

The impact of food safety label elements on consumers

**A literature review prepared for Food Standards
Australia New Zealand**

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1. Executive summary

The project aim was to review relevant literature on the impact of food safety label elements on consumers, both within New Zealand and Australia and internationally. A systematic search of the literature and quality assessment of documents was undertaken.

The majority of studies identified are surveys and focus groups, of which only some were undertaken in New Zealand and Australia. Several studies observing consumers were identified. No intervention studies were identified – which is unfortunate as these would likely have provided the strongest possible evidence.

In surveys (when not asked directly) consumers have low concern about food safety label elements. Similarly, when observed in real life settings, consumers have low levels of ‘looking for/at’ food safety label elements while shopping, storing or preparing/cooking foods.

When asked directly, consumers’ attitudes are quite different – they say food safety label elements are important to them. This apparent disconnect is most likely explained by a Food Standards Agency (United Kingdom) study which showed most food purchasing, storage, preparation and eating is based on regular habits. Therefore consumers do not refer to food labels in these common tasks. When considering buying, or preparing/cooking new foods, the chances of looking at/reading labels is far higher.

‘Use by’ dates are said to be the most widely ‘read’ or ‘looked for’ of all food safety label elements by New Zealand and Australian consumers (range of 71-89 percent across studies). However, there is also substantial misunderstanding. Only half of consumers (56 percent) can correctly define what ‘use by’ means. Despite this, of all the date marking options ‘use by’ is the best understood, whether in New Zealand/Australia, or internationally.

This modest level of understanding about ‘use by’ is complemented by studies looking at actual behaviour, where only a small number of consumers follow ‘use by’ dates. What consumers say is important to them in surveys, is not followed up with consumer understanding, nor consumer behaviour. This is a universal finding in this literature review across all topics where data can be compared. It is particularly important given all of the New Zealand and Australian data is about what consumers say.

Furthermore, large proportions of United Kingdom consumers say they would eat a food beyond its ‘use by’ date (45-74 percent depending on food type). Older people are more likely than younger people to say they would eat a food beyond its ‘use by’ date. This is because people also use taste, smell and appearance when deciding whether to continue to store/use a food, not just a ‘use by’ date.

From surveys of New Zealand and Australian consumers, about half (58 percent) say they ‘looked for/read’ cooking/storage instructions and 45 percent say they use storage instructions. However under observation, when buying and in the home, United Kingdom shoppers and consumers seldom look for or refer to directions for use, particularly if preparation or cooking practices are well known by the consumer.

About one-quarter of New Zealand and Australian consumers say they use warning and advisory statements, and of those consumers who use warning statements or advisory statements, many (about 40 percent) use them frequently.

2. Introduction

2.1 Aim

The project aim was to review the evidence and relevant literature on the impact of food safety label elements on consumers, both within New Zealand, Australia and internationally.

2.2 Background

Within the Australia New Zealand Food Standards Code there are a number of standards which relate specifically to labelling. These cover warning and advisory statements; ingredient lists; date marking; directions for use and storage; nutrition information; legibility requirements and percentage labelling.

In 2009 the Ministerial Council announced that former Australian Health Minister, Dr Neal Blewett AC, would head up a panel which would undertake a comprehensive examination of food labelling law and policy. Following two rounds of public consultation forums, submissions and consideration of literature, the final report – [Labelling Logic](#) was publicly released in 2011. Based on this report, the Ministerial Council has asked FSANZ to provide technical evaluation and advice on:

Recommendation 6: That the food safety elements on the food label be reviewed with the aim to maximise the effectiveness of food safety communication.

Food Standards Australia New Zealand (FSANZ) therefore commissioned Quigley and Watts for an evidence base to guide their assessment of the effectiveness of food safety communication, via food labels, to consumers.

2.3 Research questions

The scope of this review was designed to address the above aim, and to cover theory, consumer use and preferences, and preferred wording options for food safety label elements (but not wider food label elements). To cover this scope¹, a number of research questions were proposed by FSANZ:

Theory and current context

1. What theories or conceptual frameworks underpin the use of food safety label elements by consumers when making food purchase and use decisions?

Consumer use and preferences

What are the behavioural norms around use, preferences and understanding of the food safety label elements by consumer type (e.g. on the basis of demographics)?

2. What background factors moderate consumers' motivation or ability to seek out, understand, and use food safety label elements
3. Under what conditions do consumers currently seek out the food safety label elements?
4. Do consumers understand food safety label elements?
5. Is there a current problem with consumer understanding, attitudes or behaviours with respect to the food safety label elements?

¹ Further detail on food safety label elements which informed the scope is provided in Appendix 1.

6. Do consumers have preferences for how food safety label elements are expressed, and if so what are they (excluding preferences relating to font options such as type, point, and emphasis)?
7. How are food safety label elements used by consumers in purchase, preparation, consumption, and storage decisions?
8. How do food safety label elements affect consumer purchase, preparation, consumption, and storage decisions?
9. Do consumers give any particular element markedly greater or lesser priority if multiple elements are present?
10. Are there any situations in which some types of food safety label elements are unnoticed or ignored?

Options analysis

11. What wording options for each of the food safety label elements have been examined in the literature, and what does the literature reveal about the relative advantages and disadvantages of each option.

2.4 How is 'food safety label elements' defined for this review?

Within recommendation 6, **food safety labelling elements** have been identified by FSANZ as:

- all mandatory substance declarations in Standard 1.2.3 (allergens etc.) (but out of scope for this review)
- advisory statements
- warning statements
- date markings
- directions for storage
- directions for use.

Importantly, this definition excludes general food labelling, nutrition labelling, genetic modification labelling, pesticide and allergen labelling etc. (Further exclusions in Appendix 2).

2.5 How is 'impact' defined for this review?

Defining impact is important. To 'prove' impact or effectiveness, rigorous evaluations are required – e.g. randomised controlled trials or quasi-experimental designs that involve pre and post measures to show positive changes in outcomes, ideally over the longer term and in various contexts. Experimental evaluations typically compare the outcomes of an intervention group, which takes part in a programme, with a similar control or comparison group (World Health Organization/ London School of Hygiene and Tropical Medicine, 2010)

However, this approach is not the only way to assess effectiveness. International experts propose additional ways to gauge success via broader evidence, e.g. through addressing known risk and protective factors, and by learning from existing evaluations and theoretical explanations, well conducted observational studies and process evaluations (VicHealth, 2007). However, this broadening still typically excludes qualitative research which will be particularly important in this literature review. The author has worked closely with FSANZ to understand the outcomes of interest, and to ensure the review does not exclude most of the evidence through too narrow inclusion/exclusion criteria.

3. Methods

A scoping stage was undertaken where a draft scope was submitted to FSANZ for comment on 30 January 2014 and a meeting was held to finalise the scope in early February 2014. The scope of the project was set as a literature review rather than a comprehensive or systematic review of the evidence. It was agreed that a literature review of single studies was appropriate with a broad focus on international literature.

Searching of academic databases was undertaken at the University of Otago, Wellington. A search-strategy librarian assisted in the development of a search strategy and advised on the most appropriate databases and search terms.

The full search strategy is in Appendix 1. Key elements are described here. The search for relevant material was undertaken using:

- academic databases
 - OvidSP – Food Science and Technology Abstracts 1969 - week 2 February 2014
 - Scopus 1996 – 17 February 2014
 - OvidSP – Medline 1996 – 17 February 2014)
- Citation tracking
- Google scholar (as a double check, not reproducible)
- Web searching of relevant government and non-government databases
- Documents received directly from the client (including material sourced from FSANZ's international liaison group)
- Documents referred to in primary material.

The inclusion and exclusion criteria applied to the abstracts and articles/reports were :

- Date inclusion of 1996 onwards
- Developing economies excluded.
- The role of food labelling in addressing the risks of chronic diet-related disease was excluded
- Food safety topics excluded: pesticides, genetic modification, heavy metal contamination, traceability, allergens, pesticide residues, irradiation
- Alcoholic beverages, dietary supplements, special purpose foods and specialist sports foods were excluded
- Settings excluded: laboratory tests of label instructions (consumers not present), catering, shelf labelling, pamphlets, websites, restaurants, meals on wheels, quality assurance marks/labels, branding
- English language only.

The search of academic databases retrieved 420 abstracts of potential documents, subsequently reduced to 66 abstracts of potential documents when the title and abstract was compared against the research questions and inclusion/exclusion criteria. Attempts were made to retrieve the 66 documents, and 49 were retrieved. Articles before 1996 were not retrieved (the date cut-off for retrieval of international literature), and neither were hard-to-access newspaper or conference presentations. Eleven potential documents were supplied by FSANZ;

and seven were identified from primary material. This gave a total of 67 documents which were further reduced by a second comparison against review questions and inclusion/exclusion criteria (44 excluded), meaning 23 documents were assessed for quality and are presented in this report.

When undertaking a literature review it is typical to use a tool to assess bias of studies. Systematic review tools are available for interventions studies, but not for cross sectional study types (e.g. surveys). The only study type identified in this review which does have a recognised assessment tool is that for qualitative studies (e.g. focus groups) and we have used that tool (Appendix 2) to assess the quality of evidence from those study types. For the remaining studies (e.g. surveys, observation) we have also assessed the quality of evidence, however given a specific tool is not available the author has used his judgement based on:

- whether an aim is stated
- the sample design (e.g. random sample, from a panel, convenience sample, etc.); number of participants, etc.
- response rates
- method used
- location of study (i.e. observation of label use in home or in test kitchen)
- questionnaire design (piloting, field tested prior, etc.)
- analysis techniques e.g. weighted to census data; controlled for confounding, etc.

The above information was used to grade quality of studies into low, medium and high quality. The quality assessment (grades and rationale) for each study are presented in Appendix 3.

The information gained from quality assessment of the included studies was used to interpret and explain differences in findings across studies and to inform a qualitative assessment of potential risk of bias in selection of research participants and implementation of research. Questions related to the type of study, populations studied, methods used, and the strengths and weaknesses of each study type. Papers deemed to be low quality were included in the review, but are clearly labelled as low quality, and low quality material does not feature in the executive summary or key findings.

It is important to note from the outset we did not intend to overly restrict inclusion of articles/reports on the basis of quality appraisal of those articles/reports. This was because the topic was thought to contain few studies and it was considered more useful to include studies, while also alerting the reader of study quality.

In the past qualitative studies have not 'fit' within a typical systematic review paradigm, though that has now changed. Regarding quality appraisal of qualitative studies, there are opposing thoughts on whether quality appraisal of qualitative research is appropriate (Gallacher et al., 2013). Standard textbooks (Bamberger, Rugh, & Mabry, 2006) and University courses argue that each piece of research tells its own story and cannot be compared to another. Others working in medical fields believe it to be an essential component of rigorous qualitative synthesis, but even amongst these supporters there is no consensus on how to enact quality appraisal, unlike the widely agreed checklists available for quantitative research. Despite this, assessment tools exist and we used one tool (Health Evidence Bulletin Wales, 2004) (Appendix 2) to assess the qualitative studies sufficiently to inform the discussion and analysis.

The findings have been summarised and presented in narrative form in this report. The report draws the findings together, considers the strength of evidence, and examines possible reasons for any inconsistencies.

3.1 Strengths and limitations of this review

The review was completed within a modest timeframe and is not a systematic review.

All of the 'best available evidence' (from direct observation studies) is from the United States of America and the United Kingdom, not from Australia and New Zealand. This raises questions about applicability in the New Zealand and Australian context.

The other study types (focus groups and surveys), including all of the material from New Zealand and Australia, all report what people say, and do not observe what people actually do. It is clear there is a marked difference between the two. People behave differently from how they say they behave, and from what they say is important to them.

Furthermore, no intervention studies have been identified for this topic, which would typically be considered the highest grade of evidence.

4. Context to findings

Certain findings were closely related to food safety label elements, but not directly. These are presented in this section to provide context to the findings section. This section describes consumer knowledge, attitudes, perceptions and behaviours from studies about food labelling in general (not of a specific food safety label element) and are therefore reported for 'food labels'. However the studies included in this section had to relate to food safety in some way to be included as context for this review.

4.1 Studies about food labelling in general

Key points:

- All aspects of food labelling are important to 'someone' some of the time, but no aspects are equally important to everyone.
- United Kingdom shoppers have low overall engagement with food labels, particularly for habitual purchasing.
- Instead, with set habits, United Kingdom consumers use 'beacons' on the front of labels to guide shopping decisions.
- Of all the possible food safety label elements, United Kingdom consumers were observed only to engage with the date marking - when it is on the front of the product (i.e. for many fresh foods)
- There are two situations where the general low engagement with labels does not hold:
 - Buying for other people (especially children and babies), where people spend a lot of time looking at labels, including preparation instructions
 - Where knowledge about food and nutrition is better, interest and engagement with food labels (in general) is typically greater.
- A small proportion of non-label readers also exist in the United Kingdom, where price overshadows all other matters.
- Even after a major food related event such as food poisoning, the majority of United Kingdom consumers take no action, while a minority 'read food labels more carefully'.

A high quality study, with an excellent design for understanding *actual* consumer behaviour towards food labels while shopping, was carried out by Ipsos Mori (2010) in the United Kingdom. The study included accompanied shopping trips and eye tracked shopping trips in retail supermarkets with follow up interviews. Also, meal preparation was filmed at home with follow up interviews. Eye tracked task shopping in a simulated Retail Lab with follow up interviews was also undertaken. Finally, the study also undertook semiotic and packaging analysis. The study stood out from all other studies by virtue of its high quality methods.

This study found '*on the whole shoppers had low engagement with food labels in the store environment and paid attention to only a minimal amount of food labelling when shopping*'. This was matched by poor knowledge about food and nutrition on the whole by shoppers. Perhaps this is not such a surprising finding as low engagement was particularly true for shoppers

making habitual purchases. With set habits, consumers reported being satisfied with the 'beacons' on front of label information and felt they didn't need to read further. Food label elements on the front of the packs which shoppers did engage with were:

- Product description/name
- Brand
- Price
- Date marking²

A real strength of the Ipsos MORI (2010) study was its attempt to understand semiotics. The study identified that certain shoppers associated certain symbols with the information they wanted to know, which then acted as 'beacons' on shopping trips. For example, the word 'local' might signal high quality and/or organic. The shortcut negated the perceived need to engage with other aspects of the food label, especially the back of the pack.

Ipsos MORI (2010) concluded that well known brands had a halo effect – signifying quality and safety, and distracting from other information. Consumers assumed that well known brands had reached and surpassed minimum standards with regard to the food's quality and safety. Information, or claims, about quality and safety provided on the packaging were not sought out by consumers because of this inherent assumed trust that the product met or surpassed an appropriate standard.

Overall consumers perceived marketing claims from well known brands on the front of packs to provide reassurance and therefore they considered mandatory information (excluding date markings) as unnecessary – which highlights the critical importance of language and symbols on the front of packaging.

In the few situations where United Kingdom shoppers did read labels, it was driven by selective attention to a specific information pertaining to a particular health condition, requirement, religious belief or lifestyle choice (Ipsos MORI, 2010).

When consumers did turn over food products to look at the label information on the back '*they were daunted*'. Despite this, the authors concluded all aspects of food labelling were important to 'someone' but no aspects were equally important to everyone. Consumers perceived food labels as overcrowded, where important messages (to them) were being obscured by other (perceived) superfluous information. The challenge is that different consumers think different information is superfluous and therefore Ipsos MORI (2010) concluded it is virtually impossible to advise on improvements to food labels.

There were two situations where this general low engagement with labels did not hold:

- Buying for other people (especially children and babies), where people spent a lot of time looking at labels, including preparation instructions; and this presented an opportunity for intervention around labels (Ipsos MORI, 2010)

² Date labels and price stickers are often on front of packs, or at least in the 'field of vision' for fresh goods, e.g. meat, poultry, eggs, milk.

- Where knowledge about food and nutrition was better, interest and engagement with food labels (in general) was typically greater.

Reflecting the last dotpoint, a small proportion of participants in the Ipsos MORI (2010) study were 'detail seekers'. They had a passion for food, understood food labels and stated the need for sophisticated information. They preferred to buy food from local farmers markets and butchers. Price was a secondary consideration to quality. Despite this, label reading (in general) was not manifest in their observed behaviour and was at a similar very low level as other participants. However in the follow up interviews detail seekers were able to describe why they had purchased an item using detail recalled from previous label reading.

Finally, a small group of non-label readers were identified where price overshadowed all other information. Buying low priced food was the priority and participants approached food labels with a dismissive attitude – *'what I don't know can't hurt me'* (Ipsos MORI, 2010).

In a New Zealand and Australian survey (judged to be medium quality), participants were asked unprompted 'why information was sought on food labels', no responses of relevance to food safety label elements were reported by any participant (TNS Social Research, 2008).

TNS BMRB (2013) carried out a large (high quality) survey of 3231 United Kingdom adults. Thirty seven percent of respondents reported that they had had food poisoning in the past year. Of those respondents who reported they had had food poisoning, just eight percent reported they 'read food labels more carefully' as a consequence of having had food poisoning (TNS BMRB, 2013).

Respondents who were concerned about food poisoning were also asked what they did, if anything, as a result of having a concern about food poisoning. The majority reported that they took no action (51 percent), with the next most likely response being to read food labels more carefully (26 percent) (TNS BMRB, 2013).

5. Findings

5.1 Introduction

There were two main types of studies identified:

- Direct eye tracking/ observation of actual behaviour (either while shopping, in the home, or in test kitchens) and experimental studies
- Focus groups and surveys of knowledge, attitudes and perceived behaviour

The extracted data from all of the study types and their quality assessment is presented in Appendix 3.

No interventions were identified.

The analysis of the findings is presented in the following sections and has been organised by label element (rather than type of study or location of research). Where available, each section covers consumer knowledge, attitudes, perceptions and actual behaviour regarding different aspects of food safety label elements. Australian, New Zealand and international studies are all reported. The report structure is:

- Section 5.2 – Food safety label elements: Storage instructions; and directions for use (preparation instructions, cooking instructions), warning statements and advisory statements
- Section 5.3 –Date marking.

5.2 Food safety label elements (storage instructions; directions for use; warning statements and advisory statements)

This section describes consumer knowledge, attitudes, perceptions and behaviours from studies about specific elements of food labels.

5.2.1 Storage instructions

Key points: Storage instructions

- About half of consumers say they regularly look for and use 'storage instruction' information. Similarly, about half of people (or more, depending on the food type) say they keep food products beyond recommended package opening times (across UK and USA consumers).
- Furthermore, observation data shows
 - When shopping, consumers seldom refer to storage instructions
 - Few consumers read or apply 'use within three days' or other storage instructions on food labels
- Older United Kingdom consumers describe their reticence to 'not throw anything away'. Older consumers have noticed a vast change in buying patterns, from buying for a few days ahead (negating the need for storage and date marking) to doing weekly, fortnightly or monthly shops. A focus on the social causes of food safety-related harm allows the potential for alternative interventions such as ensuring access to regular food delivery services, rather than typical date marking interventions that put the onus onto the consumer.
- While not storage instructions per se, consumers use (and don't use) other information when determining how long to store foods
 - People use taste, smell and appearance when deciding to use products in the home
 - Most consumers have products (e.g. jars) stored in pantries and fridges beyond date markings
 - Few consumers understand how freezing foods (for storage) relates to 'best before' or 'use by' dates (via general knowledge).

Storage instructions: When buying products

In a high quality UK study which observed participants when shopping, storage instructions were low down the priority list for participants. Generally participants were not looking at storage instructions or the freezer star marking panel³ when shopping (Ipsos MORI, 2010).

A large high quality survey undertaken in New Zealand and Australia in 2003 asked what food label elements people looked for on a package, as an open-ended question. Seven percent indicated they looked for the storage/preparation instructions. When asked directly if they were aware of storage/preparation instructions, a slightly different question, 65 percent indicated they were (NFO Donovan Research, 2003).

³ The star marking panel on food labels graphically shows how long a frozen product can be stored for, depending on the type of freezer (e.g. icebox, -18°C freezer).

In a separate New Zealand/Australian survey, participants were asked what 'information they looked for when purchasing a new product for the first time'. Forty nine percent of Australian and New Zealand consumers said they 'looked for' 'cooking/storage instructions' (TNS Social Research, 2008).

In England, Milne (2011) carried out 6 high quality focus groups with older people (aged 60-90 years). The recollection of the 'war years' affected their practices as they 'did not throw anything away'. They also recollected that buying patterns have changed markedly – whereas they'd only buy for a few days ahead and eat food quickly – negating the need for storage and date marking (no refrigerators), now they do a weekly, fortnightly or monthly shop – to stock fridges, freezers and pantries. The authors concluded that focusing on social causes of food safety-related harm allowed the potential for alternative interventions such as ensuring access to regular food delivery services, rather than regular information interventions (that 'blame the consumer') (Milne, 2011).

Storage instructions: When using products

In the large high quality survey undertaken in New Zealand and Australia, when participants were asked if they used the preparation/storage instructions, 45 percent said they did (NFO Donovan Research, 2003).

However in a high quality study when United Kingdom consumers were observed in their homes, many participants did not read or assimilate information regarding 'use within three days after opening' and were observed storing opened jars in the cupboard or fridge for weeks, rather than following the storage instructions on the label (Ipsos MORI, 2010). Consumers explained that they did not look for date marking on tinned and pre-frozen items, because they were less concerned about food label information for tinned items. While not related to storage instructions per se, a large proportion of the sample did not understand the meaning of date marking (be that 'use by' or 'best before') in terms of freezing (a method of storing). For example, participants said they would throw away something past the 'use by' date despite it having been frozen within the date⁴ (Ipsos MORI, 2010). Finally, of relevance to this literature review, date marking received the highest proportion of 'I trust what it says' responses (53%), followed by storage and preparation instructions (50%).

The Food Safety Information Council (2013) carried out a telephone interview of 1201 Australians aged 18 and over (sample weighted to Australian Census data). The survey was judged to be medium quality. Over half (58 percent) of participants surveyed 'always' or 'most of the time' read 'storage instructions' (males 57 percent; females 60 percent). When asked if they complied with 'storage instructions', 89 percent indicated they did.

A structured questionnaire of 103 consumers followed by three focus groups (McIlveen & Semple, 2002) of Northern Irish consumers was judged low quality by this review. In the structured questionnaire, 'storage conditions' was not a food label element read often by participants. When queried in the focus groups why this was the case, participants described

⁴ Understanding how date marking relates to freezing is not generally explained on food labels, and for a participant to know the relationship it would rely on their 'general knowledge'.

'most households now have a fridge/freezer to store products and consequently storage is not a problem, nor a pertinent issue when choosing a product'.

The UK Food Standards Agency recommends using opened foods within two days, unless the manufacturer's instructions say otherwise. In a high quality TNS BMRB (2013) survey respondents were asked what would be the maximum number of days they would keep various food items in the fridge after opening them. While only a minority of users reported that they would look at the use by date (4% and 7%) or follow the storage information on the product (2% and 4%), a further substantial proportion (between 22-56 percent of participants) correctly reported keeping products for two days or less once opened, differing by product type:

- packet of soft or cream cheese (22 percent)
- packet of smoked fish (56 percent)
- packet of fresh dip (40 percent)
- packet of fish, meat or seafood pate (47 percent)
- packet of sliced cooked or cured meat (29 percent).

However, these percentages above still leave approximately half of the population (or more depending on food type) who keep products beyond recommended times after opening.

Similarly, Lenhart et al. (2008) asked senior-aged USA women and women of child bearing age how long they kept packages of ready to eat meat and poultry products once they were opened. Responses varied widely within focus groups in both age groups with some participants saying they stored opened products only a few days and others a few weeks past the date listed on the package. A major theme, however, was for participants to store opened packages longer than the 3 to 5 days recommended by USDA-Food Safety Information Service.

In a low quality web based survey of 2428 United States of America individuals, about one-third of respondents reported that a date mark (not further specified) is the most important factor when deciding whether to eat a refrigerated food (Kosa, Cates, Karns, Godwin, & Chambers, 2006). The most important factors reported were how it smelled and how it looked.

5.2.2 Directions for use

Key points: Directions for use

Preparation instructions

- Consumers are observed to use (and say they use) preparation guides on new and unfamiliar food products, but not on products regularly prepared by the consumer.

Cooking instructions

- Most consumers say they regularly look for and use ‘cooking instructions’
- In contrast, observation data shows:
 - When shopping, consumers seldom refer to cooking instructions
 - Consumers use (and say they use) cooking instructions on new and unfamiliar food products, but seldom on regularly cooked products.
- Cooking instructions were not followed correctly (for cooking flash fried chicken nuggets) in an outbreak of *Salmonella Typhimurium* in South Australia 15 years ago.

Preparation instructions

In a high quality United Kingdom study where participants were observed preparing a family meal (and interviewed afterwards), participants were observed (and described) that they used food labels⁵ more when preparing unfamiliar ingredients, new products or cooking methods (or attempting to make a new dish), compared with familiar products/dishes/methods (Ipsos MORI, 2010).

Cooking instructions

Cooking instructions were low down on the priority list for participants when shopping (Ipsos MORI, 2010).

A high quality study observed people in a test kitchen during the cooking of frozen, uncooked breaded chicken products. It provides reliable information about what people actually do (rather than what they say they do) (DeDonder et al., 2009). Using video observation first, followed by a survey (self-reported data), the study sought to determine if there was a difference between actual behaviour and what consumers perceived they do. Twenty-four out of 41 said in the survey the cooking instructions influenced how they prepared the products, and most participants were observed to notice label instructions during preparation. However, only 3 of 41 participants actually followed all label instructions (e.g. ‘wash hands after touching raw product’, ‘turn product half way through cooking’, ‘use food thermometer to check final temperature’). Other findings were:

- Nearly two-thirds (26 of 41 participants) were not observed washing hands correctly after touching raw product. Nearly all participants (37 of 41) had self reported they would wash hands after touching raw poultry in the survey.

⁵ No further description of ‘food labels’ is supplied – this data came from the participant discussions and observed preparation of family meals.

- Under observation, 12 of 41 participants used the same utensil to handle the raw and cooked product without washing the utensil in between (Note there was no label instruction to wash utensil in between).
- Under observation, no attempt was made to determine the doneness of the final product by over half (23 of 41) of the participants
- Just 5 of 41 participants used the approach recommended on the food label of using a food thermometer to test the final internal temperature. This was despite 30 of 41 participants self reporting they owned a food thermometer and 8 participants self reporting they used a food thermometer at home for products similar to those prepared.

However, the authors did not ask participants to explain why they behaved in the manner they did – and so there is no understanding about ‘how come’ there is such a disconnect between what the participants were observed doing and what they later self-reported in the survey (DeDonder et al., 2009).

A telephone interview of 1201 Australians aged 18 years and over (judged to be medium quality) found 50 percent of the participants read and complied with cooking instructions ‘always’ or ‘most of the time’ (43 percent males; 55 percent females). When asked if they complied with cooking instructions, 67 percent indicated they did (Food Safety Information Council, 2013).

A low quality survey of 874 Belgians attending a food fair identified that only half of the participants fully complied with the reheating instructions on the label of a cooked chilled food, 36 percent only partially followed these instructions and 13 percent did not follow them at all (Daelman et al., 2013). Consumers, who did not respect the ‘use by’ date, were also less likely to follow the reheating instructions.

A study (low quality) by Levis et al., (1996) included a mail survey of 166 women in Kansas, United States of America. Selected from the survey responses, a subset of 31 women were purposefully selected⁶ and split into four groups. At a test kitchen each group of women were observed preparing two foods (one familiar, one unfamiliar) using three different cooking instruction formats. The food preparation was followed up by discussion in focus groups afterwards about their preferred cooking instruction label formats. Consumers only used the directions for essential information when cooking the unfamiliar product (stuffing). Essential information was the required amount of water; how to combine the contents of the package correctly, heating directions, cooking times and stirring directions. Only a small amount of time was spent reading the directions during the cooking process. The authors concluded ‘cooking directions on a food package constitute only one of the many pieces of information conveyed to the consumer through the package, but may be important factor in achieving a desirable end product for unfamiliar products’.

For the familiar product (macaroni) few participants were observed to read the cooking instructions, and of those who did, only one actually followed the instructions. All others just made the macaroni as they would at home. In the focus groups afterwards participants

⁶ Participants were screened to be: (1) the primary food preparer in the household; (2) rated themselves as average cooks; (3) prepared at least three meals a week in the home; (4) prepared convenience foods as well as those made from scratch; and (5) used directions at least some of the time.

described they had little incentive to look at or follow the directions for a food they're familiar with cooking (Levis et al., 1996).

Regarding preferred cooking instruction formats in the study by Levis et al (1996) participants preferred step by step cooking instructions. Such instructions were 'easy to read, easy to follow and not as detailed' as the 'paragraph format' – the least liked format. Interestingly, the format of cooking instructions did not affect whether consumers followed the cooking instructions or not, only familiarity/ unfamiliarity of the product affected use of cooking instructions.

A final study (Kenny et al., 1999) used a case control approach to investigate the likely cause of a Salmonella Typhimurium outbreak in South Australia. The investigation identified 'flash fried' chicken nuggets (in contrast to fully cooked chicken nuggets) as the suspected source. Following interviews with the affected consumers, the investigation concluded the affected consumers did not perceive a significant difference between the flash fried vs fully cooked nuggets (similarly named, similarly packaged, same brand, same appearance). Subsequently, several affected households had used a microwave oven (instead of oven or frypan) to reheat (instead of cook) the nuggets, both behaviours that contravened the cooking instructions on the package (Kenny et al., 1999). While this study is from Australia, the study is over 15 years old.

5.2.3 Warning statements and advisory statements

Key points: Warning statements

- About one-quarter of New Zealand and Australian consumers (22 percent) say they use the warning statement and advisory statement.

A large high quality survey undertaken in New Zealand and Australia in 2003 asked what food label elements people looked for on a package. Four percent and three percent of consumers (respectively) indicated they looked for what the researchers categorised as warning statements or advisory statements. When asked directly (Have you seen any of these on a food label: 'a warning statement'; or 'an advisory statement'), 60 percent and 59 percent (respectively) indicated they had seen these. When asked if they used this information, 22 percent (for both warning statement and advisory statement) said they did (NFO Donovan Research, 2003). For those consumers who stated a warning statement or advisory statement was the label element they used most, they were asked how frequently they used that label element. The results are below:

	Only occasionally	Most of the time when I buy	Every time I buy that product	When I buy for the first time
Warning statement	18	32	40	11
Advisory statement	27	27	22	24

The authors described that if a consumer reported using warning statements, then 7 out of 10 of those consumers use the warning statement 'most of the time' or 'every time' they bought that product. Similar findings occurred with date marking, GMO declarations and allergen declarations; but not for advisory statements.

5.3 Date marking

Date marking is by far the most commonly studied food safety label element, and surveys are the most common study type.

There are many different ways to date mark a food product internationally. Examples include 'sell by', 'best before', and 'use by'. Generic terms such as 'expiry dates', 'open dates' and 'date marks' are also used in the literature.

Key points

- Date marking is the most commonly studied food safety label element. This likely relates to date marking being the most commonly looked for and used food label element.

5.3.1 'Use by' dates

Key points

- Very high proportions of New Zealand and Australian consumers (up to 92 percent) say they read and apply 'use by' dates.
- However, when asked what 'use by' means, just under half of New Zealand and Australians say a food is safe to eat after the 'use by' date has passed. The study authors commented this is concerning given 'use by' date markings are the most widely used food label element.
- Compared with 'sell by' and 'best if used by' dates, consumers say 'use by' dates are best at urging them to consume the food before the stated date. Of all the date marking options, 'use by' is the best understood by consumers.
- Depending on food type, there are differences in what proportion of the population say they would eat a food beyond its 'use by' date, but it is always a large proportion (45-74 percent depending on food type).
- People in older age brackets are more likely to eat a food beyond its 'use by' than people in younger age brackets.
- Some consumers trust 'use by' dates, and others see them as a cynical manipulation by food companies to make additional profits from wasted food. The certainty of date markings and its 'institutional origin' contributes to this feeling of distrust and rejection. Most consumers, even those who distrust 'use by' dates, see 'use by' dates as one piece of information to help decide if a food should be waste or not.
- Consumers use 'use by' (and to a lesser extent 'best before') date markings to achieve better value for money (via a product lasting longer) and to a lesser extent to maximise nutritional value.
- When trying to understand how food becomes waste (the same idea as 'use by') – there appears to be a 'boundary to cross' – when the food causes '*a feeling of disgust*'. This boundary exists at different points for different people. Cognitive thoughts (such as consideration of bacterial risk) do not typically feature.

A large high quality survey undertaken in New Zealand and Australia in 2003 asked about consumer understanding of 'use by' date. Just under half the participants (44%) responded 'use by' was a guide and it was safe to eat products after the date had passed. The study authors noted substantial concern at this finding, given 'date marks' were the most commonly identified and used food label element (NFO Donovan Research, 2003).

The Food Safety Information Council (2013) carried out a telephone interview of 1201 Australians aged 18 and over (sample weighted to Australian Census data). The survey was judged to be medium quality. Most respondents (87% total) said they '*always*' or '*most of the time*' read 'use by' dates (males 83 percent; females 89 percent). When asked if they complied with 'use by' dates, 90 percent indicated that they did.

In the large high quality face-to-face survey across the United Kingdom by GfK NOP (2009a) respondents were shown a list of dates typically seen on packaging and asked what date they thought was the best indicator of whether food was safe to eat. Half of the participants (49%) correctly identified the 'use by' date as the best indicator of whether food was safe to eat or not – and half did not. People in the highest social groups (AB – 59 percent)⁷ were the most likely to identify the 'use by' date as the best indicator of whether food was safe to eat or not compared with other social groups (C1 – 51 percent; C2 – 48 percent; DE – 40 percent).

GfK NOP (2009b) further analysed the above United Kingdom survey for those aged 65 years and over. Only two fifths of respondents (42%) aged 65+ correctly identified the 'use by' date as the best indicator of whether food is safe to eat or not. This was a significantly lower percentage than in people aged 25-44 (51%) and 45-64 (53%).

(GfK NOP, 2009a) asked each United Kingdom respondent what the maximum time after the 'use by' or 'best before' date was that they would eat certain foods. Over half of respondents (55%) said they would not cook and eat raw meat that was past its 'use by' date; cooked meat (47 percent); dairy (46 percent); eggs (42 percent) compared to around a quarter of respondents when asked about bread (27%) and breakfast cereals (26%). The authors concluded '*a significant part of the population are taking risks by eating food which is past its safety (use by) date*'.

TNS BMRB (2013) carried out a large survey of 3231 United Kingdom adults. Just under two-thirds (64%) of respondents reported that the 'use by' date was the best indicator of food safety; nearly three-quarters (72%) 'always' checked 'use by' before buying; and just over two-thirds (67%) stated they 'always' checked the 'use by' date before preparing or cooking food.

⁷ Upper and middle class backgrounds are denoted by A,B and C1 (about half the population of the United Kingdom), and those from more working class and deprived backgrounds (the other half of the population) are categorised as C2, D and E.

The TNS BMRB (2013) survey also asked three questions about 'use by' dates (participant responses are in brackets following the question):

1. Which date mark indicates whether food is safe to eat? (74 percent of participants correctly identified 'use by' date)
2. Do you check 'use by' dates when about to cook or prepare food? (92 percent of participants reported they did check)
3. What is the maximum time after the 'use by' date cooked meat would be eaten? (54% reported they would eat cooked meat beyond the 'use by' date).

As part of the detailed discussions undertaken by Lenhart et al., (2008), participants were asked what the 'use by' date meant. Compared with the other date markings ('sell by', best if used by' and 'expiration date') 'use by' 'conferred a greater sense of urgency' on participants to use the product by the date specified. Participants indicated this was related to health and safety concerns. For example, participants in most groups thought a product must be consumed or frozen by the 'use by' date or thrown away. However in contrast there were also participants in most groups that said they would probably eat the product after the 'use by' date if it still appeared good (Lenhart et al., 2008). Compared with other date marking options, 'use by' was the best understood by consumers.

A high quality study in England by Watson & Meah (2012) undertook a series of focus groups (about what people say) followed by ethnographic study in 17 homes (what they actually do). This included watching, talking and accompanying people (and a second person filming) while participants purchased (at the shops), gathered (locally), stored and used/prepared foods (at home). Photographs were taken of all aspects of the kitchen, fridge, pantry and technology available. Everyone in the house was included in the study allowing consideration of between-generation attitudes to food practices. A strength of the study design meant the authors could delve deeply into an understanding of food/waste and its relationship to use by dates.

Findings from Watson and Meah (2012) showed some participants appeared to have near non-existent food safety practices, e.g. drunken late night preparation of food, and *'I don't smell milk, but I do pour it out and I won't use it if it has bits in it'*. The authors note that even here, a boundary was crossed when food became unusable – described as *'a feeling of disgust'*. This was a common theme, but the boundary to disgust existed at different points for different people. For some it was when a food began to putrefy, and for others the boundary was crossed when a food was past its sell by date (Watson & Meah, 2012). Disgust was not thought about, it was felt. In comparison, cognitive thoughts such as consideration of bacterial risk (as per a scientific understanding of food safety) did not feature. The authors describe *'There is no stable universal line differentiating matter which is food from that which is waste. Rather, matter crosses that line, turning from food to waste, as a result of the convergence of diverse concerns and pressures, including of routine, anxieties, care, time and space'* (Watson & Meah, 2012).

Watson & Meah (2012) go on to describe *'Date labels can be understood as innovations to fill gaps of trust, responsibility and control in increasingly extended food production chains'*. Particularly older participants in the focus groups noted that date markings were not required in the past – *'you bought food from a local and ate it within a few days'*. Date markings were

considered a technical innovation required to overcome remote production, opaque supply chains and retailer practices, and food safety concerns. The authors concluded date marking redirected responsibility away from the retailer, and away from the sensory engagement of consumers – and placed responsibility in an institutional process of risk assessment. Several participants followed the use by dates closely, while others distrusted them and believed they were a cynical manipulation by companies to make additional profits (from wasted food). The certainty of the date marking combined with the unfamiliar (institutional) origins led many participants to reject use by dates. Even amongst those who distrusted use by dates, the dates were seen as one piece of information to inform a decision about whether something is still food, or is waste (Watson & Meah, 2012).

A low quality survey asked Spanish people in the street whether or not they abided by the 'use by' date of fresh cut leafy green salads. Ten percent said they did not abide by 'use by' dates (Carrasco, Perez-Rodriguez, Valero, Garcia-Gimeno, & Zurera, 2007).

A further low quality survey of 874 Belgians attending a food fair identified half (53 percent) fully abided by the 'use by' date as indicated on packaging of cooked chilled foods. The majority of the remaining participants (40 percent) said they would consume the product until three days past the 'use by' date; 2.5 percent of the consumers would still consume the product after more than three days past the 'use by' date and 5 percent did not consider the 'use by' date (Daelman et al., 2013).

A final low quality study by Hudson & Hartwell (2002) had two parts. The first was a single focus group in an older population (60-89 years) of English women who described 'use by' or 'best before' as the issue of greatest importance when reading food packaging information. Respondents reported that *'the print was often too small and difficult to read especially for those with tunnel vision and poor eyesight'*. A second component of the study was visiting 16 older people's homes to undertake additional interviews and observe what was actually in the fridge. It observed several participants bought items near to the end of the products date (either use by or best before) as they were cheaper. Although participants appreciated 'use by' dates related to food safety, several were observed to have kept food items for up to a month later (Hudson & Hartwell, 2002).

5.3.2 'Best before' or 'best if used by' dates

Key points: 'Best before' or 'best if used by' dates:

- Very high proportions of consumers (up to 89 percent) say they read and apply 'best before' or 'best if used by' dates.
- When asked what 'best before' means, a minority of consumers (one-quarter) believe food products must be eaten or thrown away if the 'best before' date is near. About half would eat food products after the 'best before' date has passed.
- Pregnant women are significantly more likely to check the 'best before' date while shopping and/or in the home, than non-pregnant women.
- People in the highest 'class groups' and 'younger people' were more likely to correctly say what 'best before' means than people in lower 'class groups' and those 'over 65 years old'.

The Food Safety Information Council (2013) carried out a telephone interview of 1201 Australians aged 18 and over (sample weighted to Australian Census). The survey was judged to be medium quality. It showed 79 percent of males surveyed '*always*' or '*most of the time*' read '*best before*' dates when they bought foods compared with 89 percent of females (84 percent overall). When asked if they complied with the 'best before' date, 87 percent indicated they did.

Two hundred and ninety one pregnant women and 200 non-pregnant women participated in a high quality survey in Slovenia about food safety knowledge and practices. The pregnant women were significantly more likely to check the 'best before' date when shopping and more likely to check the 'best before' date of food in their home refrigerator, than non-pregnant women (Jevsnik, Hoyer, & Raspor, 2008)

Almost half of respondents (45%) from the GfK NOP (2009a) survey said they would eat bread up to 3 days past its 'best before' date and over a quarter of respondents (28%) stated they would use breakfast cereal more than 7 days past its 'best before' date. However, about a quarter of respondents said they would not eat bread or cereals past their 'best before' dates, despite this being a guide to their quality rather than their safety, suggesting a significant amount of food may be being wasted unnecessarily (GfK NOP, 2009a).

Lenhart et al., (2008) showed 9 female focus groups a 'best if used by' date and asked what it meant. The label 'best if used by' was perceived by half of the groups to mean the 'quality, freshness, and taste of the product being at its best' if the product was consumed by the date listed on the package, and not related to the safety of the product. Still, there were participants in most groups that felt a product with this label must be eaten or thrown away by the date listed on the package or at least within a few days of the date.

GfK NOP (2009a) carried out a large high quality face-to-face survey across the United Kingdom. Of relevance to this literature review, people in the highest 'class groups' and 'younger people' were more likely to correctly report what 'best before' meant than people in lower 'class groups' and those 'over 65 years old'.

5.3.3 Use by and best before dates (where reported as one entity)

Key points

- Participants often confuse 'use by' and 'best before', leading to relaxed behaviours in the home about these date markings. Despite this, some New Zealand and Australian consumers understand to place greater importance on 'use by' dates with perishable foods.
- Awareness of date markings is high amongst New Zealand and Australian consumers in surveys. Consumers say date markings are one of the most frequently used label elements, are 'very clear', and are said to have one of the highest trust ratings by consumers.

Some surveys analysed the findings of 'use by' and 'best before' together, meaning it was not possible to separate out the findings into separate 'use by' or 'best before' findings (as in the previous sections).

Within the Ipsos MORI (2010) study 'best before' and 'use by' were frequently confused terms by consumers leading to relaxed behaviours around these dates once in the home. Most consumers used the term 'use by' and made no differentiation between this and 'best before'. One situation where usage of 'use by' was differentiated from 'best before' was with fresh/perishable food, where most participants placed more importance on the 'use by' date (Ipsos MORI, 2010).

Regardless of 'use by' or 'best before' (though more so for 'use by'), usage of these date markings by consumers was driven from a desire to:

1. maximise the food's value, both in terms of products lasting longer (therefore providing better value for money), and
2. to a lesser extent, maximising the food's nutritional quality (Ipsos MORI, 2010).

A large high quality survey undertaken in New Zealand and Australia in 2003 asked what food label elements people looked for on a package (NFO Donovan Research, 2003). Twenty five percent indicated they looked for the date marking⁸. When asked directly, 93 percent indicated they were aware of the date marking. When asked if they used the 'date mark', 85 percent said they did. When asked for what products they used them on, the responses were:

- Dairy products (85%)
- Oils, butter, margarine, dairy spreads and other fats (54%)
- Breads (51%).

For a single food type (the one answered first in the previous question), participants were asked how frequently they used the date marking. The response was: only occasionally (8 percent); most of the time when I buy (24 percent); every time I buy that product (67 percent) and; when I buy that product for the first time (1 percent). The authors described date marking as one of

⁸ The showcards demonstrated two images simultaneously, one with a 'use by' date and the other with a 'best before' date

those label elements used most regularly (along with warning statements, GMO declarations and allergen declarations). Regarding clarity of date marking to the consumer, 45 percent of participants said date marking was 'very clear'. The main reason participants said date marking was not clear was that 'they couldn't find it/ hidden'. Finally, of relevance to this literature review, date markings received the highest proportion of 'I trust what it says' responses (53%), followed by preparation and storage instructions (50%).

In a large United Kingdom survey, as age brackets increased the likelihood of the respondents in those age brackets stating they would eat raw meat, dairy and eggs past their 'best before' or 'use by' date significantly increased. Respondents aged 16-34 were the least likely to state that they would eat any of the different food types if they were past their 'best before' or 'use by' date (GfK NOP, 2009a).

Across all of the different food types⁹ United Kingdom respondents aged 65+ were less likely than younger respondents to say that they would never eat food which is past its use by date or best before date. The authors noted this was '*a concern as a significant proportion of the population aged 65+ are prepared to eat food which is past its use by date, a risk factor for food poisoning*' (GfK NOP, 2009b).

When New Zealand and Australian participants were asked unprompted what '*information they looked for when purchasing a new product for the first time*', 73 percent of Australian consumers and 71 percent of New Zealand consumers said '*the best before / use by date*' was information '*looked for*' (TNS Social Research, 2008).

A low quality online survey of 907 Belgians asked consumers if they were familiar with use by and/or best before labels, and if they knew the difference. The responses were captured as yes/no for all three questions. Eighty percent of participants indicated they were familiar with the terms and 70 percent indicated they knew the difference between the two terms. There was no attempt to determine what the respondents actually understood (Boxstael et al., 2014).

In the United Kingdom, the University of Sheffield (2012) produced an information flyer detailing findings of their focus group research. Because of a lack of methods in the flyer, the work is judged low quality by this review. In general, 'use by' and 'best before' dates were mistrusted by consumers because of the 'safety margin built in' and their ability to be consumed after the date has passed.

⁹ Raw meat (cooked and then eaten), cooked meat, dairy, eggs, bread, breakfast cereal.

5.3.4 Date marking

Key points

- When not directly asked, New Zealand and Australian consumers do not express concern about foods out of date or expired.
- Observation studies show that what consumers say is important to them when buying food regarding date markings (e.g. to help plan how much to buy), is not supported by what is in their cupboards at home.

'Date mark' is a generic term capturing all date labels: including 'use by', 'sell by', 'best if used by' and/or 'best before'. In the following studies, either 'open dates' or 'date marks' was the term used by the researchers, or the study did not further elaborate on the specific date marking and in any situations where this has occurred, the data has been categorised as 'date markings' for the purpose of this review.

One large consumer attitudes survey was undertaken in New Zealand and Australia in 2007, commissioned by FSANZ (TNS Social Research, 2008). It was an online survey of 800 New Zealanders and 1202 Australians. This survey was judged to be medium quality. In this survey less than one percent of participants expressed an unprompted concern about foods *'out of date/expired/supermarkets which still sell'*.

Lenhart et al., (2008) conducted 9 high quality focus groups with senior-aged women and women of child bearing age in the United States of America. The study noted a major theme in both age groups regarding practices for unopened ready to eat meat and poultry products. Respondents were shown and discussed several date markings ('sell by', 'best if used by', 'use by' and 'expiration date'). Participants relied on date markings (across all types) to know how long they could safely store ready to eat meat and poultry products, though the date mark meaning was misconceived by several participants in several groups. Participants also tended to freeze unopened ready to eat meat and poultry products in order to could keep them beyond the date listed on the label (Lenhart et al., 2008).

A United Kingdom study with an excellent design for understanding *actual* consumer behaviour in the home was carried out by Ipsos Mori (2010). This study found that what consumers *said* was important to them when buying food was not supported by what was in their cupboards at home. For example, date markings were said to be reassuring of the foods shelf life and helped to plan how much food to buy while shopping. However at home, there was little evidence of people planning meals around date markings on foods.

In a low quality web based survey of 2428 United States of America individuals, checking of dates varied depending on the food product. For example, about 60% of respondents checked dates 'all' or 'most of the time' for smoked seafood, bagged salads; but less than half of respondents checked dates 'all' or 'most of the time' for cooked crustaceans and pre-cut fresh vegetables. About 20% of respondents 'rarely' or 'never' check dates on most ready to eat foods (Kosa et al., 2006).

A (low quality) United Kingdom study found that at home, consumers used taste, smell and appearance when using products beyond date. Also, consumers said they were more likely to use date markings when preparing foods for others than themselves. Finally at home, consumers used date markings to sort frozen food or food in cupboards if foods had been stored for a long time (University of Sheffield, 2012). When shopping for foods the study found United Kingdom consumers used date markings to buy the freshest foods, and this was particularly important for those who shopped infrequently (University of Sheffield, 2012).

5.3.5 Expiry dates

Expiry dates is a colloquial generalist term used by consumers, writers and some researchers – and can relate to either ‘sell by’, ‘use by’ or ‘best before’. Often it is not stated which of the actual dates is meant.

From a convenience sample of 127 meat shoppers in Belgium, the importance attached to ‘expiry dates’ on meat products was rated. Expiry date was rated most ‘important’ out of 10 possible meat label items. The shoppers also claimed it was the most ‘used’ information (Gellynck, Verbeke, & Vermeire, 2006). This study was judged low quality.

A further low quality survey by (Cody, Gravani, Smith Edge, Dooher, & White, 2012) reported use of expiration dates was higher by older, female, and white or “other” racial groups ($p < 0.001$) than other groups. Overall, 68 percent reported ‘*looking for expiration dates when purchasing or using foods*’.

5.3.6 ‘Sell by’ dates

Key points

- Most consumers in the United States of America understand a ‘sell by’ date relates to the date by which a food should be sold by a retail store. However they do not understand how to use a ‘sell by’ date when the product is in the home and this is not surprising as that is not the purpose of ‘sell by’.

‘Sell by’ dates are a stock control tool for the store (in the United States of America). The ‘sell by’ date tells the store how long to display the product for sale, beyond which the product should be removed from sale. For consumers, the only recommendation available is to buy products before the sell by date expires. This is not particularly helpful once the consumer has the product at home. If a sell by date is present, there may be no other date marking on the product packaging to guide consumer use in the home.

Lenhart et al., (2008) showed 9 female focus groups a ‘sell by’ label and asked what it meant. There was consensus the store had to sell the product by that date or pull it off the shelf. Interpretation of what this meant for the consumer varied greatly. The most frequently mentioned response across younger and senior women was that they needed to either freeze or eat the product “right away” if the sell by date was getting near; they would not buy the product if the sell by date was close; and, if the product was already in their refrigerator at home, they

would try to use the product by that date. Alternately, an opposing major theme mentioned in groups was that the product should last for a few days to a week past the sell by date listed on the package (Lenhart et al., 2008).

In the United States of America, Kim et al. (1997) carried out a medium quality survey of 200 shoppers and asked how long after the 'sell by' date a perishable product would be usable. The mean across all foods¹⁰ was 6.5 days, with the longest of 7 days predicted for eggs and cheese and shortest for packaged lettuce salads of 2 days.

While 'sell by' dates were phased out in the United Kingdom in the early 1990s, consumers almost universally still referred to 'best before' and 'use by' dates as 'sell by' (University of Sheffield, 2012).

5.3.7 Most useful date marking for consumers

In a low quality web based survey of 2428 United States of America individuals, the most useful date to help consumers was one that provided information on the last date the food could be eaten (49% of respondents). A further 22% thought a date that 'tells a consumer the best date to discard a product' was most useful. Only a minority thought 'sell by' or 'best if used by' dates were useful (4% for each) (Kosa et al., 2006).

¹⁰ Milk, fresh meat, cured meat, eggs, cheese, packaged lettuce salads, bakery items, fresh pasta, cereals, potato crisps, ice cream, canned foods, frozen pizza.

6. Summary

The summary is set out to match the original 11 research questions. On undertaking the literature review, it became clear there was some overlap amongst the research questions and they are collapsed below for ease of reading.

Research Question 1. What theories or conceptual frameworks underpin the use of food safety label elements by consumers?

There is a small amount of research about 'food safety label elements' within the broader field of food labels. However no papers were identified in this review which focused specifically on the theoretical nature of consumer reactions to food safety label elements.

Research Question 4. Do consumers understand food safety label elements?

Research Question 5. Is there a current problem with consumer understanding, attitudes or behaviours with respect to the food safety label elements?

Research Question 7. How are food safety label elements used by consumers in purchase, preparation, consumption, and storage decisions?

Research Question 8. How do food safety label elements affect consumer purchase, preparation, consumption, and storage decisions?

In a high quality study, under observation, participants used taste, smell and appearance when deciding whether to use products in the home, in combination with date markings.

Storage instructions

Across several surveys, about half of consumers say they regularly look for and use 'storage instructions'. Also about half of people (or more, depending on the food type) say they keep food products beyond recommended package opening times. Furthermore, high quality observation data shows when shopping, consumers seldom refer to storage instructions.

While not storage instructions per se, in a high quality study which observed and talked with consumers, few consumers understood how freezing foods for storage related to the products 'best before' or 'use by' dates (expected to be 'general knowledge'). Furthermore, few consumers read or applied 'use within three days after opening' or other storage instructions on food labels, and most consumers had products stored in pantries and fridges beyond date markings.

Regarding 'use by' dates:

When asked what 'use by' means, about half of people (in a high quality survey) said it was the best indicator of whether a food was safe to eat – and half did not.

'Best before' or 'best if used by' dates

Several high quality surveys reported very high proportions of consumers (up to 89 percent) who said they read and applied 'best before' or 'best if used by' dates. When asked what 'best before' meant, a minority of participants (about one-quarter) in a high quality survey believed food products must be eaten or frozen right away if the 'best before' date was near. About half understood the product would be OK to eat after the 'best before' date had passed.

'Use by' dates

Several high quality surveys reported very high proportions of consumers (up to 92 percent) who said they read and applied 'use by' dates. When asked what 'use by' meant, about half of the participants in high quality focus groups said it is the best indicator of whether a food was safe to eat – and half did not. This is supported by a high quality survey which indicated large proportions of the population said they would eat a food beyond its 'use by' date (45-74 percent depending on food type).

High quality observation studies have shown participants often confuse 'use by' and 'best before', leading to relaxed behaviours in the home about these date marks. Despite this, some consumers understand to place greater importance on 'use by' dates with perishable foods.

Awareness of date marks is high amongst consumers in surveys (high quality). Consumers say date marks are one of the most frequently used label elements, are 'very clear', and are said to have one of the highest trust ratings by consumers. Consumers use date marks on perishable products. However, when studied by direct observation it becomes clear that what consumers say is important to them when buying food, is not supported by what is in their cupboards at home. Consumers often still have (and use) foods beyond their 'use by' dates, and have purchased foods beyond the 'best before' date to get a bargain.

'Sell by' dates

Based on a medium quality survey and high quality focus groups, it is clear most USA consumers know the 'sell by' date refers to the date by which a food should be sold by a retail store. However they do not understand how to use a 'sell by' date once the product is home.

Directions for use (cooking instructions)

In multiple surveys, most consumers say they regularly look for and use 'cooking instructions' information, however high quality observation data shows when shopping, consumers seldom refer to cooking instructions.

Data from a high quality case control study showed cooking instructions were not followed correctly (for cooking flash fried chicken nuggets) in an outbreak of *Salmonella Typhimurium* in South Australia 15 years ago.

Research Question 3. Under what conditions do consumers currently seek out the food safety label elements?

Research Question 2. What background factors moderate consumers' motivation or ability to seek out, understand, and use food safety label elements?

Storage instructions:

High quality surveys and focus groups confirm older people (greater than 65 years) are much more likely than younger people to 'not throw anything away'. Older people had also noticed a vast change in buying patterns, from buying for a few days ahead (negating the need for storage and date marking) to doing weekly, fortnightly or monthly shops. The researchers concluded a focus on the social causes of food safety-related harm would allow for the potential of alternative interventions - such as ensuring access to regular food delivery services, rather than typical date marking interventions that put the onus onto the consumer.

Directions for use (preparation instructions and cooking instructions)

High quality observation studies in test kitchens and in people's homes show people use preparation guides on new and unfamiliar food products, not on regularly prepared products.

'Best before' or 'best if used by' dates

In a high quality survey, pregnant women said they were significantly more likely to check the 'best before date' while shopping and/or in the home, than non-pregnant women.

'Use by' dates:

In high quality surveys, people in the highest 'class groups' and 'younger people' were more likely to correctly say what 'use by' meant than people in lower 'class groups' and those 'over 65 years old'. Similarly, as age increased, people were more likely to eat a food beyond its 'use by' date.

In high quality focus groups, consumers were able to shed light on what guides food becoming unusable in the home. It was a 'boundary to cross' – when the food caused '*a feeling of disgust*'. This boundary existed at different points for different people. Cognitive thoughts (such as consideration of bacterial risk) do not feature. In the same focus groups, a major theme was some users trusted 'use by' dates, and others saw them as a cynical manipulation by food companies to make additional profits from wasted food. The certainty of date markings and its 'institutional origin' contributed to this feeling of distrust and rejection. Most consumers, even those who distrust 'use by' dates, see 'use by' dates as one piece of information to help decide if a food should be waste or not.

For those consumers who do use date markings, high quality focus groups showed the rationale for their use. It was to achieve better value for money (via a product lasting longer) and to a lesser extent to maximise nutritional value.

Research Question 9. Do consumers give any particular element markedly greater or lesser priority if multiple elements are present?

Research Question 10. Are there any situations in which some types of food safety label elements are unnoticed or ignored?

A high quality study which observed and talked to people clearly demonstrated that all aspects of food labelling are important to 'someone' some of the time, but no aspects are equally important to everyone. Of all the possible food safety label elements, consumers were identified only to engage with the date marking - when it is on the front of the product (i.e. for many fresh foods). Furthermore, a small proportion of non-label readers also were identified, where price overshadowed all other matters.

In focus groups, when participants were shown mock-ups of packaging with a warning advisory on the back of the pack (about when it is was advisable to feed the food product to infants), most people deferred to the marketing information on the front of the pack 'from around 6 months' to guide their decision about when to use the product.

Research Question 6. Do consumers have preferences for how food safety label elements are expressed, and if so what are they (excluding preferences relating to font options such as type, point, and emphasis)?

Research Question 11. What wording options for each of the food safety label elements have been examined in the literature, and what does the literature reveal about the relative advantages and disadvantages of each option?

No literature was identified which answered these questions.

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Appendix 1 – Search strategy

The review required two distinct search strategies: one for empirical evidence regarding consumer’s use and preferences, and options; and one for theory and context regarding food safety label elements. We have also received materials from FSANZ including material from their Evaluation Report Series and website. FSANZ also contacted their international liaison grouping of similar regulatory agencies and asked for their input into this review.

We worked with a University of Otago librarian (Mary Neuman) to confirm our strategy.

Developing the two search strategies

In order to reduce bias in the review process, the search process will be as transparent and thorough as possible and documented in a way that enables it to be evaluated or reproduced.

	Theory and context search	Consumer use and preferences; and options analysis search
Databases searched	Ovid – Food Science and Technology Abstracts 1969 - week 2 February 2014. Scopus 1994 – 17 February 2014. Ovid – Medline 1996 – 17 February 2014)	
Websites searched	Food Standards Australia New Zealand; Australian Institute of Health and Welfare; Australian Bureau of Statistics Department of Health (Australia); Ministry of Health (NZ); Food Safety Information Council (Australia) Food Safety webpages of the Ministry for Primary Industries website (NZ) Cancer Society (NZ and Australia) Heart Foundation (NZ And Australia) Codex Alimentarius. World Trade Organization US FDA Department of Health (UK) Food Standards Agency (UK) European Food Safety Authority Health Canada Institute of Food Technologists World Health Organization University of Sheffield: Consumer culture in the age of anxiety.	
Key search terms and sequence	‘Label*’ ‘Food label*’ ‘Food safety label*’ ‘Food label*’ + ‘safe*’	See following search term example from Ovid Medline for terms used.
Secondary/related search terms to be added/replace key	Theory framework	

search terms	background context consumer motivation knowledge risk product	
Inclusion/ Exclusion criteria	<p>Including:</p> <ul style="list-style-type: none"> • theoretical underpinnings • prevalence/monitoring data • Theory - all countries. • Context - New Zealand and Australia only <p>No date restriction English language only.</p>	<p>Date inclusion of 1994 onwards.</p> <p>Developing economies excluded.</p> <p>The role of food labelling in addressing the risks of chronic diet-related disease is excluded.</p> <p>Food safety topics excluded: pesticides, genetic modification, heavy metal contamination, traceability, allergens, alcoholic beverages, irradiation</p> <p>Settings excluded: laboratory tests of label instructions (consumers not present), catering, shelf labelling, pamphlets, websites, restaurants, meals on wheels, quality assurance labels, branding</p> <p>English language only.</p>
FSANZ asked for material	Yes	Yes
Reference or footnote tracking (looking back at studies referenced in articles found)	Yes	Yes
Citation tracking (looking forward at studies that have subsequently cited articles found, using a citation database; and suggested similar articles).	Not available on websites	Yes, when the database allows such tracking to occur

Example of search terms: OvidMedline

#	Search Statement	Results
1	exp LABELLING/	8288
2	exp FOOD SAFETY/	116430
3	1 and 2	327
4	food safety label* element*.tw.	0
5	food safety label*.tw.	14
6	food safety element*.tw.	0
7	(warning adj2 statement*).mp. [mp=title, abstract, heading words]	12
8	(advisory adj2 statement*).mp. [mp=title, abstract, heading words]	14
9	(date adj2 mark*).mp. [mp=title, abstract, heading words]	134
10	"use by date".mp. [mp=title, abstract, heading words]	66
11	best before.mp. [mp=title, abstract, heading words]	89
12	(direction* adj2 us*).mp. [mp=title, abstract, heading words]	68
13	(direction* adj2 stor*).mp. [mp=title, abstract, heading words]	11
14	(cook* adj2 instruct*).mp. [mp=title, abstract, heading words]	45
15	advisory declaration*.mp. [mp=title, abstract, heading words]	0
16	mandatory warning statement.mp. [mp=title, abstract, heading words]	0
17	baked on.mp. [mp=title, abstract, heading words]	52
18	specific storage conditions.mp. [mp=title, abstract, heading words]	3
19	(direction* adj2 prepar*).mp. [mp=title, abstract, heading words]	10
20	(direction* adj2 refrigerat*).mp. [mp=title, abstract, heading words]	1
21	(instruct* adj2 refrigerat*).mp. [mp=title, abstract, heading words]	0
22	(instruct* adj2 prepar*).mp. [mp=title, abstract, heading words]	45
23	(cook* adj2 direct*).mp. [mp=title, abstract, heading words]	84
24	or/4-23	625
25	exp CONSUMER PERCEPTION/	1451
26	exp CONSUMER RESPONSE/	21297
27	exp CONSUMER ATTITUDES/	2326
28	exp CONSUMER AWARENESS/	732
29	exp CONSUMER ACCEPTANCE/	885
30	exp CONSUMER CHOICE/	741
31	exp CONSUMER BEHAVIOUR/	7585

32	exp CONSUMER CONCERNS/	314
33	exp CONSUMER PREFERENCE/	1759
34	exp CONSUMER OPINIONS/	161
35	exp CONSUMER INFORMATION/ or exp CONSUMER RESEARCH/ or exp CONSUMER EDUCATION/ or exp CONSUMER OPINIONS/ or exp CONSUMER PROTECTION/	2589
36	consumer understanding.tw.	118
37	consumer us*.tw.	132
38	consumer purchas*.tw.	272
39	or/25-38	22852
40	3 and 39	52
41	24 and 39	55
42	40 or 41	98

Appendix 2 – Qualitative research: Quality assessment tool

From Health Evidence Bulletin Wales (Health Evidence Bulletin Wales, 2004)

<p>Appraisal Question (apply each question to the whole study to reach an overall conclusion i.e. aims, sampling, data collection, data analysis, interpretations)</p>
<p><i>Does the research, as reported, illuminate the subjective meaning, actions, and context of those being researched?</i></p> <p>i.e. is it ensured through design and analysis that emphasis is given to the interpretations of those being researched rather than the researcher's or professional's viewpoint?</p>
<p><i>Are subjective perceptions and experiences treated as knowledge in their own right?</i></p> <p>i.e. does the study treat the data collected directly from the participants, representing their viewpoint, as the basic data for analysis?</p>
<p><i>Is there evidence of the adaption and responsiveness of the research design to the circumstances and issues of real-life social settings met during the course of the study?</i></p> <p>i.e. is the process of sampling, data collection, data analysis and interpretation iterative? Is there evidence of adaption and redesign as the study has progressed?</p>
<p><i>Does the sample produce the type of knowledge necessary to understand the structures and processes within which the individuals or situations are located?</i></p> <p>i.e. is sampling appropriate for the aims, objectives, methods and conclusions reached?</p>
<p><i>Is the description provided detailed enough to allow the researcher or reader to interpret the meaning and context of what is being researched?</i></p> <p>i.e. is a rich picture produced, providing the context of an experience and the intentions and meanings that feed into it, rather than simply a set of facts?</p>
<p><i>Are any different sources of knowledge about the same issue compared and contrasted and how is this done?</i></p> <p>i.e. are different methods used to answer the research question and are these examined not only for similarities but for providing different facets of the reality being investigated?</p>
<p><i>Has the researcher rendered transparent the processes by which data have been collected, analyzed, and presented?</i></p> <p>i.e. is the whole process clear to the reader?</p>
<p><i>Has the researcher made clear their own possible influence on the data?</i></p> <p>i.e. has the researcher stated their own background / experience and ontological / epistemological stance?</p>
<p><i>Is it clear how the research moves from a description of the data, through quotation or examples, to an analysis and interpretation of the meaning and significance of it?</i></p> <p>i.e. what did the researcher do to reach their conclusions and does this make sense from the original data?</p>
<p><i>Are claims being made for the generalizability of the findings to either other bodies of knowledge or to other populations or groups and if so what are these claims?</i></p> <p>i.e. is it made clear which settings the findings can be applied to and does this seem to fit?</p>
<p><i>Is there any other aspect of the study that may affect the quality e.g. conflict of interest?</i></p>

Appendix 3: Summary of studies

Summary of experimental, direct observation and case control studies

Author	Study characteristics (design; aims)	Participant characteristics	Method and/or intervention (if any)	Relevant outcome measures	Quality rating
DeDonder et al., 2009. United States of America	To identify if there is a difference between consumer intention and actual behaviour regarding preparation of frozen chicken products.	Two groups of participants were studied: 20 adolescents 12-14 years of age, and 21 adults (mean age of 40 years) who prepare food in the home at least twice per week. Two thirds of participants female.	In a model kitchen, three cameras recorded the preparation of the products. Participants were instructed to prepare the meal as they would at home. Observed practices were compared to label instructions. After cooking, participants filled in a 24-question self-report survey about their food practice intentions.	Self-report: Percent saying they noticed label instructions during preparation; percent saying the instructions influenced how they prepared the products. Observation: Number of users observed following all label instructions (e.g. wash hands after touching raw product, turn product half way through cooking, use food thermometer to check final temperature).	Medium (not in their actual home, limited sample, not eye tracking)
Ipsos MORI, 2010. Wales, Scotland, Ireland and England.	<i>Aim:</i> To provide evidence of what information people <i>actually</i> look at when shopping, as opposed to what they say they look at. <i>Design:</i> Observation and interviews.	Even split of pre-family, family and post-family participants (aged 18-60 years). Even split of urban and rural participants. Mix of social grades across the sample.	15 non-eye tracked accompanied shops and 36 eye tracked shopping trips. All in main retail supermarkets. Follow up interviews. 15 filmed meals at home. 20 eye tracked tasked shops in the Retail Lab with field of vision glasses and 6 follow up eye tracked tasked purchases. Follow up interviews. Semiotic and packaging analysis.	Observation: Proportion 'looking directly at' food labels while shopping and in the home. Stocktake: of what is actually in home pantry. Interviews: Rationale for 'looking directly at' food label. Semiotic analysis: How consumers engage with images and text on food labels.	High

Author	Study characteristics (design; aims)	Participant characteristics	Method and/or intervention (if any)	Relevant outcome measures	Quality rating
Kenny et al, 1999. Australia.	To identify the source of a Salmonella outbreak	Ten cases of salmonella infection were notified in South Australia over a four week period. Nine cases and 27 controls matched for age, sex and postcode were included in the study.	A five day food history and two-week frequency questionnaire was undertaken on all participants. Packaging of eaten foods was retrieved where possible. Infection confirmed by laboratory diagnosis.	Food items statistically associated with increased risk of illness. Odds ratio of eating chicken nuggets and risk of illness. Salmonella detected in chicken nugget packaging.	High
Levis, Chambers IV, Chambers, & Hollingsworth, 1996. United States of America.	Quantitative survey; preparation test; and focus groups. To determine if consumers use preparation directions, and/or prefer one format for directions more than other formats.	Quantitative survey of food preparers: 166 women (participants on a University-organised survey panel) aged 18-62 years.	Quantitative survey: Mail-out survey to pre-set panel members (75% response rate). Test kitchen preparation: Four groups of women (7-8 per group) were selected from the same survey panel. 7-8 consumers prepared the meals in a test kitchen while being 'observed' by a 'helper'. The 'helper' filled out a form describing whether participants were observed carrying out the preparation steps: Focus groups: Discussions followed the test kitchen preparation.	Quantitative survey: Frequency of meal preparation. Types of meals prepared. Level of cooking skill. Types of food prepared. Common sources of recipes. How directions are read/followed. Test kitchen preparation: Did they appear to read the instructions? Did they measure the water? Did they measure the salt? Did they put a lid on the pot? Did they set the timer? Did they taste for doneness? Did they drain and rinse under hot water?	Low (survey from a likely biased panel); Preparation: helper had 7-8 people to watch in real time. Focus groups self-selected from the same panel.

Author	Study characteristics (design; aims)	Participant characteristics	Method and/or intervention (if any)	Relevant outcome measures	Quality rating
				<p>Focus groups: Did participants follow the directions? Which if any of the three formats of directions are preferred, and why?</p>	
(Watson & Meah, 2012). England.	To understand all the processes through which food arrived in their cupboards and fridges, as well as what happened to it in the home.	<p>Focus groups: 37 participants in 7 focus groups (13 men). The groups were: young male house-sharers aged 23–30; older people aged 63–89 living in a former mining village; Indian and Somali women with school-aged children; low-income mothers aged 27–38; married or cohabiting couples aged 29–41; people aged 39–79 living in rural Derbyshire.</p> <p>Home study: 17 homes with between 2-4 generations in each house. 23</p>	<p>Focus groups: segmented by age and household type.</p> <p>Home study: Interviews were undertaken first to build rapport before ‘quite literally poking around in peoples cupboards and fridges’; go along shopping trips, and filmed/photographed home environment and cooking action.</p>	<p>Self report: How, where and why do people get their food, how it is used and what makes it turn into waste.</p> <p>Observation: What is in people’s fridges and pantries, how/why/when/where do they store, prepare, cook, eat and throw away foods.</p>	High

Author	Study characteristics (design; aims)	Participant characteristics	Method and/or intervention (if any)	Relevant outcome measures	Quality rating
		<p>participants in total were interviewed. Vast majority were white middle class British with one Pakistani family.</p>			

Summary of survey and focus group studies

Author and country	Study characteristics (design; aims)	Sample frame and participant characteristics	Relevant questions asked	Quality rating
(Boxstael et al., 2014). Belgium.	Online survey To obtain a view on the attitude and understanding of Belgian consumers about label dates.	907 Belgians aged 18-92 years (average of 42 years) and 50 % female. Survey posted on several websites.	Do you know the labels use by and best before' (answering categories: (a) yes, both, (b) only use by, (c) only best before, (d) neither of the two) Do you know the difference between the shelf life labels use by and best before' (answering categories : (a) yes, (b) no),	Low (poor questionnaire design, poor sample design)
(Carrasco et al., 2007). Spain.	Face: face interview. To identify the consumption patterns of fresh cut leafy green vegetables.	107 participants randomly selected from the street.	Do you respect the use by date of fresh cut leafy green salads (yes, no)	Low (poor questionnaire design, poor sample design)
(Cody et al., 2012). United States of America.	Online survey. To identify consumer attitudes to food safety and labelling practices.	A multi year survey of between 1000-1064 participants each year for 5 years. Sample selected via an online panel administered by a research company. Post-weighted to the USA census. 55 % female and 95% white and non-Hispanic.	What label components do you look for when deciding to purchase or eat a food?	Low (poor question construction, and sample via online panel).
(Daelman et al., 2013).	Self-completed survey.	874 participants of a Belgian Food Fair using Survey Monkey under supervision (female	How strict do you respect the use by date of a cooked chilled food? (four	Low (poor sample design)

Author and country	Study characteristics (design; aims)	Sample frame and participant characteristics	Relevant questions asked	Quality rating
Belgium.	To understand consumer attitudes to cooked chilled foods.	57%, over-representation of younger people (40%).	point scale) How strictly do you follow the reheating instructions of a cooked chilled food? (3 point scale)	
(Food Safety Information Council, 2013). Australia.	Telephone survey No stated aim	National sample of 1201 Australians aged 18 years and over. Random sample of household telephone numbers with a two stage design. Sample was post- weighted to Australian census.	Four point scale: reading best before; use by; cooking instructions and storage instruction labels. Four point scale: complying with best before; use by; cooking instructions and storage instruction labels	Medium (no data on response rate).
(Gellynck et al., 2006). Belgium	Survey. To identify the most important and used label components on a meat label.	Convenience sample of 127 Belgium shoppers (50% males; age range 16-79 years, mean age 38 years; 57% higher educated).	'Use' and 'importance' of 10 meat label information cues on five-point interval scales.	Low – convenience sample.
(GfK NOP, 2009a). England, Scotland, Northern Ireland and Wales.	Face-face computer-assisted personal interview. To understand public attitudes to food safety	3219 interviews in their homes with oversampling in Scotland, Wales and Northern Ireland. Random selection of participants with a 3-stage design. Post-weighted data to be representative of the UK population for social class, gender and age.	Questionnaire was piloted and field tested. Using a showcard with 'sell by; use by; and best before' the participant is asked which is the best indicator of whether food is safe to eat? What is the maximum time after the use by date you would eat raw meat, cooked meat and dairy; after the best before you would eat eggs; bread and	High

Author and country	Study characteristics (design; aims)	Sample frame and participant characteristics	Relevant questions asked	Quality rating
			breakfast cereal (7 point scale).	
(GfK NOP, 2009b). As above. Further analysis for those 65 years and over.				
(Jevsnik et al., 2008). Slovenia	Self-completed survey. To understand food safety knowledge and practices of pregnant Slovenian women.	291 pregnant women attending ante-natal classes. 200 non pregnant women from 10 randomly selected parent classes. Questionnaires were piloted with 30 participants.	Use of best before when purchasing foods and use of best before for refrigerated foods (5 point scale)	High (good sample size, good questionnaire development)
(Hudson & Hartwell, 2002)	Focus group To understand areas of concern about food safety. Followed by observational study in home.	One focus group of older (aged 70-85 years) women from Bournemouth England. Convenience sample from an older-age community group. Separate sample of 16 older women (60-89 years) were interviewed in their home and fridge contents observed.	Focus group and interviews: What are issues of importance when reading food packaging information? Observation: Actual date ranges of foods in fridges.	Low (small convenience samples)
(Kosa et al., 2006)	Web panel survey. To understand consumer knowledge and use of dates on product packaging.	2058 individuals aged 18 years and over from an existing web panel (the existing web panel was originally designed to reflect the US population).	Do you check open dates before purchasing foods? Do you use open dates before preparing and serving ready to eat foods? What is the most important factor when deciding whether to eat a refrigerated food product? What does sell by, use by and best before mean?	Low (web panel sample selection is likely to have bias)

Author and country	Study characteristics (design; aims)	Sample frame and participant characteristics	Relevant questions asked	Quality rating
			What is the most useful date label?	
(Lenhart et al., 2008). United States of America.	Focus groups. To understand acceptability and usefulness of common date labels on ready to eat products.	11 focus groups using a convenience sample of women of childbearing age (6 groups, aged 19-45 years, 71% Caucasian, 55% college graduates) and senior aged women (5 groups, 93% were 65 years or older, 88% Caucasian, 23% college graduates). Recruitment was via announcements, flyers and sign-up sheets at multiple facilities. Substantial screening ensured the correct age, language ability and requirement to be a purchaser of ready to eat products. Moderators script was piloted.	How do you typically store ready to eat products? How long do you keep ready to eat packages once they are opened? What do these labels mean: 'use by', 'sell by', 'best if used by'?	High.
(McIlveen & Semple, 2002). Northern Ireland.	Structured questionnaire followed by focus groups. No aim stated.	103 questionnaire responses (83 female) (28 professionals, 12 skilled, 13 retired, 10 students, 25 others). 3 focus groups (10 members – 3 male; all retired); (10 females – university students to middle aged mothers); (6 males aged 25-31 years).	Questionnaire not described. Focus group not described.	Low (No study aim, unclear how sample was generated for questionnaire or focus groups; method poorly described)
(Milne, 2011). England.	Focus groups. How date labels and food safety information/ behaviours relate to food safety practices.	Six focus groups of people aged 60-90 years recruited through existing social networks via trusted 'gatekeeper'. The groups were from a church group; residents group; tenants association; allotment holders; coffee morning; and church group. Urban and rural mix achieved.	Concerns about food and food storage practices.	High

Author and country	Study characteristics (design; aims)	Sample frame and participant characteristics	Relevant questions asked	Quality rating
(NFO Donovan Research, 2003). Australia and New Zealand	To provide baseline indicators of consumer attitudes towards labelling, awareness and use of different labelling elements, beliefs about the clarity and trustworthiness of labels, and which label elements consumers find difficult to interpret.	1940 door-to-door interviews in metropolitan cities in both New Zealand and Australia. The proportions of people in each age group matched very closely to that of census data. In Australia (sample 17%; population 10%) and New Zealand (sample 19%; population 7%) the sample contained a significantly greater proportion of people who have a degree than in the national population. 67 percent of the sample were female, reflecting the sample of 'household shopper'.	Unprompted: What information do you look for on the label or package? Prompted recognition: Photo card with core and non core elements. Here are a range of things found on food labels. "Which of these do you recognise?" Which of these do you look for/use" For each yes: Why? How do you/would you use? How easy/difficult to use? How useful? Issues of concern /problems?	High
(TNS BMRB, 2013) England, Scotland, Wales and Northern Ireland	Interviewer administered survey. To collect quantitative information on the UK public's attitudes, beliefs and reported behaviour towards food issues	3231 adults aged 16 years and over. A stratified clustered random probability sample of private households in the UK. Oversampling of Scotland and Northern Ireland. Post-weighted to census data. 54 percent response rate. Questionnaire was tested via cognitive testing; omnibus testing; and a pilot survey.	What is the best indicator of food safety? How often do you use 'use by' before buying? (7 point scale) How often do you check the use 'by date' before preparing or cooking food? (7 point scale) Which date label indicates whether food is safe to eat (showcard) Do you check use by dates when about to cook or prepare food (7 point scale) What is the maximum time after the	High

Author and country	Study characteristics (design; aims)	Sample frame and participant characteristics	Relevant questions asked	Quality rating
			<p>use by date cooked meat would be eaten (7 point scale)</p> <p>What is the maximum number of days to store an opened packet of sliced cooked meats, meat/fish/seafood pate, fresh dip, smoked fish, soft or cream cheese (7 point scale)</p> <p>What, if anything, as a result of having had food poisoning did you do differently (showcard)?</p> <p>What would be the maximum number of days you would keep various food items in the fridge after opening them (7 point scale)</p>	
<p>TNS Social Research, 2008.</p> <p>Australia and New Zealand</p>	<p>To identify the current views of consumers about confidence in the food supply. This included behaviour, attitudes and confidence in the labelling of food products.</p>	<p>800 New Zealanders and 1202 Australians aged 14 years and over from an existing online panel. The sample was weighted to match census data for each country, with 50% females (Australia) and 52% females (NZ). Geographic location, educational attainment, employment and income were displayed for participants – but not analysed for.</p> <p>A six section 20 minute self-complete online questionnaire was developed via focus groups and literature review. A pilot survey was undertaken to test the questionnaire.</p>	<p>Open ended question about concerns with foods (proportion responding)</p> <p>Proportion who expressed concern with a food issue and the mean level of concern; Proportion who refer to food labelling when purchasing product, and what information they look for; Proportion who refer to food labelling when purchasing a product for the first time, and what information they look for (7-point scales).</p>	<p>Medium (online panel gives no non-response data)</p>
<p>(University of Sheffield, 2012).</p>	<p>Focus groups.</p> <p>To explore contemporary</p>	<p>Method is not described beyond <i>‘the research draws on focus groups with consumers, interviews with the food industry and food</i></p>	<p>Question frames are not described.</p>	<p>Low (no method described).</p>

Author and country	Study characteristics (design; aims)	Sample frame and participant characteristics	Relevant questions asked	Quality rating
Country not stated.	concerns about date labelling.	<i>regulators, and documentary research on the history of date labels'.</i>		