



Consumers and allergen labelling:

A literature review of consumer response to allergen declarations and precautionary allergen labelling.

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Executive Summary and Key Findings

Background

This report reviews and summarises the existing literature on consumer knowledge, attitudes and behaviours relating to allergen declarations and precautionary allergen or advisory labelling (PAL). Allergen declarations refers to required information on food packaging where certain allergens are present (e.g. in the ingredient list and/or a 'contains' statement), while PAL and advisory labelling refers to statements that indicate the possible presence of allergens as a consequence of allergen cross-contact. Searches of electronic literature databases and hand-searching from reference lists and known government studies were used to identify 36 studies¹ for this review. The literature included was published between January 2000 and August 2020 for allergen declarations and January 2000 and November 2019 for PAL. The review has two parts. The first part reports on allergen declarations and draws on a previously completed literature review that has been updated and edited for this review. The second part focusses on precautionary allergen labelling. The review included only English language literature, with a focus on prepackaged food only.

Part 1 Allergen declaration findings

Repetition of consistent allergen information on a label across different locations aids consumers in the identification of allergens and the comprehension of that information.

In general, consumers preferred the presence of an allergen summary statement (e.g. 'Contains ..' or 'Allergy advice ...') in addition to the inclusion of allergen information in the list of ingredients.

The studies report that consumers consider allergen summary statements to reduce the time and effort spent identifying allergens, particularly in long or extensive lists of ingredients.

Formatting played an important role in the communication of allergen information on food labels. To highlight the presence of allergens, consumers generally preferred enlarged font size, emboldening and a contrasting colour of font (among other styles).

These formatting styles were considered preferable by research participants in the studies reviewed because they facilitate the 'standing out' of allergen information from other label text.

¹ 37 papers were identified covering 36 studies as two papers (Barnett et al 2011a and Barnett et al. 2001b) report on different findings from the same study.

Some consumers preferred allergen summaries or statements to be placed in a box, or some other eye-catching shape, to further distinguish allergen information. A small number of studies also found some consumers prefer the amount of allergen present to be declared as a percentage in the statement of ingredients.

The idea of a universal, harmonised allergen symbol was also relatively popular among food allergic consumers and those who shop for them. However, participants also recognised there would be several issues to overcome in operationalising this.

Consumers preferred allergen information to be placed in a consistent location, in a consistent format, with the belief that this enables the faster and easier identification of allergen information.

However the review found few studies that objectively assessed ease and efficiency beyond participants self-reports. Additional experimental studies could be used to determine the extent to which these factors enable quicker and easier identification of allergen information by consumers.

Consumers perceived a lack of consistency in the terminology used across different food labels, and on the same label. Overly scientific and/or vague terms were problematic and led to consumer confusion and uncertainty about which foods are safe to consume.

There is some evidence to suggest that terminology consistency may facilitate greater consumer understanding.

Some experimental studies have found that the terms used to describe milk and egg allergens were the hardest for participants to use to identify which foods are safe to consume.

Part 2: Precautionary allergen labelling (PAL) findings

Consumers viewed PAL as unhelpful and confusing, and that it ultimately restricts rather than enables safe food choices.

The evidence suggested consumers were uncertain about the meaning of PAL as statements were felt to be vague and unclear, conveying few details about why a product had an allergen cross-contact risk.

For some food allergic consumers, PAL statements created unnecessary restrictions on food choice rather than providing reassurance. In addition, some food allergic consumers distrusted the motivations behind the use of PAL by manufacturers.

Consumers therefore found it hard to assess the risk of experiencing a reaction and were not confident that precautionary statements helped them to manage their food allergies.

While many food allergic consumers avoided food with PAL, others reported consuming products labelled with these warnings at least some of the time. Attention to, and avoidance of, products carrying precautionary statements may differ between those affected to greater or lesser extent by a food allergy, though the evidence on this was mixed.

The decision to ignore precautionary statements was influenced by factors that affect risk perceptions; these include food type and/or brand involved, previous experience with the food type/product; as well as contextual factors, e.g. time available to make purchasing decisions and how hungry an individual may feel.

A small number of studies have found that individuals with severe food allergies or those with a food allergic child, were more likely to be cautious of products with PAL. Two other studies, however, reported no differences in reactions to PAL across different demographic groups.

Certain forms of precautionary statement were less likely to be ignored by food allergic consumers than others. This is despite there being no directive for PAL phrasing to correspond to different levels of allergen cross-contact risk present. In addition, the statements less likely to be ignored did not correspond to those considered by food allergic consumers to be most helpful when making a purchasing decision.

The evidence indicated that statements such as “not suitable for...” and “may contain” were more likely to deter food allergic consumers from purchasing products compared to statements such as “made in the same factory as...”.

When exploring consumer preferences for information when making a purchasing decision, statements containing a greater degree of information and specificity about the allergen cross-contact risk were favoured more than statements such as ‘may contain’.

Very few studies explored consumer perspectives on PAL outside of statement phrasing, but those that did found food allergic consumers supported heightened oversight of PAL usage.

Consumers expressed support for making PAL mandatory and supported further regulation of its usage.

One study found support for a quantitative risk assessment framework approach for PAL.

Introduction

Background to this report

In 2019 the Codex Committee on Food Labelling (CCFL) commenced new work to review and clarify the provisions relevant to allergen labelling in the General Standard for the Labelling of Prepackaged Food² (GSLPF) (CXS 1 – 1985) and develop guidance on precautionary allergen (also called “advisory labelling”). As part of this work CCFL was to consider evidence-based consumer understanding of allergen labelling and advisory statements (Codex 2019).

The genesis of this report was a face-to-face workshop of the International Social Science Liaison Group (ISSLG) hosted by Health Canada in May 2019. The ISSLG is an informal forum for international government organisations involved in the social and behavioural sciences of food regulation, food safety and public health nutrition to share information and collaborate (See Appendix 1 for more details). Food Standards Australia New Zealand (FSANZ) and the Food Standards Agency (FSA) (UK) were both independently undertaking work on consumer response to allergen declarations and precautionary allergen or advisory labelling respectively. The two agencies agreed to collaborate under the auspices of the ISSLG to bring together these two streams of work. In preparing this report we seek to assist the deliberations of the CCFL, and ultimately contribute to the evidence-based decision making.

Allergens and their labelling

Some foods and food ingredients, or their components, can cause severe allergic reactions including anaphylaxis. The majority of allergic reactions are caused by cow’s milk, egg, peanut, tree nuts, fish, shellfish, wheat and soy for most countries (Loh & Tang 2018). Allergen labelling is a risk management strategy intended to provide food allergic individuals (FAIs), and those shopping and preparing food for FAIs, with access to clear and accurate information on the presence of allergens in foods, so that they can make safe and informed food choices. Additionally, allergen labelling also assists other consumers, particularly those with coeliac disease, to identify those products that contain gluten. Some consumers may also use allergen labelling to assist in avoiding certain foods where they may have some level of food intolerance (e.g. lactose).

Provisions for the declaration of allergens³ are included in the GSLPF. Section 4.2.1.3 of the GSLPF lists the following foods and ingredients that ‘shall always be declared’:

² The General Standard for the Labelling of Prepackaged Food is a standard of Codex Alimentarius that includes provisions for the name of food, list of ingredients, country of origin, lot identification, name and address, date marking and storage instructions. Codex Alimentarius is referenced in the World Trade Organisations’ Agreement on the Application of Sanitary and Phytosanitary Measures.

³ Note that this list includes foods and substances known to cause hypersensitivity, and not all of these are allergens causing an IgE response.

- Cereals containing gluten; i.e., wheat, rye, barley, oats, spelt or their hybridized strains and products of these;
- Crustacea and products of these;
- Eggs and egg products;
- Fish and fish products;
- Peanuts, soybeans and products of these;
- Milk and milk products (lactose included);
- Tree nuts and nut products; and
- Sulphite in concentrations of 10 mg/kg or more (CXS 1 – 1985).

Internationally, the Codex Standard specifies the declarations of allergens in the list of ingredients. However, some national food regulations mandate where allergens are to be declared on a food label, although there is no uniform approach to this. For example, the US and Canadian regulations require declarations in either an allergen summary statement immediately adjacent to the ingredients list or in the statement of ingredients. The European Union requires allergen declarations in the statement of ingredients and explicitly prohibits the use of an allergen summary statement, except when a statement of ingredients is not provided (due to exemptions). In Australia and New Zealand, manufacturers must declare allergens on packaged foods, but there are currently no requirements on how declarations are to be made. Just as the nature of allergen declarations differs between nations, the substances for which allergen declarations are required may also differ. These mandatory declarations of allergen content are termed ‘allergen declarations’ in this document.

In addition to allergen declarations, some food manufacturers include additional information about the possible unintended presence of allergens in their products when not an ingredient or a food additive. Precautionary allergen labelling (PAL), also known as ‘advisory labeling’ in the United States, is a specific form of allergen labelling which communicates there is a risk of a food product having been affected by allergen cross-contact. In prepackaged food, allergen cross-contact occurs through food production and processing methods, such as the sharing of storage facilities and processing equipment (Zurzolo et al. 2012). Statements such as “may contain X” and “not suitable for someone with X allergy” are examples of PAL or advisory labelling that manufacturers use in order to communicate the risk that certain allergens may be present despite not being ingredients of the food. As with allergen declarations, PAL provides information to assist FAIs, and other consumers, to make informed decisions regarding their food choices, and therefore to help them manage their diets. We use the term ‘PAL’ to represent both precautionary allergen labelling and advisory labelling in this document.

While many countries have legislated for mandatory declaration of allergens in food products, PAL is often unregulated and unstandardised (Allen et al. 2014; Soon & Manning 2017). Many countries issue voluntary guidance on the use of PAL, advising that such statements should only be used after a risk assessment in which allergen cross-contact is found to be real and the risk cannot be removed. The way in which PAL is included by food businesses, in terms of its formatting and the phrasing used, is also mostly unregulated and phrasing differences may not correspond to actual differences in the likely presence of an allergen.

Consumers and allergen labelling

The effectiveness of allergen declarations and PAL relies on the extent to which FAIs, and other consumers, can readily locate, understand and make informed decisions about the appropriateness of products for their consumption. While knowledge of the need to avoid a particular allergen is a prerequisite of informed decisions, the content and format of allergen declarations and PAL are also important. The use and prevalence of PAL by food businesses, combined with the lack of regulation of these statements, and the variety of forms they take, has the potential to create confusion among FAIs on how they should respond to PAL in order to manage their diets effectively (Turner et al. 2011).

This report reviews the literature regarding consumer response to allergen declarations and PAL. Consumers' responses to the two types of allergen labelling are reported separately: Part 1 reports on allergen declarations and Part 2 reports on PAL. In Part 1, the review considers the response of consumers to the following aspects:

- Location and nature of allergen declarations
- Formatting of allergen declarations
- Terminology used in making allergen declarations

Part 2 is guided by the following overarching research question and three subsidiary questions:

- What evidence is there on consumer understanding and responses to PAL on prepackaged food?
 - How do consumers use PAL?
 - How does PAL affect consumers' behaviour?
 - What are the current issues with PAL for consumers?

Approach adopted

As noted, this literature review is the result of combining two streams of work. Part 1 is an edited and revised version of a literature review completed by FSANZ for a regulatory proposal P1044 – Plain English allergen labelling (PEAL)⁴. Part 2 was new work undertaken by the FSA for this project.

In editing and revising the original PEAL review, Australian and New Zealand studies were de-emphasised, study quality was reassessed using the scoring system by Verrill and Wu (2019), and studies that were assessed as low or unable to be quality rated due lack of methodological detail were not included in the write-up. An additional search in August 2020 did not identify new in-scope studies.

Despite the differences between Part 1 and Part 2, the general approach undertaken in both parts was consistent; researchers used a systematic approach to the

⁴ The original literature review for P1044 can be accessed at:
<https://www.foodstandards.gov.au/code/proposals/Documents/P1044%20Report%20SD2%20-%20Consumer%20Literature%20Review.pdf>

literature reviews. The approach consisted of several stages: refining the focus of the review questions, developing inclusion and exclusion criteria, and undertaking searches with relevant search strings of accessible electronic databases. The electronic search was supplemented by hand searching from reference lists and known government studies. The search hits were screened on title and abstract level, and subsequently on full text versions. Studies were assessed using the criteria of Verrill and Wu (2019) and data compiled into a standard template. Where studies were common to both parts, study quality was discussed to reach agreement on quality assessment. A detailed description of the methodology used is included in Appendix 2.

The review is based on 36 studies from 37 publications. Part 1 on allergen declarations drew on 28 studies, and Part 2 on PAL drew on 14 studies. Five studies were common to both parts. Eight studies reported on samples drawn from the United States and five from Canadian samples. An additional study had a sample from both the United States and Canada. Six studies reported on samples from the United Kingdom, six from European countries and five from Australia and/or New Zealand. Two studies report on South Korean samples, and one study with samples from each of Brazil, Japan and Mauritius.

The literature review did not restrict studies based on research design; all studies reporting empirical data were eligible for inclusion. The majority of studies used survey techniques to collect empirical data, some with experimental designs (e.g. Marra et al. 2017), although most used cross-sectional designs. Focus groups were used to collect data in six studies, sometimes combined with observational and survey approaches. Similarly, in-depth interviews were used in a number of studies to collect in-depth, participant perspectives of allergen declaration and PAL.

We are grateful to two independent academic peer reviewers who provided comments on the draft literature review. These comments were taken into account to produce this final version. The draft review was also provided to the Co-Chairs of the CCFL Allergen labelling electronic working group (eWG) (Australia, United Kingdom and United States of America) for their comment. Finally, the draft review was distributed to the membership of the ISSLG for comment. Comments from the Co-Chairs of the eWG and ISSLG were incorporated into this final document.

Part 1: Allergen declarations

Part 1 of this review reports on the literature regarding consumers' preferences and responses to allergen declarations. It is based on an earlier literature review which has been edited and shortened for this report. This review draws on the findings from 28 studies. Six studies report on participants sampled from the United Kingdom, five from the United States, four from each of Canada, the European Union and Australia and New Zealand. Two studies report on participants sampled from South Korea, with one each from Mauritius and Brazil. One study had a sample drawn from both the US and Canada.

The following sections summarise the findings from these publications, with the first section reporting on consumer preferences and response to the location and nature of allergen declarations. Subsequent sections summarise the findings with respect to the content and format of allergen declarations.

Location and nature of allergen declarations

This section reports on the impact of allergen declarations on consumer perceptions and decisions with respect to the location and nature of allergen declarations. Fourteen studies were reviewed. Four studies were conducted with US samples (Parikh et al 2018; Verrill et al. 2013; Vierk et al. 2007; Wortman 2016), three with Canadian samples (Brown et al 2015; Chow 2011; Marra et al. 2017), three with Australian and/or New Zealand samples (Henderson 2003; NFO Donovan Research 2004; TNS 2009), two with UK samples (Barnett et al 2011a; COI Communications 2002), and one study each with samples from Europe (Voordouw et al 2009) and Mauritius (Soogali & Soon 2018).

Eight studies used survey methods to collect data, two studies used an experimental approach and two studies used interviews combined with observational methods. Two studies used focus groups, one of which was supplemented with interviews and one study used an accompanied shop, interviews and a survey to collect data. Consequently, the majority of the studies report findings that describe the preferences of participants, with only two using an experimental approach to testing impact on participants food choice behaviour.

Generally, the reviewed studies indicate that participants preferred the presence of an allergen summary statement in addition to the inclusion of allergen information in the statement/list of ingredients. A summary statement in addition to the indication in the statement/list of ingredients was considered to reduce the time and effort spent identifying allergens in often extensive statement/list of ingredients. Additionally, the reviewed studies revealed a preference for additional allergen declarations to be located near the statement/list of ingredients.

In an analysis of data from the US Food and Drug Administration's (FDA) large nationally representative 2001 Food Safety Survey (n=4,482), Vierk et al. (2007) reported over a quarter of the FAIs rated the fact that allergens were often listed only in a very extensive statement of ingredients as a serious or a very serious impediment to allergen identification.

Chow (2011) used a triangulation of methods (validated survey, shopping observations, and follow-up interviews) to gain a deeper understanding of Canadian participants' preferences and behaviours when reading allergen labels. Location of allergen information was a prominent concern regarding allergen labelling, second only to the terminology used. Participants reported issues in locating allergen-related information and expressed frustration at increased time spent searching for it, particularly on smaller packages. During the accompanied shop, most participants were observed to search for allergen warnings (e.g. allergen summary statement) in the first instance, and when/if they could not locate this, they would then refer to the statement of ingredients. Responses provided in follow-up interviews revealed allergen warnings were viewed by participants as an indication the company was aware of, and had considered, allergies in the formulation and manufacturing of their products (Chow, 2011).

Surveys of FAIs in Australia and New Zealand on behalf of FSANZ in 2004, and repeated again in 2008/9, found that in questions on improvements to current allergen labelling, a few respondents gave unprompted suggestions that allergy declarations should be located near the statement of ingredients (NFO Donovan Research, 2004; TNS Social Research, 2009). Although this was from a small number of respondents (4-11%), open-ended questions will generally produce lower estimates than through close-ended questions (Schuman & Presser, 1981).

In a medium-quality Canadian study (Brown et al., 2015), eight focus groups were conducted with those directly affected by allergens (FAIs and those with FAIs in their immediate family, $n = 27$) and members of the general public ($n = 24$) to identify consumer preferences and current obstacles associated with allergen labelling. While participants from the general public preferred allergen information to be located on the front of the food package, those directly affected preferred allergen information to be placed near the statement of ingredients, although where exactly was not specified. Participants also expressed a strong preference for a clear distinction between the allergen summary statement and any PAL statement.

A recent high-quality Canadian study (Marra et al., 2017) first used focus groups to identify the attributes of allergen labelling preferred by consumers, (precautionary statement; safety statement; allergens symbol, and location of information) and then used a discrete choice experiment to measure participants' preferences in their choices for food with a number of allergens. They found participants were heterogeneous in their preferences and latent class modelling revealed three classes. For two classes (accounting for 82% of respondents) participants preferred allergen information to be located on the front of the food package, and next to a statement of ingredients (which also declared the allergens) at the back. This option was preferred to the additional allergen information being in just one location. The final class (accounting for 18% of respondents) preferred allergen information to be located next to the statement of ingredients.

The effect of an allergen summary statement was investigated in Parikhal et al.'s (2018) experimental study of non-FAIs asked to shop for someone with a nut-allergy. The stimuli in this study included 49 products which contained a combination of ingredients, the presence or absence of a nut warning label, and a range of warning and package styles (including an allergen summary statement). Participants ($n = 32$) were asked to examine each product label and determine whether they would be

safe for someone with a nut allergy to consume. Products were divided into six categories depending on the amount and type of nut-related information present on the packaging. Participants reactions to the products were recorded with a digital video camera, and participants were unaware they were being recorded. Speed, number of times the product was turned, and accuracy of responses were the dependent variables. Unsafe products with a 'contains' label were categorised faster and more accurately than unsafe products without this statement. This finding suggests that allergen summary statements could help FAIs make safer, more accurate evaluations of which products contain allergens.

In a high-quality US study (Wortman, 2016), respondents were presented with a mock-up label for a 'Soy Yoghurt' product, based on current food labels available in the market place. FAIs or those who shop for them ($n = 223$) were asked to examine the labels, then report whether or not they would purchase the item if they were avoiding dairy/milk ingredients. Results indicated that the presence of a 'contains' (or 'does not contain') statement did not affect respondents' belief that the product would (or would not) be safe for a person with a dairy/milk allergy. However, where the back labels were incongruent with the front label (i.e. where Soy Yoghurt *did* contain a milk/dairy ingredient), the presence of the 'contains' statement reduced the time respondents took to evaluate the labels. These findings suggest that where the source of an allergen (e.g. milk) is clearly declared in a statement of ingredients, the presence of a 'contains' statement may not further improve the accuracy of consumer judgements of whether the food is safe to eat. However, these statements may increase the efficiency of decisions by reducing the time needed to decide whether a food is safe to eat or not, particularly where other information on the label is unclear or seemingly contradictory.

A high-quality UK study conducted by COI Communications on behalf of the UK Food Standards Agency (2002) examined consumers' responses to nut allergy labelling. The sample comprised FAIs and those who shopped for them ($n = 21$). Participants reported a desire for a mandated allergen symbol system to be introduced, with symbols being placed on the front of the packet, ideally next to an allergy alert e.g. "Take Care – Nuts", as a prominent first line alert. This was desired in addition to a separate allergen summary statement that would be located at the back of the package, to the left of or above the statement of ingredients, but not below it (where it could be easily missed).

A high-quality qualitative study conducted in Greece and the Netherlands (Voordouw et al., 2009) involved an accompanied shop followed by a series of interviews to explore FAI participants' preferences and behaviours surrounding allergen labelling. Participants reported they preferred having an allergen summary statement above (not below) the statement of ingredients, as it enabled quicker identification of allergens and reduced their likelihood of missing the statement and/or first unnecessarily reading the entire statement of ingredients. Although this data was self-reported, the observational findings suggests that altering the location of allergen information may result in reduced time taken to identify allergens.

A study of medium-quality conducted in the United Kingdom (UK) examined how 32 adult participants with a clinical history of nut or peanut allergy used information on food labels to avoid target allergens (Barnett et al. 2011a). The study methodology involved an accompanied shopping excursion followed by a semi-structured

interview. Observers noted some participants referred to the statement of ingredients as their primary check for allergens, however most used the voluntary allergy advice box⁵ in the first instance, then referred to the statement of ingredients. When later questioned, participants revealed their preference for summarised allergy declarations, as they found these were easier and faster to read than an extensive statement of ingredients. Participants also reported frustration with allergens often listed at the end of a long statement of ingredients due to their small, albeit significant, presence in a product's formulation. There was a strong desire for labelling to be clear in its indication of nuts in the statement of ingredients, combined with a 'contains nuts' statement to prompt inspection of the statement of ingredients or a 'nut free' statement.

The preference for a separate allergen summary statement to be placed above or adjacent to the statement of ingredients has been echoed in other international studies. Over 70% of shopper respondents (both FAIs and members of the general public) who were surveyed in a medium-quality study conducted in Mauritius (Soogali & Soon, 2018) reported that the allergen summary statement could be placed adjacent to the statement of ingredients.

In an Australian quantitative study with FAIs, Henderson (2003) revealed only 39% of participants knew to look for allergens in the statement of ingredients. Thirty-six percentage incorrectly believed if allergens were present in the product, a separate allergen declaration would be placed on the front label of the food package⁶. This suggests some consumers incorrectly believed separate allergen declarations (in addition to listing them in the statement of ingredients) are a mandatory requirement in Australia. A similar finding was noted in Barnett et al (2011a) where the absence of the allergen advice box was often incorrectly taken as a signal there was nothing to worry about. Respondents had a strong preference for allergen information to be displayed both in the statement of ingredients and in a separate allergen summary statement, believing this would increase their likelihood of identifying the presence of allergens, and reduce the time taken to determine whether the product was safe for consumption.

Conclusion

The location of allergen declarations plays a significant role in the ease of allergen identification. The literature highlighted a desire for a brief allergen summary statement that would provide a short summary of any allergens present in the product separately (but in close proximity to) the statement of ingredients. Research suggests repetition of consistent allergen information across different locations on a label aids in identification and comprehension.

⁵ The allergy advice statement is a voluntary measure that can be used to explain how allergens are emphasised within the ingredients list e.g.

'Allergy advice: for allergens, see ingredients in **bold**', or

'Allergy advice: for allergens, including cereals containing gluten, see ingredients highlighted in **blue**'.

⁶ Allergens declarations were mandatory from 2002 in Australia and New Zealand.

Formatting of allergen declarations

Eighteen studies examined the role of formatting in communicating allergen information on food labels. Four studies used samples from the UK (Barnett et al., 2011a; COI Communications & Creative Research, 2002; Define Research & Insight, 2009; Noimark et al., 2009), four from Europe (TNS BMRB, 2016; Voordouw et al., 2009; Voordouw et al., 2011; Voordouw et al., 2012), three from each of Canada (Brown et al., 2015; Chow, 2011; Marra et al., 2017) and Australia and New Zealand (Henderson, 2003; NFO Donovan Research, 2004; TNS Social Research, 2009), two from South Korea (Choi & Choi, 2016; Ju et al., 2015) and one each from Mauritius (Soogali & Soon, 2018) and the USA (Parikhal et al., 2018).

As with the studies on location of allergen declaration, the majority of studies examining allergen declaration formatting used approaches that collected data on preferences using natural observation, surveys, and/or interviews and focus groups. Some studies used a combination of methods (e.g. accompanied shopping experience followed by an interview). Two studies used experimental designs (Marra et al., 2017; Parikhal et al., 2018).

The key formatting elements are discussed individually in the following sections. These are font size, boldening, colour and contrast, allergy summary statement in a box, percentages, and symbols.

Font size

Seven studies (Barnett et al., 2011a; Choi & Choi, 2016; Chow, 2011; COI Communications & Creative Research, 2002; NFO Donovan Research, 2004; Parikhal et al., 2018; TNS Social Research, 2009) reported on font size as a factor in the formatting of allergen declarations. Generally, the studies report a preference for a larger font size. This sentiment was shared by both FAIs and those who shop for them.

In two allergen-related surveys undertaken for FSANZ several years apart (NFO Donovan Research, 2004; TNS Social Research, 2009), font size was reported as an issue. In 2003, seven percent of the respondents who had encountered problems when trying to identify foods suitable for a person with an allergy indicated that illegible writing or writing that was too small was a problem for them. This was still a problem for seven percent of respondents in the follow-up survey in 2008-09 (TNS Social Research, 2009). Respondents in the 2003 survey suggested bold print or larger writing on labels would make labels easier for FAIs to use (NFO Donovan Research, 2004). This was the most common suggestion for improving allergen labelling and was suggested by 16% of respondents.

In Barnett and colleagues' (2011a) aforementioned observational study examining the shopping habits of adults with a diagnosed peanut or tree nut allergy, observers noted participants used the statement of ingredients only if they were unable to discern the presence of allergens based on other label features e.g. a precautionary or allergen summary statement. During the follow-up interviews, participants reported

frustration with the small font sizes used in the statement of ingredients, rendering some of them illegible.

Participants in Chow's (2011) high-quality Canadian study also reported searching for allergen warnings (e.g. allergen summary statements) in the first instance, and only inspecting the statement of ingredients when necessary. Twenty five percent of participants reported small font size of the statement of ingredients as being a significant labelling issue, and a barrier to allergen identification.

In the previously-mentioned medium-quality qualitative study commissioned by Food Standards Agency UK (COI Communications & Creative Research, 2002), participants (FAIs and partners/parents who shop for them) suggested font size should be large enough that those with mild near-sightedness do not require glasses to read the information. Participants claimed small font size was a major barrier to allergen identification, particularly creating a safety concern for the elderly or even those with minor visual impairments.

In a survey of 302 members of the general public, Choi and Choi (2016) report that increasing the font size of allergens would aid consumers in locating and distinguishing them from general nutrition information. While a survey of shoppers in Mauritius (Soogali & Soon 2018), report more than 60% of respondents agreed that font size in the ingredient list was 'sufficient for reading'. However, they also report that more than 80% of respondents felt that allergens in the ingredient list should be emphasised (through contrast or emboldening).

Conclusion

Overall, the literature reviewed is consistent in finding that most FAI believe enlarged font size would assist them in identifying allergens on a food label. While some would prefer the font size of the entire statement of ingredients to be increased, others suggested that only increasing the font size of allergens would help distinguish this information from other ingredients and nutrition information. Importantly, the actual font size used in the studies was not reported, though this does not detract from the finding that FAIs would prefer it to be larger.

Emboldening

Eight studies (Barnett et al., 2011a; Choi & Choi, 2016; Chow, 2011; Henderson, 2003; Ju et al. 2015; Soogali & Soon, 2018; TNS BMRB, 2016; Voordouw et al., 2009) reported that the emboldening of allergens on food labels was desired across both FAIs and those who shop for them. Consumers believe emboldening allergens would facilitate rapid and effective identification, particularly in an extensive statement of ingredients. However, emboldening was desired in all locations where allergens were declared e.g. in the statement of ingredients and any additional allergy summary statements. Across studies, the emboldening of allergens was cited as one of the simplest and most effective ways of improving allergen labelling. Indeed, Soogali and Soon (2018) found emboldening allergens in the statement of ingredients was the most preferred option for over 80% of respondents when asked how allergen labelling could be improved. Similarly, in Chow's (2011) high-quality

Canadian study, bolding of font and increased font size was the most popular option amongst respondents (58% in support), when asked how allergen labelling could be improved. Ju et al. (2015) also reported bold font for allergen declarations as important among both doctor-diagnosed FAs and those without allergies.

In Voordouw et al. (2009) observational study, participants were asked to purchase 15 potentially problematic food items (containing the allergen they were trying to avoid), and to comment on the labelling elements that were problematic. When noting areas for improvement, participants suggested consistency in the bolding of allergens in the statement of ingredients, as this increased readability and assisted with faster identification.

Bolding of allergen information appears to be the preference regardless of where allergens are declared on the food label. For example, in a medium-quality international study (Choi & Choi, 2016), survey respondents reported a desire for allergens to be bolded when they appeared in voluntary precautionary statements, in addition to when they appeared in the statement of ingredients. In a large-scale survey commissioned by the Food Standards Agency (TNS BMRB, 2016), respondents valued label consistency in allergen labelling to create habitual rather than occasional use, and noted allergens not always being bolded as causing confusion and frustration.

Conclusion

As with font size, consumers suggested bolding as a mechanism to give greater visual salience to allergen declaration. However experimental studies exploring the impact of bolding on accuracy and efficiency of allergen declarations are currently lacking.

Colour and contrast

Eight studies (Barnett et al., 2011a; Choi & Choi, 2016; COI Communications & Creative Research, 2002; Ju et al. 2015; Parikhal et al., 2018; Soogali & Soon, 2018; TNS Social Research, 2009; Voordouw et al., 2009) found colour to be an important formatting element that may influence the ease of allergen identification on food labels. In particular, consumers expressed a desire for allergen information to stand out in the statement of ingredients and viewed coloured font as a formatting option that could facilitate this. In the 2008-09 FSANZ allergen labelling survey, seven percent of respondents spontaneously suggested either putting common allergens in bold or in a different colour (TNS Social Research, 2009). In other studies, the desire for allergens to be in a standardised colour (e.g. red) was also expressed.

Across studies, consumer preference for allergens to be bolded was often accompanied by the desire for allergens to be in colour. Both formatting alterations would cause the information to stand out from other nutrition information. Consumers expressed frustration at how, at present, allergen information is difficult to discern, and blends into the rest of information displayed on food labels (Barnett et al., 2011a). Again, the desire for consistency was evident with respect to colour. Consumers reported the use of the same colour to declare allergens wherever they

appeared on the product e.g. in the statement of ingredients, allergen summary statement and any symbols, as well as across products, would result in more rapid and easier identification (COI Communications & Creative Research, 2002; Voordouw et al., 2009). Colour consistency would indicate to consumers that all information presented in that colour referred to allergen information and warranted attention (COI Communications & Creative Research, 2002).

Poor contrast was noted in four studies as a significant barrier to allergen identification (Barnett et al., 2011a; Chow, 2011; Parikhal et al., 2018; Voordouw et al., 2009). In particular, consumers noted issues with dark font being used on labels with a dark background colour, and/or shiny packaging being used alongside white font. These colour schemes were seen to limit consumers' ability to read the statement of ingredients, and in turn identify allergens.

In the aforementioned observational study conducted in Greece and the Netherlands, Voordouw et al. (2009) investigated FAIs' preference for allergen labelling in a real shopping environment. Participants reported colour contrast between label and font colour was low on several food packages, either partially or totally inhibiting their ability to identify allergens. Participants also noted food packaging was often shiny, glossy or clear, and, when combined with white font, presented a significant barrier to effective and easy label reading. Consumers expressed frustration at the increased time spent attempting to discern ingredients as a result of poor colour contrast. In the survey component of Chow's (2011) high-quality study, 25% of participants reported that colour contrast was an area where improvement was needed to enhance identification and comprehension of allergen information.

In the medium-quality government-commissioned UK study (COI Communications & Creative Research, 2002), interview and focus group participants suggested placing allergen information in a different coloured panel if the background colour of the label made it difficult to read the text information.

Conclusion

Overall, the need for increased colour contrast (e.g. by using a light font colour when a label's background colour is dark or vice versa) was a recurring theme in consumer-identified formatting issues. The use of colour and contrast can make the allergen declaration more noticeable. However, the studies reviewed report current issues and consumer preferences and more experimental approaches that demonstrate the effectiveness of colour and contrast are lacking.

Allergen summary statement in a box

Five studies reported consumers' desire for allergen summary and/or precaution allergen statements to be placed in a box (or some other eye-catching shape) (COI Communications & Creative Research, 2002; Define Research & Insight, 2009; Ju et al. 2015; Voordouw et al., 2009; Voordouw et al., 2011). This is consistent with the preference to distinguishing allergen information from other nutrition information.

Voordouw et al. (2011) found survey respondents (n = 287 FAIs and parents of food-allergic children) in all countries rated a standardised label to be their preferred information delivery tool. The inclusion of an eye-catching box with a standardised

allergen declaration was viewed as an important label element in aiding allergen identification. Some Greek participants in an earlier accompanied shopping study suggested that allergen information be in a frame or a box (Voordouw et al. 2009).

The Food Standards Agency UK commissioned research to investigate consumer understanding of new labelling requirements for foods marketed to those with gluten sensitivity (Define Research & Insight, 2009). The high-quality qualitative study included 58 participants, including 15 parents of children diagnosed with Coeliac disease and/or gluten sensitivity, and 43 diagnosed Coeliacs. Individuals participated in a series of focus groups, paired in-depth interviews, and individual face-to-face interviews. Results revealed participants relied heavily on information displayed in the allergen box, particularly in the absence of explicit “free from” claims. Allergy boxes were viewed favourably by consumers, as they were easy to identify, and led to easier and faster decision making.

Conclusion

The formatting option of using a box to highlight allergen declarations, like other formatting options, was supported by consumers. As with other approaches to formatting the lack of experimental studies limits comments on whether consumers’ preferences align with what would be most effective formatting option for consumers to identify suitable food.

Percentages in the statement of ingredients

Five studies (Choi & Choi, 2016; NFO Donovan Research, 2004; TNS Social Research, 2009; Voordouw et al., 2009; Voordouw et al., 2011) reported a consumer preference for declaring the amount of the allergen present in brackets in the statement of ingredients (e.g. “peanuts (2%)”). This was considered to enable risk assessment, particularly for those who believe they can tolerate trace amounts of an allergen.

In the survey conducted on behalf of FSANZ in 2003 (NFO Donovan Research, 2004), respondents were asked if they had any suggestions for how food labels could be improved to assist in identifying allergens. Respondents were asked to provide free text responses to this question. Six percent of Australian respondents and two percent of New Zealand respondents suggested that all ingredient percentages should be listed on the label (to ascertain the level of the ingredient in the food). Similarly, in the subsequent survey (2008/09), six percent of Australian respondents and seven percent of New Zealand respondents suggested including percentages for each ingredient (TNS Social Research, 2009).

In Choi and Choi’s (2016) survey of supermarket shoppers (FAIs and members of the general public), respondents reported concern with the exact quantity of the allergen present in a food product, and suggested percentage labelling would enhance transparency.

In Voordouw et al.’s (2009) interview study, some participants (particularly those from Greece) suggested it would be useful to list the percentages of all the ingredients on the food label. This desire was also expressed by respondents in the survey by

Voordouw et al. (2011) conducted in Germany, Greece and the Netherlands. The FAIs and parents of food-allergic children in this study rated the option of percentage labelling for allergens significantly higher than either showing percentages of all ingredients in the statement of ingredients, or not showing percentages at all.

Conclusion

Five studies explored the use of quantitative allergen declarations, and they generally report that FAIs may find this type of highlighting allergen content to be useful. It is worth noting that, while a quantitative allergen declaration may be useful to those consumers with coeliac disease or those with food intolerances, the quantitative declaration may be less relevant for those with IgE-mediated allergies, as even small quantities of the allergen can trigger a potentially fatal reaction.

Allergen symbols

Ten studies reported on the use of allergen symbols to alert FAIs to foods containing allergens (Brown et al., 2015; Chow, 2011; COI Communications & Creative Research, 2002; Define Research & Insight, 2009; Marra et al., 2017; Noimark, Gardner, & Warner, 2009; Soogali & Soon, 2018; Voordouw et al., 2009; Voordouw et al., 2011; Voordouw et al., 2012). Allergen symbols have been suggested as a useful aid for children, those who shop for FAIs, those with vision impairments, and consumers from a culturally and linguistically diverse backgrounds (CALD) (Noimark et al., 2009).

In Voordouw et al. (2011), a high-quality international study, respondents supported the use of a standardised symbol representing allergy information, located at the front and back of the package. The use of a symbol was seen to be particularly beneficial for small packaging, where small font size limited legibility.

In the qualitative study by Brown et al. (2015), FAI focus group participants reported that symbols would be particularly useful for those not directly affected by allergy, and those of low English proficiency. Participants did however, acknowledge it would be difficult to introduce a distinct symbol for each potential allergen due to the number that exist.

In the study by Voordouw et al. (2012), with respondents from The Netherlands and Germany, consumers indicated a preference for symbols, as these were seen to speed up the decision-making process. However, the results came with the caveat that symbols required explanation if consumers were to use them correctly (e.g. whether a symbol on a food label indicated the presence or absence of an allergen).

Similar results were reported in a study by Voordouw et al (2009) conducted in Greece and the Netherlands. In this high-quality study, participants expressed positive views regarding symbolic representation of allergens e.g. a cow's head and glass of milk to represent cow's milk. Some participants did indicate confusion about whether the presence of an egg symbol indicated the presence or absence of egg in the product, and that this should be clarified when symbols are used to display allergen information on food labels. Importantly, symbolic representation in addition

to (but not as a replacement for) text information was viewed favourably. Participants ideally wanted symbols to be placed on the front of the food package to act as a first-line alert that would prompt inspection of the allergen box and/or statement of ingredients.

As in the above studies, in the aforementioned UK study (Define Research & Insight, 2009) examining foods marketed as gluten free, participants shopping for those avoiding gluten found the use of symbols aided in their decision-making. However, Coeliac participants reported confusion over whether the presence of a symbol indicated the presence or absence of gluten in the absence of supplementary text information e.g. “gluten free”.

Soogali and Soon (2018) report that 88% of shoppers (FAIs and members of the general public) felt symbols were useful in indicating the presence of allergens, particularly when declaring whether a product was gluten free. Consumers suggested the use of asterisks next to allergens wherever they appeared in the statement of ingredients e.g. sugar, milk*, apple, soy*. Similar to boldening, this was seen to make allergens easily distinguishable from other ingredients in what can often be an extensive statement of ingredients.

In Chow’s (2011) high-quality Canadian study, participants viewed an allergen-free symbol to be an eye-catching cue that drew immediate attention, especially when located on the front of the food package. Symbols were apparently viewed as particularly useful in this study, where participants main labelling concerns (reported by 58%) were terminology related (e.g. complex and vague terms). In the study commissioned on behalf of Food Standards Agency UK (COI Communications & Creative Research, 2002) consumers expressed a preference for the use of symbols as a prominent first line alert the product did contain allergens (e.g. ‘contains nuts’). In the latter study, focus group and interview participants expressed the desire for the symbol to be placed in a prominent and consistent position on the label, ideally at the front, and also next to the allergen summary statement at the back. The sample in this study included a mix of FAIs and those who shop for them (e.g. parents of food-allergic children).

In the aforementioned high-quality experimental study (Marra et al., 2017) label elements (e.g. use of voluntary precautionary statements, symbols, and placement of information) were manipulated and presented to participants ($n = 985$) across 18 choice sets. Results revealed participants in two groups – FAIs or those purchasing for an FAI, and older individuals who were not in a partnership, had not completed high school or post-secondary education and who considered allergens for more than one reason (e.g. potentially working in a service industry where allergens may be an issue), preferred the use of allergen declarations (text) in addition to symbols.

Conclusion

Overall, while most consumers (FAIs and those who shop for them) saw benefit in including an allergen symbol, the consumers also drew attention to issues that would need clarification when implementing the approach.

Consistency in allergen declaration location and format

Twelve studies reported on consistency in the location and formatting of allergen declarations (Brown et al. 2015; Chow 2011; COI Communications & Creative Research 2002; Joshi et al. 2002; Marra et al. 2017; NFO Donovan Research, 2004; Noimark et al. 2009; TNS BMRB 2016; TNS Social Research 2009; Voordouw et al. 2009; Voordouw et al. 2011; Wortman 2016). These studies generally report a desire for consistency in both the location of allergen declarations and the formatting to draw attention to the declaration. Consistency was seen to enable faster and easier identification of suitable products to purchase or to avoid. These studies drew research samples from Canada (Brown et al. 2015; Chow 2011; Marra et al. 2017), Europe (TNS BMRB 2016; Voordouw et al. 2009; Voordouw et al. 2011), Australia and New Zealand (NFO Donovan Research, 2004; TNS Social Research, 2009), the United Kingdom (COI Communications & Creative Research 2002; Noimark et al. 2009) and the United States of America (Joshi et al. 2002; Wortman 2016).

In a survey commissioned by FSANZ, six percent of New Zealanders and nine percent of Australian respondents indicated that the location of information not being standardised on the label was a problem (NFO Donovan Research, 2004). In a subsequent open-ended question where respondents were asked for suggestions for improvements to allergen labelling, six percent of New Zealand respondents and two percent of Australian respondents suggested that the location of label information should be standardised.

In the subsequent survey conducted on behalf of FSANZ, respondents continued to indicate problems with the lack of standardisation of location of allergen information (TNS Social Research, 2009). Fifty-eight percent of respondents indicated they had encountered 'other labelling issues' that had caused them concern. Of these respondents, 21% of New Zealanders and 13% of Australians identified the difficulty of finding (including non-existence of) the ingredients list or allergen warning as a problem.

Participants in the follow-up interview component of the Canadian study by Marra et al. (2017) described being confused about where to look for allergen information in the first instance due to labelling inconsistencies and even changes across the same product (e.g. when a product changes formulation).

In the USA, Joshi et al. (2002) used a combined survey and experimental study design to examine how parents of food-allergic children ($n = 91$) interpret food ingredient labels. Twenty-two percent of parents correctly identified the presence of soy across the seven food labels presented. These labels were taken from widely available products to reflect a natural setting. Joshi et al. (2002) noted that the errors centred on two products where the word 'soy' was 'buried within the ingredient list'. They noted participants' frustration with how the statement of ingredients and allergen information were presented inconsistently amongst products, including differences amongst size variations of the same product (e.g. a block of chocolate when compared to a single-serve bar version).

Focus group participants stressed the importance of standardising the location of allergen information (Brown et al. 2015). Participants in Canada claimed that if they knew where to look from the outset, this would reduce the time and energy burden of having to inspect every label element. This sentiment was echoed by respondents in Chow (2011) in which 8% of respondents rated inconsistency in how allergen information is displayed as being the most significant allergen labelling issue. When respondents were asked to report what improvements could be made to current labelling to facilitate identification and comprehension of allergen information, 33% nominated consistency in location of allergen information across food packages.

The desire for an allergen summary statement to always appear adjacent to the statement of ingredients regardless of packaging size was expressed by the Greek and Dutch participants (Voordouw et al. 2009). In the above-mentioned qualitative UK study examining nut labelling (COI Communications & Creative Research, 2002), participants expressed a strong preference for greater visibility and consistency in the placement of the three food label components considered essential to FAIs – an allergy symbol (if included), the statement of ingredients, and the allergen summary statement.

A nationally representative survey conducted on behalf of the Food Standards Agency in Northern Ireland (TNS BMRB, 2016) found respondents valued label consistency to create habitual use. For those with an allergy, this included consistent format and positioning of allergen information. Respondents reported this could encourage more regular use of labelling information by reducing their current frustration with the time and energy that goes into identifying allergens across different packages.

There was a strong consumer desire for consistency in formatting of allergen information. This was consistent across FAIs and those who shop for them – both frequently (e.g. parents of food-allergic children), and infrequently (e.g. members of the general public). Consistency was seen to reduce the time taken to identify allergens, particularly when inspecting new products. Eight studies (Brown et al., 2015; Chow, 2011; COI Communications & Creative Research, 2002; Noimark et al., 2009; TNS BMRB, 2016; Voordouw et al., 2009; Voordouw et al., 2011, Wortman 2016) suggested consistency in font size, colour, emboldening, and symbol use could aid in allergen identification.

A desire for consistency in formatting even applied across elements within the same label. For example, consumers expressed a desire for emboldening (TNS BMRB, 2016) and the same colour to be used (COI Communications & Creative Research 2002; Voordouw et al. 2009) when displaying allergen information whenever it appeared on the label (statement of ingredients, allergen summary statement, voluntary precautionary allergy labelling).

Consistency across products was also valued. Some studies noted how consistency would facilitate at-a-glance decision-making when confronted with a new product. Consistency was also seen to reduce the likelihood of confusion e.g. over whether the presence of a symbol indicated the product was safe or should be avoided (Voordouw et al., 2009). There is evidence that consistency in formatting may create

habitual behaviours in consumers (e.g. mentally associating emboldened font with allergens) that could facilitate faster allergen identification and potentially reduce the number of accidental exposures (Wortman, 2016).

Conclusion

Overall, there was a clear consumer preference for allergen information to be placed in a consistent location, and in a consistent format. Respondents generally considered that consistency would enable faster and easier identification of suitable foods to consume and would facilitate 'at a glance' decision-making.

Terminology in allergen declarations

This section of the review reports on the findings related to the terminology used in allergen declarations. Terminology refers to any of the various terms that can be used to declare a particular allergen; for example 'casein', 'caseinate' and 'milk' all seek to describe the same allergen. Twenty-one relevant studies were identified that explored issues related to terminology with samples drawn from the United Kingdom (Barnett et al. 2011a; COI Communications & Creative Research 2002; Creative Research 2016; Monks et al. 2010; Noimark et al. 2009), Canada (Brown et al. 2015; Chow 2011; Marra et al. 2017; Sheth et al. 2010), United States of America (Joshi et al. 2002; Marchisotto et al. 2017; Parikhal et al. 2018; Vierk et al. 2007), Australia and New Zealand (Hu et al. 2007; NFO Donovan Research 2004; TNS Social Research 2009;) European Union (TNS BMRB 2016; Voordouw et al. 2009; Voordouw et al. 2012), Brazil (Weber et al. 2007) and Mauritius (Soogali & Soon 2018).

The majority of studies examining allergen terminology focused on consumer preferences rather than testing consumer understanding of terminology. Six studies (Joshi et al., 2002; Marra et al., 2017; NFO Donovan Research, 2004; Parikhal et al., 2018; TNS Social Research, 2009; Weber et al. 2007) incorporated a task to test consumers' understanding of allergen terminology. Data was primarily obtained through natural observation, surveys, and/or interviews and focus groups. Some studies used a combination of methods (e.g. accompanied shopping excursion followed by an interview).

Consistency of terminology in allergen declarations

Eleven studies (Barnett et al., 2011a; Brown et al., 2015; COI Communications & Creative Research, 2002; Joshi et al., 2002; Marchisotto et al., 2017; Marra et al., 2017; NFO Donovan Research, 2004; TNS BMRB, 2016; TNS Social Research, 2009; Vierk et al., 2007; Voordouw et al., 2009) point to consumers finding a lack of consistency in terminology used across food labels, and/or differences amongst terms used on the same label (e.g. in the allergen summary statement and the statement of ingredients). These studies generally noted that their participants reported this was a source of frustration and confusion. Survey, interview and focus group data revealed consumers were often left questioning whether the product in question contained the target allergen, sometimes leading them to contact the manufacturer. In the case of FAIs, this confusion also led to unnecessary food restriction and/or risk-taking behaviour.

Participants raised the issue of consistency in allergen terminology in the survey component of Joshi et al. (2002). Differences in terminology used to describe ingredients across products, different package sizes, and even across different label elements on the same food package reportedly caused confusion, frustration and errors in allergen identification amongst parents of food allergic children. Observational data from Voordouw's et al (2009) accompanied shop suggested inconsistency in allergen labelling was associated with increased time spent

examining the product label. Follow-up interviews suggested this was the result of consumers not understanding the terminology used, and thus searching for other sources of information on the food package. Similarly, Vierk et al. (2007) reported over 40% of FAI respondents found inconsistency in the terms used for the same allergen across food products to be a serious or very serious impediment to effectively managing their food allergy.

Australian and New Zealand respondents voiced similar concerns regarding consistency in terminology. Twenty-five percent of survey respondents reported often encountering '[d]ifferent names on label for the ingredients I need to avoid' (NFO Donovan Research, 2004). Twelve and nine percent of Australian and New Zealand respondents respectively, indicated in an open-response question that the many names that were used on labels for the same thing was a problem for them. Dairy ingredients were particularly problematic. In the subsequent survey, 20% of survey respondents reported often encountering the problem of different names on the label for the ingredients they needed to avoid (TNS Social Research, 2009).

Inconsistency in terminology used amongst different label elements was also identified by Parikhal et al. (2018). Results from this experimental study revealed that participants were generally able to accurately identify both safe (products that did not contain nuts) and unsafe products. Across all products and participants, the average time spent to examine a product and reach a decision was 20.2 seconds. Products were turned an average of 2.15 times before a decision was reached. Participants had to look at safe products for longer to reach a decision than for unsafe products. Where participants made incorrect decisions (i.e. categorising an unsafe product as safe or categorising a safe product as unsafe) this was associated with looking at the product for longer. This suggests many of the incorrect decisions were not due to lack of effort by participants, but due to products that were difficult to categorise as either safe or unsafe based on the label information. Older consumers required additional time to categorise each item compared to younger consumers, however accuracy was not associated by age. Parikhal et al. (2018) reported that participants seemed to adopt a "better safe than sorry" mentality. That is if they were unsure of a product's safety, after a period of time they gave up on searching and defaulted to avoiding the product. Safe products with a nut-free label were examined significantly faster and more accurately than those without a nut-free label. Thirty-one percent of participants mentioned that inconsistencies in the allergen labels on the products in the study made it difficult to categorise products as safe or unsafe.

These results are supported by consumers' comments during interviews and focus groups. Using samples from Greece and the Netherlands, Voordouw et al.(2009) found that participants reported inconsistent terminology used in the statement of ingredients was partially to blame for increased time spent examining a food package for allergen identification.

Conclusion

Overall, studies indicated a strong consumer preference or desire for consistency in the terms used to declare allergens. The use of different terms on the same package

and also across packages was highlighted as causing concern for those seeking quick identification of foods suitable to eat. At least one study also suggested that some consumers with allergies would not select a product if they were unable to confirm presence or absence of allergens of concern.

Plain language allergen labelling

Plain language allergen labelling is the use of clear and unambiguous terms in allergen declarations, primarily by reference to the specific source of the allergen. Twelve studies (Chow, 2011; COI Communications & Creative Research, 2002; Henderson, 2003; Joshi et al., 2002; Monks et al., 2010; NFO Donovan Research, 2004; Sheth et al., 2010; Soogali & Soon, 2018; TNS Social Research, 2009; Vierk et al., 2007; Voordouw et al., 2012; Weber et al., 2007) found a strong consumer preference for the use of plain language allergen labelling. Participants reported being left confused and frustrated with the use of technical and scientific terms to describe common allergens.

Two experimental studies (Joshi et al., 2002; Weber et al., 2007) demonstrated the use of technical language was a significant barrier to participants correctly identifying whether a product was safe for consumption. Weber et al. (2007) used a sample of parents whose child was on a cow's milk and by-products exclusion diet, and a control group of parents whose child was not on an exclusion diet. Popular terms (e.g. powdered milk) were recognised by a majority of participants in both groups (from 88% to 100% for parents with a child on an exclusion diet; from 70% to 97% for the control group). Scientific expressions (e.g. casein) were recognised by a minority in both groups (from 8% to 25% for parents with a child on an exclusion diet; from 0% to 4% for the control group). In the case of technical expressions (e.g. cow's milk protein) a higher proportion of parents with a child on an exclusion diet were generally aware of the terms than the control group. This study highlights that even among those with a child who needs to avoid milk and milk by-products, recognition of scientific and technical terms was low to moderate, however the use of plain language terms were more readily recognised by parents in both groups.

Weber et al. (2007) compared the difference in accuracy of allergen identification between parents of food-allergic children who had received prior nutrition counselling with those who had not. Parents who had received education (the experimental group; n = 24) were significantly more accurate in identifying the term 'caseinate' compared to participants who did not receive prior training (the control group; n = 23). The two groups did not differ significantly in identifying casein, lactalbumin, or lactoglobulin. Overall the number of labels read correctly by members of the experimental group was lower than expected. The authors concluded that the use of simple terms on food labels and frequent reading of labels (to gain familiarity with terms) may be just as important as formal allergen management education.

Joshi et al. (2002) undertook a study with parents of food allergic children regarding the use of various terms to indicate the presence of allergens in commercial food products. The labels included terms for milk, egg, wheat, soy and peanut allergens. Nearly all parents were able to correctly identify wheat and egg allergens; 54%

correctly identified peanut allergens; 22% for soy and 7% for milk. Most of the errors occurred when the symbol of DE (to indicate use of dairy equipment) was used to indicate dairy; and when 'soy' was located in the ingredient list only. The authors suggest replacing less familiar terms, such as 'casein', with 'milk', to make allergen identification simpler. A preference for the term 'milk' in place of more complex terms such as 'casein' and 'whey' was expressed by over 80% of respondents in Soogali and Soon (2018).

In Australia and New Zealand, 18% of Australian respondents and 25% of New Zealand respondents indicated they did not understand what was meant by some things on the label when trying to identify suitable foods in 2004 (NFO Donovan Research 2004). This had improved by 2009, with a lower level of 7% reporting lack of understanding over some terms (TNS Social Research, 2009). Testing respondents' knowledge of some terms, 42% of respondents responsible for buying food for a person with a soy allergy believed they would need to avoid textured vegetable protein (TNS Social Research, 2009). While this is an increase from 36% in the 2004 survey, these data suggest more than 50% of respondents did not realise that they should avoid textured vegetable protein when purchasing to manage a soy allergy. Among respondents buying food for a person with a milk allergy, 71% identified whey as an ingredient to avoid, 73% identified casein and 81% identified lactose (TNS Social Research, 2009). Ovalbumin and albumin were identified as problematic ingredients by 54% and 64% of respondents buying for someone with an egg allergy respectively. These results suggest that many FAIs (and those that buy food for them) are unaware of terms that indicate the presence of common allergens in food products.

In the Vierk et al. (2007) large-scale US survey, over one-third of respondents noted the use of technical terms was a serious or very serious impediment to identifying allergens on food labels. A Canadian study of medium-quality (Sheth et al., 2010) found FAI respondents who were allergic to peanut, tree nut, fish or shellfish reported fewer accidental exposures due to an allergen not being identified in plain English language. This may be attributed to the fact there are few, if any, alternative terms to describe these foods. This is in contrast to allergens such as milk and egg, which are sometimes identified by complex terminology not readily recognised by consumers e.g. 'casein' (for milk) or 'ovalbumin' (for egg).

Conclusion

These studies reviewed reveal that the terminology used in allergen declarations can be a problem for FAIs. They suggest that milk and egg allergens were the hardest for participants to identify and were associated with the highest number of incorrect responses in tasks undertaken in the studies.

Source of allergen declaration

While the use of complex terminology has been noted as an allergen labelling issue, the use of vague, generic terms has also been identified as a major impediment to consumers correctly discerning whether a product is safe for consumption. In seven studies (Barnett et al., 2011a; Chow, 2011; Hu, Grbich, & Kemp, 2007; NFO

Donovan Research, 2004; TNS Social Research, 2009; Vierk et al., 2007; Wortman, 2016), consumers expressed a strong preference for the source allergen to be identified whenever allergen information was presented (e.g. in the statement of ingredients and allergen summary statement). Five studies (Barnett et al., 2011a; Chow, 2011; Hu et al., 2007; NFO Donovan Research, 2004; TNS Social Research, 2009) identified this was particularly the case for specifying the type of nut included in the product e.g. 'almond', as opposed to the use of generic terms such as 'tree nuts'.

Consumers reported the use of ambiguous allergen terminology caused them to potentially restrict certain foods from their diet unnecessarily, or from the diet of the FAI they were purchasing for. Focus group data reveals consumers may trust some company's labelling over others, sometimes based on previous bad experiences or assumptions about the company's safety policies or quality (Barnett et al. 2011a).

In one UK study, 32 FAIs with a clinically-diagnosed allergy to peanuts and/or tree nuts participated in an accompanied shop followed by an individual interview (Barnett et al., 2011a). During the interview component, FAIs reported that labels that included more specific wording (e.g. reference to the type of nut as opposed to the use of generic 'nut' or 'tree nut') suggested there was greater knowledge by the manufacturer about the increased risk of the presence of a particular allergen because they specified them individually on the label. Another paper using the same data highlighted that specificity in terminology was particularly valued when consumers were purchasing an item for the first time (Barnett et al., 2011a).

In the aforementioned US survey, 40% of FAIs claimed that a statement of ingredients containing a general name for an ingredient without specifying its source (e.g. spices and flavourings not declaring the presence of milk solids) was a very serious barrier to their effective allergy management (Vierk et al., 2007). This did not differ between FAIs who were self- or clinically-diagnosed.

In a qualitative study on behalf of the UK Food Standards Agency, participants ($n = 32$ consumers, $n = 15$ health professionals and $n = 16$ businesses) with a lactose intolerance were uncertain whether products described as 'dairy free' or 'milk free' were safe for consumption (Creative Research, 2016). Similarly, there was considerable uncertainty (amongst all participant groups) as to whether products labelled 'lactose free' were suitable for those with a milk allergy or intolerance. There was also confusion among some participants over the term 'milk', as this was thought by some to include alternative milks e.g. soy and nut milks. Other participants reported associating the term 'milk' only with cow's milk. This suggests nutrition knowledge as opposed to labelling ambiguities may be behind these results. "Dairy free" was the term that had the broadest appeal and was most frequently used and understood across all three audiences.

The above findings are supported by results from a high-quality, qualitative Australian study examining parental food allergy information needs (Hu et al., 2007). Forty-four parents of food-allergic children participated in a series of in-depth semi-structured interviews and focus group discussions. Overall, participants expressed confusion as a result of the then current allergen labelling. In particular, participants were unsure of what to exclude from their child's diet and environment, e.g. whether all foods from

a food group (e.g. tree nuts) should be avoided if they had been told their child was allergic to one particular ingredient (e.g. walnut).

The 2003 allergen labelling survey commissioned by FSANZ examined issues that FAIs had with food labelling and improvements they would like to see (NFO Donovan Research, 2004). Among those who indicated they had encountered problems when trying to identify foods, 12% mentioned determining what an ingredient was derived from was a problem. This was also apparent in other problems identified, including terms like 'flavours' and 'spices' not being explicit enough (7%) and the use of non-specific terms such as 'vegetable oil' (10%).

In a subsequent survey conducted in 2008-09 (TNS Social Research, 2009), seven percent of Australian and New Zealand respondents stated not knowing what certain ingredients in the statement of ingredients were derived from was a problem. Four percent were confused over the use of non-specific terms (especially where codes, E-numbers, and spices and flavourings were mentioned). As in the 2003 survey, four percent of respondents suggested being more specific about which nuts are in products would improve food labels.

Conclusion

In summary, the literature reports that consumers (FAIs and those who purchase for them) would benefit from consistent, simple and specific terminology to appear on food labels when declaring allergens. Current practices (e.g. the use of vague and/or overly technical terms) contribute to consumer confusion and uncertainty about which foods are safe for consumption.

Conclusion

This report is a revised and edited version of an original literature review prepared and published by Food Standards Australia New Zealand (FSANZ) in November 2019. It provides a broad analysis of available evidence regarding consumer preferences, understanding and behaviours related to allergen declarations on food products. The bulk of the research identified examined consumer preferences and was collected using survey, focus group or interview methodologies.

Overall the studies are consistent in reporting that consumers were dissatisfied with allergen declarations. Food allergic individuals and those who either frequently or infrequently purchase food for them reported confusion and frustration at inconsistencies and ambiguities in labelling practices, particularly relating to location of allergen information, terminology being too vague or too technical to understand, use of formatting that does not highlight allergens, and failures to list the source allergens (e.g. 'almond' versus 'tree nut').

These labelling issues may result in overly cautious or risk-taking behaviour, with the latter having potentially fatal consequences. Overly cautious behaviour may further restrict dietary choices for a group of individuals who already have a limited diet.

Studies on the location of allergen information demonstrated a consumer preference (both in FAIs and those who shop for them) for an allergen summary statement in addition to allergen information being displayed in the statement of ingredients. Experimental evidence indicates allergen summary statements can reduce the time needed to evaluate whether a food is safe for someone with an allergy to eat and may improve the accuracy of these evaluations. Consumers expressed a preference for the allergen summary statement to be located either adjacent to, or above, the statement of ingredients, noting it could be missed if placed below.

Studies report that consumers found a lack of consistency in terminology used across food labels, and/or amongst terms used on different elements of the same label could give rise to problems. There was a strong consumer preference for the use of plain language allergen labelling. In these studies, consumers reported not understanding technical and scientific terms used to describe common allergens (e.g. casein for milk or ovalbumin for egg). This appeared to be the case both for FAIs and those who shop for them.

Experienced label readers did appear to make fewer allergen identification errors in the limited number of studies that incorporated a label identifying task. The research suggests that repeated label reading may be more beneficial than formal education (e.g. nutrition counselling through an allergy clinic or support group) in learning to identify allergens declared using complex terminology. However, familiarity with a product may also lower the likelihood of label reading. This could have dire safety implications when products change formulation (Barnett et al., 2011a). In addition, errors were still common among experienced label readers

As with location and terminology used in declaring allergens, formatting appeared to be another label element where consumers expressed a desire for greater

consistency. Eight themes emerged from the existing literature surrounding formatting of allergen information - a desire for and in some cases, demonstrated efficacy of: consistency, large font size, coloured font for allergens, high contrast between allergen information and the background label colour, the use of symbols, listing the percentage amount of the allergen present, the emboldening of allergens in the statement of ingredients and allergen summary statement, and placing the allergen summary statement in a box/attention-grabbing shape. These formatting options seek to make allergen labelling stand out from the rest of the label.

Despite its broad scope, several areas that may provide important insights may not be apparent in literature on food allergen labelling. For example, there are many factors involved in shopping and consumption decisions. These may be factors such as: shopping time, habit, taste preferences, use of heuristics, price, brand loyalty, and motivation. It is important to understand the context of label use; such as whether consumers only use labels (and allergen information) when purchasing an item for the first time. If consumers are not checking food labels for frequently purchased items (after first purchase), labelling may have a lesser effect than intended on consumer use of allergen information. In addition, the effect of other factors (e.g. susceptibility to take risks) may have a greater impact on behaviour than the effect of information communicated via labelling.

A key limitation in the available research is that most of it reported consumers' preferences for improved allergen declarations and their self-reported issues with current allergen declarations. Experimental designs with objective measures of effectiveness (e.g. eye tracking of where participants look on packages; time taken to search and identify information) would provide more robust evidence on what improvements to allergen declarations result in real-world enhancements in accurate and efficient identification of appropriate products for food allergic individuals.

Part 2: Precautionary allergen labelling

Introduction

Allergen labelling is a risk management tool intended to provide consumers with the information they need to enable safe food choices. Precautionary Allergen Labelling (PAL), also called 'advisory labeling' in the United States, is a specific form of allergen labelling intended to convey the potential for a food product having been affected by allergen cross contact. Statements such as "may contain X" and "not suitable for someone with X allergy" are examples of the PAL statements that manufacturers use in order to communicate the resultant risk that certain allergens may be present, though in reality these statements can take various forms. FAI are expected to use these statements, alongside other label information, to assess the risk of experiencing an adverse reaction before making food choices. The purpose is to enable FAI consumers and those who shop for them to make informed decisions regarding their food choices, and therefore to help them manage their diets.

Allergen labelling legislation differs between countries and their associated regulatory bodies. Many countries have issued voluntary guidance on the use of PAL, advising that such statements should only be used after a thorough risk assessment in which allergen cross-contact is found to be real and cannot be removed. The way in which PAL is included by food businesses, in terms of its formatting and the phrasing used, is also mostly unregulated and there is no directive for particular phrasing differences to correspond to actual differences in the likely presence of an allergen.

The effectiveness of PAL in enabling consumers to make safe, informed food choices is dependent on consumers' understanding and responses to the information conveyed. However, the prevalence of PAL usage by food businesses, combined with the lack of regulation of these statements and the variety of forms they take, has the potential to create confusion among FAIs on how they should respond to PAL in order to manage their diets effectively (Turner et al. 2011).

Part 2 is guided by the following research questions and three subsidiary questions:

- What evidence is there on consumer understanding and responses to PAL on prepackaged food?
 - How do consumers use PAL?
 - How does PAL affect consumers' behaviour?
 - What are the current issues with PAL for consumers?

Consumer perceptions of PAL

This section reports the findings on consumer knowledge of precautionary allergen labelling (PAL) and overall attitudes towards it as a tool intended to assist food purchasing decisions. In total, nine studies examined consumer perceptions of PAL. Two studies were conducted with UK samples (Barnett et al. 2011b; Monks et al. 2010), two with Canadian samples (Brown et al. 2015; Marra et al. 2017), two with samples from Europe (Cornelisse-Vermaat et al. 2007; DunnGalvin et al. 2019) and three studies with samples from Australia and/or New Zealand (NFO Donovan Research 2004; TNS Social Research 2009; Zurzolo et al. 2013). Five studies were assessed as being of high quality and four of medium quality. Most of the studies reported participants' views on precautionary allergen labelling from qualitative interviews and focus groups or quantitative surveys. Two studies combined one of these methods with an accompanied shopping excursion and product choice reasoning task.

Generally, the reviewed studies indicated that participants found PAL unhelpful and confusing in terms of how it is used and what it means for them. Additionally, there was a lack of trust in how PAL is currently used, with the motivations behind its presence considered to be questionable. Finally, PAL was perceived to limit rather than enable safe food choices for FAIs by imposing an overly restricted diet.

In the analysis of data from a nationally representative sample of consumers, Marra et al. (2017) reported that precautionary statements were preferred the least out of four common attributes of food allergen-related labelling. The other attributes included in this study were i) the use of symbols, ii) general safety statements and iii) placement of information. The study employed a discrete choice experiment, and this finding was the same for both general consumers and those who reported that they consider allergens when making purchasing decisions.

In a Canadian study (Brown et al. 2015), eight focus groups were conducted with two types of consumer, people 'directly affected' by food allergies⁷ ($n = 27$), and members of the general public ($n = 24$). The group explored participant perceptions of the 'may contain' precautionary statement, as well as preferences for PAL on labels. Overall, participants reported being confused about the meaning of precautionary statements. Most participants across both consumer groups reported that they found 'may contain' statements unhelpful and unclear, as they include few details about why a product might carry a risk of allergen cross-contact. Both groups were also doubtful of the motives behind the inclusion of PAL as it was thought to often be used for liability reasons.

In Monks et al.'s (2010) qualitative study with 18 adolescent FAIs in England, participants with an IgE-mediated food allergy were recruited from a children's allergy clinic and were asked to complete a short survey followed by semi-structured interviews. Participants reported that the extensive use of PAL (in this study referred

⁷ 'Directly affected' here means FAIs or people with FAIs in their immediate family.

to as 'may contain' labelling), was unhelpful and restrictive on their food choices. Additionally, participants reported difficulty in assessing the risks of experiencing an allergic reaction when different forms of PAL were used by manufacturers, further complicating their understanding of what food is and isn't safe to eat. Unclear or confusing labelling, not believing labels or believing that the risk of allergen cross-contact is low were all reasons that participants provided for not avoiding certain foods.

A 2008/9 follow-up survey of FAIs in Australia and New Zealand found that between one third and a half of respondents considered the four precautionary statements⁸ they were questioned about to be not very useful (TNS Social Research 2009). In response to an open, unprompted question capturing suggestions for improvements to allergen labelling, 5% of 1,028 respondents stated that manufacturers needed to be more specific about the risk in products containing traces, and 10% noted that they found the 'may contain' precautionary statement, in particular, to be vague and sometimes used when there isn't a 'true risk' (p.97) of an allergen being present. This latter finding corresponds with data collected from the 2004 baseline study (NFO Donovan Research). In 2004, in a similar, unprompted question, respondents noted that 'may contain' labelling was overused (4%), unsubstantiated (3%) and that it was used by manufacturers for liability reasons (5%) (base sample 510).

The perceived lack of usefulness of PAL was also captured in a survey (Zurzolo et al. 2013) of parents of 497 children attending an Australian hospital allergy and immunology department. The parents were asked to rate the extent to which they agreed with a series of statements for six different forms of PAL. Across all statements, the parents of between 78% to 84% (88 to 106) of children who had experienced anaphylaxis agreed that 'I do not find this statement useful, as I don't know if it is safe to eat'. These results indicate that regardless of phrasing, participants struggled to understand how to factor PAL into their purchasing decisions.

Consumer understanding and attitudes towards PAL was also examined in DunnGalvin et al.'s (2019) cross-sectional survey of adult FAIs, and parents of children with a food allergy across 5 European countries. When asked whether a product containing no PAL is safe to eat, 18% of 1,560 respondents included in the analysis stated 'yes', 22% reported 'no', 51% reported 'not necessarily' and 9% were 'unsure', indicating uncertainty about how PAL is used by manufacturers. In addition, respondents were not confident that precautionary statements help them to manage their allergy and avoid allergic reactions. The mean score of reported confidence among their sample was 2.8 (SD 1.4) out of 5⁹, meaning that on average respondents were 'hardly confident' that this was the case.

Barnett et al.'s (2011b) UK-based study investigated how 32 peanut and nut allergic individuals interpreted and used 'may contain' labelling when making food purchases. Participants undertook an accompanied shopping excursion followed by semi-

⁸ The statements included were: i) 'may contain traces of...'; ii) 'made in the same premises as products containing...'; iii) 'made on the same equipment as products containing...', and iv) 'may be present...'.
⁹ Response options included: 'not at all', 'hardly', 'somewhat', 'quite', 'very much'.

structured interviews. While participants preferred 'may contain' to receiving no information on the possibility of allergen cross-contact, particularly for foods perceived to be potentially risky, they also reported that they disregarded the message in a range of ways, indicating that, overall, PAL is not viewed positively. To avoid all foods with 'may contain' labelling was considered to create an overly restricted and therefore impractical diet. FAIs often distrusted the motivations of the message source and therefore the message itself. Participants overlooked the messaging when it was considered particularly dubious, and these occurrences were felt to worsen attitudes towards PAL considering the dietary constraints it can create. There was also confusion about when PAL is used by businesses, as some FAIs suggested its presence indicated that the level of risk had been assessed by manufacturers and to some extent addressed. This is despite there being no such directive within the UK regarding the presence of PAL and the associated level of risk to FAIs.

The perception that PAL limits the food choices of FAIs was also reported in Cornelisse-Vermaat et al.'s (2007) qualitative study conducted with 40 participants with a food allergy to milk, egg, peanuts or tree nuts living in Greece and the Netherlands. Precautionary statements such as 'may contain' were not viewed positively by participants and were felt to create 'unnecessary restrictions' (p.118) on FAIs' diets rather than providing greater reassurance about purchasing decisions.

To conclude, overall FAIs do not view PAL positively and consider it unhelpful and restrictive rather than enabling food choices. Issues noted by consumers include confusion about when PAL and its various forms are used by manufacturers, and uncertainty about the risk present within a product due to the often unclear and vague nature of these statements. The literature also highlighted a distrust of PAL, with some FAIs questioning the motives behind its use by manufacturers.

Consumer preferences for PAL

Five studies specifically examined consumer preferences on how precautionary statements are used by manufacturers. Of the relevant studies, samples were drawn from Canada (Brown et al. 2015), the United States (Verrill & Choinière 2009), Europe (DunnGalvin et al. 2019) and Australia and/or New Zealand (TNS Social Research 2009; Zurzolo et al. 2013). Studies mostly investigated preferences for different forms of PAL phrasing, but some also looked more widely at other aspects of PAL usage by manufacturers. Two studies were assessed as being of high quality and three of medium quality. The majority of studies captured data on preferences via consumer surveys, with only one study (Brown et al. 2015) drawing on data generated by focus group discussions.

Statement content

Four studies (Brown et al. 2015; DunnGalvin et al. 2019; TNS Social Research 2009; Verrill & Choinière 2009) examined consumer preferences regarding different types of precautionary allergen statements. Due to the small number of studies and the variation in statements included in each study, there is no clear picture on which particular statements FAIs and those who shop for FAIs consider most useful when making purchasing decisions. The literature does, however, indicate a preference among some FAIs for statements which contain a greater degree of specificity about the allergen cross-contact risk enabling them to make informed purchasing decisions for themselves. In addition, one study found that having layers of information was popular, such as accompanying PAL with a symbol and risk assessment statement.

Of the four statements⁸ included in the 2008/9 survey of FAIs in Australia and New Zealand, 'made on the same equipment as products containing...' was considered most useful (32% reported it is 'quite useful' and 34% 'very useful') (TNS Social Research 2009). 'May contain traces of...' was preferred the least, with only 24% finding this statement 'quite useful', 27% 'very useful' and almost half (48%) of respondents describing it as 'not very useful'. There were no significant differences observed between respondents based in Australia and New Zealand, or between households with different types of food allergy.

A slightly different set of statements were included in a survey of 1,243 individuals by the Food and Drug Administration (FDA) in which respondents were questioned about four PAL statements¹⁰ related to peanut cross-contact (Verrill & Choinière 2009). The sample was composed of 530 FAIs, 209 people with food allergic dependents and 504 individuals with no food allergies or food allergic dependents. Across the three sample subgroups 'Allergy information: may contain peanuts' was the statement which was felt to best provide information that can help someone with a peanut allergy to make a food choice, with approximately 40% of both FAIs and

¹⁰ The statements were: i) 'Allergy information: may contain peanuts'; ii) 'May contain peanuts'; iii) 'Manufactured on the same equipment as food that contains peanut'; iv) 'Produced in a facility with an allergy control plan. The possibility of contact with allergenic ingredients has been minimised. May still contain trace amounts of peanut'.

non-FAIs, and 32% of care givers, ranking this first. In second place across all three groups was 'manufactured on the same equipment as foods that contain peanut'. There were differences observed between FAIs and the other two groups for third and fourth place. FAIs preferred 'produced in a facility with an allergen control plan [...] peanut' in third place, whereas people with food allergic dependents and people with no food allergies or dependents preferred the 'may contain' statement on its own ahead of the longer statement describing manufacturing controls.

DunnGalvin et al. (2019) also surveyed adult FAIs and parents of child FAIs about their preferences for different PAL statement formats. Overall, the most popular statement was 'this product is not suitable for consumers with xy allergy', with 46% of respondents selecting this as their first choice. This was closely followed by 'may contain xy (allergen)' (44%), with 'accidental presence of xy (allergen)' preferred the least (7%). A significant association was observed between preferences and country of respondents. For example, the statement on suitability was ranked more highly by respondents from the UK and Ireland (56%) and Germany (48%), whereas 'may contain' was preferred the most among respondents in the Netherlands (44%), indicating that preferences on statement wording vary by country. Most respondents (68%) preferred the use of a single PAL statement phrase as opposed to the use of different phrases to represent varying likelihoods of allergen cross-contact within products. Respondents were also presented with a selection of additional layers of information that could be included alongside a statement on unintended presence of allergens. The more layers of information included, the more helpful the statements were considered to be, with the most popular option being a statement of unintended allergen presence alongside a risk assessment statement and a risk assessment symbol (66% of respondents reported this would be 'quite a bit' or 'very' helpful when choosing a product).

A qualitative study found that directly affected participants preferred phrasing that was more specific, as this was considered more useful in making purchasing decisions (Brown et al. 2015). Examples of this include statements that summarised the manufacturing process in terms of allergens present in the same factory or on the same production line. There was less consensus among participants directly affected by food allergies regarding the 'not suitable for' statement. While most viewed the statement positively with some participants agreeing with the general consumer groups that this phrasing simplified decision-making, others felt that it implied manufacturers were assessing the suitability of a product on their behalf, rather than enabling them to make informed food choices.

Together, these studies demonstrate the variety of precautionary statements used on products by manufacturers and how FAIs and those who shop for FAIs view some forms of PAL more favourably than others. Across the four studies included, in general, specific and/or detailed statements were considered by FAIs to be more helpful when making a food choice, this is despite there being no relation between the phrasing used and the likelihood of an allergen being present within a product.

Other preferences for PAL

Three studies (Brown et al. 2015; DunnGalvin et al. 2019; Zurzolo et al. 2013) looked at consumer preferences outside of PAL phrasing. Each study had a different focus and given the small number of studies; firm conclusions cannot be drawn. However, together the literature suggests a consumer preference for further regulation of PAL statements.

A desire for clarity and consistency in the PAL terminology used across different brands/manufacturers was expressed by participants directly affected by food allergies in the aforementioned study by Brown et al. (2015). Additionally, FAIs and the majority of the general consumer participants were supportive of the idea of PAL statements being made mandatory. The perceived need for greater oversight of the use of PAL was also found by Zurzolo et al. (2013). In this study most parents agreed that the Australian government should better regulate the way that PAL is used by manufacturers.

DunnGalvin et al. (2019) explored a range of ways of communicating PAL. This included the collection of consumer views on the use of a quantitative risk assessment (QRA) to determine which products are likely to cause a reaction and should therefore have a precautionary statement. Almost three quarters of respondents (73%) reported that their trust in a product would increase if a QRA process had been used to inform whether it carried a precautionary statement, with no differences observed between country of respondents. Respondents also reported that they would be safer when eating a product if QRA was made a mandatory part of deciding when to use PAL. In addition, respondents reported that QRAs would lower their anxiety when shopping, and that shopping would be quicker and there would be fewer products labelled with 'may contain'. Using regression analysis, these attitudes were found to be significantly and positively associated with trust in the food product.

While only a small number of studies are included here, the results from this section indicate that participants across the three studies would value some form of heightened oversight of PAL statements.

Consumer usage of PAL

In total, 13 studies examined consumer usage of precautionary statements. Five studies were conducted with samples from within the UK (Barnett et al. 2011b; Cochrane et al. 2013; Monks et al. 2010; Noimark et al. 2009; TNS BMRB 2016), three with samples from the United States (Hefle et al. 2007; Sampson et al. 2006; Verrill & Choinière 2009), two with samples from Australia and/or New Zealand (NFO Donovan Research 2004; TNS Social Research 2009), two with European samples (Cornelisse-Vermaat et al. 2007; DunnGalvin et al. 2019) and one with a sample from Canada (Ben-Shoshan et al. 2012). Five studies were assessed as being of high quality and eight of medium quality. The bulk of the studies relied on participant self-reports of their adherence to PAL and its various forms, while three used some form of accompanied shop or other experimental approach to observe the impact of PAL on participants' purchasing behaviours.

Overall usage

Eight studies (Barnett et al. 2011b; Cochrane et al. 2013; Hefle et al. 2007; Monks et al. 2010; NFO Donovan Research 2004; Sampson et al. 2006; TNS Social Research 2009; TNS BMRB 2016) examined FAIs' overall usage of PAL. The reviewed literature indicates that while there were a range of behavioural responses among participants to PAL, a significant minority of FAIs reported consuming foods labelled with these warnings. There is also some evidence that the proportion who reported doing so had increased over time. Additionally, the studies suggested that, when deciding to disregard PAL, FAIs are influenced by several factors including previous experience of the product, circumstances at the time of purchasing such as how hungry or time-pressured they are, as well as personal preferences.

Across the included studies, at least some, and sometimes a significant proportion of participants, reported consuming food labelled with PAL. In Cochrane et al.'s (2013) online survey of FAIs, and people who purchase food for FAIs, only 34% of the 949 respondents reported always avoiding products with a relevant 'may contain' label. Similarly, within Monks et al.'s (2010) qualitative study with food allergic adolescents, more than three quarters of participants reported eating foods labelled with 'may contain' labels in the pre-interview questionnaire. And finally, within Sampson et al.'s (2006) survey of 174 respondents aged 13-21 with food allergies to peanuts, tree nuts, shellfish, milk, eggs and fish, only just over half (58%) of respondents indicated that they avoid foods that are suggested to 'may contain' an allergen.

Within two sets of studies, it was noted that the proportion of participants who self-reported ignoring PAL had increased over time. In a 2004 baseline (NFO Donovan Research 2004), and 2008/9 follow-up survey (TNS Social Research 2009) of FAIs in Australia and New Zealand, both studies found the presence of PAL on a product did not always mean that consumers would avoid that product. Respondents to the follow-up survey were more likely than those in the baseline study to say that they would always use a product containing one of the PAL statements included in the survey questionnaire. Respondents to the follow-up survey were also less likely to

say that they would always avoid a product containing one of these statements. In addition, within Hefle et al.'s (2007) survey conducted at a food allergy and anaphylaxis network conference in 2003, and later repeated in 2006, the proportion who self-reported that they would never purchase a product carrying an advisory warning decreased from 85% to 75%. This trend was observed across all 8 advisory statements tested in the conference survey questionnaires.

In line with the above studies, Barnett et al. (2011b) concluded that while some participants would always avoid products with "may contain" labelling, many stated that they ignored this when deciding whether to purchase a specific product. Of those who reported that they ignored PAL, there was variation among participants of the perceived risk of doing so. Some participants believed there was no or very little risk of an allergic reaction after consuming these products, whereas others considered the risks 'preferable' compared to the uncertainty the statements induced. Finally, there was a group who understood the risk of allergen cross-contact but reported consuming such products anyway.

Precautionary statements are disregarded for a variety of reasons and these include reviewing the food type and/or brand involved, previous experience with the product, and the wider context to purchasing a product. Participants in Barnett et al.'s (2011b) study reported that previous experience with a product indicated its safety for future consumption, and this was also reported by Monks et al. (2010) and TNS BMRB (2016), whereby food allergic participants in both studies reported only checking the labels of new foods or when they felt unsure. In addition, within Sampson et al.'s (2006) survey of adolescents with food allergies, while 58% stated that they avoid foods labelled with PAL, 19% of respondents indicated that they eat these foods because they had no prior reactions when doing so.

Beliefs about the product or food type involved were also used when considering the safety of a product containing PAL. For example, in Monks et al. (2010) some participants reported not believing labels, and that they thought the chance of an allergen being present was low. In Barnett et al. (2011b), participants felt that PAL featured on certain products was more credible and that these products should be avoided. Barnett et al. (2011b) also reported that personal preferences for the food in question played a role, as participants were more likely to report eating food labelled with PAL when they enjoyed these foods as opposed to foods they didn't like. Finally, the 'experience of the moment' was mentioned as a reason for taking risks with products containing PAL, such as being hungry, in a rush (Barnett et al. 2011b:6), or being in a familiar environment with people participants knew and/or having medication that was readily available (Monks et al. 2010).

To summarise, FAIs do not always avoid food labelled with PAL, and there is some indication that the proportion who report consuming PAL-labelled food has increased over time. Several different factors can influence FAIs and those who shop for them, in their decisions to disregard PAL.

Usage by consumer group

Eight studies (Barnett et al. 2011b; Ben-Shoshan et al. 2012; Cochrane et al. 2013; Cornelisse-Vermaat et al. 2007; DunnGalvin et al. 2019; Noimark et al. 2009; TNS Social Research 2009; Verrill & Choinière 2009) examined if usage of PAL differed by demographic characteristics. The evidence from these studies regarding which consumers are most likely to adhere to PAL statements is mixed. Three studies reported that those with more severe symptoms are more likely to be cautious of products carrying PAL. Two studies reported that parents/care-givers of children with food allergies were more likely to self-report more cautious behaviour than other participants. However, two further studies reported no significant differences in adherence to PAL associated with participant characteristics.

In Cornelisse-Vermaat et al.'s (2007) qualitative study, while many participants reported that precautionary statements limited their food choices, this was found to be particularly the case among participants with, or shopping for, severe food allergies. Supporting this finding, Cochrane et al.'s (2013) survey also found that behaviour differed according to the severity of respondents' food allergies, with respondents who reported severe symptoms more likely to self-report cautious food purchasing behaviour in relation to PAL than those with milder symptoms. Finally, within Ben-Shoshan et al.'s (2012) survey of Canadian households directly and indirectly affected by food allergies, participants living with an allergic subject who had experienced a previous moderate or severe reaction were more likely to self-report never purchasing a product containing PAL than participants living with people who had experienced milder food allergic reactions.

Within Ben-Shoshan et al.'s (2012) study, households with a child with a food allergy (in this study to peanut, tree nut and sesame), were also more likely to self-report vigilant behaviour towards PAL than households with an allergy in adults only. In addition, DunnGalvin et al. (2019) asked survey respondents about the circumstances in which they read PAL and found that parents of children with food allergy were more likely than adults with food allergy to report checking food labels every time that a product is purchased (68% of parents reported this compared to 55% of adults with food allergy).

Two studies suggest that FAls who are part of allergy support groups are more likely to adhere to PAL statements. Ben-Shoshan et al.'s (2012) study recruited 1,318 participants directly affected by food allergy from two different sources; from a random sample of the Canadian population ($n = 127$), as well as through a peanut allergy registry and food allergy support associations ($n = 1,191$). Indirectly affected participants ($n = 1,113$) were recruited from the same random population survey, and this group consisted of individuals that did not report any allergies in their own household, but either reported purchasing or preparing food for an allergic subject outside of their household. The difference in behaviour between the two directly affected groups was evident even after adjusting for potential confounders such as education and severity of reaction. The authors suggest that this may reflect the fact that individuals who are members of allergy associations tend to be highly informed and motivated regarding food allergy management. This difference in behaviour is

also evident within TNS Social Research's (2009) survey for FSANZ, which found that for each of the precautionary statements included in the survey questionnaire, respondents recruited through allergy support groups were significantly more likely to report always avoiding products labelled with PAL than respondents to the survey who were recruited through hospital or private allergy clinics.

Verrill and Choinière (2009) also found a significant difference in reported behaviour between FAIs and non-FAIs in their experimental study. Within this study 4,049 online panel members were shown two mock packaged food products before answering a questionnaire designed to understand how consumers use advisory statements to make decisions. Behaviour differed between the two groups in terms of likelihood of eating or serving the product containing PAL to someone with a minor food allergy, with FAI participants more likely to eat or serve the product than the non-food allergic group.

However, two studies included in this review found no differences in adherence to PAL based on participant demographics including age, gender or severity of food allergy (Barnett et al. 2011b), and whether or not a child with food allergy had a history of more or less severe reactions (Noimark et al. 2009).

The evidence on how adherence to PAL does or does not differ according to consumer demographics is therefore mixed and no firm conclusions can be drawn as to which groups are likely to take more risks in their response to PAL on food packaging.

Usage by PAL phrasing

Seven studies (Barnett et al. 2011b; Ben-Shoshan et al. 2012; Hefle et al. 2007; Monks et al. 2010; Noimark et al. 2009; TNS Social Research 2009; Verrill & Choinière 2009) found that the different ways that PAL is phrased influences the self-reported purchasing behaviours of participants. This indicates that participants perceive the risk of allergen cross-contact to be tied to the phrasing of PAL statements.

Hefle et al. (2007), in their survey circulated at a series of allergy and anaphylaxis conferences, found that while there were no differences in self-reported purchasing behaviours between PAL statements that were thematically similar, there were significant differences in purchasing behaviours between thematically different sets of statements. The study found that 'may contain...' labelling was most likely to be heeded (86% of participants reported they would 'never' purchase a product with this warning), compared to a statement on shared equipment (79%) and shared facilities/premises (64%). Noimark et al. (2009) also found that while most parents they surveyed (more than 80%) would report avoiding a product labelled 'may contain nut' or 'not suitable for nut allergy sufferers', fewer parents would report always avoiding products labelled with 'may contain traces of nuts' or 'cannot guarantee this is nut free' (approximately 60% of parents), and only 40% of parents would avoid products with labels stating that the same factory premises uses nuts.

A similar pattern in reported behaviour was also found by Ben-Shoshan et al. (2012). Across all participant groups (directly and indirectly affected), respondents were most likely to report never purchasing a product labelled 'not suitable for' (ranging from 80% of directly affected participants recruited from a random population survey, to 97% of directly affected participants recruited from allergy support organisations).

Variances in self-reported behaviour were also found within TNS Social Research's (2009) survey of FAIs in Australia and New Zealand. Again, participants were least likely to 'always avoid' a product with a label stating it had been made in a shared premises with other products containing an allergen (33%) and were more likely to report always avoiding a statement relating to traces of an allergen (42%) and a statement on shared equipment (47%). However, only one statement, 'may be present', was always avoided by most respondents (60%).

Verrill and Choinière (2009), in their experimental study asked participants viewing mock packaged products labelled with different variants of PAL (two statements related to manufacturing and two related to 'may contain') to assess the likelihood that the products contained peanut. Participants viewing the two 'may contain' statements were significantly more likely to think the product they were viewing contained peanut than participants viewing the products with manufacturing-related precautionary statements. This is despite the participants who viewed the two manufacturing statements rating these as more helpful and believable than participants viewing the 'may contain' labels.

Within Barnett et al.'s (2011b) qualitative study, participants thought that the different phrasing of PAL messaging was tied to the level of risk of allergen cross-contact within a product and used this to justify particular avoidance strategies. This study found that statements that were more specific in their warnings, tended to be associated with a perceived increased risk of cross-contact within a product, and participants were therefore more likely to report adhering to these. Monks et al.'s (2010) study of food allergic teenagers also found that participants reported eating food labelled with PAL depending on the wording used within the statement, as they assumed that the wording indicated the level of risk that the product contained nuts.

While overall a small number of studies, together, they suggest that FAIs, and those who care/shop for them, behave differently in their responses to PAL depending on how these warnings are worded. In general, products with labels that state 'not suitable for' and 'may contain' are more likely to be avoided than products with warnings related to being manufactured on the same premises as other products containing a relevant allergen. These findings suggest that FAIs, and those purchasing for FAIs, assume that the variation in phrasing of PAL corresponds to actual differences in the likely presence of an allergen, despite there being no directive for this.

Conclusions

This review explored the existing evidence on consumer understanding and responses to precautionary allergen labelling (PAL) on prepackaged food. It gathered and summarised international literature on this subject, while considering the strength of this evidence.

It found that, overall, consumers view PAL as unhelpful and confusing and that ultimately it restricts rather than enables safe food choices. It is difficult for FAIs to understand the risks involved in consuming a product labelled with PAL due to the often unclear and vague nature of these statements. FAIs also reported a lack of trust of the motivations behind the use of PAL on products.

A small number of studies have investigated preferences among FAIs for different types of PAL wording. Though the variations in statements used across the different studies mean comparisons are difficult, overall FAIs within the included studies expressed a preference for PAL which contained a greater degree of information and specificity about the allergen cross-contact risk.

A couple of studies also found that FAIs and those who shop or care for FAIs, would value some form of heightened oversight of the way in which PAL is used on products by manufacturers, such as support for making PAL mandatory and the use of QRA. However, due to the small number of studies these findings are indicative only.

While many FAIs and those who shop/care for FAIs are vigilant towards PAL and will not consume products labelled with these warnings, some report consuming these products at least some of the time, and there is limited evidence that the proportion doing so has increased. When deciding whether to purchase products labelled with PAL, FAIs are influenced by a range of factors, and these include previous experience with a product/brand, and beliefs about the product or food type which they use to assess the level of risk present, as well as personal preferences and wider context at the time, such as time available to make a purchasing decisions and how hungry they feel.

Currently, there is no clear picture on which demographic groups are more likely to report avoiding purchasing food that carries a precautionary statement on its label. There is more evidence, however, on how reported behaviour differs according to the wording of the PAL statement used. For example, within the included studies, products labelled with 'not suitable for' and 'may contain' tended to be more likely to be avoided than warnings related to where a product is manufactured. This is interesting when compared with the findings related to preferences for PAL, which suggested 'may contain' was often preferred the least of the statements used across the included studies.

There is evidence that FAIs assume that the difference in wording on PAL statements reflects variations in the likely presence of an allergen within a product. This subsequently influences purchasing behaviours. It is, however, important to

note that there is no directive for PAL phrasing to correspond to different levels of allergen cross-contact risk.

This evidence review drew from 16 empirical research studies conducted across a range of countries. Most studies relied on self-identified food allergic participants or those who shop for people with food allergies, and required these participants to self-report their preferences and behaviours towards PAL. The conclusions above are therefore only a starting point in gathering the evidence on consumer understanding and usage of these precautionary statements

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Appendix 1: International Social Science Liaison Group

Increasingly, the issues confronting food regulators and government agencies seeking to enhance food safety and public health nutrition require an understanding of how consumers and citizens understand and respond to policy interventions and risk management options. While the traditional disciplines of nutrition, microbiology and toxicology provide risk assessment advice that can be used to develop and frame food regulation, the social and behavioural sciences provide the theories, methodologies and evidence that can assist in understanding how consumers and citizens respond to that regulation.

The International Social Science Liaison Group (ISSLG) was established in 2012 as an informal forum for government organisations involved in the social and behavioural sciences of food regulation, food safety and public health nutrition to discuss and collaborate on issues of mutual interest. The ISSLG provides a forum where members:

- Share information and encourage collaboration regarding social research activities
- Share information on types of issues and topics where social research has been of use
- Share details on methods and tools used in social research, including theoretical basis, questionnaires, sampling, computer software and analytical techniques
- Share details of completed social research, including summaries of findings, reports and, where appropriate, data
- Identify opportunities to collaborate in the development of social research and questionnaires to enable comparative work to be carried out
- Provide a forum for seeking comment upon and/or peer review of reports, questionnaires and research proposals
- Enhance capacity in the application of the social sciences to food regulation issues through development and support of appropriate forums
- Identify professional development opportunities such as mentoring and secondments, and
- Identify and share best practice in communicating social sciences research and outcomes to senior managers, decision makers and key stakeholders.

The membership of ISSLG is limited to government organisations to retain the focus on policy-relevant, applied social and behavioural research and evidence. Current members are from Australia (Food Standards Australia New Zealand, Department of Health), Canada (Health Canada, Canadian Food Inspection Authority), the European Union (European Food Safety Authority), New Zealand (New Zealand Food Safety, Ministry for Primary Industries), United Kingdom (Food Standards Agency), and the United States of America (US Food and Drug Administration).

ISSLG meets approximately 4 times per year via video/teleconference. When possible the group holds a face to face meeting over several days for more in-depth interaction and discussion.

Appendix 2: Method

Focus of the review

The key focus of the literature review was on consumers' responses to allergen declarations and to precautionary allergen or advisory labelling. The review process was separated into two parts: Part 1: allergen declarations undertaken by FSANZ, and Part 2: precautionary allergen or advisory labelling undertaken by the FSA.

Part 1: Allergen declarations

The key focus areas for Part 1 were:

- Location and consistency of allergen declarations (including placement of the statement of ingredients and allergen summary statement)
- Terminology used in making allergen declarations
- Formatting of allergen information.

Part 1 of the review is an edited and revised version of a literature review that FSANZ undertook to inform a proposal to change Australia and New Zealand's allergen declaration requirements (FSANZ 2019). In editing and revising the original Plain English Allergen Labelling (PEAL) review, Australian and New Zealand studies were de-emphasised, study quality was reassessed using the scoring system by Verrill and Wu (2019), and studies that were assessed as low or unable to be quality rated due lack of methodological detail were not included in the write up. An additional search was carried out in August 2020. This did not identify any new studies for inclusion.

Part 2: Precautionary Allergen Labelling

The overarching research question was:

- What evidence is there on consumer understanding and responses to PAL on prepackaged food?

This was broken into three subsidiary research questions:

- How do consumers use PAL?
- How does PAL affect consumer's behaviour?
- What are the current issues with PAL for consumers?

The focus of the literature review was developed by officers at FSANZ and FSA. Members of the ISSLG¹¹ provided feedback on a draft project template. This was further refined following input from an electronic working group established by the Codex Committee on Food Labelling to review allergen labelling.

¹¹ The ISSLG is a forum for government organisations involved in the social sciences of food regulation, food safety and public health nutrition to discuss and collaborate on issues of mutual interest.

Scope

Part 1: Allergen declarations

For Part 1 of the literature review on allergen declarations the following inclusion criteria had to be satisfied:

- **Study type:** empirical studies that reported consumer response to location, terminology, formatting and consistency of allergen declarations. No exclusion criteria were set with regard to study design. Editorials and commentaries, and other studies that did not report empirical results were excluded from the review.
- **Populations of interest:** food allergic individuals (FAIs) and carers and guardians of food allergic individuals.
- **Language:** English only.
- **Date of publication:** Between January 2000 and August 2020.

The initial focus was on peer-reviewed published literature. Grey literature was included where it met inclusion criteria.

Part 2

For Part 2 of the literature review on PAL the following inclusion criteria had to be satisfied:

- **Study type:** empirical studies that reported consumer experience of PAL in relation to pre-packaged food. This is food that is 'packaged or made up in advance in a container, ready for offer to the consumer, or for catering purposes' (Codex 1991). No exclusion criteria were set with regard to study design. Editorials and commentaries, and other studies that did not report empirical results were excluded from the review.
- **Populations of interest:** food allergic individuals (FAIs), or those purchasing on behalf of these individuals (e.g. parents, care-givers). Studies that conducted research among both FAIs and non-FAIs were also included.
- **Language:** English only.
- **Date of publication:** Between January 2000 and November 2019.

The initial focus was on peer-reviewed published literature. Grey literature was included where it met inclusion criteria.

Search

Part 1: Allergen declarations

For Part 1 of the literature review on allergen declarations we searched the following on-line electronic databases:

- PubMed
- Science Direct
- Food Science Source
- FSTA - Food Science and Technology Abstracts
- MEDLINE with Full Text
- SocINDEX with Full Text

The search string used was:

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TI(allerg* OR gluten* OR intoler* OR celiac*) AND AB((allerg* OR gluten* OR intoler* OR celiac) AND (consumer* OR people OR person OR "allergen sensitive consumer" OR babysitter OR "baby sitter" OR "baby-sitter" OR parent* OR adult* OR infant* OR
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baby OR babies OR child* OR infant* OR pediat* OR teenager* OR adolescent* OR caregiver* OR “care giver” OR “care-giver” OR individual) AND (label* OR pack* OR list* OR claim* OR contain* OR “ingredient list” OR “ingredients lists” OR “ingredient lists” OR “summary statement” OR “nutrition facts” OR “nutrition information” OR “back of pack” OR “back-of-pack”) AND (understand* OR interpret* OR awar* OR decid* OR use* OR usable* OR choos* OR choic* OR buy OR purchas* OR select* OR inten* OR prefer* OR pick* OR behav*))

Using the search software the search was limited to studies that were:

- from peer-reviewed sources
- in English language
- published between January 2002 and 3 August 2018

The initial search was conducted on 3 August 2018. A subsequent search to update the literature reviewed was carried out on 18 August 2020. No new studies were added to the review as a consequence of this search.

Hand searching was also undertaken to identify further papers that may not have been captured through the electronic search. The hand searching included review of reference lists of in scope publications.

Part 2

For Part 2 of the literature review on precautionary allergen labelling the following on-line electronic resources were searched:

- Scopus database
- Google/Google Scholar

The search strings used were:

Food allerg* , food intolerance, coeliac, food hypersensitivit*

precautionary statement* , precautionary labelling, precautionary allergen labelling, PAL, allergen advisory labelling, allergen labelling, label* , may contain, cross-contamination allergy warning, precautionary allergen labelling international, precautionary allergen labelling legislation, precautionary allergen labelling regulation, allergen labelling risk assessment, allergen labelling consumer, mandatory allergen labelling international,

Food allergy attitudes, preferences, risk taking

Using the search software the search was limited to studies that were:

- in English language
- published between January 2000 to November 2019

The initial search was conducted in July 2019 and updated in November 2019

Additional literature was sourced using a ‘pearl growing’¹² technique. This approach was used to identify further sources cited within the previously identified literature, and sources that cited the previously identified literature.

Screen

Parts 1 and 2

Following the removal of duplicates, the remaining papers were screened by title and abstract and those that were not in scope were removed.

The following types of papers were removed during screening on title and abstract:

- journal editorials
- comment papers
- systematic review papers
- clinical studies/allergen thresholds/treatments
- business response/understanding of allergen declaration/precautionary allergen labelling

Full-text versions of in scope studies were obtained.

Quality assessment

Parts 1 and 2

The quality of all in-scope studies were assessed by a single researcher, using a series of questions drawn from Verrill and Wu (2019) (see below). They use a system based on 5 key criteria, and two additional criteria for grey literature. The criteria apply across all types of study design. However the criteria were separately operationalised for study both qualitative and quantitative studies. Studies were rated as high (2), medium (1) or low (0) with respect to each criteria and an overall quality rating of high, medium or low given to the study.

Studies rated as low quality were excluded from the literature review.

There were six studies that were common to both parts 1 and 2 of the review. These were reviewed by both the FSANZ and FSA teams. Where quality ratings were different, the issues were discussed and a consensus rating was agreed upon by both teams.

Points ¹	Criteria Category	Quantitative Studies	Qualitative Studies
0-2	Theory	Clearly specified theoretical framework	Appropriate discussion of theory
0-2	Population or Unit of analysis	Clearly specified and justified population	Clear description of- and justification for- of the choice of participants

¹² ‘Pearl growing’ is an approach to systematic literature searching in which the references in, and citations of, the literature obtained are used to locate further studies for potential inclusion.

0-2	Methods and Measures	Non-Experimental study: Measures are appropriate and clearly described Experimental study: Stimuli, measures, and procedures are appropriate and clearly described	Questions, probes, and procedures are appropriate and clearly described
0-2	Analysis	Statistical tests are appropriate and clearly described	Analytical method is appropriate and clearly described
0-2	Results	Results clearly described and appropriately reported	Results combine researcher's interpretations and supporting quotes from participants
0-2	Discussion	Conclusions are well-supported by the data and are clearly tied to the research question; uncertainties, limitations, and potential biases are reported	
-2	Peer-review	Not peer reviewed – excluding government-produced reports	
-2	Conflict of interest	Research conducted for or by the person/organization with a proprietary interest in the results	

Data extraction

Parts 1 and 2

Data extraction was completed simultaneously with quality assessment. As the paper was read key features and findings were extracted and summarised. The data extracted from each paper included: country of study, study aims and/or research questions, study type, description of research methods and sampling strategy, summary of data collection and analysis, relevant findings, and notes on the quality assessment.

This data was summarised for each paper and is presented in Appendix 3.

Write-up and synthesis

Parts 1 and 2

The evidence drawn from each study was then collated thematically under the research objectives to present a narrative overview of the available evidence.

Peer review

Parts 1 & 2

After completion, the draft literature review was reviewed by members of the ISSLG. Review comments and suggestions were considered and incorporated into the subsequent version of the literature review.

The Draft Final review was externally reviewed by academics with expertise in behavioural sciences and allergen research specifically. Peer review comments have been considered and changes to the text incorporated.

Appendix 3: Summary of studies cited

Study details	Study type	Sampling	Quality Assessment	Relevant findings
<p>Barnett, J. et al. (2011a)</p> <p>Title: How do peanut and nut-allergic consumers use information on the packaging to avoid allergens?</p> <p>Countries: United Kingdom</p> <p>Aim: “To understand the complex risk assessment decisions made by peanut and nut-allergic adults when purchasing food, with particular reference to use of printed package information”</p>	<p>Qualitative - Observational and semi-structured interviews (which involved a product choice reasoning task).</p> <p>All packaged foods examined by participants while shopping at their local grocery store that bear a label and may contain traces of peanuts and nuts.</p>	<p>32 respondents aged 16 years and over with a clinical history compatible with IgE-mediated reactions to peanuts and/or tree nuts</p> <p>Participants were recruited via three sources –specialist allergy clinics at one hospital trust, primary care settings, or from staff and students from the University of Surrey.</p> <p>Potential participants completed a postal screening questionnaire, and those with allergies or intolerance to foods other than peanuts/tree nuts were excluded.</p> <p>Participants were classified as having a mild, moderate or severe allergy by an allergen consultant. Eligible participants participant in the accompanied shop followed by an interview.</p>	<p>High</p> <p>Participants took part in three tasks: an accompanied shop, followed by an interview which also included a product choice reasoning task. This triangulation of methods was used to reveal the different dimensions of choice.</p> <p>Response rate (59.3%) may indicate those who chose to participate were particularly motivated (response bias), and may reflect other systematic differences.</p> <p>While participants were trained in a ‘think aloud’ methodology prior to the accompanied shop, social desirability and differing levels of literacy may have influenced results.</p> <p>No mention of how many observers there were, or whether the same observer was used. No mention of participant nor observer blinding.</p> <p>Stimuli was realistic (during observational shop participants viewed real labels, and real labels were presented at the interview)</p> <p>Insufficient information provided to determine whether procedures were standardised</p> <p>Correlation not causation (participants revealed via interview which label elements they believed caused them to act a certain way, but this was not tested)</p> <p>Some wording used in the interview questions may have lead participants to respond in a certain way</p>	<p>Some participants used the statement of ingredients alone as their primary check for allergens, but most used the allergy advice box, or a combination of the two. Allergy declarations were deemed easier to read than the statement of ingredients. The concise summary of allergens was welcomed, however the lack of detail (e.g. no elaboration on which type of nut was present) was disliked, particularly for products considered foreign.</p> <p>Participants disliked allergens being listed at the end of often an extensive statement of ingredients due to their minor (albeit significant) presence in a product.</p> <p>Participants expressed frustration with the small font size of the statement of ingredients and poor contrast between text and background.</p> <p>A desire for allergens within statement of ingredients to be bolded and in colour so as to stand out was expressed.</p> <p>Where the first-line strategy (examination of product by type or brand name) did not lead to a confident decision, participants used other printed packet information such as the statement of ingredients. Images and products names (not intended by manufacturers as a risk assessment aid) were used to draw inferences about the presence of nuts.</p> <p>Participants preferred labelling was clear in its indication of nuts in the statement of ingredients combined with a ‘nut free’ or ‘contains nuts’ label to prompt inspection of the statement of ingredients.</p>

Study details	Study type	Sampling	Quality Assessment	Relevant findings
<p>Barnett et al. (2011b)</p> <p>Title: Using 'may contain' labelling to inform food choice: A qualitative study of nut allergic consumers</p> <p>Countries: United Kingdom</p> <p>Aim: "To understand how peanut and nut allergic adults interpret 'may contain' labelling and how they use this information when purchasing food"</p>	<p>Observational and semi-structured interview (qualitative)</p> <p>Natural observation – included all packaged foods examined by participants while shopping at their local grocery store)</p>	<p>32 respondents aged 16 years and over with a clinical history compatible with IgE-mediated reactions to peanuts and/or tree nuts</p> <p>Participants were recruited via three sources –specialist allergy clinics at one hospital trust, primary care settings, or from staff and students from the University of Surrey.</p> <p>Potential participants completed a postal screening questionnaire, and those with allergies or intolerance to foods other than peanuts/tree nuts were excluded.</p> <p>Participants were classified as having a mild, moderate or severe allergy by an allergen consultant. Eligible participants participant in the accompanied shop followed by an interview.</p>	<p>High</p> <p>Participants took part in three tasks: an accompanied shop, followed by an interview which also included a product choice reasoning task. This triangulation of methods was used to reveal the different dimensions of choice.</p> <p>Response rate (59.3%) may indicate those who chose to participate were particularly motivated (response bias), and may reflect other systematic differences.</p> <p>While participants were trained in a 'think aloud' methodology prior to the accompanied shop, social desirability and differing levels of literacy may have influenced results.</p> <p>No mention of how many observers there were, or whether the same observer was used. No mention of participant nor observer blinding.</p> <p>Stimuli was realistic (during observational shop participants viewed real labels, and real labels were presented at the interview)</p> <p>Insufficient information provided to determine whether procedures were standardised</p> <p>Correlation not causation (participants revealed via interview which label elements they believed caused them to act a certain way, but this was not tested)</p> <p>Some wording used in the interview questions may have lead participants to respond in a certain way.</p>	<p>Part 1</p> <p>Clear nut warnings were seen to convey the message the nut content of food products had been assessed and considered by the manufacturer. More specific wording (e.g. reference to the type of nut) indicated there is some particular knowledge by the manufacturer about the increased risk of the presence of allergens and participants were more likely to take precautionary action accordingly.</p> <p>There was evidence that variation in labelling wording played a role in leading nut allergic individuals to choose or reject foods on the basis of minor (and often meaningless) variations.</p> <p>The authors suggest that standardised wording may be usefully backed up by legislation.</p> <p>Part 2</p> <p>May contain labelling was preferred over receiving no information about the allergen cross-contact risks of a product. It was particularly important when the food product concerned is considered 'riskier'.</p> <p>Participants did, however discount the message for a variety of reasons, including: 1) for pragmatic reasons e.g. to avoid a very limited diet; 2) suspected motivations of the message source; 3) the risk was perceived to be lower when tied to weaker phrasing of the message.</p> <p>There were a broad range of behavioural responses to 'may contain' labelling, a minority said they would always avoid foods labelled with this statement, but the majority ignored it when deciding to purchase a product. There was variation among those who ignored this labelling in terms of the perceived risk of a reaction.</p>

Study details	Study type	Sampling	Quality Assessment	Relevant findings
<p>Ben-Shoshan, M. et al. (2012)</p> <p>Title: Effect of precautionary statements on the purchasing practices of Canadians directly and indirectly affected by food allergies.</p> <p>Country: Canada</p> <p>Aim: To “describe the effect of precautionary statements on the purchasing habits of Canadian consumers either directly or indirectly affected by food allergy”.</p>	<p>Quantitative – non-experimental. Survey of households.</p> <p>The survey collected demographic data for the household, followed by data on attitudes towards food labelling, including whether the eligible household respondent would purchase products containing 3 different types of commonly used PAL.</p> <p>The PAL types under review were: 1) statements that describe the product e.g. “may contain”; 2) statements that describe the manufacturing process; and 3) statements that provide suitability information.</p>	<p>The sample was recruited from multiple sources and included households directly and indirectly affected by food allergy (indirectly affected is defined as the purchase or preparation of food for an allergic individual outside of their household).</p> <p>1,318 individuals from directly affected households, and 1,113 individuals from indirectly affected households participated.</p> <p>Households directly affected by food allergy were recruited from a random sample from a Canadian population study (SCAALAR)¹³ (127), as well as through the Canadian peanut allergy registry and food allergy support organisations (1,191). To participate, respondents needed to report a convincing history of an IgE-mediated food allergy or medical diagnosis.</p> <p>Indirectly affected households were also recruited through the SCAALAR study (1,113).</p>	<p>Medium</p> <p>The conclusions drawn are generally well supported and illustrated by the data.</p> <p>Directly affected participants were included based on either a convincing history of an IgE-mediated reaction, or a medical diagnosis, however this was self-reported by respondents and may have introduced some bias to the findings.</p> <p>Multiple sources were used to recruit to the study and the key characteristics of the participants was documented.</p> <p>Respondents were predominantly female, and of a certain age. This likely reflects to some extent the food shopping behaviours of households but may have skewed the results. Respondents recruited from the registry and support organisations are likely to be highly informed and motivated to manage the allergic conditions within their households, introducing selection bias.</p> <p>One respondent per household means that they were reporting on behalf of others and they may not accurately reflect all demographics and behaviours.</p>	<p>The effectiveness of precautionary statements in deterring consumer purchasing varied a lot, though for all groups, the statement “not suitable” was reported as most effective at deterring purchasing products.</p> <p>The directly affected subsample recruited from the SCAALAR general population survey (127) were the least vigilant in terms of reported avoidance of the precautionary statements under review. Participants recruited from indirectly affected households were more diligent than the general population of directly affected participants in this study.</p> <p>Households that reported having a child with peanut, tree nut or sesame allergies, or an individual with a previously moderate or severe reaction, were more vigilant in their purchasing of products carrying precautionary statements.</p>

¹³ SCAALAR, ‘Surveying Canadians to assess the prevalence of common food allergies and attitudes towards food labelling and risk’.

Study details	Study type	Sampling	Quality Assessment	Relevant findings
<p>Brown et al. (2015)</p> <p>Title: Canadian policy on food allergen labelling: Consumers' perspectives regarding unmet needs</p> <p>Countries: Canada</p> <p>Aims: "To explore the perspectives of directly affected individuals as well as members of the general public regarding their needs and preferences for precautionary labelling, allergen symbols, and suggestions for improving labelling practices in Canada".</p>	<p>Focus groups</p> <p>All frequently purchased grocery items that bear a label and may/may not contain allergens</p>	<p><i>n</i> = 52 participants - FAIs or members of their family (<i>n</i> = 27) and members of the general public who had no FAI in their immediate family (<i>n</i> = 24).</p> <p>Participants residing in the Vancouver area were invited to participate if they were 19 years or older and fluent in both reading and writing English.</p> <p>Directly affected participants were recruited through an allergy support charity. The general public subsample was recruited using a market research agency.</p> <p>Participants in the directly affected sample were predominantly female, middle-aged (40-49) and had an average household income of > \$75,000.</p>	<p>Medium</p> <p>Focus group sizes kept small to allow for adequate exploration of each participant's perspective</p> <p>Participation incentive (offered a monetary reward)</p> <p>Social desirability and confirmation bias may have affected results</p> <p>Focus groups were digitally recorded and transcribed verbatim for subsequent thematic analysis. Both deductive and inductive approaches to coding were used to identify themes related to the research objectives.</p> <p>Standardised methods were used to conduct the interviews, although no mention of whether the same interviewer was used, nor whether they were trained</p> <p>Unknown whether more than one researcher performed the analysis</p> <p>Selection bias may have occurred for the directly-affected group (membership in support groups is associated with higher income and education)</p>	<p>Part 1</p> <p>Symbols were deemed to be very useful for those not directly affected by allergy and for those with low English proficiency. Participants did acknowledge it would be difficult to include a symbol for each potential allergen due to the sheer number.</p> <p>Participants from the general public preferred allergen information to be located on the front of package, while those directly affected preferred it to be near the statement of ingredients.</p> <p>Both groups wished for labels to be legible and easy to read. Standardising terminology, allergen information placement, and formatting of symbols was also stressed.</p> <p>Part 2</p> <p>Most participants in the directly and indirectly affected groups did not find "may contain" statements helpful, this was linked to a lack of explanation for why there was a risk of cross-contact.</p> <p>Participants in the directly affected focus groups preferred statements that described the manufacturing process. These were considered more specific and therefore useful in making informed choices.</p> <p>There were mixed responses to the "not suitable for" statement. Some participants felt it would simplify their purchasing decisions, but this was mainly among the participants recruited from the general population. Some directly affected groups felt it inappropriate for manufacturers to determine a product's suitability and that statements should instead inform their decision-making.</p>

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<p>Choi & Choi (2016)</p> <p>Title: Perception of food labelling about allergens in food products in South Korea</p> <p>Countries: South Korea</p> <p>Aim: To investigate what information consumers are concerned with as well as improving the allergen information on product labels</p>	<p>Survey</p> <p>All food items bearing a label that may contain potential allergens. Questions related to labelling elements.</p>	<p>$n = 302$ (48 excluded as being ineligible for consideration) – a combination of FAIs and those with no direct link to food allergies</p> <p>Respondents were approached in the general community by fieldworkers and asked to participate.</p>	<p>Medium</p> <p>Questionnaire was designed based on previously validated items from prior studies</p> <p>Questions were screened by experts to ensure readability and comprehension</p> <p>No mention of response nor dropout rate</p> <p>Respondents were made aware of the aims of the study</p> <p>Every attempt was made to obtain a representative sample</p> <p>Surveys were self-administered (no standardised delivery)</p> <p>Relatively small sample size for survey methodology</p> <p>Only perception was analysed, not actual purchasing behaviour or knowledge comprehension.</p> <p>No mention of the criteria used to exclude the 48 respondents not included in the final analysis</p> <p>Diagnosis of food allergy had no validation (self-reported)</p> <p>Recall, memory, and social desirability bias may have affected results</p> <p>Correlation study</p>	<p>Most respondents agreed improvement was needed in allergen labelling.</p> <p>Respondents reported food allergen font, colour and size needed to be improved to distinguish it from general nutrition information.</p> <p>Respondents desired a mandatory bolded allergen cautionary statement, and reported frustration at the current location of allergen information, which is often under the nutrition information and difficult to identify.</p> <p>Respondents were concerned with the exact quantity of the allergen present in the food product, suggesting the need for a (%) behind each allergen.</p> <p>These responses were consistent amongst those purchasing for themselves or others, and those with a previous or no previous history of allergic reaction.</p>

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<p>Chow (2011)</p> <p>Title: Everybody else got to have this cookie: The effects of food allergen labels on the well-being of Canadians</p> <p>Countries: Canada</p> <p>Aims: “To explore the effects of food allergen labels on the well-being of affected Canadians, using a social constructionist framework and a mixed methods approach”</p>	<p>Survey and accompanied shop/interview</p> <p>Items bearing a label the participants chose to purchase at the grocery store</p>	<p>$n = 1308$ completed the survey</p> <p>$n = 12$ anaphylactic individuals, or parents of anaphylactic children participated in the accompanied shopping trip</p> <p>Survey data was drawn from a nation-wide, cross-sectional, computer assisted telephone interview survey conducted in 2008. Random sampling was used to select household telephone numbers from the White pages.</p> <p>To recruit shopping participants, recruitment posters were posted at community centres and circulated on Anaphylaxis Canada’s website.</p>	<p>High</p> <p>Study replicated the methodology of a high-quality study conducted in Greece and Netherlands by Cornelisse Vermaat et al. (2007)</p> <p>For the interview component, previously validated questions were asked by the same trained interviewer</p> <p>Participation incentive offered (monetary reward)</p> <p>Mixed method approach allows for richer data collection</p> <p>Perceived and doctor-diagnosed allergies were not distinguished amongst FAIs, possibly inflating the estimate of directly affected population</p> <p>Sampling bias may have affected those recruited for the qualitative component (shopping trip)</p> <p>Observer was trained (to reduce observer bias) to discretely monitor participants’ shopping behaviour (to minimise the likelihood of social desirability bias)</p>	<p>Most participants searched for allergen warnings as the primary source of information, followed by the statement of ingredients. Participants trusted allergen free and contains claims more than precautionary allergen labelling.</p> <p>Allergen warnings (e.g. allergen summary statements) were viewed as an indication of the company’s awareness of food allergies, and their commitment to adopting good manufacturing practices.</p> <p>An allergen-free logo was found to be an eye catching cue that drew immediate attention.</p> <p>The most frequently voiced concerns were terminology related (58%). Hidden ingredients and words not being in lay terms (e.g. spices) was an issue.</p> <p>25% reported small font sizes, 8% reported inconsistent labels, and 42% reported location of allergen information. When asked to report where improvements could be made: 58% reported font size and bold text in the statement of ingredients, 33% reported consistent labels, location of allergen information, stricter regulations, 25% reported other and colour contrast, and 8% reported identifying tree nut type in labels.</p>

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<p>Cochrane, S.A. et al. (2013)</p> <p>Title: Characteristics and purchasing behaviours of food-allergic consumers and those who buy food for them in Great Britain.</p> <p>Countries: Great Britain</p> <p>Aim: To explore the characteristics and buying-behaviours of members of the general public who consider themselves to have a food allergy and/or who buy food for allergic individuals.</p>	<p>Quantitative – non-experimental. Online survey of food allergic consumers and people buying for food allergic consumers.</p> <p>The survey collected demographic data in addition to information on reported purchasing behaviours of products containing PAL.</p>	<p>Overall 949 respondents participated, including 537 food allergic individuals and 501 food buyers (including 89 of the food allergic individuals).</p> <p>The survey was conducted using an online panel representative of the general population of Great Britain.</p> <p>The survey included a filter to focus on participants experiencing a 'true' food allergy. This question asked about prior experiences of symptoms synonymous with allergic reactions.</p> <p>Over half (55%) of the respondents were female. The authors note the sample was close to being nationally representative in terms of age, regional and socioeconomic distributions, though the source used to facilitate this comparison was not documented.</p>	<p>Medium</p> <p>No guidance was provided to respondents regarding the questions or terminology used (e.g. anaphylactic shock). This will have had implications in terms of whether the final sample was reflective of individuals with food allergy, and those shopping on their behalf, or not.</p> <p>The questionnaire used was short, with only one question relating to PAL, meaning the findings should be used with caution.</p> <p>Some of the PAL question response options did not seem to be mutually exclusive, despite appearing to be presented to respondents in this way. This may have affected the accuracy of the data collected.</p> <p>A reasonable proportion of respondents stated 'other' to the PAL question, and these responses were not unpacked by the researchers in the paper.</p>	<p>A third of respondents (34% of 949) reported always avoiding products with a relevant "may contain" label. A further 27% reported buying such products regularly if the allergen is not listed as an ingredient, and 8% regularly purchase such products.</p> <p>Generally, the responses to this question differed according to the severity of the way in which the allergy manifested itself. Respondents with severe symptoms reported more cautious and vigilant buying behaviour than those with less severe symptoms.</p>

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<p>COI Communications on behalf of Food Standards Agency UK (2002)</p> <p>Title: Nut allergy labelling – report of research into the consumer response</p> <p>Countries: United Kingdom</p>	<p>Individual interviews and focus groups</p> <p>Common foods found in the respondents' houses that bear a label</p> <p>Twenty one in-depth individual interviews (both with FAs and partners/parents who may occasionally shop for them) in addition to three focus group discussions with six respondents who occasionally shop on behalf of someone with a nut allergy</p>	<p>21 participants in the individual interview component</p> <p>6 x 3 = 18 participants in the focus group discussions</p> <p>Participants of varying ages, gender, and ethnicity were recruited from several sites around the UK to ensure a representative sample was obtained. However, recruitment method was not revealed</p>	<p>Medium</p> <p>Research was carried out in five locations</p> <p>Mixed method design was used to obtain richer, and more complete information from a range of consumers</p> <p>Discussions with individuals or pairs were conducted in their own homes to allow access to food packaging from their own cupboards/fridges to illustrate buying habits and views – allowed for a form of validation and reduced recall/memory bias likelihood</p> <p>No information was provided as to whether pre-validated questions were asked, although a standardised procedure was followed for questioning</p> <p>No information supplied about number of interviewers, training etc.</p>	<p>In making decisions about whether to purchase a product, the food label was the most relied upon method, as it was perceived to be the most up to date source of information.</p> <p>Participants gave support for greater standardisation across allergen labelling (both content and format of presentation).</p> <p>A symbol as a prominent first line alert (placed in a prominent and consistent position on the label – ideally the front and the back of the pack next to the cautionary statement) was also suggested, with the text "Take Care - Nuts". Greater visibility was desired for the three main components considered essential to a food allergic individual (symbol, nutrition table with statement of ingredients, and allergen summary statement or warning), all in a consistent position.</p> <p>Participants desired more simpler and definitive wording in the form of an allergen summary statement e.g. "contains nuts", with reference to the species of nut in the statement of ingredients and highlighted. The allergen summary statement was desired to be positioned above or to the left of the statement of ingredients, not below it.</p> <p>Participants suggested placing allergen information in a different coloured panel if the colour of the packaging makes it difficult to distinguish from other information.</p> <p>They desired a consistent colour used for the statement of ingredients, symbol, and cautionary statement as an alert this all referred to allergen information.</p> <p>The requested font size be large enough for those to read without glasses, and use a mix of upper and lower case.</p>

Study details	Study type	Sampling	Quality Assessment	Relevant findings
<p>Cornelisse-Vermaat, J.R. et al. (2007)</p> <p>Title: Food allergic consumers' labelling preferences: a cross-cultural comparison.</p> <p>Countries: The Netherlands and Greece</p> <p>Aim: To "test consumers' preferences regarding food labelling in a realistic shopping environment" and "to elicit understanding of the preferences of food-allergic consumers regarding labelling of potentially problematic ingredients".</p>	<p>Qualitative - Observational and semi-structured interviews.</p> <p>Participants were provided with a shopping list containing 15 potentially problematic food products and were then instructed to purchase all of the items mentioned. Participants were observed and interviewed throughout this shopping trip.</p> <p>Half of participants in each country shopped in a familiar and unfamiliar shop.</p>	<p>20 participants were recruited in each country.</p> <p>Half of the participants were parents of children with food allergies, with the rest being adults with food allergies.</p> <p>Participants were recruited through advertisements posted using a variety of channels (newspapers, patient group websites, adverts etc.)</p> <p>Participants were included if they reported that they, or their children, had one or more of the following food allergies: peanuts; tree nuts; milk; and egg.</p> <p>Participants were mostly female and aged between 25 and 44, and the authors note that this may reflect the fact that in the countries included in the study, women are mostly responsible for food shopping.</p>	<p>High</p> <p>The conclusions are well-supported by the data and are presented alongside a reflection on the main limitations of the study.</p> <p>Quality assurance procedures are documented to a reasonable level.</p> <p>It is unclear how participants' self-reported food allergies were confirmed, e.g. if they were asked to detail symptoms of previous reactions.</p> <p>The sampling approach is likely to have introduced some self-selection bias to the study findings.</p> <p>Observed shopping may not be representative of a natural unaccompanied shopping experience and may have elicited some desirability biases.</p> <p>Participants were encouraged to find all of the items on the shopping list they were given, which may have led them to take more risks due to the desire to succeed in the task and please the interviewers.</p> <p>It's unclear how comparisons between the wording on the Greek/Dutch labels were made.</p>	<p>Precautionary allergen labelling was not viewed positively by consumers included in the study. Many felt that it caused unnecessary restrictions, limiting their food choices. This sentiment was particularly strong among individuals with, or shopping for, severe food allergies, who would not take the risk in purchasing products with PAL.</p> <p>Participants did not think that they would contact shop personnel if they needed more information about potential allergens in the food they were shopping for, as they didn't think that the retail staff would have the knowledge to be able to provide reliable information on this. Participants were more likely to state that they would contact the producer if they had further queries.</p>

<p>Creative Research on behalf of FSA (2016)</p> <p>Title: Understanding of food labelling terms used to indicate the absence or reduction of lactose, milk or dairy</p> <p>Countries: United Kingdom</p> <p>Aims: “To explore understanding of the terms used on food labelling – ‘dairy free’, ‘milk free’, ‘lactose free’ and others – among three key audiences: consumers with sensitivity to milk, health professionals who may advise such consumers, and food businesses who produce and market products suitable for these consumers”</p>	<p>A mix of telephone and face-to-face interviews</p> <p>Packaged products that bear a label and that contained milk/milk by-products</p> <p>The terms: ‘lactose’, ‘milk’ and ‘dairy’ were examined.</p>	<p>Total of 63 interviews – $n = 32$ interviews were with consumers, and the remainder split between health professionals – ($n = 15$) and food businesses ($n = 16$).</p> <p>Participants were recruited using mixed methods – recruiters identified consumers through networking and the Galactosaemia Support Group</p> <p>Health professionals were found using a mix of databases and recruiters on the ground.</p> <p>Intermediaries and Food Standards’ own internet and retail searchers helped identify businesses. Recruitment screening questionnaires were used to select consumers and health professionals for interview. Consumers who made use of food labels and who were milk sensitive themselves or who had a child who was affected were selected.</p>	<p>Medium</p> <p>Demographic data was collected to try to achieve a mix in terms of age, gender and ethnicity</p> <p>The purpose of the study was made clear to participants</p> <p>Every attempt was made to standardise interview questions and information collection methods – interviewers followed standardised discussion guides</p> <p>No mention of whether interviewers received prior training</p> <p>No mention of whether the same interviewer was used</p> <p>There may have been systematic differences in how respondents answered depending on whether they were interviewed in person or over the phone (e.g. may be less influenced by social desirability over the phone)</p> <p>Leading questions may have been an issue</p> <p>Neyman’s bias may have affected results for FAls or those who shop for them</p> <p>Response and memory bias may have influenced results</p> <p>Only correlational (descriptive) data was collected – cannot draw causal conclusions</p>	<p>Products described as ‘lactose free’ were generally assumed to be suitable for people with lactose intolerance, but there was considerable uncertainty about whether or not they were suitable for people with a milk allergy or intolerance.</p> <p>Participants with a lactose intolerance were uncertain whether products described as ‘dairy free’ or ‘milk free’ were suitable for them. It was understood to refer to the absence of both milk and products derived from milk, such as butter, yoghurt, and cheese, although some mistakenly thought this also meant the product was free from eggs.</p> <p>There was significant confusion about the term ‘milk free’, as this was thought to mean the absence of alternative ‘milks’ made from plants e.g. soy, as well as animal milks. Others thought this only referred to cow’s milk. There was confusion about whether ‘milk free’ products could contain butter, yoghurt, and cheese, or were just free from milk itself.</p> <p>Health professionals and consumer respondents displayed similar uncertainties regarding terminology use.</p> <p>“Dairy free” was the term that seemed to have broadest appeal across all audiences.</p>
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Study details	Study type	Sampling	Quality Assessment	Relevant findings
<p>Define Research & Insight – Commissioned by FSA UK (2009)</p> <p>Consumer understanding of new labelling terms for foods marketed for people with gluten intolerance</p> <p>United Kingdom – England, Northern Ireland, Scotland & Wales</p> <p>To explore reactions towards the new EU labelling legislation with regard to labelling on products marketed to individuals who follow a gluten free diet. Also, to understand current strategies used by individuals with Coeliac disease – the labels and information used to make informed food choices”.</p>	<p>A combination of focus groups (3–7 participants), paired in-depth interviews and face to face individual interviews with health professionals</p> <p>Labels of common food products found at participants’ local supermarkets and home</p>	<p>Total $n = 58$ (including 15 parents, 43 individuals with Coeliac disease – both doctor and self-diagnosed)</p> <p>Two methods were used to recruit participants. Many were free-found by recruiters using their contacts (convenience sampling). Coeliac UK’s extensive database was also drawn upon to attract Coeliac participants. A monetary incentive to participate was offered.</p>	<p>High</p> <p>The sampling method aimed to achieve a representative sample (self and doctor diagnosed, a range of ages, genders, ethnicities)</p> <p>Prior to attending, all respondents were asked to complete a three-day food recall</p> <p>Face to face interviews were held ‘in home’ to allow moderators to view the types of food purchased and verify information collected via recalls</p> <p>Interviewers also followed an accompanied shopping trip</p> <p>The monetary incentive offered to participants may have resulted in selection bias</p> <p>Interviewer training, briefing and debriefing sessions were held – different interviewers used</p> <p>Experts e.g. dietitians were consulted throughout the process, including during the formation of questions</p> <p>Interview procedures were standardised</p> <p>Most individuals with Coeliac disease recruited were members of Coeliac UK support group (80%), and therefore sampling bias may have occurred</p> <p>No mention on how data was analysed/themes were drawn out</p> <p>Participants were made aware of the study’s objectives</p> <p>Potential for Neyman’s bias</p>	<p>While on the whole participants prefer products to be marked as “gluten free” or “containing gluten”, some felt these products were unnecessarily more expensive than their ‘ordinary’ counterparts and therefore sought gluten-free products that were not marketed as such.</p> <p>Symbols to indicate a product is gluten free or contains gluten was viewed favourably by food allergic individuals, but often not understood for those shopping for Coeliacs.</p> <p>In the absence of the word “gluten”, there is a heavy reliance on the information provided on the label and packaging.</p> <p>Allergy boxes were viewed favourably as they are seen to ease and speed up the decision-making process. Some accuracy issues with allergy boxes were noted as a source of frustration.</p> <p>The use of ‘scientific’ terms for the ingredient’s names were noted by some as misleading and ambiguous, and some were unsure about the suitability of certain ingredients e.g. Barley Malt Extract.</p> <p>Most participants did not feel confident enough to simply rely on reading the products’ composition and preferred to have some claim/mention of gluten.</p>

Study details	Study type	Sampling	Quality Assessment	Relevant findings
<p>DunnGalvin, A. et al. (2019)</p> <p>Title: Understanding how consumers with food allergies make decisions based on precautionary labelling.</p> <p>Countries: Europe</p> <p>Aim: “To understand how those living with food allergy assess risk with precautionary allergen labelling (PAL) and their preferences in how risks are communicated within a quantitative risk assessment (QRA) framework.”</p>	<p>Quantitative – non-experimental. Cross-sectional online survey.</p> <p>Respondents were split into 3 groups: 1) food allergic adults; 2) parents of children with a food allergy; and 3) food allergic adults who also have a child with a food allergy.</p> <p>The survey collected data on demographics; use and current perceptions of PAL; preferences in terms of labelling and symbols for PAL; perceptions around the potential use of a QRA framework in deciding when PAL should be used; and preferences in terms of how QRA should be communicated to consumers.</p> <p>The fieldwork was conducted in 2017.</p>	<p>The final sample used for the analysis was 1,560.</p> <p>The survey was distributed across Germany, Ireland, the Netherlands, Spain and the UK via patient support groups. Versions of the questionnaire were available in the different languages of the participating countries.</p> <p>34% of respondents were adults with a food allergy, most of whom were diagnosed formally; only 2% reported being self-diagnosed or diagnosed by someone other than a health professional.</p> <p>58% of respondents were parents (86% mothers). Finally, 8% were parents of a child with a food allergy who also had a food allergy themselves.</p>	<p>High</p> <p>The survey had no random sampling frame. Due to the potential biased population of patient support group members, the results may not be generalisable to the general food allergic population. In addition, the response rate is unclear.</p> <p>It doesn't appear as though many questions were used to validate whether individuals did have a food allergy, for example, what symptoms they have experienced from a previous reaction.</p> <p>However, the key demographics of the sample population are documented, and the sampling approach used is justified.</p> <p>The findings are explained and discussed in detail.</p>	<p>Participants were unsure whether a product is safe to eat if its packaging doesn't contain any form of PAL, indicating uncertainty over what PAL means.</p> <p>Overall consumers welcomed seeing a label that stated clearly that a product has undergone a risk assessment, reporting that it would be useful and helpful. A reasonable proportion of adults and parents reported that mandatory use would 'considerably improve their trust'.</p> <p>There was agreement in terms of preference for a combination of an unintended allergen presence statement, risk assessment statement and risk assessment symbol. Although all four options were rated as helpful by participants, level of helpfulness increased with the complexity of statements that were presented.</p> <p>The regression analysis undertaken found that respondent perceptions of safety, anxiety, convenience, choice and understanding would be “positively impacted” when making a purchasing decision if a QRA had been carried out on the product.</p>

Study details	Study type	Sampling	Quality Assessment	Relevant findings
<p>Hefle et al. (2007)</p> <p>Title: Consumer attitudes and risks associated with packaged foods having advisory labelling regarding the presence of peanuts.</p> <p>Country: United States</p> <p>Aim: “to determine whether consumers with food allergy heeded advisory labels and whether products with advisory labels contained detectable peanut allergen.”</p>	<p>Quantitative – non-experimental. Paper-based surveys of food allergic consumers and parents of children with food allergies.</p> <p>Different forms of PAL were explored including: “may contain...”, ‘...shared equipment...’ and ‘...facility that also...’.</p> <p>The authors also conducted a survey of retail-packaged foods containing advisory labelling statements for peanuts to determine the prevalence of detectable peanut residues.</p>	<p>Two surveys were undertaken across 3 Food Allergy and Anaphylaxis Network (FAAN) conference locations in two separate years, 2003 and 2006.</p> <p>Overall, there were 645 and 625 respondents in 2003 and 2006 respectively.</p> <p>96% of surveys were completed by a parent of a child with food allergy. No further demographics in terms of age, gender, income etc. were reported.</p>	<p>Medium</p> <p>The conclusions relating to PAL are supported by the data presented, but there could have been more detail provided about the approach used in the study paper.</p> <p>As the sample was predominantly composed of parents recruited from a series of food allergy conferences, the respondents are likely to be highly informed and motivated to manage the allergic conditions within their households and take PAL statements into account, introducing selection bias to the findings.</p> <p>The exact survey dissemination process and response rate is unclear and undocumented in the study paper.</p> <p>The criteria for participating in the survey are unknown other than attendance at the conferences, it is therefore unclear how severe the allergies of the respondents are.</p>	<p>Consumers with food allergy, or consumers who have children with a food allergy, are increasingly ignoring this form of advisory labelling. In 2003, 85% of respondents stated that they would never purchase a product with an advisory warning. This decreased to 75% in 2006.</p> <p>For each of the 8 advisory statements included in the survey, the percentage of respondents who excluded products containing these forms of PAL was significantly lower in 2006 than in 2003.</p> <p>In 2006, some PAL statements were reported to be heeded more than others. 'May contain...' labelling was most likely to be heeded (86%), compared to '...shared equipment...' (79%), and '...facility that also...' (64%).</p> <p>In terms of the survey of foods, no correlation was found between the format of the labelling statement and the likelihood of finding detectable peanut residues within the products surveyed.</p>

Study details	Study type	Sampling	Quality Assessment	Relevant findings
<p>Henderson et al (2003)</p> <p>Title: The impact of FSANZ labelling changes</p> <p>Country: Australia</p> <p>Aims: To discover consumers', health professionals' and allergen sufferers' knowledge and perception of changes to food label regulations by Food Standards Australia New Zealand".</p>	<p>Survey</p> <p>Four allergen food labels for a range of Heinz products (soup, baked beans and spaghetti) were presented and respondents asked to indicate their preference and why</p>	<p>$n = 170$ ($n = 107$ food allergic individuals and $n = 63$ health professionals</p> <p>Respondents were recruited through Anaphylaxis Australia Inc. A link to the online questionnaire was provided to the organisation, who sent an email to members.</p> <p>Various health professional associations in Australia were contacted via e-mail and asked if the members would be happy to participate and if an advertisement could be included in their newsletter/webpage.</p>	<p>Medium</p> <p>Questionnaire included a combination of closed and open-ended questions</p> <p>All questions included a clear rationale, and were based off previously-validated instruments</p> <p>Computer program used to administer survey – may have resulted in sample bias (only those with access could participate)</p> <p>Pilot questionnaire completed by health care professionals</p> <p>Incentives offered to participants may have resulted in response bias</p> <p>Small sample size for survey methodology</p> <p>Responses may have varied according to the type of food, allergy of the respondent (e.g. a mild peanut allergy versus Coeliac)</p> <p>No information provided on response rate</p> <p>Purpose of the study was revealed to participants</p>	<p>Only 50% of respondents were shown how to recognise alternative allergen ingredient names that trigger their allergy during their time of diagnosis.</p> <p>Only 39% of respondents knew to look for allergens in the statement of ingredients.</p> <p>36% believed allergen declarations were located on the front of the food label, and if not, this signified the products were allergen-free.</p> <p>The most popular label option had allergens emboldened in the statement of ingredients, in addition to a summary of allergens at the end of the list. Respondents felt having allergens displayed twice increased their likelihood of detecting it.</p>

Study details	Study type	Sampling	Quality Assessment	Relevant findings
<p>Hu et al. (2007)</p> <p>Title: Parental food allergy information needs: A qualitative study</p> <p>Country: Australia</p> <p>Aims: To examine information needs and preferences of parents regarding food allergy</p>	<p>In-depth semi-structured interviews and focus group discussions</p>	<p>$n = 84$ parents of children with food allergy</p> <p>Families were recruited from three paediatric allergy clinics in NSW, Australia. Families presenting with a child for evaluation of food allergy were sampled purposively to include a range of allergy types and severity, children's ages and length of time since diagnosis.</p>	<p>High</p> <p>Use of multiple data collection methods is shown to enhance internal validity</p> <p>Interviews were audio-recorded to allow for later analysis (themes drawn out using the validated constant comparative method)</p> <p>Summaries of the interviews were returned to participants to check for accuracy</p> <p>Another follow-up interview was conducted to ensure coverage of all key concerns</p> <p>A series of follow-up focus group discussions followed to confirm and extend findings</p> <p>To validate the established thematic categories, a selection of contrasting cases was independently reviewed by six expert reviewers from allergy and non-allergy specialists</p> <p>High response rate (92%) may reflect sampling bias</p> <p>Sample & Neyman's bias - the inclusion of consumer organisation members may have skewed results towards a preference for greater information provision</p>	<p>Parents expressed confusion at what to exclude from their child's diet and environment e.g. whether all foods from a group (e.g. tree nuts) should be avoided if their child had been diagnosed with an allergy to one food e.g. peanut.</p>

Study details	Study type	Sampling	Quality Assessment	Relevant findings
<p>Ju et al (2015)</p> <p>Title: Attitudes and preferences of consumers toward food allergy labeling practices by diagnosis of food allergies</p> <p>Country: South Korea</p> <p>Aims: “To investigate food allergens and prevalence rates of food allergies, followed by comparison of consumer attitudes and preferences regarding food allergy labeling by diagnosis of food allergies”</p>	<p>Survey</p> <p>Allergens studied: eggs, cow’s milk, buckwheat, peanuts, crab, shrimp, soybeans, wheat, mackerel, pork, peaches, tomatoes, Sulphite, other.</p> <p>Six label items examined: bold font, font colour, box frame, warning statement, front label, and addition of potential allergens</p>	<p>$n = 543$ participants living in Seoul and Gyeonggi area</p> <p>No details provided on recruitment method, other than participants were grouped by age; teenagers (elementary – high school), twenties, thirties, forties, fifties and sixties, with a relatively even split amongst all supplied demographic variables (age, sex)</p>	<p>Medium</p> <p>Limited methodological information provided</p> <p>Used items validated in a Korean population throughout the questionnaire</p> <p>Survey methodology is subject to several biases (response, social desirability, recall)</p> <p>High response rate (97.3%) may reflect sampling bias</p> <p>Surveyed members of the general public in addition to FAls and those who shop for them</p> <p>Reasonable sample size</p> <p>Survey was kept brief to minimise respondent fatigue</p>	<p>All respondents (self and doctor diagnosed) reported that all six items (bold font, font colour, box frame, warning statement, front label, and addition of potential allergens) was necessary for an improved food allergen labelling system.</p> <p>While the doctor-diagnosed group was more concerned with the checking of food allergens on labels, the non-allergy group was more concerned with checking product brands.</p>

Study details	Study type	Sampling	Quality Assessment	Relevant findings
<p>Joshi et al. (2002)</p> <p>Title: Interpretation of commercial food ingredient labels by parents of food-allergic children</p> <p>Country: United States</p> <p>Aims: To determine the accuracy of label reading among parents of food-allergic children".</p>	<p>Survey followed by allergen identification task (experiment)</p> <p>23 food labels taken from widely available commercial products – allergens to identify included milk, soy, peanut, wheat and egg (including traces of these allergens)</p>	<p>91 parents of food allergic children</p> <p>Parents of children attending the paediatric allergy clinic of a hospital were asked to participate in the study if they indicated on their preclinical screening form their child followed a restricted diet.</p>	<p>Medium</p> <p>8 parents were not included in the final sample (did not return the initial survey)</p> <p>Random sampling was used, as were validated methods to measure the predictor and outcome variable</p> <p>There was no mention as to whether participant/researcher blinding occurred</p> <p>Limited methodological information provided to ascertain whether standardised procedures were used during the experiment</p>	<p>Of parents of milk-allergic children, 7% were able to identify all 14 labels indicating milk. Errors occurred where milk by-products were a part of "natural flavour".</p> <p>Only 22% of the parents of soy-allergic children correctly identified soy protein in all 7 products. Errors occurred where the word soy was buried in an extensive statement of ingredients. Parents incorrectly assumed foods containing refined soybean oil in the ingredients to be allergenic and restricted these.</p> <p>Peanut was identified correctly in all 5 products by 54% of parents restricting peanut. Errors occurred on a product where "trace peanut" was not included within or adjacent to the main statement of ingredients.</p> <p>Wheat (10 labels) and egg (7 labels) were correctly identified by most parents.</p> <p>Survey results revealed differences in ingredients amongst different package sizes, differences between ingredient labels on inner packaging and ingredient labels on outer packaging, and ingredients visible in the product that were not listed on the label.</p> <p>In this study, milk was the ingredient most difficult to identify. The authors suggest simple terms e.g. milk in place of casein.</p>

Study details	Study type	Sampling	Quality Assessment	Relevant findings
<p>Marchisotto et al. (2017)</p> <p>Title: Food allergen labelling and purchasing habits in the United States and Canada</p> <p>Countries: United States and Canada</p> <p>Aims: “To establish knowledge of PAL and its impact on purchasing habits</p>	<p>Survey</p> <p>Food products bearing a label and featuring different types of Precautionary Allergen Labelling (PAL)</p>	<p><i>n</i> = 6684 respondents (84% caregivers of food-allergic children and 22.4% FAIs)</p> <p>Respondents were recruited through Food Allergy Research & Education (FARE) and Food Allergy Canada’s membership lists and social media. They were invited to participate if they had a food allergy, someone in the family with whom they resided had a food allergy, or they were the parent/caregiver of someone with a food allergy for whom they purchased food. Day-care operators or school personnel were excluded.</p>	<p>Medium</p> <p>The global thresholds survey was developed and validated by FARE for the US FDA to explore consumer opinions on allergen thresholds</p> <p>The survey was offered in English, and in Canada in English and French</p> <p>Despite the large sampling size, self-reported data is subject to biases and causal conclusions cannot be drawn.</p> <p>Sampling bias may have also influenced results</p> <p>Neyman’s bias may have influenced results from FAIs completing the survey</p> <p>Demographic characteristics were controlled for statistically</p> <p>Survey was completed electronically (restricting respondents to those with computer access)</p>	<p>Wording and terminology differences cause confusion and anxiety in food-allergic individuals and their caretakers.</p> <p>29% of respondents did not know that names of major allergens were legally required to be reported on labels.</p> <p>37% assumed advisory labels were based on the amount of allergen present.</p>

<p>Marra et al. (2017)</p> <p>Title: Consumer preferences for food allergen labelling</p> <p>Country: Canada</p> <p>Aims: “to use a stated choice experiment to evaluate Canadians’ preferences for different types of food allergen-related information on food labels, and to determine if there are differences in preferences across different types of respondents.”</p>	<p>Quantitative - experiment (discrete choice)</p> <p>18-choice sets (representing hypothetical but realistic scenarios) per version to examine consumer preferences for different attributes of food labelling - precautionary statements (“not suitable”, “may be present”, “may contain”, “contains”), safety statements (“does not contain”), use of symbols, and placement of information in various places (front, next to ingredients, package front and next to ingredients)</p>	<p>In the final latent class analysis, $n = 985$ participants</p> <p>The sample was recruited using an existing survey panel. The sample was nationally representative, aged 19 years and over, fluent in reading and writing in English, and resided in Canada.</p> <p>39% of the sample reported the presence of at least one food allergic individual in their household, 40% consider allergens when purchasing food, and 12% of respondents, or a member of their household, had previously experienced an anaphylactic reaction to food.</p> <p>The mean age of respondents was 46 years and 56% were female.</p>	<p>High</p> <p>Discrete Choice Experiment = a validated tool for assessing consumer preferences (selected due to its theoretical validity)</p> <p>A qualitative study using eight focus groups to identify specific attributes of allergen-related food labelling that are most important to consumers was conducted prior to and to inform the development of the choice sets</p> <p>Interviews were recorded, transcribed and analysed</p> <p>The internal consistency of individuals’ responses was evaluated and shown to be high</p> <p>Sampling/selection bias may have occurred - participants were recruited through an IPSOS panel and only those who had computer access could participate, as the experiment was delivered online</p> <p>The 10% of respondents considered inconsistent in their responding were omitted from data analysis</p> <p>18 choice sets were developed to limit the likelihood of participant fatigue – each participant had to choose between two hypothetical scenarios (e.g. use of symbols versus no use)</p> <p>Study was pilot tested in 100 respondents</p> <p>Choice scenarios may not reflect realistic examples</p> <p>Results support those of prior qualitative studies examining similar variables</p>	<p>Part 1</p> <p>The use of safety symbols and precautionary labels was the most important food allergen-labelling attribute for those in class 1 (44% of participants who reported considering allergens when buying food due to presumably having someone in their household having a food allergy).</p> <p>Those in class 2 (older individuals, not in a partnership, who had not completed high school or post-secondary education and who considered allergens for more than one reason e.g. potentially work in a service industry where allergens may be an issue) preferred the use of safety statements and both precautionary and safety symbols.</p> <p>Class 3 (who did not consider allergens when buying foods, were not willing to pay for the inclusion of allergen information) reported no difference in the relative importance of each labelling attribute.</p> <p>Participants reported inconsistent terminology and placement leaving them confused.</p> <p>Most preferred allergen information to be on the package front and next to the statement of ingredients at the back, as opposed to it in one location or no information at all.</p> <p>Part 2</p> <p>The use of precautionary statements was the least preferred by consumers of the four attributes that the discrete choice experiment explored. Of consumers who consider allergens when making purchasing decisions, the use of precautionary statements was again preferred the least of the four attributes. It was suggested that this may be due to the ambiguity of PAL statements.</p>
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Study details	Study type	Sampling	Quality Assessment	Relevant findings
<p>Monks et al. (2010)</p> <p>Title: How do teenagers manage their food allergies?</p> <p>Country: United Kingdom</p> <p>Aims: “To understand the practical challenges that teenagers with food allergy experience using a qualitative approach and to generate potential interventions for tackling these”.</p>	<p>Qualitative – short survey and semi-structured interviews.</p> <p>Questionnaire topics included: demographics; clinical information; how their food allergy is managed.</p> <p>Interview topics included: their food allergy; managing allergic reactions; family/home; friends/peers; school/work; hobbies; travelling away from home and education/support. Parents were not present during the interview.</p>	<p>$n = 18$ participants (10 females)</p> <p>Participants (aged 11–18 years) were recruited from a Children’s Allergy Clinic</p> <p>Inclusion criteria included an existing food allergy as diagnosed via positive skin prick test or serum-specific IgE.</p> <p>Purposive sampling was used to ensure there was representation from males/females and younger/older teenagers.</p> <p>Sampling ceased when data saturation had been achieved.</p> <p>All participants were of White British ethnicity, and the median age was 15 years. All participants had peanut or tree nut allergies.</p>	<p>High</p> <p>Initial survey was developed from previously validated measures on a similar population</p> <p>Parents were not present for interviews to minimise likelihood of response and social desirability bias</p> <p>All interviews conducted by the same, trained interviewer</p> <p>Unknown whether participants’ responses were fed back to them for verification/ feedback</p> <p>Open questions guided by a-priori topic areas</p> <p>Interview transcripts were analysed using a thematic approach. Transcripts were coded into the topic areas pre-determined by the researcher’s clinical experience and prior literature</p> <p>Emerging themes explored in greater depth</p> <p>A sample of transcripts were coded independently by two investigators to ensure coding was similar</p> <p>Results were compared with the survey data</p> <p>Emerging themes validated in discussion with external experienced multidisciplinary team</p> <p>The small sample size prevented comparing how behaviour changes across early adolescence</p> <p>Response biases may have occurred as interviews were conducted by a medical student, who may have been perceived by teenage respondents as being close to their medical team/a source of authority and power</p>	<p>Part 1</p> <p>Simpler, more consistent allergy warnings were suggested as possible solutions for determining when avoidance was warranted.</p> <p>Part 2</p> <p>The teenage participants found it difficult to understand the risks involved in consuming foods labelled with different allergy warning phrases. Some participants reported avoiding different foods depending on the warning phrases used.</p> <p>The use of “may contain” is perceived as widespread and this is unhelpful. Many participants reported not believing labels.</p> <p>Many participants reported that they don’t check the labels of food they have eaten before, instead adding them to a list of foods they can safely eat, despite any allergy warnings.</p>

Study details	Study type	Sampling	Quality Assessment	Relevant findings
<p>NFO Donovan Research on behalf of Food Standards Australia New Zealand (2004)</p> <p>Title: Quantitative consumer survey on allergen labelling: Benchmark survey 2003</p> <p>Countries: Australia and New Zealand</p> <p>Aims: “The survey was designed to assess the understanding and use of food label information in food selection decisions made by the main grocery buyer in a household when shopping for foods for consumption by those who are ‘at risk’ of adverse or allergic reactions to food.”</p>	<p>Survey</p> <p>Household grocery items that may contain allergens listed in Standard 1.2.3 of the Code, including: wheat (gluten containing cereals and their products); eggs and egg products; fish and fish products; milk and milk products; nuts and sesame seeds (including their products); peanut and soybeans (including their products) and added sulphites (in concentrations of 10mg/kg or more)</p>	<p>$n = 510$ respondents (413 from Australia and 97 from New Zealand)</p> <p>Recruitment undertaken via 3 routes:</p> <p>1) immunology/allergy clinics in hospitals and medical institutions; 2) private immunology/allergy clinics and 3) allergy support groups across both Australia and New Zealand</p> <p>Children and adults with different types of food allergies were contacted from all states, territories and regions with access to medical specialists. The three recruitment groups were controlled to ensure similar sampling proportion</p>	<p>High</p> <p>At the time of the survey, foods were still legally available for sale that had been manufactured and labelled according to the old food standards</p> <p>A broad definition of food allergy was adopted by FSANZ to target households with members who were ‘at risk’ of adverse reactions to foods, thereby obtaining a wider cross-section of respondents who may be assessing food labels critically because of concerns about food labelling</p> <p>Despite validated items being included, survey methodology is subject to several biases (recall, social desirability etc.) The low response rate (45% in Australia and 40% in New Zealand) may reflect sampling bias</p> <p>Segmentation approach was used to group individuals into segments with like characteristics</p> <p>Potential Neyman’s bias when surveying FAls</p>	<p>The ability of respondents to identify food products that contained allergens varied considerably depending on the terms used on the labels to declare the allergen.</p> <p>Those with tree nut, milk or egg allergies were most accurate in their assessment of ingredients whilst those with peanut and wheat allergies were less accurate.</p> <p>The complexity or lack of clarity of terms used on labels (e.g. substances like ‘emulsifiers’) were attributed to some of the errors. Further, the derivation of some ingredients in foods e.g. source of vegetable oils not stated, unlabelled ingredients, changes to the ingredients in products without notice, and food labelling information e.g. location of the information on the labels or the belief there was a difference in labelling requirements for imported foods were also noted as barriers to effective identification.</p> <p>Respondents noted clarity of labelling information could be improved by: adopting more meaningful or accurate labelling or advisory statements, ensuring the origin/derivations of certain ingredients are stated, using uniform wording in plain English, using % labelling for allergens to indicate how much of the substance of concern is in the food to enable risk assessment, and considering formatting issues e.g. print size and standard placement fields</p>

Study details	Study type	Sampling	Quality Assessment	Relevant findings
<p>Noimark et al. (2009)</p> <p>Title: Parents' attitudes when purchasing products for children with nut allergy: A UK perspective</p> <p>Country: United Kingdom</p> <p>Aims: To understand and quantify the attitudes of parents of children with nut allergy towards labels informing that the product could contain nuts".</p>	<p>Quantitative – non-experimental. Paper-based survey.</p> <p>The survey was distributed following an initial consultation by parents of children with food allergies with a food allergy clinic physician.</p> <p>Participants were asked about 5 common labelling options, and whether they would avoid a product bearing these labels.</p> <p>Participants were also asked if they had previously avoided foods not considered to be nuts in the UK (coconut, nutmeg and chestnut).</p>	<p><i>n</i> = 184 parents of food allergic children</p> <p>Respondents were recruited from a paediatric allergy clinic based in London.</p> <p>Participation required respondents to have children with a previously diagnosed nut or tree nut allergy, meaning they had either had a previous reaction to these allergens, or had a positive skin prick test equal to or larger than a 10% histamine control.</p>	<p>Medium</p> <p>All parents and patients had previously been counselled and educated regarding restriction of nut products</p> <p>The questionnaire was completed after initial consultation with the physician, and collected by the allergy nurse immediately after</p> <p>Data collection occurred at different times in the same location</p> <p>Unknown whether standardised procedures were used to collect information (e.g. if the same physician administered the test/answered any questions)</p> <p>Surveys are subject to self-report, Neyman's, leading questions and wording, acquiescence, social desirability, and recall bias</p> <p>While the stimuli presented (five real world labels) was reflective of reality, responses relied on participants literacy.</p> <p>Data produced was descriptive in nature</p> <p>Results may have been influenced by differing levels of familiarity with the small number of stimuli presented</p> <p>100% response rate may reflect sampling bias</p> <p>Few details are provided regarding the demographics of the respondent group so it is hard to understand how homogenous this group may be in this respect</p>	<p>Forty four percent of respondents would avoid nutmeg and coconut because of concerns they were nuts, with 71% of respondents avoiding chestnuts for this reason.</p> <p>Approximately 50% of respondents reported ignoring certain labels despite their children being at risk of an anaphylactic reaction to nuts.</p> <p>The authors suggest a universal, common symbol for individual allergens to assist the many patients that visit their clinic who do not speak English fluently and struggle to read the statement of ingredients.</p> <p>Reported avoidance practices differed according to the phrasing of the statements used. Most respondents reported avoiding a product labelled 'may contain nut', or 'not suitable for nut allergy sufferers'. On the other hand, only 40% of respondents would avoid a product with the label 'this product does not contain any nuts but is made in a factory that uses nuts'.</p> <p>No significant differences were detected between the practices of parents of children with a history of more and less severe allergic reactions.</p>

<p>Parikhal et al. (2018)</p> <p>Title: These labels are nuts: Challenges to safe product identification for nut-allergic consumers.</p> <p>Country: United States</p> <p>Aims: “To investigate the speed and accuracy of allergen identification on commercial packaging across different types of warning labels”.</p>	<p>Experiment</p> <p>49 products were selected based on a combination of ingredients, presence or absence of a nut warning label, visual style of warning (e.g. just in the statement of ingredients or advisory statement), type of package – without regard for brand or food type (products were equally divided into six categories by the amount and type of nut-related information on the packaging)</p>	<p><i>n</i> = 32 non-FAIs in reasonably good health for their age (aged 18–24 and 55–69) Participants were equally divided into quadrants depending on age group and gender.</p> <p>No information regarding sampling technique information provided</p>	<p>High</p> <p>The products were placed at random within a large bin to block sight of the products and allowing participants to reach in and retrieve them (participant blinding to stimuli to not allow for spill over effects)</p> <p>Standardisation occurred across the study procedure</p> <p>Objective measures (duration spent examining a product, number of times a product was turned, and accuracy of response were measured using a Go-Pro camera) were used</p> <p>Participants completed a pre-experimental questionnaire and had their vision assessed prior to participation to limit confounding variables</p> <p>Data was analysed by two trained researchers, and moderated by a third – no mention of researcher blinding</p> <p>Participants were compensated in this study, and may have been more motivated/spent more time examining each product than they would have in a grocery store, meaning the number of errors may have been underestimated</p> <p>No information provided on drop-out rate</p>	<p>When products were examined carefully and for longer, participants were generally able to accurately identify both safe and unsafe products. However, ensuring a product was safe (contained no nuts), rather than eliminating unsafe products, took significantly more time and led to more errors than identifying a product as unsafe.</p> <p>Older consumers required additional time to safely categorise each item compared to younger consumers.</p> <p>Participants seemed to adopt a “better safe than sorry” mentality; if they were unsure of safety, after a period of time they gave up on searching and defaulted to avoiding the product.</p> <p>Non FAI participants reported the burden of reading food labels placed on FAIs and expressed empathy for the additional difficulties FAIs experience while grocery shopping.</p> <p>Safe products with a nut-free label were examined significantly faster and more accurately than those without a nut-free label. Similarly, unsafe products with a ‘contains’ label were identified faster and more accurately than unsafe products without a ‘contains’ statement.</p> <p>The lack of consistency in warning labels (e.g. mismatch between information presented in the product name, allergen summary statement and statement of ingredients) created a high burden for food allergic consumers, who had to re-assess food labels whenever they shop. This may have accounted for the fact that unsafe products containing allergen warnings took more time to classify as opposed to other unsafe products with no warning. These products were incorrectly categorised as safe just as frequently as products with nuts in the ingredients but no warning label.</p>
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Study details	Study type	Sampling	Quality Assessment	Relevant findings
				Participants also noted formatting issues posed additional barriers to easily classifying products, such as glossy packaging, poor contrast between font and packaging background and small font.

Study details	Study type	Sampling	Quality Assessment	Relevant findings
<p>Sampson, M.A., Muñoz-Furlong, B.A. & Sicherer, M.D. (2006)</p> <p>Title: Risk-taking and coping strategies of adolescents and young adults with food allergy.</p> <p>Country: United States</p> <p>Aim: To explore "risk-taking behaviours and coping strategies of individuals aged 13 and 21 years with food allergies".</p>	<p>Mixed methods – qualitative focus groups followed by an online survey.</p> <p>The four focus groups investigated areas of risk-taking, the effect of food allergy on quality of life, and coping strategies.</p> <p>The findings from the focus groups were used to inform the design of an online survey. The questionnaire focused on factors that influence diet decision-making and medication adherence; food allergy in social contexts such as interactions with friends; preferences for food allergy management; and emotional concerns.</p>	<p>The focus groups were conducted with individuals with food allergy aged 13-16 years and 17-21 years in two cities in separate states. Participants were recruited by a market research company.</p> <p>The survey received 174 responses. It was disseminated through the channels of the allergy support organisation that had commissioned the study, as well as the channels of two other support organisations.</p> <p>Participants were asked to describe the food they were allergic to, the symptoms they experienced and the frequency of their reactions.</p> <p>Participants needed to be aged between 13 and 21 years and have food allergies, though no detail is provided in terms of how the latter detail was checked.</p> <p>Of the respondents, 49% were male, 51% were female. Food allergies noted included: peanut (75%), tree nut (56%), shellfish (21%), milk (20%), egg (16%) and fish (14%). Most (67%) reported having experienced an allergic reaction in the last 5 years.</p>	<p>Medium</p> <p>The criteria used to determine if individuals had a food allergy and therefore if they could be recruited to the focus groups is unclear.</p> <p>The survey sample was self-selecting and drawn from those who receive content from a small number of allergy support organisations. The sample are therefore likely to be more educated about food allergy than other adolescents and young adults with these conditions.</p> <p>The self-reporting of behaviour may under-represent risk-taking.</p> <p>However, the conclusions are well-supported by the data and the main limitations and potential biases of the study approach are considered.</p>	<p>Over half (58%) of respondents to the survey reported that they avoid foods that indicate they "may contain" a relevant allergen.</p> <p>A small proportion (5%) of respondents reported that they eat these foods because they believe the risk of doing so is low. Almost 1 in 20 (19%) reported that they eat these foods because they have had no prior reactions when doing so, and 13% tasted the food and continued to eat it if they had no symptoms.</p> <p>Just over half of respondents (54%) admitted to eating at least a tiny amount of a food that was known to contain an allergen. One of the reasons associated with this risk-taking was the presence of "may contain" labelling (33%). Other reasons included that similar foods had not caused a reaction (57%) and it looked good/wanting to eat it (49%) [results were cumulative].</p>

Study details	Study type	Sampling	Quality Assessment	Relevant findings
<p>Sheth et al. (2010)</p> <p>Title: Role of food labels in accidental exposures in food-allergic individuals in Canada</p> <p>Country: Canada</p> <p>Aims: To explore factors associated with accidental exposure to allergens, and how this may link to food labelling.</p>	<p>Quantitative – non-experimental. Paper-based questionnaire.</p> <p>Questionnaire topics included: demographics, clinical information about food allergy, experiences of accidental exposure and suspected causes of these exposures.</p>	<p>$n = 1454$</p> <p>Two recruitment approaches were used. The first involved the distribution of paper-based surveys to individuals on a registry who also had a physician-confirmed diagnosis of peanut allergy.</p> <p>The second approach involved disseminating the survey via several allergy awareness organisations.</p> <p>Two contact attempts were made.</p> <p>Most respondents from the allergy support organisations were parents or caregivers of food allergic children, female and 60% had a university-level qualification.</p>	<p>Medium</p> <p>Given the data was collected retrospectively, recall bias may have affected results. However, to limit this, respondents were contacted by telephone to verify equivocal responses.</p> <p>Neyman’s bias may have been an issue, as the sample comprised FAIs or their caregivers</p> <p>Food-allergic individuals may have attributed their accidental exposure to inappropriate labelling but not verified whether this was a manufacturer error e.g. cross-contact may have been the fault of the consumer, not the manufacturer</p> <p>Relatively high response rate of 78.1% may reflect sampling bias</p> <p>No details on method of survey administration e.g. whether systemisation occurred</p> <p>Questionnaire not provided to determine whether leading questions were used</p>	<p>Part 1</p> <p>Food-allergic individuals who were allergic to peanut, tree nut, fish or shellfish were less likely to experience an accidental exposure due to the allergen not being identified in plain language. Historically, these four allergens are known to cause more severe reactions, and therefore manufacturers are likely to be more prudent about clearly identifying them. Further, there are few, if any, alternative terms to describe these allergens when compared to allergens such as milk and egg, which are sometimes identified by complex terminology e.g. casein or ovalbumin, which are not readily recognised by consumers.</p> <p>Labelling issues noted: allergen not identified in plain language (e.g. “casein” instead of milk”), allergen listed but not clearly visible on the label or package (e.g. boldfaced or listed on the main food label with other ingredients), allergen was a hidden ingredient that was not listed/declared on the food label (e.g. “natural flavouring” listed but contained traces of milk), and errors in translating an ingredient from one country to another</p> <p>Part 2</p> <p>Just under half (48%) of respondents reported having at least one accidental exposure to an allergen since they have been diagnosed with a food allergy. Of this proportion, 47% attributed this exposure to a food labelling-related issue, 29% to failure to read a food label, and 8% to ignoring a precautionary statement.</p> <p>Of those who reported that they thought the accidental exposure had been due to a labelling issue, cross-contact with no precautionary statement was most commonly reported as the reason for that exposure (reported by 17% of this subsample).</p>

Study details	Study type	Sampling	Quality Assessment	Relevant findings
<p>Soogali & Soon (2018)</p> <p>Title: Food allergies and perceptions towards food allergen labelling in Mauritius</p> <p>Country: Mauritius</p> <p>Aims: “To determine the self-reported prevalence of food allergies and consumers’ perceptions towards food allergen labelling in Mauritius.”</p>	<p>Survey administered using face-to-face interview approach</p> <p>All food products that contain a label sold in Mauritius</p>	<p>113 respondents</p> <p>Shoppers at four separate supermarkets were approached and asked to participate.</p>	<p>Medium</p> <p>Previously validated items assessing attitudes towards food labelling were included in the questionnaire</p> <p>A pilot study was conducted to evaluate language, clarity and suitability of wording</p> <p>The purpose of the study was explained to respondents, potentially discriminating between those who are more motivated in health (especially allergies)</p> <p>Questionnaires were administered using a face-to-face interview approach as this helps to increase response and completion rate</p> <p>The researchers controlled statistically for demographic cofounders.</p> <p>No information provided as to whether the same person delivered the questionnaire, nor whether training has occurred to ensure delivery was as standardised as possible</p> <p>Sampling occurred at different times/days in the week in an attempt to capture a diverse demographic of shoppers</p>	<p>Over 80% of respondents felt allergens in the statement of ingredients should be emphasised (e.g. in bold font – the most preferred/commonly used, or contrasting colour, italics, or enlarged font) and appear in plain English (or French) e.g. “milk” instead of “milk protein, casein and whey”.</p> <p>59% of respondents felt the statement of ingredients could provide more information about food allergens in the label.</p> <p>56.6% agreed it is difficult for those with food allergies or intolerances if there are different variations of food labels among imported products.</p> <p>87.6% felt symbols could be used to indicate the presence of allergens. Symbols such as asterisk (*) were used in food labels to indicate presence of allergens e.g. in vitamins* where this indicated the presence of soybean oil. Symbols were preferred to indicate a product is gluten-free.</p> <p>73.5% indicated that allergy warning could be placed adjacent to the statement of ingredients.</p>

Study details	Study type	Sampling	Quality Assessment	Relevant findings
<p>TNS BMRB on behalf of Food Standards Agency (2016)</p> <p>Title: Understanding NI consumer needs around food labelling</p> <p>Country: Ireland</p> <p>Aims: “Explore consumer awareness, understanding and views of retail food labelling and how this currently affects purchasing decisions”.</p>	<p>Mixed methods – focus groups, a panel survey and observational accompanied shops followed by semi-structured interviews.</p> <p>For the accompanied shop, participants were observed during a 'normal shop'. The follow-up interviews lasted 45 minutes.</p> <p>The findings relating to PAL appear to be captured from the focus groups element of the methodology.</p>	<p>The 8 focus groups included 8 people each ($n = 64$)</p> <p>Accompanied shops included 8 participants</p> <p>Survey ($n = 201$)</p> <p>Respondents were recruited from the Food Standards Agency consumer panel (people who have made a conscious decision to participate in online surveys through a double opt-in registration) to include a mix of those who primarily do their shopping online and those who primarily shop in supermarkets, and included a mix of demographic variables, and whether people suffered from allergies.</p>	<p>Medium</p> <p>A representative sample was recruited</p> <p>The mixed method design adopted (focus groups, accompanied shops, survey and online panel) increases the reliability of findings</p> <p>Previously validated measures were used</p> <p>Quantitative measures were informed by early findings from the focus groups</p> <p>Online survey was conducted with a representative cross-section of consumers which was monitored by collecting house and demographic information</p> <p>For the accompanied shop and focus group, interviewers followed a structured discussion guide</p> <p>Procedures were systemised as much as possible for all data collection</p>	<p>Part 1</p> <p>Respondents valued label consistency to create habitual use e.g. allergen emboldening. This included format, positioning and language, which could encourage more regular usage of labelling information.</p> <p>For respondents, the ability to use allergen information rested on finding information instantly understandable and accessible, and this could only be achieved when it was presented in recognisable, repeated formats which could facilitate “at a glance” decision making.</p> <p>Part 2</p> <p>Participants directly affected by food allergies tended to check the lists of ingredients and the precautionary information provided when buying a product for the first time. Following this, they then build up a list of “safe for consumption” products which they purchase regularly, and which reduces the requirement to check for allergen information in every shop.</p> <p>Participants directly affected by food allergies were dissatisfied with the placement of precautionary allergen information on packaging. The different formats used were linked by participants to having accidentally purchased unsuitable products in the past.</p>

<p>TNS Social Research on behalf of Food Standards Australia New Zealand (2009)</p> <p>Title: Consumer Study on Food Allergen Labelling: Follow-on Survey 2008–09</p> <p>Country: Australia and New Zealand</p> <p>Aims: “To provide a picture of allergy management and any issues encountered with current labelling and information”.</p>	<p>Survey</p> <p>Allergies targeted: peanut, soy, wheat, egg, tree nuts, fish, shellfish, sulphites and sesame seeds</p> <p>General questions regarding allergy management strategies (including for packaged and unpackaged foods)</p>	<p>Total $n = 1028 - 893$ in Australia and 135 in New Zealand</p> <p>Questionnaire sent to households in which one or more members has a food allergy or allergies. Sampling was opportunistic, with samples drawn from a number of nationally-dispersed hospital-based allergy clinics, private allergy clinics and support groups, many of whom participated in the 2003 benchmark study. Paper questionnaires or a link to complete an identical version of the questionnaire online were sent out through hospitals and allergy clinics. The main grocery buyer within the household (either the FAI themselves or the caregiver of an FAI) was the target respondent</p>	<p>Medium</p> <p>Every step was taken to replicate the methodology and sampling approaches used in the 2003 benchmark study to ensure comparability could be deduced from the data (only minor changes to the original questionnaire)</p> <p>However, both samples remain opportunistic and therefore may not be representative of the general population, despite the large sample size</p> <p>There may have been systematic differences between those who participated and those who did not (very low response rate – 25%) – potential participant fatigue ? (response rate was 40% in the benchmark study)</p> <p>Survey administration was conducted in a controlled environment (may not reflect reality), and several biases (e.g. social desirability, recall, Neyman’s, response) may have influenced findings</p> <p>Study was conducted 10 years ago (may be that attitudes and beliefs have changed since then)</p>	<p>Part 1</p> <p>Both PAL and the statement of ingredients were used by respondents in determining the presence of allergens.</p> <p>Issues arose where a technical name or code number, or derivative was listed without individual ingredients broken down and spelled out in plain English.</p> <p>43% reported being able to find the information they need on food labels. 7% reported lack of understanding over some terms, 7% not knowing what the ingredient listed is derived from, and 4% being confused over the use of a non-specific term. 20% reported coming across products with different names on labels for ingredients which should be avoided.</p> <p>Consistency in labelling (common format and method for highlighting allergen), and addressing issues regarding unpackaged and imported products were all cited as at-risk consumer wants.</p> <p>Part 2</p> <p>33% to 48% of respondents considered the four PAL statements they were questioned about to be not very useful.</p> <p>When asked about further issues and suggested improvements to the way allergens are labelled, 5% stated that manufacturers needed to be more specific about the risk in products containing traces, and 10% suggested reducing ‘may contain’ and other PAL warnings.</p> <p>The use of PAL didn’t mean consumers would always avoid a product, and respondents were less likely to say they would always avoid a product containing one of these statements than in the 2003 baseline study. Reported avoidance varied according to PAL statement.</p>
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Study details	Study type	Sampling	Quality Assessment	Relevant findings
<p>Verrill, L. & Choinière, C.J. (2009)</p> <p>Title: Are food allergen advisory statements really warnings?</p> <p>Country: United States</p> <p>Aim: To i) “determine consumer preferences for some common allergen advisory statements”; and ii) “to compare the efficacy of these statements by measuring their differential impact on simple, decision-making related tasks.”</p>	<p>Quantitative - experimental. An online survey followed by an online experiment using two mock packaged food products.</p> <p>The survey involved respondents viewing the front and back panels of 4 identical mock food products, each carrying a different advisory statement. These were then ranked by the respondents in terms of preference.</p> <p>The experiment involved two mock packaged food products as the treatment conditions. On the back of the product was one of the four advisory statements included in the earlier survey. Each participant viewed the product before completing a questionnaire about the label they had been shown.</p>	<p>The survey had a sample of 1,243, recruited from an online household panel.</p> <p>Of this sample, 530 self-reported a medically diagnosed food allergy, allergic to one of eight allergens. 209 were full time care-givers to an individual with a medically diagnosed food allergy, and 504 respondents had not food allergies or food allergic dependents.</p> <p>Within the food allergic and care-givers groups, respondents were mostly female (62% and 64% respectively), compared with the non-food-allergic group (49%).</p> <p>The online experimental method involved 4,049 participants. Again, an independent, online consumer panel was screened for individuals with self-reported medically diagnosed food allergies as well as care-givers. Quota sampling was used to ensure participants with a range of demographic characteristics were recruited, and this broadly reflected the US general population.</p>	<p>High</p> <p>The methodological approach and measures used are described in detail.</p> <p>The findings are clearly reported.</p> <p>The statements tested only focused on peanut allergen advisory statements, the findings may not be applicable for different allergens.</p> <p>The sample was self-identifying in terms of having a food allergy or caring for someone with a food allergy. More information could have been provided about any screener questions used to ensure the intended sample had been recruited.</p>	<p>Food allergic respondents, and non-food allergic respondents didn't significantly differ in reported attitudes in the survey, and only for one measure in the experiment. In the experiment, food allergic respondents were found to be more likely to serve or consume a food that potentially contained an allergenic ingredient.</p> <p>All groups surveyed preferred the statement "Allergy Information: May contain peanuts" over the other three statements shared. In second place, all three groups preferred "Manufactured on the same equipment as foods that contain peanuts". For 3rd place, care-givers and people without food allergies chose "may contain peanuts", but the reverse was the case for individuals with food allergies, who preferred the more detailed label in 3rd place.</p> <p>In the experiment, when asked how likely it is that the products contained peanut allergen, participants viewing the "may contain peanut" and the "allergen labelling: may contain peanut" statements labelled the likelihood of that the product containing peanut significantly higher than the manufacturing-related labels.</p> <p>The manufacturing-related advisory statements were rated higher on a 'believability scale' by respondents than the "may contain" statements. The same statements were also rated higher in terms of their perceived helpfulness.</p>

Study details	Study type	Sampling	Quality Assessment	Relevant findings
<p>Verrill, Zhang, and Kane (2013)</p> <p>Title: Food label usage and reported difficulty with following a gluten-free diet among individuals in the USA with Coeliac disease and those with non-Coeliac gluten sensitivity</p> <p>Country: United States</p> <p>Aims: “To explore the link between the food label, gluten-free (GF) claims and the difficulty associated with following a Gluten Free Diet (GFD)</p>	<p>Survey</p> <p>Food labels (some containing gluten free claims) of commonly purchased supermarket food items</p>	<p>$n= 2380 - 1583$ with Coeliac Disease and 797 with Gluten Sensitivity</p> <p>Purposive sampling – The FDA conducted a survey and experimental study in early 2010 – the data from the survey was used to inform this study. A notice publicising the web-based survey was disseminated by major Coeliac disease treatment and research centres located in the US and amongst the US-based interest/support groups. Potential respondents had to be 18 years plus, be following a gluten free diet, and have met the criteria for Coeliac disease or gluten sensitivity. Only those who indicated Coeliac diagnosis by biopsy of the small intestine were included in the CD group, others were included in the self-diagnosed GS group.</p>	<p>Medium</p> <p>Reporting and social desirability bias may have influenced results as data was self-reported (e.g. compliance with a GFD)</p> <p>The large sample size increases confidence in findings *Participants were geographically dispersed across the country and recruited to be as representative as possible in terms of age, gender and ethnicity</p> <p>Tests for equality of means provided statistical evidence justifying the need to separate the CD and GS groups for analysis</p> <p>Results must be interpreted in light of the purposive sampling strategy employed</p>	<p>On average, gluten-sensitive (GS) individuals reported slightly more difficulty following the gluten free diet (GFD) than did respondents with Coeliac disease.</p> <p>Reading the food label often was significantly associated with less reported difficulty following a GFD, whereas consuming packaged processed foods and looking for GF claims more often were significantly associated with more reported difficulty for both respondent groups.</p> <p>The authors conclude respondents with GS may rely more heavily on the GF claims for information about a product’s gluten content. Individuals with Coeliac Disease (CD) may be more experienced food label readers and may rely more on the statement of ingredients for finding GF foods.</p> <p>Gluten free claims may assist those who have difficulty determining whether certain processed, packaged foods are safe to consume without the need to review the statement of ingredients (e.g. CALD, those less literate or newly diagnosed).</p>

Study details	Study type	Sampling	Quality Assessment	Relevant findings
<p>Vierk et al. (2007)</p> <p>Title: Prevalence of self-reported food allergy in American adults and use of food labels</p> <p>Country: United States</p> <p>Aims: “To report the prevalence of self-reported food allergy, to identify the characteristics of food allergy reactions, and to describe the use of labels among adults with food allergy”.</p>	<p>Survey</p> <p>Questions asked about commonly purchased food products with either stand-alone or combination allergens e.g. milk/dairy, fish, eggs, crustaceans, tree nuts, wheat/gluten, peanuts, soy, fruit/vegetable, shellfish, chocolate and food additive (general term)</p>	<p><i>n</i> = 4482 - The prevalence of self-reported food allergy is 9.1% among all survey respondents, with 5.3% of all respondents reporting a doctor-diagnosed food allergy. Those respondents who indicated a sulphite allergy (<i>n</i> = 5) were excluded from analysis</p> <p>Random sampling (nationally representative single-state sample of telephone numbers generated by the GENESYS Sampling System) was used. The majority of nonresponse was caused by initial refusals, quits, or non-availability of respondents (# not reported). Both individuals with a self-diagnosed and doctor diagnosed allergy were included and separately identified. The family member with the most recent birthday (aged 18 years +) was asked to participate</p>	<p>Medium</p> <p>Data from the FDA’s 2001 Food Safety survey was analysed to determine prevalence of food allergy and opinions about food labels in the management of food allergy</p> <p>Validated measures were used</p> <p>The food allergy questions were cognitively tested with members of the Food Allergy & Anaphylaxis Network for clarity, completeness and relevance of item content</p> <p>A Spanish version was also developed to capture a wider demographic of respondents</p> <p>A large nationally representative sample participated, however response rate was low at 35.8%, and there may have been systematic differences between those who refused and those who agreed to participate</p> <p>Statistical methods were used to control for demographic confounders. However, the correlational nature of survey data prevents causal conclusions being drawn.</p> <p>Food allergy (even doctor diagnosed) was self-reported *Survey may have been subject to recall error (being asked to reflect on the past year), and no food lists were provided to prompt participants when listing their current/previous food allergies (potential memory bias)</p> <p>Data almost 10 years old – may not be reflective of current views</p>	<p>Forty percent of respondents with food allergies who read food labels found the following labelling issues were serious or very serious barriers to them effectively managing their allergy: 1) some statement of ingredients give a general name for an ingredient without specifying the source e.g. spices and flavours 2) inconsistency in terms used for the same allergen across food products.</p> <p>One third of respondents rated as a serious or very serious label issue that words on some statement of ingredients are too technical or hard to understand.</p> <p>Over a quarter of respondents rated as a serious or very serious problem the length of statement of ingredients, which makes it difficult to locate the ingredient of concern. This did not differ between those who were self- or doctor-diagnosed.</p> <p>32% said that if a ‘may contain’ or ‘contains’ statement lists only one potential allergen e.g. “may contain egg”, they took this to mean no other allergen was present.</p>

<p>Voordouw et al. (2009)</p> <p>Title: Food allergic consumers' preferences for labelling practices: A qualitative study in a real shopping environment</p> <p>Countries: Greece and The Netherlands</p> <p>Aims: "To investigate whether information provided through current labelling practices meets the need of food allergic consumers".</p>	<p>Observational and Interview</p> <p>Participants asked to purchase 15 potentially problematic food items as if for their own household. Potential allergen included milk egg, and/or tree nuts or peanuts</p>	<p><i>n</i> = 40 participants in total (20 in each country). Half the sample were adults who suffered from single or multiple food allergies, and half were parents of food-allergic children</p> <p>Participants in Greece and the Netherlands were recruited through local newspaper advertisements and through patient group websites. Participants were included on the basis of self-reported perceived or diagnosed allergies to milk, egg and/or tree nuts or peanuts (milk being common in children and eggs/nuts in adults).</p>	<p>High</p> <p>Sample size was determined to be sufficient for an in-depth exploratory investigation, and validated methods were used to assess level of food allergy severity</p> <p>On face validity, results indicate the presence of the interviewer had minimal effect on respondents' answers and behaviours</p> <p>Little methodological data provided on the interviewing component</p> <p>Low, middle and high-priced supermarkets were included in the study to minimise for SES confounding results</p> <p>Participants were not informed of the reward (paid groceries) at the conclusion of the study to minimise the likelihood of choice bias</p> <p>A pilot study (with <i>N</i>=4 food allergic consumers) was conducted to check if the study design was appropriate to the objectives</p> <p>Interviews were audiotaped, transcribed into English, and analysed using a validated coding scheme</p> <p>A cross-check was performed to assess whether the codes attached to the quotes were assigned the same code by different researchers (inter-coder reliability 70%)</p> <p>No mention of how many observers were used, whether it was the same observer for each participant, nor whether the observer underwent training</p> <p>Several food products normally used for preparation of breakfast, lunch and dinner, as well as snacks were included in the shopping (designed to resemble a real shopping list)</p>	<p>Colour contrast of the label was reported to be low, and packaging was sometimes shiny or glossy (or used white font), making the label difficult to read.</p> <p>Participants suggested a preference for emboldening of the allergens in the statement of ingredients to increase readability and assist with locating relevant information faster. A desire for the statement of ingredients to be written in a specific colour was expressed. Greek participants suggested allergen information be contained in a box to stand out.</p> <p>A standard location for allergen information was also preferred – e.g. above the statement of ingredients to reduce likelihood of consumers missing it and having to read the entire statement of ingredients.</p> <p>Origin of the ingredients e.g. in oil or starch should be specified. Participants wanted milk proteins to mention lactose if it was present. Food additives (preservatives, emulsifiers, stabilizers, taste/flavour enhancers, and antioxidants) and E-numbers caused a lot of confusion among food allergic individuals.</p> <p>If the additional allergen information did not include the allergen in question, participants would proceed to read the full statement of ingredients, increasing the time spent on shopping.</p> <p>Participants expressed positive views on symbolic representation of allergens (e.g. a cow's head and glass to milk to indicate presence of cow's milk). Some indicated confusion about whether the presence of an egg symbol indicated the product did or did not contain egg, and that this should be clarified. Symbolic information was viewed favourably in addition to (not as a substitute for) written allergen information, with a desire for it to be placed on the front of the packet.</p> <p>Participants suggested limiting the number of languages present, and translating ingredients correctly. Consistent terminology in preparation methods and the statement of ingredients was</p>
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Study details	Study type	Sampling	Quality Assessment	Relevant findings
<p>Voordouw et al. (2011)</p> <p>Title: Preferred information strategies for food allergic consumers: A study in Germany, Greece and the Netherlands</p> <p>Countries: Germany, Greece and the Netherlands</p> <p>Aims: "To identify the preference of food allergic consumers regarding different information provision scenarios".</p>	<p>Survey</p> <p>Milk, eggs and/or tree nuts or peanuts were selected as the allergens to study from the EU list of 14 potential food allergens</p> <p>Information delivery scenarios tested included: standardised label with symbols, booklet with allergen information, and information communication technologies e.g. personal shopping assistant, information terminal, handheld scanner, or an internet shop.</p>	<p><i>n</i> = 287 participants - only 255 were included for analysis of ICT data</p> <p>Adult food allergic individuals and the parents of food allergic children were recruited through advertisements in national newspapers or e-letters from national patient groups related to food allergy in Germany, Greece and the Netherlands. Participants were also recruited through advertisements published trade magazines.</p>	<p>High</p> <p>A fractional factorial design was employed to minimise the number of profiles presented to respondents</p> <p>To reduce potential fatigue, each respondent rated half of the profiles (8 questions per information scenario)</p> <p>The statistical model was shown to be reliable</p> <p>Demographic information and experience with using ICT tools were controlled for as potential confounding variables *Validated items were used to measure the dependent variable</p> <p>The questionnaire was piloted in English with students from the three participating countries prior to translation into the relevant language</p> <p>Important to note the correlational nature of the data (limiting causal conclusions to be drawn)</p> <p>Demographic data did not allow for accurate separation of self and physician diagnosed food allergy, nor identification of families where multiple members suffered allergies</p> <p>Information delivery scenarios (the independent variables) were developed through a combination of stakeholder analysis of what was possible given existing and emerging technologies</p> <p>Stimuli was presented in theory (through images and questions) – not realistic</p>	<p>desired, as was including the % of each allergen in the statement of ingredients.</p> <p>The option to show the percentage of allergens was rated significantly higher than either showing percentages of all ingredients, and not showing percentages at all.</p> <p>Respondents supported the use of an eye-catching box with a standardised allergy information and placed in a standardised location versus no box.</p> <p>A standardised symbol representing allergy information at the front and back of the product was preferred, especially for small packaging.</p> <p>The inclusion of a food allergy glossary in any ICT approach was preferred.</p> <p>Participants in all countries gave the highest average preference rating to an adjusted label, ICT as the second best solution (especially from non-native speakers/bi-lingual participants), and the booklet as the least preferred solution.</p>

Study details	Study type	Sampling	Quality Assessment	Relevant findings
<p>Voordow et al. (2012)</p> <p>Title: Optimising the delivery of food allergy information. An assessment of food allergic consumer preferences for different information delivery formats</p> <p>Countries: Netherlands and Germany</p> <p>Aims: “To assess the preference of food allergic consumers for different prototype information delivery tools, with the aim of improving informed product choices”.</p>	<p>Survey</p> <p>Three categories of food were included: ready-made meals, snacks and pre-prepared salads. Two products were provided for each category – one containing at least one allergen and one allergen free. Fictitious food products bore an ‘ideal format’ label that had been developed based on consumer preference research.</p>	<p>$n = 62$ respondents (24 in Germany and 38 in the Netherlands)</p> <p>Participants (FAIs or their spouses or parents of food allergic children) were recruited through advertisements published in national newspapers, on patient organisation websites, and via nutritionists based on their self-reported perceived or diagnosed food allergy or intolerance to at least one of the following: eggs, milk, tree nuts, peanuts, and/or gluten.</p>	<p>Medium</p> <p>Procedures were put in place to randomise the interaction effect of the food product, the information delivery tool, and the order effect of the tool in each version of the questionnaire</p> <p>Both quantitative and qualitative (through free text boxes) information was collected</p> <p>The questionnaire was piloted in the Netherlands, albeit only with three respondents</p> <p>As much as possible, the limitations associated with questionnaire methodology were controlled for (e.g. participant fatigue, response and social desirability bias)</p> <p>The small sample size restricted the number of statistical analyses that could be performed</p> <p>Monetary incentive may have led to sampling and response bias</p> <p>Stimuli was developed for the purposes of the study (fictitious food products bearing manipulated labels) – may not be reflective of a real-world environment</p>	<p>Some respondents indicated their appreciation of the symbols (fast to read), with the caveat that the symbols required explanation before they were able to use them correctly. However, some indicated that symbols could lead to confusion as to whether or not the allergen was actually present.</p> <p>The action of using lay terminology in the statement of ingredients, and putting the chemical terminology between brackets afterwards was viewed positively by participants.</p>

Study details	Study type	Sampling	Quality Assessment	Relevant findings
<p>Weber et al. (2007)</p> <p>Title: The performance of parents of children receiving cow's milk free diets at identification of commercial food products with and without cow's milk</p> <p>Country: Brazil</p> <p>Aims: "To investigate how well the parents of children on cow's milk free diets perform at recognising whether or not expressions describe foods containing cow's milk proteins".</p>	<p>Interviews followed by a label identifying task (experiment)</p> <p>10 products commonly given to infants and/or toddlers e.g. margarine, cereal, whole milk drink, cookies, and yoghurt</p> <p>12 expressions relating to cow's milk were tested</p>	<p>$n = 47$ - 24 parents of children on diets free from cow's milk and by-products (study group) and 23 parents or guardians of children with no need for any type of exclusion diet (control group)</p> <p>Parents of children treated at the paediatric gastroenterology department were randomly invited to participate in the study. No mention of how parents of children without need for an exclusion diet were recruited.</p>	<p>Medium</p> <p>Purpose of the study was explained to participants (no blinding occurred)</p> <p>Study was pilot tested on 10 participants</p> <p>Questionnaire delivery was standardised</p> <p>Sample size determined using statistical methods</p> <p>Differences observed in the experimental component of the study reached statistical significance</p> <p>Authors suggest replication on a larger, more culturally diverse sample</p> <p>Groups did not differ in terms of sex, age or economic class</p> <p>No mention of whether items included on the questionnaire had been previously used/validated, or developed for the purposes of this study</p> <p>Participants were made aware of their correct/incorrect answers at the conclusion of the experiment</p> <p>Participant fatigue may have influenced performance on the label identification task (participants had just completed a questionnaire)</p> <p>Comparison with a control group increases validity of findings</p>	<p>For technical expressions, the proportions of correct identifications amongst parents who received training versus those who did not were: dairy products (71 vs 9%), traces of milk (54 vs 9%), and milk formulation or preparation (42 vs 13%).</p> <p>Recognition of the scientific expressions did not exhibit statistically significant differences for casein, lactalbumin, or lactoglobulin, whereas for caseinate the difference did have statistical significance between the experimental and control group.</p> <p>A smaller proportion of the control group correctly identified the presence/absence of cow's milk and by-products for all products, however the difference was only statistically significant for margarine without cow's milk.</p> <p>The number of labels read correctly by members of the study group (parents who received education) was lower than expected.</p> <p>Results indicate it is not sufficiently to merely inform or educate parents on allergen terms, but that frequent reading of labels is required to be able to correctly identify (especially more complex) terms.</p>

<p>Wortman (2016)</p> <p>Title: Impact of product label communication congruency on attitude certainty and purchase intention for food allergy stakeholders under high and low levels of elaboration</p> <p>Country: United States</p> <p>Aims: “To conceptualise a decision-making process based on the degree of elaboration the consumer engages in when reading and evaluating information contained on the food product label and nutrition facts panel.”</p>	<p>Survey</p> <p>Soy yoghurt, coffee creamer, and chocolate</p> <p>Stimuli included mock-up food product labels based on current food product labels available in the marketplace</p>	<p>223 respondents were included in the final analysis (completed all 4 surveys)</p> <p>Online surveys disseminated by Qualtrics labs (market research company) to self-identified food allergic individuals or caretakers/stakeholders of a food allergic individual(s)</p>	<p>High</p> <p>Study design replicated a similar prior study</p> <p>Previously validated items informed development of items included in all surveys</p> <p>Label stimuli was derived from actual products currently in the marketplace so as to enhance the realism of the manipulations</p> <p>A pilot study was conducted to check the study design was fit for purpose</p> <p>Statistical methods were employed to check for validity and reliability of the newly formed questionnaire</p> <p>Survey length was kept brief to minimise respondent fatigue *Manipulation checks were also incorporated</p> <p>A survey setting may not reflect the actual shopping experience, where time constraints and distractions are more likely to lead to errors</p> <p>Limitations include delivering the survey via a single means (online), potentially restricting the number of respondents who could participate, and investigating a single type of consumer-packaged food product (dairy-containing)</p> <p>No mention of whether participant blinding occurred</p>	<p>70% of respondents accidentally purchased a food product containing an allergen they were trying to avoid.</p> <p>Results showed confusion among participants when the label claims did not align with ingredient information.</p> <p>Another issue identified is misleading product names e.g. “Soy Yoghurt” than contained dairy.</p> <p>Greater congruence between information on the front and nutritional content on the back led to more positive attitude towards product safety, as did greater elaboration of allergen information (more methods of information). Congruency and elaboration also led to increased perceived credibility of label claims, and trust in nutrition information, thereby increasing purchase intention</p> <p>Errors were made where a product contained “non-dairy” on the front of the package but contained milk as an ingredient in the ingredient’s list, as consumers stopped at the front of package claim and did not investigate further.</p>
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<p>Zurzolo, G.A. et al. (2013)</p> <p>Title: Perceptions of precautionary labelling among parents of children with food allergy and anaphylaxis.</p> <p>Country: Australia</p> <p>Aim: To gain an understanding of the behaviour, perceptions and opinions of parents on precautionary labelling, and to explore if this is influenced by whether or not their children have a history of anaphylaxis.</p>	<p>Quantitative – non-experimental. Self-administered questionnaire.</p> <p>A copy of the questionnaire used is not available to view. However, the topics covered in the study paper included medical history of their child's food allergy; usefulness of PAL; understanding of PAL; and self-reported behavioural responses to different forms of PAL</p>	<p>The survey was completed by the parents of 497 children, which equated to a response rate of 93%.</p> <p>Analysis was only carried out on responses where a child had a medically diagnosed food allergy, which was 59% of the obtained sample.</p> <p>Parents were recruited from a specialised children's hospital department of allergy and immunology over a 3-month period in 2011.</p> <p>The survey data was analysed for two different groups: 1) children with a past history of anaphylaxis and 2) children with a past history of mild to moderate reactions (but still IgE-mediated). 84% of responses contained enough information to enable categorisation into one of these two groups.</p>	<p>Medium</p> <p>'Most useful' PAL statements appear to be considered within this study as those which are not ignored or that individuals report that they avoid purchasing, though this is unclear as a copy of the questionnaire is not available.</p> <p>The key demographics of the sample described by the paper are for the overall study, and not for the subsample who were included in the final analysis.</p> <p>The study reflects parental choice only, and not the decision-making of older food allergic children.</p>	<p>Across all statements, the parents of between 78% to 84% (88 to 106) of children who had experienced anaphylaxis agreed that 'I do not find this statement useful, as I don't know if it is safe to eat'.</p> <p>Most parents thought that the government-imposed regulations that manufacturers must follow when using PAL should be improved.</p> <p>The proportion of respondents whose children had previously experienced anaphylaxis, and who would avoid feeding their child a product containing a relevant precautionary label, varied depending of the wording of the PAL statement.</p> <p>There was no difference in the self-reported behaviours between those with a child who had experienced anaphylaxis, and those whose children had a history of more moderate reactions, in terms of reading food labels or whether they would give their child a product if the food they were allergic to was listed in the PAL section. However, the statement "may be present" was perceived to be less useful by parents with a child with a history of anaphylaxis compared with parents of children without a history of anaphylaxis (47% vs 82%).</p>
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