage of opportunities to engage with vulnerable groups was also important. References were made to obstetricians, increasing their provision of information about foods for pregnant women to avoid, and for community champions to engage with elderly individuals at specific community clubs/groups that they attended. Home healthcare nurses were also identified as being in a unique position where they could, within the context of their role, also act as a conduit for disseminating information to patients they were nursing such as the elderly, those who were immunocompromised, or had suppressed immune systems. Supportive agencies such as 'meals-on-wheels', were also suggested as a potential resource for relaying important food safety advice for the elderly on delivered meals to encourage appropriate handling and heating behaviours (e.g. information stickers being prominently placed on high risk products).

The benefits of using a face to face approach for the elderly with GPs and Health Visitors was suggested as being more effective and personalised than a campaign. However, it was noted that at present, when individuals from vulnerable/at risk groups visited a health professional, other issues were of greater priority than food safety, so within this context there was a limited scope for using staff working within health as a useful resource. The exception being the immune compromised where it was believed that they were receiving information from their primary healthcare providers.

Interviewees also mentioned the importance of targeting young adults with food safety education because they were likely to have imminent responsibilities of caring for at risk groups, such as family members in their later years, as well as any children they may have in the future. So although this group were not vulnerable it was felt that there was a “*need to educate this group in advance*” of them needing to care for those that would be classed as vulnerable so that they were well prepared.

8.1.6 Promoting food safety and education

Information/advice dissemination

With it acknowledged that consumers often disassociated food safety messages due to perceptions of the information being targeted at other people, it was reiterated that information needed to be embedded in education in a variety of forms using different mediums. Overall, most interviewees advocated a holistic approach whereby food safety was incorporated within wider messages of general health and well being and infection control, although there were a few interviewees who felt food hygiene and food safety needed to be divided into separate issues. However, in providing information and dissemination a multiagency approach using health professionals, the media (TV as well as online, printed, and radio), ongoing campaigns and specific events were suggested as ways to suitably capture attention, and increase the relevance of messages to different audiences. Through these various channels key safety messages would be reinforced and remembered. A multiagency approach was deemed to be the best approach to take, using health professionals and various media messages to educate consumers of risks and practices.

Overall, it was felt that there was food awareness education and promotion activity in the UK, that this was being given suitable attention in the UK and that approaches were similar to those in other European countries, Australia and the United States. It was also commented on that research findings and areas of focus also appeared to be similar across these countries. It was suggested that in less developed countries there was less knowledge of food safety due to them lacking basic hygiene supplies in the home (running water, soap, etc.) and most initiatives were focused around reducing germs.

Food safety campaigns

Food campaigns had not been subjected to rigorous/formal evaluations and hence it was not clear exactly how effective they have been, although there was positive anecdotal evidence and findings from telephone polls. Whilst campaigns had a role to play in providing information and raising awareness it was sometimes the consumers who were already aware of food safety, rather than those who the campaigns were wanting to target, who responded to messages.

Overall, there did not seem to be hard and fast rules in relation to what was an effective campaign. For example, while there was a view that a good food safety campaign should make recommendations based on science, another interviewee commented that there was “*lots of mistrust in scientists*” and that consumers “*need to have had a firsthand experience*” to trust the judgements of scientists and researchers. Campaigns and events

around food safety cited by interviewees included engaging large numbers of the public in hand washing, a campaign focused on the 4Cs, campaigns on barbecue cooking in the summer months, and a campaign to reduce the incidence of listeriosis among pregnant women.

For a food safety campaign to be effective it needed to convey good food safety handling behaviours and why consumers should follow them in an easy to understand format. Another essential requirement was for the campaign to capture the attention of key food preparers in an ongoing, yet constantly rejuvenated way. The media was highlighted as a key way of transmitting messages, and various suggestions were made. While television adverts could be useful it was felt that they had a transient effect and were only remembered at the time, but did not create any lasting impacts, another issue was that some people (including the elderly) may just switch channels rather than watching adverts. Cookery programmes and getting celebrity chefs involved was suggested although it was noted that presently these programmes did not have much of a focus on food hygiene or safety at present. If a celebrity figure were to endorse a campaign or initiative was used, care would also need to be taken to consider any sponsorship deals they may also be involved in. The need to make food safety practices automatic and habitual was highlighted, as well as the need to emphasise the potential severity of foodborne illness and the role consumers could play in preventing it. As noted previously, the routine practices, short cuts and unconscious habits individuals followed as part of their cooking and kitchen practices needed to be challenged and also discussed. One of the issues was that individuals may not view messages as relevant. Therefore through subtle underlying messages being relayed within popular entertainment shows/films not specifically related to food, it was thought that consumers may pick up messages and apply these practices to their own routines. An example was given of Marge Simpson washing her hands at the kitchen sink before preparing dinner.

In addition to informative campaigns, many interviewees felt that schools could play a bigger part in encouraging food hygiene among their pupils. Suggestions included incorporating food hygiene within the curriculum, as well as learning by the appropriate behaviour from staff and practically making hand washing facilities available in close proximity to where food was available. For example, “*provision of sinks directly outside of school cafeterias so that kids can wash their hands before entering*”.

8.1.7 Further research

It was highlighted that a lot of research had involved self reported surveys which were subject to biases and inaccuracies especially as “*people do not want to admit to their poor hygiene behaviours*.” Research within test kitchens was also not able to fully capture people’s true behaviours, due to a relatively controlled setting, and individuals being aware of being watched.

Instead observational and video ethnographic research of individuals’ practices within their homes was suggested to provide a more accurate and realistic reflection of actual behaviours related to context and the everyday activities of life such as interruptions and distractions during food preparation (e.g. from the phone ringing, and pets and children). In particular it was thought that video observations over a prolonged period of time would enable a greater depth of information. Furthermore, without the presence of the researcher it would be less obtrusive and peoples’ natural behaviours and routines would be captured. However, it was also recognised that while there were benefits with observational research, there were also many challenges such as the expense, time required, difficulties in recruiting individuals and securing their continued engagement, and potential ethical concerns.

Future research areas which interviewees identified as areas to explore included identifying “*how people trade off perceived risk and benefit*”, the motivators for people engaging in appropriate food hygiene practices and what encouraged behaviour change and the modification of habits. Research findings could lead to a better understanding of food hygiene and the formulation of predictive models, which could be used to help understand behaviour and how to induce changes, which in turn could be applied to developing appropriate strategies to target behaviour. Other areas included more research with other populations, as to date a greater proportion of research has been centred on young adults. It was also suggested that future research characterise the behaviours of different population groups and segment individuals, for example the over 60s. This would potentially enable the design of effective programmes to best support and educate these groups in food safety. It was also felt that there were research gaps on individuals who were immunocompromised such as cancer patients.

A lot of interviewees noted that food safety messages needed to be targeted. They went on to say that research could explore the use of social media and new technologies to disseminate information, particularly by exploring individuals' engagement and experiences of accessing information on internet sites such as YouTube.

It was also suggested that as food safety education and campaigns were not formally evaluated further studies should:

- Capture the impact and effectiveness of interventions and educational campaigns on behaviour and not just their impact on behavioural intentions;
- Identify what approaches were working well and why and how these could be further developed.

8.2 FSA focus group

8.2.1 Key trends and behaviours regarding food safety

4Cs and food safety

In discussions around food safety, the 4Cs and their importance, the proper cooking of food was emphasised as important. It was explained that even if food did contain some microbiological contamination, by cooking it thoroughly this should destroy any potential pathogens that could be present. Avoiding cross-contamination was also important especially for foods which would not be cooked before consumption and it was felt that cross-contamination and cleaning were closely related. With *L. Monocytogenes* chilling was important, as *L. Monocytogenes* could grow at low temperatures, including fridge temperatures, and tended to be associated with ready-to-eat foods which required refrigeration.

It was felt that over the last 20 years there had been a trend which had seen the public moving away from cooking food using raw ingredients to a greater reliance on convenience foods and reheating prepared foods. It was explained how this had resulted in a general lack of awareness and a reduction in the level of cooking skills as people had not learnt what to do from their parents or grandparents. People were also unaware about how to handle and look after raw produce properly, and how to ensure food was safe. Issues facing the public concerned: “What [do] you need to do with raw products? How [do] you need to look after raw meat? What [do] you need to do to make it safe?”

The group discussed the explosion of cleaning products now available to keep surfaces clean; “cleaners are better these days” and “it is easier to keep things clean”. There had also been changes in technology with antibacterial soap dispensers which could be used without having to touch the dispenser. However, one of the concerns was that people were

distancing themselves from cleaning responsibilities as products took care of any potential risks, and it was questioned “whether these products are taking responsibility away from individuals so that they are relying on the products they are using to do all of these things for them.”

Other trends mentioned included how there had been a move from purchasing food in local shops to supermarkets, and from food being sold loose to now being pre-packaged. The product life of foods and their window of consumption was also longer. While previously people would have bought food in smaller amounts and been likely to shop a few times a week, now people may shop only once a week and were able to buy items in greater bulk and expect them to last.

Relationship between food safety knowledge, beliefs and actual behaviours and unsafe handling behaviours.

Group members commented that people could be broadly segmented into two groups of people, those that knew how to care for food and were interested, and those that did not know how to care for food and were not concerned.

One of the interviewees commented that a lot of the research exploring food safety messages they had been involved with had found that people often thought they already knew all they needed to about food safety, and that the challenge was to show that they did not know it all; “everyone always thinks that they know everything and that when we show them something, that advert or that piece of communication is intended for someone else so it’s getting over that and how can we make people think you don’t know everything.” It was discussed that as many people managed to prepare their food and did not experience any food poisoning, they wrongly attributed that they were not at risk; “From people’s experience they manage to prepare their own food successfully without being aware of giving themselves food poisoning or the people around them food poisoning so they think they are safe operators, they think they are in control.” However, interviewees suggested that in reality it was often the case that members of the public practiced poor or flawed hygiene in food preparation and that in many instances it was luck that had prevented food poisoning.

It was highlighted that there was a discrepancy between reported and actual behaviours, with individuals often reporting the ideal behaviours rather than what they actually did. One respondent explained that how an individual “might say that they take it very seriously and this is what they do all the time but the fundamental problem is we don’t know, they might be doing something we don’t know.” The respondent elaborated that (as individuals) “you have a certain impression about yourself which includes an aspiration of what you want your diet to be like and your behaviour to be like, but if you keep a food diary, you may not be entirely honest with yourself or accurate.”

Another key theme was that whilst people knew about food hygiene, the corresponding food safety behaviours were not always being implemented. For example people took shortcuts which meant there were opportunities for things to go wrong. “Errors start to come in, shortcuts start to come in and so there are opportunities for a breakdown in food safety, there are opportunities where things can go wrong and sometimes you get away with it and sometimes you don’t.” There were discussions between group members why this was the case with one interviewee questioning; “I think quite often people do know basic food hygiene hints and tips, but when it comes down to it in their own kitchen they are too busy or they just don’t take [the messages in].”

Group members discussed how the media often distorted messages around food safety which could confuse consumers. An example was given of every six months there would

be a story about 'use by' and 'best before' dates in the newspapers. In general all interviewees felt that consumers were confused by the various labels on food and what 'use by', 'sell by', and 'best before' dates meant. It was commented upon that the instructions about how to store foods, and the expiry date once packaged food had been opened were also unclear, with consumers failing to recognise that an original 'use by date' was not always applicable once a product has been opened. It was highlighted that often people would make their own judgements through the smell and look of food.

Interviewees highlighted that the public were often unaware of why certain rules and cooking behaviours were used. For example while consumers knew about cooking food sufficiently they may not be able to articulate the reasons why this was done. Comments made in the focus group included "some people know you shouldn't do things but don't know why" and "they know the practices but don't know why it is important."

Food safety and other behaviours/social trends

It was felt that people were eating more chicken as it was perceived to be healthy. However, it was thought that there were differences in the handling of chicken. It was discussed how many consumers were washing chicken which increased the risks of contamination, although this was advised against. Interviewees commented that there was a trend whereby some cooking skills had been lost, but certain previous habits had been retained. An example given was how in the past meat purchased from a butcher may still have had bones and feathers attached, and cleaning a chicken would have removed the debris. However, with the majority of chickens now being sold through supermarkets and already clean there was no need to wash them.

It was felt that consumers therefore needed to adapt past behaviours which may have been appropriate to food production methods in the past to fit in with current practices for how food was now produced and made available. Interviewees commented that the public needed to have an "awareness of the changes in food production systems" and how "food is produced in a slightly different way now, some of the practices that were maybe appropriate, either that were handed down by your parents or practices that older people were used to carrying out as part of their routine in years gone by that may not be applicable".

An example discussed in the focus group was how packaged cold meats were now more readily available and were vacuum packed and therefore may require different handling instructions being adopted once opened.

When exploring the public's awareness of food production it was commented upon that in the past children's programmes had contained segments on farming and food production, but this was now missing. Furthermore, it was reflected that there did not seem to be much consciousness of the origins of food other than it coming from the supermarket where as in the past there "used to be a closer connection of where your food comes from."

8.2.2 Vulnerable groups

Characteristics of vulnerable groups

Interviewees suggested that the over 60s could be separated into two groups, namely those that were active (food independent) and were "still preparing and cooking for themselves" and those that were inactive (food dependent, e.g. people in care homes). The inactive elderly were more vulnerable as they were dependent on others and were more likely to have suppressed or compromised immune systems which could also make them vulnerable and inactive. It was recognised that "as people get older immune function declines and so our bodies are not as good at fighting diseases as they were when younger." However, respondents highlighted that age was not the defining issue, as

individuals did not age uniformly. Instead the association's common with being older needed consideration such as a reduced independence, an immune system in decline, and a reduced ability to care for yourself. Individuals who were on medication were also at risk. Apart from the broad categories of over 60s and pregnant women, most other at-risk sectors were believed to be small niche sectors that would be hard to target and reach effectively.

Reducing/protecting vulnerable groups from food poisoning

Interviewees felt there needed to be a recognition and awareness by individuals who were vulnerable that they were at a higher risk than the general population. It was important for individuals to know what the consequences would be and why certain practices and behaviours around food handling and storage needed to be adopted, and the benefits that safe food practices would bring to encourage a long term change. It was commented that; "if you haven't got a reason why a change is needed or how that [change is] going to benefit you it's not likely to stick."

Issues around *Campylobacter* and making the public more aware

It was felt that there was a greater awareness of pathogens such as *E. coli* and *Salmonella* by the public in comparison to *Campylobacter* and so having more knowledge of the bug was important. It was discussed that while consumers may know about chicken requiring careful preparation they did not recognise that this was due to *Campylobacter*. And although they had some awareness of the need to cook chicken thoroughly they did not know why. One of the respondents commented that in Scotland research with consumers had indicated that: "people had a very low awareness of *Campylobacter*, but when they found out about it they were pretty horrified and couldn't believe that we hadn't told them about it before, or they hadn't heard anymore about it, it's a big awareness issue."

It was discussed how an awareness of food poisoning tended to be linked to large outbreaks, or when deaths occurred from outbreaks of *E. coli* and *Salmonella* and were publicised in the media. Interviewees reflected that *Campylobacter* was different as it was not associated with outbreaks, but sporadic cases. Consequently it did not receive as much media attention as other pathogens, resulting in less awareness. All interviewees felt there was a need to research *Campylobacter* and its impact further.

Interviewees questioned if knowing about pathogens and their effects could be used to target people's behaviours and if this would in turn affect how people cooked and treated their food. An interviewee queried if raising awareness was going to make people do things differently and "whether knowing about *E. coli* affects the way [the public] cook, prepare meats etc or knowing about listeriosis" and questioned "how people that know and don't know, what do they do with a packet of sliced meat, how do they treat it?"

The group discussed that promotions on food safety had tended to generically focus on pathogens as a group, and food poisoning, with an emphasis placed on the positive actions to prevent food poisoning and not on specific bugs.

Issues around *L. Monocytogenes*

While one of the respondents felt that listeriosis was not more well known than *Campylobacter*, another respondent reported "my experience of doing a Google search, searching the term listeria and *Campylobacter* [found] there will be far more hits for listeria."

One of the key issues explored was that while some people may have heard about *L. Monocytogenes* and have some awareness they did not know the risk factors which were specific to listeriosis and differed from other common pathogens. It was felt that there was

a lot of confusion, especially around soft cheeses such as cream cheese, with individuals being unaware of how the bacteria grows even when food is chilled. Another issue was the reluctance of people to waste food and to throw it away, especially given the current economic climate. Having the correct fridge temperature to keep food safe and using fridge thermometers were mentioned as ways of reducing risk.

FSA work to reduce the number of cases of listeriosis in the over 60s and other groups

The group discussed the listeriosis campaign from the previous year which had been carried out as a response to data indicating an increase in listeriosis and funding being available for a campaign. Interviewees emphasised how this had been the first time that the over 60s had been particularly targeted. The campaign had involved magazines and newspapers in all regions, with information provided on the types of foods affected, differences between 'use by' and 'sell by' dates and the importance of checking fridge temperatures. It was felt that this campaign had been well received, but the impact was not known.

It was felt that there was a need to use different approaches for different vulnerable groups or at risk individuals as they were not "homogenous" groups. One interviewee reported that "for each of these vulnerable groups, they are vulnerable for a reason. I think it's about looking at those groups individually and what works for them." It was suggested that campaigns needed to use a variety of approaches to target individuals. Examples of promotional activities which had been used included stands at exhibitions, working with intermediaries, and articles in the press. In Northern Ireland "Beat the Bingo Bug" a game about food poisoning and home practices had been used with the over 60s which had been felt to be appropriate for this age group. It was thought that learning "by accident" or picking up important messages indirectly (e.g. learning about food hygiene issues but not necessarily through a "food hygiene issues" class) was a good way of engaging interest and stimulating conversations about food safety.

8.2.3 Promoting food safety and education

Campaigns to promote food safety and different approaches used to disseminate messages

It was discussed that it was difficult to go from local to national campaigns. An interviewee commented that while a particular campaign may be a good idea locally this may not always work if the same approaches were scaled up nationally. However, there was scope to pilot or roll out in particular English regions. It was also noted that within Wales, Scotland, and Northern Ireland, Local Authorities were set up differently from how they were in England. Interviewees reflected that the 4Cs review was a comprehensive review of all that had been done by the FSA over the last five years and documented the various approaches that had been used in providing information. These included working with intermediary partners, games, going into schools, press releases in magazines and newspapers, exhibitions and stands, TV campaigns and radio messages and a cooking bus. Work done regionally was explored with interviewees and in Wales the FSA had focused on working with schools for food safety week to promote awareness. In Scotland the FSA had attended the Royal Highland Show and farmer markets. In Northern Ireland the FSA had been present at the Balmoral show, farmers' shows, and they had tried to deliver seasonal messages such as during Christmas and summer.

Effective food safety campaigns

When exploring what made an effective campaign there were discussions on who were the target group(s) and what were the aim(s)? One interviewee posed the question

"Are you going for a national figure, are you trying to achieve a national reduction or a national awareness of something or are you working to achieve good interaction with a particular group. So it depends on what you are trying to achieve and what your objectives are". It was also highlighted that finance played a large role in what was done and how. Campaigns were determined according to key priority areas and the key messages disseminated and approaches to be used were decided through working with media planning agencies to determine how messages could be best relayed and the cost effectiveness of approaches. It was mentioned that it was important to think of the intended audience and to have a range of resources which were appropriate, with the mechanisms used depending on the campaign aim. For example, when targeting young people it was good to use interactive tools. Campaigns also needed to be ongoing and not limited to standalone events but based upon the repetition and reinforcement of key messages.

The targeting and timing of campaigns was important as was awareness of particular opportunities. For example, campaigns on turkey safety needed to be done at Christmas time as it would be relevant to individuals at that point and not a month before. Christmas was thought to be a good opportunity for transmitting messages as it was a time when the public would be cooking different things, buying more food, and cooking for more people than they may normally do, and so messages may have more significance and impact. Campaigns and their effectiveness had been evaluated through pre and post tests to look at any changes.

Yet it was difficult to attribute cause and effects and to assess the success of campaigns as external events and other messages and information also affected people's behaviours and evaluation data may not be able to fully reflect this. One interviewee explained "it is very, very difficult to know, even if you go back and say overall have all our activities resulted in a reduction in the number of cases, there may have been a reduction in cases but there [is] so much other stuff going on. If there was another BSE, or avian influenza, those sort of events can change people's attitudes and perceptions which is nothing necessarily related to what we have been doing and it's very difficult to tease out." Another issue was that data obtained was subject to self reporting bias.

The focus of campaigns and the 4Cs

Campaigns were based on exploring what was an issue or a risk with the focus of a campaign determined by what was a risk to the public. In the past campaigns had tended to focus on all 4Cs and all pathogens as a general group. However, there was now a move to focus on specific pathogens and to link this to changing behaviours. It was felt that there had been a lot of work on cross-contamination using TV and other forms of media and showing how easily cross-contamination could occur.

At present, *Campylobacter* and listeriosis were a key focus and looking at the preventative measures and so the relevant Cs would be incorporated. Cooking and cross-contamination were of concern for *Campylobacter* as these were the major factors involved. Chilling was important when addressing listeriosis, but for specific audiences. It was also noted that out of the 4Cs chilling tended to be the least critical except regarding *L. Monocytogenes* and that there had been less attention focused on chilling compared to the other Cs.

There was a general view that food safety messages needed to be specific to create a greater impact as campaigns that related to general risks did not capture the public's interest as effectively as a single issue. One interviewee mentioned that "you can get more impact and more attention if you get more specific but that automatically limits the number of people you are talking to".

Strategies to engage vulnerable groups/individuals

It was felt that supermarkets and retailers had a large role to play in engaging the public and disseminating advice as the majority of people visited supermarkets and returned to the same supermarkets. It was discussed that research had showed that people looked for, and wanted to receive information from within a retail environment. Furthermore, within this environment they were in the right frame of mind to absorb information and this would be something that the FSA was interested in exploring further.

Respondents discussed that celebrity chefs were potentially an untapped resource as they had a lot of influence over consumers and people “see this person on TV and they feel that they know them and trust what they say.” However, it was noted that sometimes incorrect practices were used. An example was given of a chef using a sniff test to check food was suitable, and it was commented that you could not smell *L. Monocytogenes*. Other suggestions made by interviewees included trying to incorporate food safety storylines into soaps/serials although it was recognised that this was an area which policy makers had the least amount of control over. Documentaries which focused on food were also suggested as potentially being able to play a part, but unfortunately at present these programmes were more focused on being sensationalist and the shock factor of what was in food.

Community and voluntary groups, Local Authorities and Primary Care Trusts, were seen to have roles to play in engaging with the public on food safety. Presently the Food Standards Agency was providing resources to complement the approaches being used and a toolkit had been provided which included lots of practical help regarding press releases, presentations and games.

Interviewees mentioned that in the future the FSA was going to be engaging more within the healthcare environment especially with the work they would be carrying out on listeriosis and it was felt that there were various approaches that could be taken such as being very specific, or integrating their information with already established sources of advice being provided. For example if focusing on people with cancer it would be more appropriate to link in with carers for these individuals to be involved in “one to one conversations with their carer” and add to something that was already provided to this patient group, rather than create a new leaflet just about listeriosis. It was recognised that this was a new area and that they were just at the start of this process and this would require a lot of learning and development such as how the NHS worked, the effects of current restructuring, and how best to deliver messages.

It was noted that the over 60s could be segmented in different ways and that the Health Protection Agency and the Advisory Committee on the Microbiological Safety of Food would be assisting in this. The level and depth of how people were segmented would need to be considered such as if you narrowed it to certain types of disease, or drugs, or both together. It was felt that there were lots of levels that could be explored which would depend on the data available. Interviewees mentioned that the FSA has information on specific groups of people and that while the over 60s may be a particular group of focus at present, information could also be included for other high risk groups.

Food safety awareness and education management in the UK and other countries

It was felt that within the United States there was a lot of activity which tended to promote comprehensive and detailed information on food safety awareness and education management. Australia and New Zealand were thought to have a similar approach to the United Kingdom. Some of the interviewees reflected on how New Zealand and Scandinavian countries had reduced their *Campylobacter* rates and had shared good

practice and learning from the interventions they used at a conference organised by the Agency in March 2010 and attended by counterparts. It was felt that it was hard to make comparisons between the United Kingdom and other countries as populations and contexts may be different, and it was important to know your audience and what may be expected. It was also noted that there may have been particular issues within individual countries (such as with a supply chain) which had a bearing on the approaches they had used. It was felt that in the United Kingdom humour tended to be used in food safety messages and that messages were getting stronger with the public wanting to know the hard facts.

8.2.4 Future research priorities and gaps in research

Research priorities

All interviewees were asked to assign a priority rating to various topics around food safety (topics listed below). Interviewees were asked to assign ratings before the focus group and then within the focus group each interviewee was asked about the ratings they had given and why. Afterwards the group were asked to agree on priority ratings for each of the topic areas, with the outputs from this exercise illustrated below Table 13.

Table 13: Focus group rating of research priorities

	High Priority	Medium Priority	Low Priority
Knowledge about food storage and handling behaviours relating to food safety in the home for ⁴⁸ :			
<ul style="list-style-type: none"> • The general population. • Vulnerable groups. 	✓ ✓		
Factors associated with food storage and handling behaviours in the home. (e.g. socio demographic factors including age, ethnicity and income, illness, accommodation, kitchen facilities, etc)	✓		
The relationship between food safety knowledge, beliefs and actual behaviours.	✓		
Factors which encourage the adoption of safe food storage/handling practices and how can change in practices be encouraged.		✓	
Factors which inhibit the adoption of safe food storage/handling practices and how can these be overcome.	✓		
Knowledge about influencing safe food storage/handling behaviours.		✓	
How existing literature on food safety behaviours fit with			✓

⁴⁸ Note: Participants viewed actual behaviour as a greater priority than self reported behaviour in the case of both the general population and vulnerable groups.

	High Priority	Medium Priority	Low Priority
the literature on food and kitchen practices and behaviour more broadly.			
Theoretical approaches that have been adopted to explore and explain food storage/handling behaviours.			✓
Research techniques which have been used in the past for exploring food storage/handling behaviours, including how to measure actual rather than stated behaviours.		✓	
Knowledge about how food safety advice is disseminated to vulnerable groups via health professionals, carers, or care organisations		✓	
Knowledge about how to disseminate food safety advice to particular groups of the population.			✓
Educational campaigns that have been undertaken to provide the general public with information about food safety in the home, how these have been evaluated and what has been learnt.		✓	

It was felt that a lot of the topic areas crossed over and were difficult to separate from each other. Generally it was felt that the items at the top of the list were rated as higher priority. The roles of interviewees had some bearing on priority ratings. For example from a press perspective there were opportunities for stories from the topic areas related to factors associated with food storage, the relationship between food safety knowledge and actual behaviours and factors which inhibit safe food handling practices.

Interviewees considered topics with a focus on research methods and theoretical frameworks to be longer term aims which would contribute to an understanding of other areas. Although these areas were difficult to rate they were not viewed as high priority. Looking at how existing literature on food safety behaviours fits in with the literature in broader areas (e.g. broader food practices) was considered a lower priority than topics that were more specific.

However, interviewees felt that it was important to know about people's behaviours and what could be learned from existing evidence in this area. It was felt that acquiring knowledge about the factors which inhibit safe food practices was a higher priority than knowledge about the factors which encourage the adoption of safe food practices.

Interviewees reasoned that knowing what encourages some people to practice good behaviours is linked to, but does not necessarily inform why other people do not practice good behaviours. Knowledge about factors that inhibit safe food practices was seen as more useful for informing ways to encourage changes in behaviour.

Gaps in evidence/research

When identifying gaps in evidence or research a suggestion was made to look at long term trends passed on through generations and cultural influences and how food safety attitudes are formed. There were also some further comments around at risk populations such as pregnant women, and people from deprived backgrounds which would be interesting to explore further as these groups had not been researched as much as older people. It was commented that individuals from different ethnic minority backgrounds may be at risk from listeriosis (although specific ethnic groups had not been narrowed down). It was also commented upon that people who were pregnant and from different ethnic

groups were also at a higher risk of listeriosis. Other areas included looking at the different cultural practices of food preparation such as halal foods, and the role that businesses could play in ensuring food was made safer before it reaches consumer homes (such as improved packaging of foods etc) to keep it safe and prevent any leakages from meat.

9 APPENDIX F: REVIEW OF DATABASES

9.1 Review of the Food and You Survey

The Agency carried out the first Food and You Survey in 2010. This study aimed to inform analysis of Food and You survey findings and make recommendations for what further analysis could be undertaken of data expected to emerge from the Food and You survey and whether analysis of any other robust data sets could complement this. The Food and You survey includes an extensive set of questions about food safety attitudes, knowledge and behaviours in the home, along with diet, shopping habits, physical activity, demographics and household information.

The Food and You survey was being analysed by another organisation at the time of this review. The specification for this analysis clearly addressed some key issues, including:

- Profiling food safety behaviours;
- Segmenting food safety behaviours by factors such as children in the household;
- A summary of behaviours by demographic breakdowns;
- Correlating food safety behaviours to knowledge and attitudes.

The findings from these analyses would be of clear benefit to the review of food safety behaviours in the home.

There are three areas where further analysis of the Food and You survey may have limitations:

1. Health status of respondents

Whilst the analysis aims to map food safety behaviours across demographic groups, the questionnaire has limited questions about the health status of the respondents. Whilst it asks if the person is “long term sick or disabled” or “Unable to work because of short term illness or injury” it does not specifically survey people with conditions such as cancer, immunocompromised or whether they are pregnant. Therefore, at this time it does not provide a basis to further explore the key issue of listeriosis amongst vulnerable patients.

2. Attitudes and Knowledge

Given the restrictions on the length of such a questionnaire, the Food and You survey has not covered all aspects of food safety. Although the survey asks about attitudes to some aspects of food safety, including the possibility of food poisoning and related concerns, the survey does not ask about attitudes towards specific food safety practices in the home. For example, it does not ask whether respondents accept the need to wash their hands before preparing meals or whether they feel the effort needed to adopt specific practices is justified by the risks of not doing so.

People’s knowledge of different types of foodborne disease, pathways and consequences of food poisoning, or their perceptions of the risk is another area the survey has not covered. Therefore it is not possible to explore associations between knowledge of pathogens and food poisoning/associated risk perceptions and behaviours.

Food and You includes knowledge questions on some aspects of food safety in the home. For example, correct fridge temperatures, how you can tell that food is safe to

eat, the meaning of labels (e.g. sell by date), the duration in which it is still safe to eat leftovers and the reason for washing chopping boards. However, knowledge questions on other aspects of food safety, including why you should not store raw meat at the top of fridges, are not included.

Respondents were also not asked if they are aware of the types of food that are high risk for those who are pregnant or immune-compromised (e.g. pate, ham). The majority of questions explore food safety practices in the home, addressing many of the key food safety practices covered by this review, but not those specific to people who are immune-compromised. Some of these issues may be more suitable for a qualitative methodology.

3. No previous surveys

The Food and You survey was first run in 2010. Therefore, there is currently no comparable data to assess trends, particularly to explore any changes in behaviours that could explain the rise in listeriosis in the 2000's. The previous Consumer Attitudes to Food Standards survey used a different question set and sample frame.

Overall conclusion regarding Food and You

Given these limitations, it is difficult to identify how further analysis of the Food and You survey would directly indicate food safety behaviours of patients regarding listeriosis. However, as noted in section 3.2.4, Food and You survey may assist with exploring behaviours amongst the non-patient population.

9.2 Review of other data sets

What specific secondary analysis could be undertaken of the data sets identified by the SSRC working group on listeriosis and are there any other data sets that should be considered?

Comments are offered on each survey below.

Living Costs and Food Survey (LCF)

The Expenditure and Food Survey (EFS) was renamed as the Living Costs and Food Survey (LCF) in 2008 when it became a module of the Integrated Household Survey (IHS). The LCF and its predecessor have been in operation since 1957. The sample size per age group is in the region of 1120 to 6700 and thus provides statistically powerful samples per age group.

The survey does enable comparison of expenditure by type of food across the years. The published data is presented by age group. Therefore, it does allow some comparison by age. An example is shown below in **Figure 5**. It shows that the average expenditure rises for older age groups until 65 to 74. This could be repeated for earlier periods to develop trends.

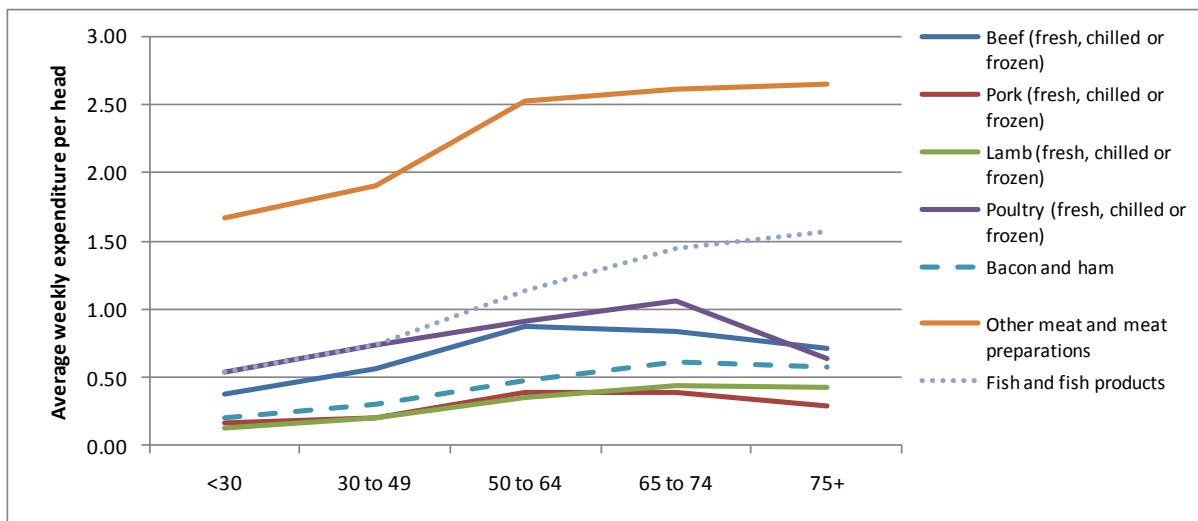


Figure 5: Example of LCF data (2008)

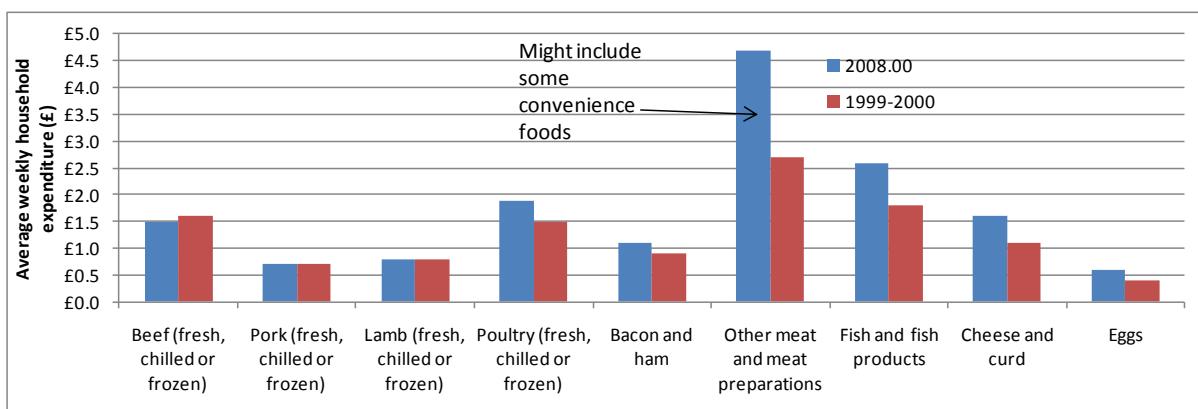
Figure 6 provides an example of what can be done with the LCF data. It compares average weekly expenditure for 65 to 74 year olds for a selection of food items. It should be noted that:

- The categorisation of items has changed – the 1999-2000 survey split cold meats/ready to eat meals from meat pies, sausages and other meals. It also listed Other Convenience foods.
- The 2008 survey does not list Other Convenience foods and has Other meat and meat preparations.
- Therefore, the data is not necessarily directly comparable. As they note, the commodity categories are not necessarily comparable to those before 2001-02.

Thus, the surveys would have to be used with some reservations for long term trend analysis.

The 2008 report does note trends (deflated to 2008 prices) in total expenditure on food and non-alcoholic drinks, reporting no significant change in the amount spent since 1992 (p62 and p64).

Figure 6: 1999-2000 versus 2008 weekly expenditure for 65 to 75 year old (selected items)



Finally, the value of the data is limited by the fact that it relates to expenditure rather than amount of food bought. The trend in expenditure could reflect changes in pricing as

opposed to changes in consumption.

Food in later life

The three year Food In Later Life project provided cross European results regarding food behaviours of older people.

The Food In Later Life project is limited in respect of:

- Only covering three years – 2003 to 2006;
- Using qualitative samples of people;
- Did not target patients;
- It did not explore food safety behaviours.

As such it cannot inform the assessment of changes in listeriosis trends before and after 2000 or profile food safety behaviour of elderly patients.

English Longitudinal Survey of Ageing (ELSA)⁴⁹

ELSA started in 2002-03. It explores older persons' economic, social and health status. It could provide trends in older persons' health status and economic position since 2002. As a large scale survey it has statistical power.

However, ELSA does not explore food behaviours in any way. Nor does it cover the period prior to the reported rise in listeriosis. Therefore, it would provide limited input into explaining the rise in listeriosis amongst older persons.

Low Income diet and nutrition survey⁵⁰

The Agency's Low Income diet and nutrition survey of 2002 with 3,728 respondents. The survey includes daily consumption of food stuffs.

It does ask about health status, long standing illness, being in hospital, having operations, consumption habits and cooking skills. Therefore, secondary analysis could explore the consumption habits of low income people with long term illnesses, and specifically of older persons. This would help profile exposure to *L. Monocytogenes* related foods amongst older persons, particularly those with long term illness.

It does not survey food safety behaviours, nor does it provide any trend over years.

Time Use survey⁵¹

The main aim of the Time Use survey (TUS) is to measure the amount of time spent by the UK population on various activities. The UK 2000 Time Use Survey was the first time that a major survey of this type had been conducted in the UK. The UK 2000 Time Use Survey was the first time that a major survey of this type had been conducted in the UK. The Time Use Survey was designed, where possible, to provide results comparable with other European studies as part of a wider Harmonised European Time Use Survey. The most recent survey was 2005.

It shows, for example, that older people spend more time cooking and washing up. Data can be assessed by age and gender for example. Trend can be plotted since 2000 to 2005.

⁴⁹ <http://www.ifs.org.uk/elsa/>

⁵⁰ <http://www.food.gov.uk/multimedia/pdfs/lidnssummary.pdf>

⁵¹ <http://www.statistics.gov.uk/statbase/Product.asp?vlnk=9326&More=Y>

No particular application of this to food safety could be identified by the researchers.

TNS Worldpanel

The TNS Worldpanel clearly provides data on trends in purchase of foods and could be used to explore trends in purchasing in specific age groups over a number of decades.

However:

- It does not record persons health status, i.e. whether they are a patient;
- It does not record individual consumption (it records household purchases).