Preprepared convenience foods and associated food safety risks

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Foreword

In December 2019 *safe*food commissioned a research project to understand the nature of preprepared “convenience foods” and associated food safety risks on the island of Ireland.

The aim of this research was to collect data on the types of ready-made, prepacked “convenience foods” available in retailers and businesses across the island and to assess the behaviours and understanding of people who consume these foods.

This report presents the research findings and recommends ways to support the safe use of preprepared “convenience foods” that are available on the island of Ireland.

Acknowledgements

*safe*food would like to acknowledge and thank the project team from Queen's University Belfast for their significant contribution to this research:

- Professor Moira Dean, Principal Investigator
- Dr Fiona Lavelle, Project Manager and Research Fellow
- Dr Blain Murphy, Dr Claire McKernan and Dr Mairead Campbell, Research Fellows
- Ms Joanne Bertenshaw, Master of Science in Global Food Security Postgraduate Student.

Executive summary

Aims

This project aimed to:

- Audit, or survey, the on-pack and manufacturer-provided instructions on "preprepared convenience foods[1]" available on the island of Ireland.
- Observe how people treat convenience foods in the home.
- Explore consumer purchasing, as well as attitudes and understanding around convenience foods (including the on-pack and manufacturer-provided instructions).

Objectives

The objectives of the research project were to:

- **Examine** (through selected product audit surveys) the on-pack and manufacturer-provided instructions for handling, storing and preparing (including the use of leftovers) a variety of preprepared convenience foods from retail outlets and meal preparation businesses that sell direct to the consumer.
- **Determine** (through in-home observations) how people handle, store and prepare selected convenience foods in the domestic environment, and their compliance with on-pack and manufacturer-provided instructions (including the use of leftovers).
- **Explore and investigate** further (through interviews and an online survey) consumer purchasing, knowledge, attitudes and understanding (including the on-pack and manufacturer-provided instructions) with regard to handling, storing and preparing preprepared convenience foods.
- **Provide recommendations** for consumers and food manufacturers regarding the handling, storage, and preparation of preprepared convenience foods to maximise

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[1] *For the purposes of this project, "preprepared convenience foods" means a whole preprepared meal (not a single ingredient) that is purchased chilled (not frozen) and requires the consumer to carry out a treatment step at home before consumption (for example, heating the meal).*

food safety and quality, and provide sound scientific advice to inform practice, policy and future research.

Methods

To meet the aims and objectives, the researchers used both quantitative and qualitative study methods to collect data. The researchers completed 5 tasks designed to meet the objectives. They conducted

1. A literature review of relevant articles
2. An audit survey of on-pack and manufacturer-provided instructions from 266 preprepared convenience meals collected at retail outlets across the island of Ireland
3. In-home observations of 50 consumers
4. Interviews with 50 consumers (instead of planned focus groups, to comply with COVID-19 regulations)
5. An online survey of 500 consumers

The **review of available scientific literature** explored consumer knowledge, behaviours and attitudes in relation to use and associated safety risks of preprepared convenience foods.

Data was collected on on-pack and manufacturer-provided information and instructions for selected preprepared convenience foods, as well as on consumers' perceived and actual behaviours, relating to the handling, storage and preparation of convenience foods (including the use of leftovers).

- Quantitative data on on-pack and manufacturer-provided information and instructions for consumers was collected through an **audit survey of selected products** from 6 locations (3 urban and 3 rural) across the island of Ireland. The information on the 266 products was collected, organised and analysed in detail to gain a greater understanding of the instructions provided.
- Quantitative data was collected from **observations made in people's homes**, involving 50 participants across the island of Ireland, to understand actual consumer behaviour in relation to their handling, storage and preparation of 5 selected preprepared convenience foods (including the use of leftovers).
- Qualitative data was collected from **interviews** with the 50 participants that took part in the in-home observations, to gain insights into consumers' perceptions relating to their handling, storage and preparation of selected preprepared convenience foods,

their general use of convenience food products and their perceptions around the clarity of the provided instructions. (These interviews replaced the planned focus group interviews, to comply with COVID-19 regulations.)

- Quantitative data was collected from an **online survey** of 500 participants from the island of Ireland. The survey used a representative sample of frequent users of preprepared convenience foods to explore consumers' behaviours in relation to convenience foods and to understand the factors that influence these behaviours.

Results

The **literature review** highlighted limited research in the area of consumers' behaviours relating to preprepared convenience foods. The limited relevant literature indicated that food safety knowledge varied among sociodemographic groups (based on income, education, gender and age, for example), and that people's behaviours relating to storage and following use-by dates were not always in line with the guidance.

The **audit survey** indicated that some preprepared convenience foods did not comply with legislation around ingredient and allergen lists and that the details provided for reheating and freezing were insufficient.

The **in-home observations** showed that participants did not always check the use-by instructions and were extremely unlikely to identify food safety hazards such as damaged packaging. Also, some participants were willing to reheat and consume leftovers of preprepared convenience foods. However, in general, the majority of the participants complied with the cooking instructions as much as possible.

The **interviews** revealed the main reasons for using preprepared food products are "convenience" (the products are quick and easy to use) and a general belief that convenience foods are safe. Participants reported a high compliance with use-by dates and cooking instructions. However, problems relating to the size of the font, the level of detail and location of the instructions were identified.

Overall, the **online survey** participants demonstrated relatively low safe behaviours in relation to storage, preparation and use of leftovers of preprepared convenience foods. Older participants had higher food safety knowledge and safer behaviours relating to preprepared convenience foods. The significant variables influencing better overall behaviours in the usage of preprepared convenience foods were food safety knowledge, believability of the use-

by dates, perception of food poisoning susceptibility, belief in the likelihood of getting food poisoning, perceived food poisoning severity and age.

Conclusions

- Key information relating to ingredients, allergens, cooking instructions, reheating and freezing is missing from some preprepared convenience food products.
- Greater consumer compliance with product use-by dates and cooking instructions are required for better food safety.
- Some consumers reheat leftovers of preprepared convenience foods and consume them, which may have food safety implications.
- Older consumers have a higher food safety knowledge and better behaviours relating to storage, heating and use of leftovers of preprepared convenience foods than younger consumers.
- Several variable factors influenced people's behaviour relating to the handling, storage, preparation and use of leftovers of convenience foods. These include:
    - Higher levels of food safety knowledge
    - Greater belief in use-by dates
    - Greater belief in susceptibility to food poisoning
    - Lower belief in the likelihood of getting food poisoning from convenience foods
    - Greater perceptions around the severity of food poisoning
    - Higher age

Key recommendations for consumers, manufacturers, educators and policy makers

Recommendations for consumers

- Check and comply with the use-by date
- Store products in the fridge unless specific instructions are provided for freezing
- Do not reheat and consume leftovers unless specific instructions are provided for the safe reheating of the product

Recommendations for manufacturers of preprepared convenience foods

- Clearly state the ingredients list and all allergens on all preprepared convenience food products
- Use larger writing (in bold print and capitals) for all instructions
- Provide clear freezing and reheating instructions or information that the product is unsuitable for these processes

Recommendations for educators and policy makers

- Increase consumer food safety knowledge
- Change consumer perceptions on food poisoning, potential food hazards, and possible severe consequences of and susceptibility to food poisoning

Contents

1 Introduction

Multiple factors, such as lack of time and changes in family food preferences, have led to an increase in the use of preprepared "convenience foods" – ready-made, prepacked foods, for example chilled meals that need little processing in the home. Convenience foods have been acknowledged as a rapidly expanding supermarket category on the island of Ireland (IOI). These meals may be marketed to the general population or targeted to specific types of consumers (for example by advertising preprepared meals as being high in protein "for muscle gain" or as "fat loss" products that can help people achieve personal health goals).

Due to the wide variety of products available – uncooked, partially cooked or fully cooked – consumers must undertake different handling, storage and preparation procedures in the home environment to ensure the quality and safety of preprepared convenience foods. Consumers may ignore, misunderstand or misinterpret on-pack or manufacturer-provided instructions, and so it is vital to improve awareness of consumer understanding and behaviour in relation to preprepared convenience foods.

Recent results of research from the Food Safety Authority of Ireland (FSAI) highlighted an increased reliance on convenience foods among Irish consumers, with 84 per cent of consumers stating that they purchase convenience food products (ready-to-eat or preprepared products), and 36 per cent of consumers purchasing these products at least once a week (FSAI, 2019). A substantial shift in lifestyle demands and priorities over the last 10 to 20 years may have contributed to the increase in use of convenience foods. Studies have found several factors underpin the attractiveness of these food products to consumers, including changes in family structure, changes in family food preferences, more women joining the workforce, people working longer hours and a decline in cooking skills in recent generations (De Boer et al., 2004; Buckley et al 2005; Brunner et al., 2010; Hartmann et al., 2013). In response to consumers' preferences, the provision of preprepared meals (chilled meals that require little preparation or processing in the home) is diverse to cater to consumers' demands, such as for high-protein or calorie-counted products.

It is important to note that the domestic kitchen is considered a high-risk area in which people are likely to be exposed to a broad diversity of microbes (for example bacteria, viruses and fungi) (Flores et al, 2013). The United Kingdom (UK) Food Standards Agency (FSA) reports that up to 64 per cent of foodborne illness in the European Union (EU) originates from the home environment (FSA, 2018). A recent study found that Irish consumers participate in "risky" food usage behaviours in the home, with 45 per cent of consumers not adhering to "use-by" dates and the majority (72 per cent) of consumers admitting to consuming food after its use-by date. In relation to leftover food practices, 62 per cent of people let leftovers cool on the counter overnight and 49 per cent did not cover foods in the fridge appropriately (FSAI, 2019). In addition to ignoring use-by dates, consumers may also misunderstand or misinterpret on-pack and manufacturer-provided product handling, storage and preparation instructions.

The wide variety of preprepared convenience foods available to consumers – uncooked, partially, or fully cooked – means different preparation and storage instructions are needed to ensure food quality and safety is maintained in the home environment. The increased risk of food poisoning within the home environment, together with consumers' dismissal of food handling recommendations and the lack of clarity and detail in the instructions for some of these products, makes it important to obtain a deeper understanding to assess consumer knowledge, attitudes and behaviour in relation to convenience foods.

Defining "convenience food[2]" is challenging. Definitions found in the literature are multiple and vague, with many authors providing a definition of convenience foods that is suitable to their own investigation (Scholliers, 2015; Jackson and Viehoff, 2016). For example, Charles and Kerr (1998) defined convenience foods as "any food which has had work performed on it outside the home". Brunner et al. (2010) define convenience foods as "those that help consumers minimise time as well as physical and mental effort required for food preparation, consumption and clean-up". While a focus and clarity on what "convenience foods" means is

[2] *For the purposes of this project, "preprepared convenience foods" means a whole preprepared meal (not a single ingredient) that is purchased chilled (not frozen) and requires the consumer to carry out a treatment step at home before consumption (for example, heating the meal).*

essential, common themes used to define “convenience” are associated with partly processed food and saving time.

2 Aims and objectives

Aims

This project aimed to:

- Audit, or survey, the on-pack and manufacturer-provided instructions on preprepared convenience foods available on the IOI.
- Explore consumer purchasing, as well as attitudes and understanding around convenience foods (including the on-pack and manufacturers' instructions).
- Investigate how people handle, store and prepare convenience foods.

Objectives

The objectives of the research project were to:

- **Examine** (through selected product audit surveys) the on-pack and manufacturer-provided instructions for handling, storing and preparing (including use of leftovers) a variety of preprepared convenience foods from retail outlets and meal preparation businesses that sell directly to the consumer
- **Determine** (through in-home observations) how people handle, store and prepare selected convenience foods, and their compliance with on-pack and manufacturer-provided instructions (including the use of leftovers).
- **Explore and investigate** (through interviews and an online survey) consumer purchasing, attitudes and understanding around the handling, storage and preparation of preprepared convenience foods (including the on-pack and manufacturer-provided instructions). (The planned focus groups were replaced with interviews with consumers, to comply with COVID-19 regulations.)
- **Provide recommendations** for consumers, food manufacturers and educators regarding the handling, storage and preparation of convenience foods to maximise food safety and quality, and provide sound scientific advice to inform practice, policy and future research.

3 Methods

Background

Preprepared "convenience foods" are a new concept within food environment research. To our knowledge, to date, little research has been carried out around consumer behaviours relating to the safe handling, storage and preparation of these products on the IOI.

For the purposes of this research, "preprepared convenience food" means

A whole preprepared meal (not a single ingredient) that is purchased chilled (not frozen) and requires the consumer to carry out a process at home before consumption (for example, heating the meal).

This research project employed a "mixed methods" approach: both quantitative and qualitative research elements were used to bring different perspectives and understandings on the food environment of preprepared convenience food.

The researchers completed 5 tasks designed to meet the objectives:

1. A literature review of relevant articles
2. An audit survey of on-pack and manufacturer-provided instructions
3. In-home observations of consumers
4. Interviews with consumers (replacing planned focus groups, to comply with COVID-19 regulations)
5. An online survey of consumers

The first task conducted was a review of available, reliable scientific publications, government and other organisation reports and "grey" literature. ("Grey" literature means information produced by people and organisations that are not academic publishers.) This provided a thorough and up-to-date overview of consumer behaviours, knowledge and attitudes in relation to handling, storing and preparing convenience foods. The review also noted any reported food safety risks and incidents or outbreaks related to these types of foods. The information the researchers found in the literature review was used to design the further studies, or tasks.

The second planned task was a quantitative study in the form of an audit survey (which was eventually conducted third, after the online survey, because of delays due to the COVID-19 pandemic). This study examined the availability across the IOI of preprepared convenience foods and the on-pack and manufacturer-provided instructions for consumers, including information displayed with preprepared convenience foods from retail premises and meal preparation businesses that sell direct to the consumer.

The audit survey provided an overview of the types of convenience food products available, and the clarity of the on-pack and manufacturer-provided instructions on these types of products, on the IOI. The audit survey collected data on 266 products from 3 rural and 3 urban environments and the results of this study informed the design of the remaining 3 tasks.

The third planned task was an in-home observation study of 50 participants (eventually running fourth due to delays). This study was conducted to determine how people handle, store and prepare selected preprepared convenience foods (including the use of leftovers) in the domestic environment. Most participants were regular convenience food consumers. To consider the potential vulnerability of older adults to food poisoning, 50 per cent of participants were over the age of 60 years.

The fourth planned task was a qualitative study involving interviews with the same 50 participants observed in their homes (which took place last due to COVID-19 restrictions). The interviews explored consumer purchasing, attitudes and understanding around the handling, storage and preparation of preprepared convenience foods (including the on-pack and manufacturer-provided instructions).

The fifth planned task was an online survey (conducted second due to the pause in other activities caused by COVID-19 restrictions). The participants were a nationally representative sample of 500 respondents: 350 people living in the Ireland and 150 people living in Northern Ireland (NI) aged between 18 and 80 years, half of them female and half male. In addition to gathering sociodemographic information (such as age, gender and education), the survey further investigated consumer purchasing, attitudes and understanding around the handling, storage and preparation of preprepared convenience foods, as well as food safety knowledge.

Literature review of consumer knowledge, behaviours and attitudes around preprepared convenience foods

A critical review of existing articles and papers was conducted using a structured approach.

Search strategy

Articles exploring knowledge, behaviours and attitudes in relation to consumer use and safety risks of preprepared convenience food products were sourced. To ensure relevant search terminology was maximised a second researcher (Dr Claire McKernan) reviewed and added to the search terms.

In December 2019 and January 2020 a comprehensive and systematic search of the keywords was conducted across electronic databases: MEDLINE®, Web of Science®, PsycINFO® and Mintel®.

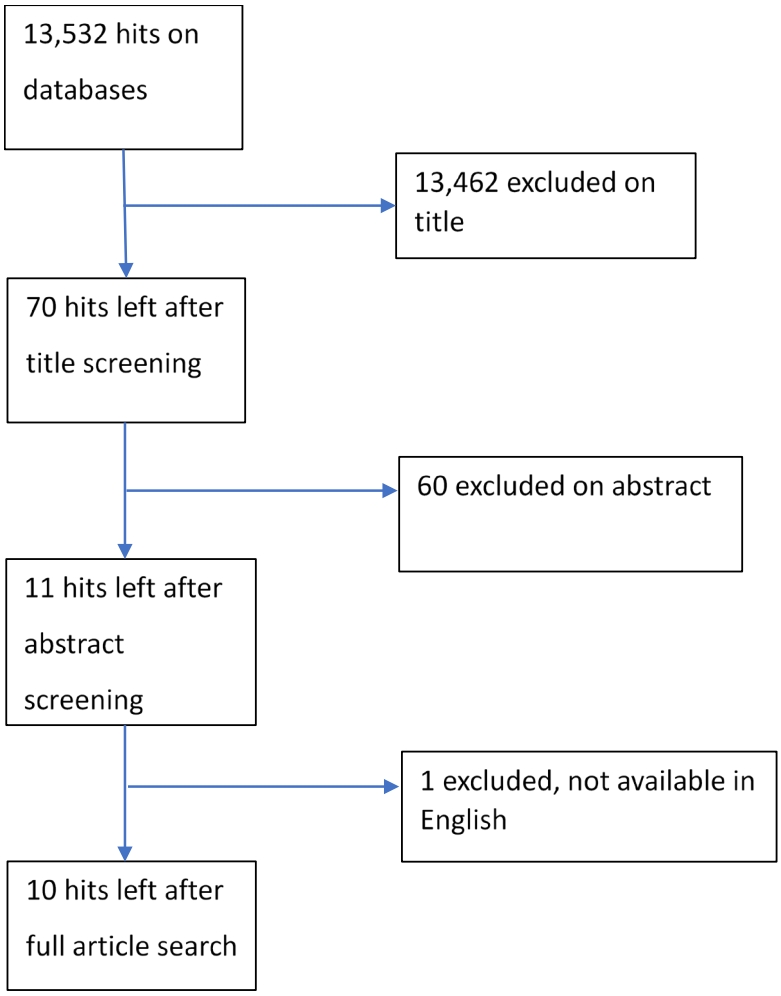
Eligibility criteria

To be eligible for inclusion in the literature review, articles or papers must have been published in English, at any date, in any part of the world.

Article screening

Key search terms identified 13,532 articles from the databases. One author (Dr Fiona Lavelle) independently screened article titles and abstracts (short extracts describing full articles). Duplicated articles were crosschecked and removed. After screening the article titles and abstracts, 11 papers were retained. A further paper was excluded as it was not available in English. This process resulted in a total of 10 papers identified for full text review (Figure 1).

Figure 1. A flow diagram showing the screening process for selection of articles for the literature review assessing consumer knowledge, behaviour and attitudes around preprepared convenience foods.



Data extraction and synthesis

All articles were deconstructed and the following data was extracted: country of study, study design, sample size, sample description, aim, intervention, outcomes measured, measurement tools, validation, limitations, and key results. Extracted data was inductively thematically coded in accordance with the Braun and Clarke protocol (2006). Findings from the eligible articles were coded for relevant information to fulfil the research preprepared convenience foods and associated food safety risks 11 aims. Subsequently, all articles relating to behaviours, knowledge and attitudes to consumer use and safety risk of preprepared

convenience food products were coded. To ensure reliability, 50% of the papers were independently reviewed and findings crosschecked and verified by a second author (Dr Claire McKernan).

Audit survey of on-pack and manufacturer-provided instructions on preprepared convenience foods available on the island of Ireland

To collect quantitative data about the on-pack and manufacturer-provided instructions on preprepared convenience foods available in shops and food establishments on the IOI, the researchers conducted an audit survey.

Sampling locations and reasons for selection

The urban centres (over 10,000 inhabitants) selected included Dublin, Galway, and Belfast. Dublin and Belfast are the capitals of the respective jurisdictions (Ireland and NI), while Galway is the primary city in the West of the island. The rural regions (towns/villages with under 10,000 inhabitants, as per Irish census (2016) and NI census (2011)) selected include the southwest (county Wicklow), the mid/northwest (counties Mayo and Sligo) and the East Tyrone area. Within each region, different types of premises were chosen to provide varied eligible range of available products. The retail premises were categorised as Supermarket chains (such as Dunnes Stones, Tesco, and Supervalu), Supermarkets under a franchise license (smaller iterations of supermarket chains (such as Centra and Spar shops), Independent food stores (such as Specialty food stores and butchers) and meal preparation businesses (such as cafes). The different establishments were then subcategorised based on their size as being: small, small-to-medium; medium; medium-to-large and large.

Product selection and sampling

The researchers selected a range of products with differing features (for example pack size, type of heating required or length of storage recommended).

Five categories of known potential food safety risks were suggested and researchers aimed to select a certain percentage of products for each food risk category. Table 1 indicates the proposed risk categories for the selection of preprepared convenience foods.

Table 1: Categories of food products for selection for an audit survey of on-pack and manufacturer-provided instructions on preprepared convenience foods available on the island of Ireland, and suggested potential food safety risks

Preprepared convenience food category	Potential food safety risk category	Percentage aim for selection
Rice	**Generally advised against reheating** Potential bacterial hazards: • *Bacillus cereus* • *Staphylococcus aureus*	65
Meat, poultry and fish	**Hazardous meats and fish** Potential bacterial hazards: • *Salmonella* • *Campylobacter* • *Escherichia coli* • *Listeria monocytogenes*	65
Allergens	**Milk, eggs or nuts in ingredients** Potential severe hazard to some people if not labelled correctly	65
Traditional meals (roast dinners and main meals with meat and 2 vegetables)	**Taste and quality may be affected when reheating** Potential bacterial hazards: • *Salmonella* • *Campylobacter* • *Escherichia coli* • *Listeria monocytogenes*	25
Vegetarian and vegan products	**New products may be seen as "low risk"** Instructions may not be followed as closely	10

Data collection and processing

Between May and August 2021, 3 researchers (Dr Blain Murphy, Dr Fiona Lavelle and Dr Mairead Campbell) travelled to the 6 selected locations across the IOI and purchased preprepared convenience food products in line with the sampling strategy. The products were photographed. All on-pack and manufacturer-provided instructions were inputted into a Microsoft® Excel® framework.

The on-pack and manufacturer-provided labels were analysed to extract relevant information relating to the

- Type of product
- Portion size
- Ingredient list
- Allergen list
- Cooking instructions
- Reheating instruction
- Storing instructions for freezing or refrigeration
- Use of product leftovers.

In-home observations to determine consumers behaviours around preprepared convenience foods on the island of Ireland

To determine how people handled, stored and prepared 5 selected preprepared convenience foods, and their compliance with on-pack and manufacturer-provided instructions (including the use of leftovers), in-home observations were conducted with 50 consumers from across the IOI.

The observations were made between August and November 2021 and were conducted in line with COVID-19 regulations in both jurisdictions.

Participant selection and recruitment

Researchers recruited participants by using a combination of convenience sampling and snowball sampling. ("Convenience sampling" in this case means the researchers selected participants living nearby or in easily accessible places. "Snowball sampling" means the researchers then asked each recruited person to suggest other people who might agree to take part in the study.)

The participant sample selection criteria aimed to recruit the following: jurisdiction on the IOI (50 per cent NI: 50 per cent Ireland), location (50 per cent Urban: 50 per cent rural), gender (50 per cent male: 50 per cent female), usage of preprepared convenience foods (60 per cent frequent users) and age (50 per cent under 60 years old: 50 per cent over 60 years old) to recruit a range of individuals from across the population living on the IOI.

Once participants were recruited, arrangements were made to conduct the in-home observation and the individual consumer interview (replacing planned focus group interviews) at a time that was convenient to them. Observations and interviews were conducted during August and November 2021.

Before the observation and interview, participants were provided with information about the study and were given time to consider their participation and ask any questions they had about the research. Written consent was sought from participants before beginning the observation study and interview. Participants received a £60 or €70 payment to compensate for their time and any costs incurred from taking part in the interviews (for example electricity charges).

Product selection

Five products were selected for participants to prepare during the observation. The products were selected as they represent a range of risks, different heating appliances, as well as difference in required recommended times. The five products selected were: 1) chicken product (bacterial hazards: *Salmonella*, *Campylobacter*); 2) rice product (bacterial hazards: *Bacillus cereus* & *Staphylococcus aureus*); 3) Mince product (needs to be thoroughly cooked, bacterial hazards: *E. coli*, *Salmonella*, *Listeria monocytogenes*); 4) Beef product (bacterial hazards: *E. coli*, *Salmonella*, *Listeria monocytogenes*); 5) Oven product (different heating appliance).

Observation behaviour checklist development

No existing behavioural checklist relating to preprepared convenience foods was available for the researchers to use. Therefore, they designed, developed, and piloted a behaviour checklist to record safe and unsafe handling, storage and preparation of convenience foods including the use of leftovers (Appendix 1). The checklist was devised to record attempts and adequate or inadequate implementation of practices. Key practices incorporated into the checklist included hand decontamination practices, assessing product use-by dates, reading of storage and preparation instructions, correct appliance chosen, correct time and temperature applied, removal of product packaging and use of leftovers. Additionally, a safety hazard was purposely planted, for example a hole in product packaging or an out-of-date product. Participant identification of this safety hazard was also assessed. The behaviour checklist was developed from the limited literature and initial phases of the audit and critically reviewed by the research team and refined. It was then piloted with two participants (one male, one

female, one under 60 and one over 60) for clarity and flow during the observation procedure and no further adaptions were undertaken.

Observation procedure

All in-home observations were conducted as safely as possibly during the COVID-19 pandemic. One researcher (Dr Fiona Lavelle) conducted all observations.

Participants in this study were advised to act as if they had purchased the preprepared convenience foods themselves and told to prepare the products as they normally would. Products were provided to each participant in a random order. The participant then prepared each product individually, without knowledge of the other products. The researcher recorded the participants' actions for each product on the behaviour checklist.

Upon completion of the preparation of all 5 products the participants completed an interview with the researcher and a final survey (assessing their sociodemographic characteristics and food safety knowledge). The survey was conducted last so that the questions relating to food safety knowledge did not prompt any behaviours in the participants.

Data analysis

The in-home observations behaviour checklist data was inputted by an independent researcher (Dr Claire McKernan) into a specifically designed database using IBM® SPSS® Statistics V26 (International Business Machines Corporation [IBM], Armonk, New York [NY], United States of America [USA]). All statistical analysis was conducted using SPSS® V26.

The data was summarised using descriptive statistics: means, or the average or most common values; standard deviations (SD) or variations from the average or common values; and percentages, or proportion of the whole data set.

Ethical approval

Ethical approval was sought from the Faculty of Medicine, Health and Life Sciences Ethics Research committee at Queen's University Belfast for the studies. Ethical approval was granted in Jul 2021 for the observation and interview studies (Registration number: MHLS 21_78).

Interviews with consumers to explore attitudes and understanding around preprepared convenience foods on the island of Ireland

Interviews (replacing planned focus groups) were conducted directly after the in-home observations, with the same 50 participants. The researcher explored each participant's perceived own behaviour around the handling, storage and preparation of preprepared convenience foods, as well as their reported usage and perceptions of the on-pack and manufacturer-provided instructions.

Interview topic guide

The interview topic guide was informed by the review of the literature about knowledge, behaviour and attitudes around the use of convenience foods and by the initial phases of the audit survey of on-pack and manufacturer-provided instructions. The interview guide was refined and rewritten through a series of meetings with the project team.

The interview guide was piloted after the pilot in-home observations, with the same 2 participants (1 male, 1 female, one under 60 years and one over 60). Pilot interviews were recorded using Dictaphones®. The pilot interviews indicated that the topic guide questions were clear to understand and sufficiently open to elicit (encourage and draw out) responses, therefore no adjustments were required. The interview topic guide is in Appendix 2.

Product selection

A further 5 products were selected to be used during the interviews to explore participant's perceptions and perceived own behaviours around preprepared convenience foods. In addition to the type of food products that are viewed as "risky", such as chicken and meat, products were selected to take in other factors that may impact perceptions around food safety – for example the product packaging, the instruction details and the appliance required for heating the food. The five products selected included:

- Biodegradable packaging (cardboard) – may potentially not be seen as safe packaging
- Plastic Tupperware container – less detailed instructions provided
- An oven-based product – perceptions around appliances
- A larger portioned product – behaviours may differ for quantities
- Vegetarian product – may be seen as 'less risky,' thus behaviours may be more lenient

Interview procedure

The interviews were conducted with a trained and experienced researcher directly after the observation study, to minimise contact in compliance with COVID-19 regulations. Interviews lasted between 9 and 42 minutes (mean time of 17.18 minutes) and were audio-recorded. Interviewees were encouraged to provide their opinions about the tasks. Interviews were recorded on Dictaphone® recording devices.

Data collection and analysis

After the interviews, recordings were transferred from the recording devices onto password-protected, encrypted personal computers and deleted from the recording devices. Audio recordings were professionally transcribed verbatim (typed out word-for-word) and checked for accuracy by Dr Blain Murphy.

Inductive thematic analysis was used as it is considered to be flexible yet structured in terms of accommodating theoretical perspectives, highlighting commonalities and differences in a data set and generating insights (Braun & Clarke, 2006; Nowell et al., 2017). By using inductive thematic analysis, the analysts (Dr Blain Murphy and Dr Fiona Lavelle) were able to compare the themes developed.

In this study, thematic analysis allowed the research to develop themes in response to broad patterns, which can be further developed in later work. The lack of theory or previous research around preprepared convenience food meant an inductive methodology linked to the data was the most appropriate (Braun & Clarke, 2006; Fereday & Muir-Cochrane, 2017).

Online survey to investigate consumer purchasing, attitudes and understanding around preprepared convenience foods on the island of Ireland

Researchers conducted an online survey of 500 nationally representative respondents: 350 participants living in Ireland and 150 living in NI. The researchers investigated consumer purchasing, attitudes and understanding in relation to the handling, storage and preparation of preprepared convenience foods.

Photographs of preprepared convenience foods were shown to participants to gauge their perceptions. Each participant was shown 2 products out of a possible 4 products and were asked questions relating to their behaviours for handling, storage and preparation of the products.

Participant selection

The sample of 500 consumers of preprepared convenience foods (350 people living in Ireland and 150 living in NI) were recruited by an external research agency (Kantar) from their online panel of consumers to complete a 20-minute online survey. The sample was made up of people aged between 18 and 80 years, half of them female and half of them male. All participants had to be frequent users of preprepared convenience foods (defined a greater than 2-3 times a month for this study).

People with advanced knowledge of food safety, food processing or manufacturing, or living in a household with someone working in those industries, were excluded from taking part in the survey. People under 18 years of age and people over 80 were also excluded.

Online survey development

The online survey was developed based on the results of the literature review. The proposed survey was critically reviewed by Principal Investigator Professor Moira Dean, the research team and ***safe***food and was refined. The survey was piloted with five participants, resulting in minor changes to make it clearer.

The survey (Appendix 3) measured several factors including:

Product-specific beliefs and behaviours

To gather insights into participant behaviours and beliefs around specific preprepared convenience foods, the research team developed specific measures. Each participant was shown 2 pictures out of a possible 4 preprepared convenience foods and were asked questions relating to that product. The four products selected for inclusion were a Roast Beef dinner, Roast Chicken dinner, Chicken Curry with rice and Beef Stroganoff with rice. These products were chosen as traditional roast dinners remain a popular meal option on IOI, additionally specific components within the meals have potential bacterial hazards; chicken (*Salmonella* and *Campylobacter*), beef (*E. coli, Salmonella* and *Listeria monocytogenes*) and rice (*Bacillus cereus* and *Staphylococcus aureus*). Each participant saw one beef meal and one chicken meal and were shown one roast meal and one rice meal, i.e., a participant could not be shown a roast chicken meal and chicken curry with rice. Product selection and product order was randomized for the participants, to reduce bias. This process resulted in 250

participants viewing each product. For each product, 3 factors were assessed, understandability of cooking instructions, understandability of storage instructions and product specific behaviour. Additionally, an overall behaviour score was created:

- *Product Specific Behaviour* – participants were shown a product and then asked seven questions relating to the product around their storage, preparation and use of leftover behaviours, without the product visible. Correct responses were scored as 1.
- *Overall Behaviour Score (dependent variable)* – this was a sum of the two product specific behaviour scores for each participant.
- *Understandability of cooking instructions* - was measured with 1 item on a scale of 1 to 7, 1 meaning extremely difficult to understand and 7 meaning extremely easy to understand, adapted from Benson et al. (2018). The product picture was visible for this question.
- *Understandability of storage instructions* - was measured with 1 item on a scale of 1 to 7, 1 meaning extremely difficult to understand and 7 meaning extremely easy to understand, adapted from Benson et al. (2018). The product picture was visible for this question.

General beliefs and behaviours around preprepared convenience foods

- *Believability of use-by date on convenience foods* - was measured with 1 item on a scale of 1 to 7, 1 meaning 'not at all believable' and 7 meaning 'extremely believable,' adapted from Benson et al. (2018).
- *General storage of convenience foods* – this was measured with one item adapted from Daelman et al. (2013).
- *Respecting the use-by date of convenience foods* – this again was measured with one item adapted from Daelman et al. (2013).
- Following instructions of convenience foods – this was assessed using one item adapted from Daelman at al. (2013).
- Likelihood of getting Food Poisoning from convenience foods – this was measured using one item adapted from Clayton et al. (2003) using a 5-point Likert scale, where 1 means 'very unlikely' and 5 means 'extremely likely.'

Food Safety Knowledge

- *Food Safety Knowledge was* an adapted 10-question measure (Cairnduff et al. 2016). Questions related to general safe food practices and were scored as incorrect or correct, with some items having multiple correct responses. Each correct response was given a score of 1, with a possible scoring range of 1 – 13.

Sociodemographic variables

- *Sociodemographic details* record included each participant's Living situation, income, marital status, occupation, location, education, gender, age, and meal preparation responsibility.

Psychosocial variables

- *Health consciousness* was measured using the General Health Interest scale (Roininen et al., 1999), an 8-item measure using a 7 point Likert scale, from 1 meaning strongly disagree to 7 meaning strongly agree.
- *Health and Lifestyle* – participants' perceptions of their own health – was measured with 1 item on a scale of 1 to 5, (1 = excellent, 2 = very good, 3 = good, 4 = fair and 5 = poor). This was reverse coded for analysis.
- *Food Poisoning Susceptibility* - was measured using a 6-item measure from Cairnduff et al. (2016), using a 5-point Likert scale.
- Food Poisoning Severity – assessed participants' perceptions around the severity of food poisoning and was measured using a 6-item measure from Cairnduff et al. (2016), again on a 5-point Likert scale.

Food Chain Engagement

- *Food Chain Engagement* - was measured using the newly developed and validated 10-item scale (O'Kane et al., under review) measuring engagement behaviours along the food chain, in areas around communication, food waste reduction and meal planning and preparation. It is measured on a 5-point Likert scale.

Cooking Skills confidence

- *This* was measured by the cooking skills confidence measure (Lavelle et al., 2017). This measured perceived cooking confidence of 14 cooking skills, including skills such as chopping, peeling, weighing ingredients, and using an oven. This is measured on a 7-

point Likert scale. The score for each skill is then summed to create a total cooking competence score, with possible scores ranging from 0 to 98.

Food practices

- *Food practices* were measured using the food skills confidence measure (Lavelle et al., 2017; Murphy et al., 2021). In total, nineteen items were included: "plan meals ahead or plan to buy? (e.g., for the day/week ahead)", "cook more or double recipes which can be used for another meal or freezing". This is measured on a 7-point Likert scale, with possible scores ranging from 0 – 133.

Trust in the product (preprepared convenience foods)

- *Trust* was measured using the product trust construct obtained from the validated trust toolkit (Benson et al., 2020). In total, the 10 items ascertained how much an individual trusts a specific product (preprepared convenience foods) on issues such as "safety", "authenticity" and honesty. This is measured on a 7-point Likert scale.

Analysis

Data analysis was conducted using IBM SPSS Statistics v26 (IBM Corporation, Armonk, NY, USA). As forced response options were used in the survey, no data was missing. Descriptive statistics (Mean, SD, percentages) were used to explore and summarise the data. Differences between groups (such as gender and age) were assessed using T-tests, Analysis of Variance (ANOVAs) with Bonferroni post-hoc tests (assessing if there are group differences with post-hoc testing to understand where the differences are), and Welch ANOVA with Games-Howell post-hoc analysis (assessing if there are group differences with post-hoc testing to understand where the differences are, when the data is not normally distributed). Additionally, using a Hierarchical Multiple Regression, it was determined how much of the variance in the dependent variable (Overall Behaviour score) was accounted for by the predictor variables (sociodemographic variables, psychosocial variables, food behaviours, etc.). For regression analyses, multicollinearity was assessed using the variance inflation factor and by examining the tolerance statistic (to check if several of the independent variables in a model are correlated). These were below the suggested critical values of 10 for variance inflation factor (Myers, 1990) and above 0.2 for tolerance (Menard, 2002), indicating that the level of multicollinearity was acceptable. All analysis was considered significant at a level of 0.05.

Ethical approval

Ethical approval was sought from the Faculty of Medicine Health and Life Sciences Ethics committee at Queen's University Belfast for the study. Ethical approval was granted in March 2021 for the online survey study (Registration number: MHLS 21_27).

4 Results

Literature Review

The 10 articles retained for this review were published between 2006-2019. Research was conducted in 5 countries globally (in descending order), UK (n=4), USA (n=3), Brazil (n=1), Poland (n=1) and Thailand (n=1). Experimental design included quantitative approaches such as surveys, microbial analysis and observations in addition to qualitative approached including interviews and focus groups. Mixed-methods approach incorporating elements of quantitative and qualitative data collection were popular (n=4). Surveys were the most popular component (n=5), followed by observations (n=3), microbial analysis (n=3), interviews (n=1) and focus groups (n=1). Finally, the majority of articles focused on the food practices and potential risk of food poisoning to vulnerable groups i.e., >60-year-olds (n=4). Three key themes were identified in relation to food safety practices handling convenience products in the domestic environment, 1) Knowledge, 2) Behaviour, and 3) Attitudes.

Knowledge

A US study reported that less than half of respondents were not aware of *Listeria* and unable to identify the foods typical associated with *Listeria*. Moreover, awareness and knowledge of *Listeriosis* was lower amongst adults >60 years old and in individuals with lower income (Cates et al., 2006). In another study age was reported as an influential factor in food safety knowledge although this was country specific. For example, in Thailand younger consumers were more likely to respond correctly, where as in Poland older respondents were more likely to respond correctly (Tomaszewski et al., 2018). Consumers in USA, Thailand and Poland indicated that higher education correlated with elevated food safety knowledge (Cates et al., 2006; Tomaszewski et al., 2018). A survey completed in Poland and Thailand found that consumer knowledge of food safety was lower in Thailand than Poland. However, it is worth noting that in both countries there was inadequate food safety knowledge in relation to the causes of food poisoning and food hygiene practices during food preparation and consumption (Tomaszewski et al., 2018). In Poland and Thailand, a higher level of knowledge was demonstrated by women than men and, women were more aware of the importance of adequate food hygiene

practice during food preparation (Tomaszewski et al., 2018). These studies have highlighted that demographic characteristics such including age, gender, level of education and income can influence food safety knowledge. However, results from a US study focusing on understanding client's food safety knowledge in a home-delivered meals programme found that demographic characteristics such as age and ethnicity did not influence knowledge (Almanza et al., 2007). Numerous studies called for the incorporation of food education programmes for consumers to elevate awareness of cross-contamination risk in the home to minimise risk of food poisoning (Hessel et al., 2019; Evans and Redmond, 2015; Tomaszewska et al., 2018).

Behaviours

Overall, the food handling malpractices was reported in all studies to varying degrees (Hessel at al., 2019; Zoellener et al., 2019) For instance, in Poland and Thailand the majority of correct responses were noted only in the cases of washing hands after using the toilet. However, incorrect food hygiene practices were frequently reported in both countries in relation to, defrosting, storage of cooked foods and hand washing after handling raw foods (Tomaszewski et al. 2018). A US study focused on the food safety knowledge and practices with frankfurters and deli meats found that participants correctly stored these products in the fridge. However, in relation to storage duration, participants adhered to the recommended storage duration for frankfurters, while stored deli meats for longer than recommended (Cates et al., 2006). In a US study focusing on consumers understanding and practices of food safety with home-delivered meals found that a third of clients did not eat the meal after delivery, with one third of respondents reporting that they stored the food on counter/table. 35 per cent of respondents had leftovers, within this 41 per cent of respondents consumed leftovers between 4 hours – 4 days after delivery, outside the recommended 2 hours (Almanza et al., 2007). A similar finding was observed in a UK study, where 66 per cent of participants intended to store and consume "ready to eat" food products beyond the recommended 2 days after opening (Evans and Redmond, 2015). Data suggest that, although the purpose of use-by dates is reportedly understood by older adults, forty-one percent of foods in home refrigerators were beyond the use-by date and are not always be adhered to (Evans and Redmond, 2015; Evans and Redmond, 2016). Furthermore, research found that >50 per cent of participants refrigeration temperatures was above the recommended 5^{o}C, coupled with disregarding use-by dates and extended storage indicate older adults' failure to comply with

recommended practices could increase risk of contamination and food poisoning as *Listeria spp* was isolated in 7 per cent of kitchens (Evans and Redmond, 2015).

Men, more educated, and individuals living in metropolitan areas were more likely to engage in risky storage practices (Cates et al., 2006). This finding was also replicated in a UK observation study where the use of hot water was significantly lower among men than among women (Evans and Redmond 2018). In an "in kitchen" food preparation study, overall older adults frequently implemented unsafe food handling practices. For example, 90 per cent failed to implement adequate hand decontamination immediately after handling raw chicken, and other behavioural malpractices. Furthermore, this study emphasised the elevated risk of cross contamination and food poisoning due to these malpractices, as 46 per cent of 'cleaned chopping boards and 90 per cent of dishcloths were considered contaminated after microbial analysis (Evans and Redmond, 2018).

Attitudes

There is a paucity of studies centred on the attitudes towards food safety in relation to the preparation, storage, and consumption of meals within the home. Evans and Redmond (2016) conducted a survey on 100 older adults (>60), and found that overall, the majority of respondents have a neutral attitude towards food safety, where no participants found "themselves" to be at risk from *L. monocytogenes.* Additionally <30 per cent of participants considered the "vulnerable elderly" to be at an increased risk of becoming ill with *L. monocytogenes*. Participants' neutral attitudes towards food safety are illustrated by the following example, while the majority of participants (72 per cent) knew what a use-by date was, neutral attitudes were evident among participant group as 67 per cent believed it was safe to consume food after this date and 57 per cent reported doing so. Similarly attitudes towards consuming ready to eat foods within the recommended 2-days was neutral, as 55 per cent reported that they were aware of recommendations and 84 per cent reporting that they consume ready-to-eat foods beyond recommendations (Evans and Redmond 2016). These findings demonstrated despite an awareness and knowledge towards food safety practices, it does not necessarily mean that 'good' practices will be adhered to and neutral attitudes towards the risks of food safety needs to be addressed with consumers. While the findings show that elevated food safety knowledge positively correlated with level of education, research also found that more-educated individuals are more likely to engage in risky food behaviours with less-educated individuals following the recommended storage

guidelines for frankfurters, suggesting an attitudinal challenge requiring attention (Cates et al., 2006).

Audit survey of on-pack and manufacturers' instructions on preprepared convenience foods available on the island of Ireland

An audit survey of on-pack and manufacturer-provided instructions on preprepared convenience foods available on the IOI was conducted. Samples were collected across Ireland (n = 183) and NI (n = 83). The sampling strategy ensured that products were gathered from both urban and rural areas. Across Ireland and NI, 6 regions were selected for the survey. Researchers purchased sample products in: Galway (n = 45), Dublin (n = 47), County Wicklow in the South-East (n = 44) and Counties Mayo and Sligo in the West of Ireland, and in Belfast (n = 41) and East Tyrone (n = 42), with even distribution throughout the regions, Table 2.

A total of 67 shops and food establishments were visited. From these n=36 shops and food establishments contained pre-prepared uncooked convenience foods suitable for the project. In total, 266 number of meals were purchased, an average of 7 per establishment.

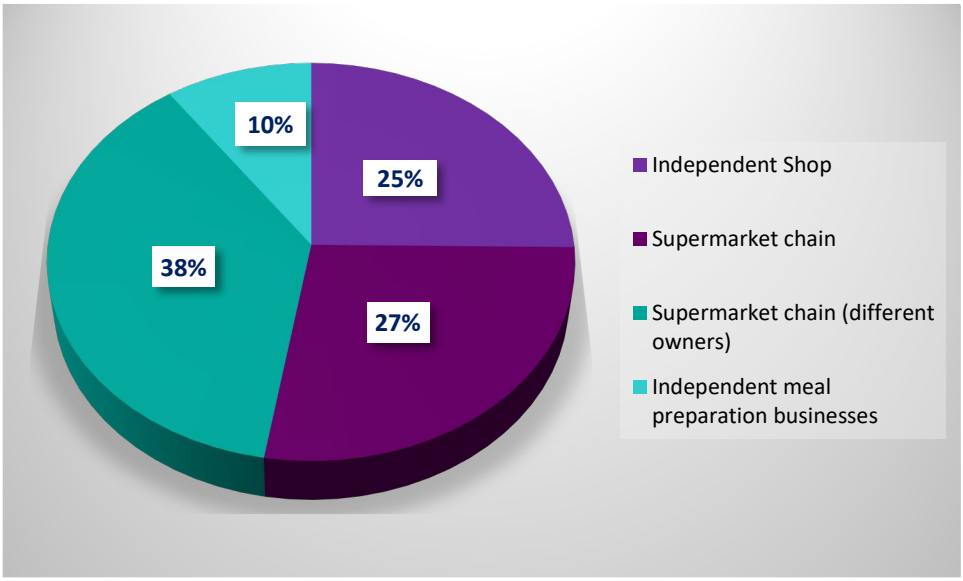
Table 2: Location and seller demographic details for the preprepared convenience foods audit.

Characteristic	Number	Percentage
Jurisdiction		
Ireland (4 locations)	183	68.8
NI (2 locations)	83	31.2
City/Region		
Galway	45	16.9
Dublin	47	17.7
Rural Wicklow	44	16.5

Characteristic	Number	Percentage
Rural Sligo/Mayo	47	17.7
Belfast	41	15.4
East Tyrone	42	15.8
Products by Seller Type		
Independent shop	67	25.2
Supermarket chain	73	27.4
Supermarket chain (Independent Owners)	100	37.4
Business	26	9.8
Products by Seller Size		
Small	67	25.2
Small/Medium	6	2.3
Medium	128	48.1
Medium/Large	6	2.3
Large	59	22.2

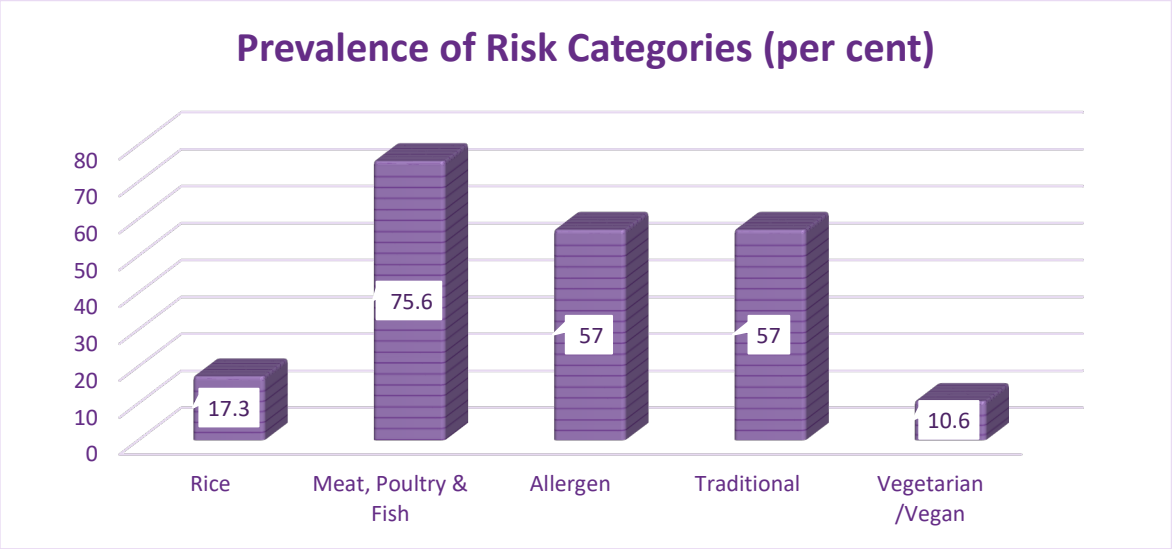
The preprepared convenience foods were purchased from different types of retailers: 25 per cent from independent shops, 27 per cent from supermarket chains, 38 per cent from supermarket chains with different owners under franchise licences and 10 per cent from independent meal preparation businesses, (Figure 2). The size of the establishments ranged from small to large, with the largest group of products purchased from medium-sized retailers (48.1 per cent).

Figure 2. A pie chart showing the distribution of the types of food retail establishments included in sampling for an audit survey of on-pack and manufacturer-provided instructions on preprepared convenience foods available on the island of Ireland.



In terms of risk, dishes were designated into 5 risk categories, with the possibility of being classified into more than one risk category. Products containing rice comprised of 17.3 per cent of the total. Meat, poultry, or fish products comprised of 75.6 per cent of the meals. Both “allergen products” i.e., milk, egg, nuts, and traditional meals, i.e., roast dinners, meat and two vegetables comprised of 57 per cent of the products analysed. Vegetarian or vegan meals made up 10.6 per cent of the products. These are shown in Figure 3.

Figure 3: Distribution of products across risk categories (in per cent)



There were various types of cuisine, including traditional, Indian, Asian, Mexican, American, Italian, Fish dishes, Thai, Vegan and Vegetarian. The majority of samples purchased were traditional meals such as a Roast dinner (57 per cent); with the least number of products in the category being Thai and American, 0.4 per cent in each. Asian and Italian were a close second with 15 per cent and 15.8 per cent samples purchased, respectively. Vegan and vegetarian had a combined total of 4.5 per cent of products, Table 3. Additionally, researchers noted a lack of availability of vegetarian and vegan products, especially in rural locations. Portion sizes varied with a majority (67.7 per cent) portioned for 1 person. Ingredient lists and allergens listed were present on 94.7 per cent and 89.5 per cent of products respectively, with a small minority having no information present on packaging, (Table 3).

Table 3: Description of products included in the audit

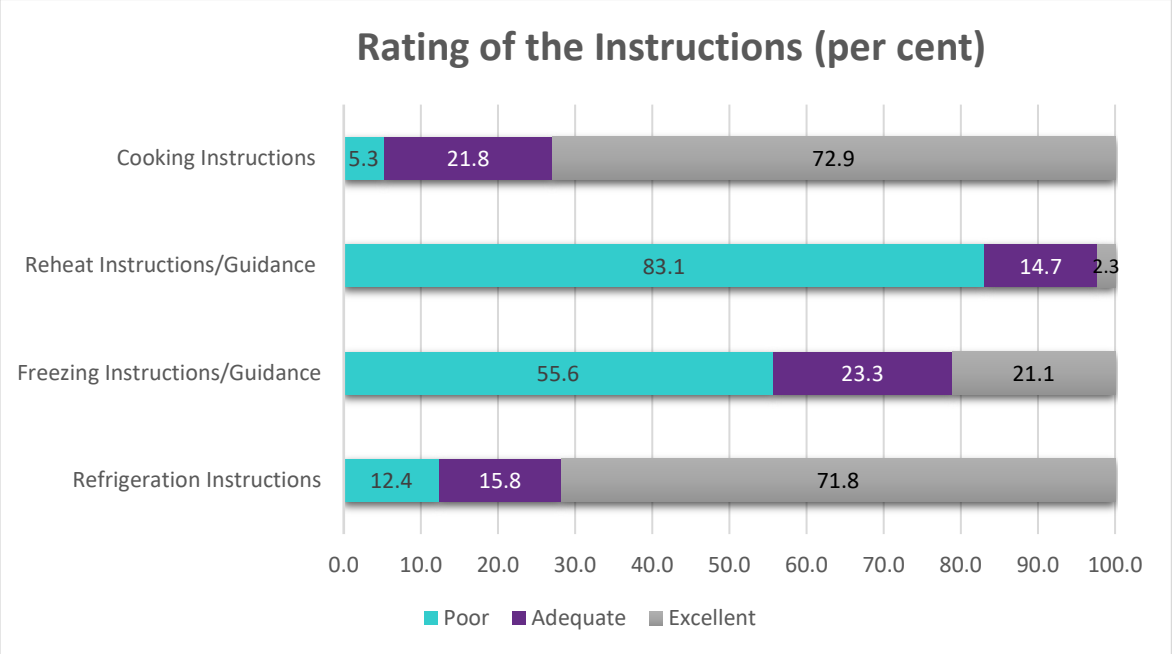
Characteristic	Number of samples (n)	Percentage of total samples (per cent)
Type of cuisine		
Traditional (e.g. roast dinner, meat and 2 veg, cottage pie, etc.)	133	50.0
Indian	9	3.4
Asian	40	15.0
Mexican	9	3.4
American	1	0.4
Italian	42	15.8
Fish	8	3.0
Healthy	11	4.1
Thai	1	0.4
Vegan	4	1.5

Characteristic	Number of samples (n)	Percentage of total samples (per cent)
Vegetarian	8	3.0
Portion size		
1	180	67.7
2	61	22.9
3	0	0
4	8	3.0
Doesn't Specify	17	6.4
Ingredients list present		
Yes	252	94.7
No	14	5.3
Allergens listed		
Yes	238	89.5
No	28	10.5

Full cooking instructions, which included temperatures, cooking timings and operational instructions, were given for 72.9 per cent of products. For the other products, 21.8 per cent of preprepared convenience foods included had cooking time and temperatures only, whilst the remaining 5.2 per cent had no information given. Additionally, the preprepared convenience foods were rated on their level of guidance on 4 criteria: Cooking instructions, Reheating instructions/guidance, Freezing Instructions/Guidance and Refrigeration instructions. The instructions/guidance were rated as poor, adequate or excellent. Freezing instructions were poor for many products, with the majority of

preprepared convenience foods not identifying if the product was suitable for freezing (55.6 per cent). Of the pre-prepared convenience foods which contained freezing instructions, whether the product could be frozen at home or not was clarified by 23.3 per cent, whilst the remaining 21.1 provided more details (such as when to consume after freezing and to ensure it is thoroughly thawed and to not refreeze after thawing). Reheating instructions were similarly poor in 83.1 per cent of the products not containing this information. Only 2.2 per cent of preprepared convenience foods stated instructions to ensure safe reheating, while the remaining 14.6 per cent stated if they were or were able to be reheated (figure 4).

Figure 4: Guidance rating for four criteria (cooking instructions, reheating instructions, freezing instructions, and refrigeration instructions) on audit products



Limitations

In total, 31 premises (Ireland) and 5 (NI) premises supplied products for the audit. However, an additional 23 premises (Ireland) and eight NI establishments were also visited but did not contain meals that fulfilled the inclusion/exclusion criteria. It is unclear, whether external factors such as the COVID-19 pandemic and Brexit impacted on the availability of the products. This resulted in an 11 per cent shortage of products from the original target, however this shortage prevented product repetition. Additionally, a relatively even

distribution products across the areas including both NI/Ireland and Urban/Rural was obtained, that is reflective of the products available at the time of the audit.

In-home observations to determine consumer behaviours around preprepared convenience foods on the island of Ireland

In total, 50 participants between 18 and 67 years old (mean = 46.6 years old) completed the observation and interviews (Table 4). In terms of education, 44 per cent of participants had less than university-level education. In terms of gender, 52 per cent of participants identified as female. Half of the participants were from rural areas. Over half of the participants (60 per cent) were very frequent users of preprepared convenience food products, consuming them more than once a week, herein known as 'frequent users'. Participants had an average "food safety knowledge" score of 7.24.

Table 4: Sociodemographic description of participants in an in-home observation study to determine consumer behaviours around preprepared convenience products on the island of Ireland

Characteristic	Number	Percentage
Jurisdiction		
Northern Ireland	23	46
Republic of Ireland	27	54
Total	50	100.0
Location		
Village/countryside (Less than 2,250 people) - Rural	17	34
Small town (Less than 10,000 people) - Rural	8	16
Town (Greater than 10,000 people) - Urban	14	28
City (Greater than 75,000 people) - Urban	11	22
Gender		

Characteristic	Number	Percentage
Male	24	48
Female	26	52
Age		
Under 60 years	28	56
Over 60 years	22	44
Education		
Secondary school to age 15/16 or junior cycle certificate, GCSE or O Level	10	20
Secondary school to age 17/18 or leaving certificate or A Level	5	10
Additional training (e.g. NVQ, BTEC, FETAC, FAS, other)	7	14
University undergraduate/nursing qualification	15	30
University postgraduate	13	26
Occupation Status		
Full time paid work	29	58
Part-time paid work	6	12
Retired	11	22
In full time higher education	2	4
Full time homemaker	2	4
Frequency of use of prepared convenience foods		
2-4 times a week	12	24

Characteristic	Number	Percentage
Once a week	18	36
2-3 times a month	4	8
Once a month	8	16
Every 2-3 months	2	4
Less than twice a year	6	12
Marital Status		
Married	24	48
Living with partner	7	14
Single	17	34.0
Widowed	2	4
Income*		
Low	14	28
Middle	14	28
High	15	30
Prefer not to say	7	14

**Income classification: Low <£30,000 or <€40,000, Middle £30,001 - £60,000 or €40,001 - €80,000, and High as >£60,001 or >€80,001*

For the observation, participants prepared the 5 selected products, provided to each participant in a random order. Table 5 below provides an overview of the different behaviours observed during the preparation task and the percentage of participants that performed the correct behaviour for each product during the observation.

Table 5: Overview of correct food behaviours of participants in an in-home observation to determine consumer behaviours around 5 selected preprepared convenience foods available on the island of Ireland

Category of behaviour	Action performed	Chicken product	Rice product	Mince product	Beef product	Oven-cook product
		Correct	*Correct*	*Correct*	*Correct*	*Correct*
		Number (Percentage)	*Number (Percentage)*	*Number (Percentage)*	*Number (Percentage)*	*Number (Percentage)*
General hygiene	*Washed hands*	2 (4)	0 (0)	2 (4)	2 (4)	0 (0)
Use-by date	*Checked use-by date*	18 (36)	13 (26)	12 (24)	16 (32)	15 (30)
Storage	*Read storage instructions*	38 (76)	39 (78)	37 (74)	40 (80)[a]	42 (84)
	Where product should be stored	49 (98)	45 (90)	41 (82)	45 (90)	39 (78)
	How long product should be stored for	47 (94)	47 (94)	44 (88)	40 (80)	40 (80)
Heating of product	*Correct heating appliance chosen*	46 (92)	48 (96)	48 (96)	47 (94)	42 (84)
	Correct temperature set	43 (86)	45 (90)	46 (92)	44 (88)	42 (84)
	Removal of product packaging in line with instructions	41 (82)	40 (80)	26 (52)[b]	31 (62)[b]	44 (88)
	Correct heating time followed	37 (74)	39 (78)	40 (80)	40 (80)	42 (84)
Leftovers	*Correct use of leftovers*	36 (72)	33 (66)	30 (60)	34 (68)	23 (46)

Notes:
a: Two participants looked for instructions but could not see them.
b: Some products did not provide instructions for removal of packaging.

Hand washing

Most of the participants did not wash their hands before taking part in the task or between the products. While the participants did not have direct contact with the food during the task, if consuming some of the products after preparing there is potential to touch some of the food (for example, bread that accompanied some of the meals). Additionally, while all precautions were taken for this study, in a real-life situation there is a potential risk, even if small, for cross-contamination between the packages of different products. It is good practice to wash hands before any sort of meal preparation, especially considering the COVID-19 pandemic.

Use-by dates

Around a third of participants checked the use-by date of the products. However, it was noted that this step would more commonly take place at the point of purchase in the shop or supermarket, rather than in the home environment.

Reading instructions for use and storage

The majority of participants read the heating instructions before preparing the products.

Most of the participants would store each of the products in the fridge for up to 2 days or until the use-by day. A small minority of participants said they would store the products in the fridge for a week. Additionally, a minority would store the products in the freezer, with the duration varying from a week to 2 months.

Heating

The majority of participants chose the correct appliance for the heating of the different products and set the correct temperature. Additionally, the majority of participants removed the packaging in line with the instructions; however, the clarity of the instructions was highlighted as an issue. Furthermore, some products provided no information regarding removal of packaging or opening the products for heating.

Around a fifth of the participants did not set a sufficient time for heating the products in line with the provided instructions. While some participants suggested that they “just knew” when the product was fully heated, others stated they would check if it was hot and would heat further if needed.

Additionally, the majority of products did not provide instructions on whether they should be left to stand after heating, to allow for full heat dispersal, or as to whether they should be consumed straight away.

Use of leftovers

The products provided no information on what to do with leftovers of the meals.

The majority of participants who were observed using the chicken (72 per cent), rice (66 per cent), mince (60 per cent) and beef (68 per cent) products would dispose of leftovers or give them to a pet. However, only a minority of participants (46 per cent) would dispose of the oven-cook product leftovers. Using the oven to prepare the oven-cook product was seen more as "cooking" (rather than simply "heating") and this was provided as a reason by some participants as to why they would then re-use leftovers.

Of the participants that did not dispose of leftovers, the majority reported that they would store them in the fridge and reheat them either the same day or within 24 hours. A small number said they would eat the product cold.

Identification of food safety hazards

For each observation, 1 food safety hazard, for example a hole in the product packaging or an out-of-date product, was added. Only a minority of participants (8 per cent) successfully identified the safety hazard.

Comparison of younger and older participants

Interestingly, younger participants had a higher "food safety knowledge" score (7.82) than older participants (6.50). In general, a similar pattern of behaviours was seen between younger and older participants, although a higher percentage of older adults checked the use-by date of each product. All 4 participants who identified the added safety hazard were under 60 years of age.

A comparison of correct behaviours between younger and older participants is shown in Table 6.

Table 6: Comparison between correct food behaviours of younger and older participants in an in-home observation to determine consumer behaviours around 5 selected preprepared convenience foods available on the island of Ireland

Category of behaviour	Action performed	Chicken product		Rice product		Mince product		Beef product		Oven-cook product	
		Age under 60	Age over 60	Age under 60	Age over 60	Age under 60	Age over 60	Age under 60	Age over 60	Age under 60	Age over 60
		Correct	Correct	Correct	Correct	Correct	Correct	Correct	Correct	Correct	Correct
		Number (Percentage)	*Number (%)*	*Number (%)*	*Number (%)*	*Number (%)*	*Number (%)*	*Number (%)*	*Number (%)*	*Number (%)*	*Number (%)*
General hygiene	Washed hands	1 (3.6)	1 (4.5)	0 (0)	0 (0)	0 (0)	2 (9.1)	1 (3.6)	1 (3.6)	0 (0)	0 (0)
Use-by date	Checked use-by date	7 (25.0)	11 (50.0)	5 (17.9)	8 (36.4)	4 (14.3)	8 (36.4)	6 (21.4)	10 (45.5)	6 (21.4)	9 (40.9)
Storage	Read storage instructions	22 (78.6)	16 (72.7)	22 (78.6)	17 (77.3)	21 (75.0)	16 (72.7)	22 (78.6)	18 (81.8)	24 (85.7)	18 (81.8)

	Where product should be stored	27 (96.4)	22 (100)	25 (89.3)	20 (90.9)	24 (85.7)	17 (77.3)	25 (89.3)	20 (90.9)	20 (71.4)	19 (86.4)
	How long product should be stored for	26 (92.9)	21 (95.4)	26 (92.9)	21 (95.4)	25 (89.3)	19 (86.4)	22 (78.6)	21 (95.4)	21 (75.0)	19 (86.4)
Heating	Correct heating appliance chosen	27 (96.4)	19 (86.4)	28 (100)	20 (90.9)	28 (100)	20 (90.9)	27 (96.4)	20 (90.9)	24 (85.7)	18 (81.8)
	Correct temperature set	25 (89.3)	18 (81.8)	26 (92.9)	19 (86.4)	26 (92.9)	20 (90.9)	25 (89.3)	19 (86.4)	23 (82.1)	19 (86.4)
	Removal of product packaging	24 (85.7)	17 (77.3)	24 (85.7)	16 (72.7)	18 (64.3)	8 (36.4)	20 (71.4)	11 (50.0)	23 (82.1)	21 (95.5)

	in line with instructions										
	Correct heating time followed	22 (78.6)	15 (68.2)	22 (78.6)	17 (77.3)	24 (85.7)	16 (72.7)	23 (82.1)	17 (77.3)	24 (85.7)	18 (81.8)
Leftovers	Correct use of leftovers	21 (75.0)	15 (68.2)	19 (67.9)	14 (63.6)	18 (64.2)	12 (54.6)	18 (64.3)	16 (72.7)	12 (42.9)	12 (54.6)

Interviews to explore consumer attitudes and understanding around preprepared convenience foods on the island of Ireland

Thematic analysis identified three overarching themes (figure 5), 'Using preprepared convenience foods,' 'The food safety risks, behaviours and responsibilities' and 'Recommendations for future development.' These themes focused on the rationale behind the using/not using preprepared convenience foods, their beliefs and behaviours around food safety and what they saw as the next steps for developing better ways for food safety in preprepared convenience foods.

Figure 5. A thematic map for the interviews conducted to explore consumer attitudes and understanding around preprepared convenience foods on the island of Ireland.

Use of preprepared convenience foods

In summary, consumers described their experience of using preprepared convenience food products as straightforward and that the instructions were clear and easy to put into practice. This was consistent with both frequent and occasional users.

Some participants highlighted that their use of preprepared convenience foods has decreased since COVID-19 due to reduced time pressures.

> *"I find it fairly straightforward. I'm not unfamiliar with cooking preprepared meals."*
>
> *(NI04,male, older)*

Participants used preprepared convenience foods for multiple reasons, most commonly for convenience – the products were a quick solution when participants were under time pressure, and they filled gaps in participants' food planning. Preprepared convenience foods were also used as lunch or snack meals and when participants only had limited access to cooking appliances, such as microwaves in work environments.

> *"Because everything was done for me. It was all prepped. I didn't have to think. It was just all done." "Because it's so easy for work. It's portioned out for me. It's much handier and I can cook it in 5 minutes and eat it in 10."*
>
> *(NI03, female, younger)*

However, some participants did not use preprepared convenience foods regularly and did not see them as part of their food planning. These individuals preferred their own cooking or fresh food, saw themselves as fussy about food, viewed preprepared convenience foods as overly processed, or had previous negative experiences with preprepared convenience foods. Preprepared convenience foods were believed to be inferior to fresh food as they lacked "substance" and "colour", and inferior to delicatessen food that came hot.

"Because we prefer to cook our own; [it] would just be more if I didn't want to cook dinner, and I don't know or want all preservatives and stuff."

(NI09, male, older)

The food safety risks, behaviours and responsibilities

This theme discussed participants' adherence to cooking instructions, their strictness on use by dates, their reheating/food portioning behaviours and what preprepared convenience foods and ingredients carried the highest levels of risk. It also explored the perception of safety of preprepared convenience foods and who was responsible for safety.

Adherence to cooking instructions was claimed to be high in general and even more so for larger portions. However, 2 types of participants were apparent: those that complied with the instructions exactly and those that viewed the instructions as a minimum and would often add additional cooking time. Participants that followed the instructions believed that manufacturers had tested the products thoroughly and if followed the product will be cooked safely.

"Because they've tried and tested these … so I'm just going for convenience really. That – I don't want to think about that. It's like 25 minutes, that's what they say, and that's that – no thinking."

(NI14, male, younger)

Those participants that went above and beyond the instructions had concerns around variations in appliances and preferred to overcook the product to ensure its safety.

"Sometimes until I know it's piping hot. I probably got more nervous."

(NI13, female, younger)

Again, the majority of participants reported a high compliance with use-by dates and claimed they would dispose of preprepared convenience foods if past the use-by date. However, some participants used the use-by date as a guide rather than a strict rule but were reluctant to go past the use-by date by more than 2 days. These participants tended to apply a "smell test" or inspected the appearance of a product to assess whether the product had spoiled.

> *"If they still smell okay and that there, yeah; if they still look and smell okay some things I would. Like ham or crisps and stuff like that – never anything like dairy products or anything like that."*
>
> *(NI15, female, younger)*

Participants were particularly careful with chicken products in terms of use-by dates with the majority claiming to be especially strict with these products. This was consistent even when they were not strict (for example, being willing to go a day or 2 over the use-by date) on other products. Interestingly, the vegetarian option with cheese was another product that many participants were wary about due to fears about the dairy content or cheese spoiling and the firmness or integrity of the vegetable ingredients. Meat products, in particular the lasagne, was more likely to be considered safe to eat past the use-by date. Participants commented on the difficulty of finding use-by dates on some products.

Several participants viewed reheating meat (especially chicken) and rice as extremely unsafe practices. Product quality and a decline in taste, particularly if the product was highly processed (such as the meal that came in a plastic container) was also highlighted as problematic in terms of reheating. However, if the participants originally heated a product in the oven, it was felt that it was more acceptable to reheat this product.

> *"Because of health and safety and it could make you sick. Give you a dicky stomach, you know, all those things. So, with reheating food you have to be very, very careful."*
>
> *(IRL05, female, older)*

Some respondents were also willing to eat leftovers of the product cold, although many participants threw away leftovers or gave it to a pet. To prevent food waste and to avoid reheating products, a number of participants pre-divided the meals so that they were able to cook it in 2 portions. However, there were no instructions on how to do this, and participants relied on their experience to cook the smaller portions.

> *"It's a big meal so I might split it in half before I'd actually heat it."*
>
> *(IRE20, female, older)*

In terms of risk, participants believed preprepared convenience foods containing rice and chicken posed a heightened risk of food poisoning. The mince meatball dishes were also highlighted as a potential safety hazard.

There were some differences in opinion as to whether products produced in factories (large-scale distribution) or "in-store" had more risk of food poisoning. Where the food came from was important to consumers and their safety rating of the products was framed by this.

> *"I'd just be afraid of rice products. Because I think I got food poisoning from it once."*
>
> *(NI13, female, younger)*

Interestingly, many participants drew their perception of chicken and rice as more "risky" products from their upbringing but did not know why they are potentially dangerous.

> *"I'm always wary of chicken. For whatever reason, don't know whether it was [how I was] brought up and always careful of chicken. You're brought up to believe."*
>
> *(IRE08, male, older)*

Overall, participants viewed preprepared convenience foods as safe. The majority had little concern around the safety of the food products provided they were stored correctly and the cooking instructions and use-by dates were followed.

> *"I think they're relatively safe, as long as you're heating them properly and are actually reading the instructions."*
>
> *(NI15, female, younger)*

Participants saw it as their role to ensure that preprepared convenience foods were safe. Preprepared convenience food products were viewed as an established component of the food chain, and a sector that undergoes extensive testing and quality control or compliance checks to ensure their safety. Participants believed it was the food producers' responsibility to ensure standards were followed in their factory or manufacturing facility and were following food safety regulations and procedures.

While the primary responsibility for ensuring product safety was with the producer and consumer, the retailer and the governmental bodies were also seen as accountable in the preprepared convenience food product chain. Retailers had the responsibility to ensure the correct storage of the products and governmental bodies to provide food hygiene ratings and set the rules for manufacturing. In general, there was the more "holistic" perspective that it requires input and responsibility from all parts of the food chain to ensure food safety.

> *"I think it's whoever is producing and making these products has the duty to make sure that they are producing food in a safe way but then you also have to rely on the store. I suspect that these meals are not necessarily made ... all of them are not made up in store. Some may be, some may not be, and so there is, you know, then the responsibility of, you know, the transport and logistics and also the store itself to make sure that they're storing things at the correct temperature in those fridges or on their counters, whatever way they do it, but there's also a personal responsibility on the person that's buying it. So,*

you don't want to buy that and then leave it lying in your car for 2 or 3 hours and then try and reheat it."

(NI01, female, younger)

Recommendations for future development of safer food practices

The final theme explored participant perceptions around the information and instructions provided on preprepared convenience foods and their recommendations for improvements.

The majority of the participants, especially older people, raised the issue of small writing affecting their ability to read the cooking instructions, and this reduced the likelihood of them adhering to the instructions. Increasing font size, capitalised writing and emboldening important parts were solutions offered by some participants.

"The writing is quite small. I mean, I get my glasses or magnifying glass. Without glasses I'm struggling, here. Now, if I'd seen that before I could probably guestimate what's expected but seeing that for the first time, so, I have to read it quite intensely."

(NI05, male, older)

Additionally, the location of the instructions was a point of frustration for the participants. Some of the products' instructions were on the underside of the container, meaning that participants had to turn the product on its back to view the instructions, reducing the visibility of the instructions and potentially spilling or spoiling the products. Once opened they were not able to look again at the instructions without a lot of care. Placing the instructions on the top of the product (most preferred) or on the side were the solutions envisioned by the participants.

"I had to turn one upside down to read it, which means the food dropped."

(IRE23, male, older)

Providing more detailed instructions was strongly recommended by the participants. One of the products used was encased in tinfoil and could be cooked in the microwave or the oven; however, on the packaging, there was no recommendation that the tinfoil casing must be removed before being placed in the microwave. This is despite the dangers of microwaving metal objects.

More information was desired on microwave instructions specific to the wattage of the microwave. As household microwaves commonly range from 650 W to 1,000 W, it was considered important to clarify the timings to ensure that the product was cooked safely.

> *"It does say reheat for 4 minutes but, you know, that's … you don't have … Is it a 650 watt or 1,000 wattage microwave? So, again, you're kind of … If you're not clever enough, you would put that in for 4 minutes. If it's a low-watt microwave, it's not gonna come out cooked correctly. So, only that I suppose for my age I would know over the years that, you know, the wattage shows a different microwave, so it needs to be checked, it needs to be sure. It does say, you know, 'until piping hot'. But again, if you're in a rush, and it's convenient, and you throw it in for 4 minutes and you take it out – over a 650-watt microwave, it might not be cooked. So, I think it's very, very vague."*
>
> *(IRE12, female, younger)*

As many of the products came in boxes, whether the lid should be kept on during the microwaving process or not was raised by multiple participants and was desired as information. Additionally, the majority of participants wanted further information on whether preprepared convenience foods could be reheated or frozen for later consumption, as this was unclear for many of the products.

> *"Basically, to let you know whether you can or can't freeze them, yeah, because it doesn't tell you."*
>
> *(NI07, female, older)*

Other aspects of information on food packaging were highlighted by the participants as important. These related to nutrition, allergens and environmental impact.

Some of the products included claims about the healthiness of the products, specifically that they were "healthy and lean". While participants identified that they were more likely to purchase these products out of a desire to be healthy, they believed that these claims were unsubstantiated (not proved) and misleading.

> *"The stickers for the 'lean and healthier', whatever – it gets a bit misleading sometimes because, ah, this is 'low-fat' but it's terrible in all the other ways and high salts or whatever. But, yes ... Some of those I don't like."*
>
> *(NI02, male, younger)*

However, greater nutritional information was seen as a positive for the products and the utilisation of "traffic light" labelling was considered a positive development that could be incorporated in the future.

> *"I think the 'traffic light' labels would be [good] because I think then they show how healthy and lean they are."*
>
> *(NI06, female, older)*

While the products included in the study had allergen information on their packaging, the importance of clear allergen labelling was emphasised by some participants, even if they did not have food allergies themselves.

> *"I was saying about that 'Natasha's Laws', so, for anybody who's resistant or [it] will flare them up – just so that it's all labelled."*
>
> *(NI09, male, older)*

A number of participants raised concerns about the environmental impact of preprepared convenience foods, with many products in single use plastics and non-recyclable materials. Similarly, the issue of unnecessary packaging was raised. One of the products used was

housed in biodegradable material, and some participants saw this as more environmentally friendly than the black plastic containers used for other products.

> *"Sometimes I think there's a lot of unnecessary packaging, but they're not, they're not too bad. And I'm not sure those there are recyclable."*
>
> *(NI19, Female, younger)*

Online survey to investigate consumer purchasing, attitudes and understanding around preprepared convenience foods on the island of Ireland

In total, 500 participants from the IOI (350 people living in Ireland and 150 living in NI) completed the survey. Participants ranged from 18 to 80 years old (mean = 45.19). Participant characteristics are detailed in Table 7.

Table 7: Sociodemographic characteristics of participants in an online survey of consumers to investigate purchasing, attitudes and understanding around preprepared convenience foods on the island of Ireland

Description of participants in online survey	Number of participants (n)	Percentage of total participants (per cent)
Jurisdiction		
Northern Ireland	150	30.0
Republic of Ireland	350	70.0
Total	**500**	**100.0**
Age		
Mean age (years)	45.19	Not applicable

Gender		
Male	249	49.8
Female	248	49.6
Nonbinary, gender nonconforming or other personal identification	3	0.6
Education		
None or primary school	5	1.0
Secondary school to age 15 or 16 or Irish Junior Cycle Certificate, or UK General Certificate of Secondary Education (GCSE) or General Certificate of Education (GCE) Ordinary Level ("O" Level)	74	14.8
Secondary school to age 17 or 18 or Irish Senior Cycle Leaving Certificate, or UK General Certificate of Education (GCE) Advanced Level ("A" Level)	98	19.6
Additional training (such as UK National Vocational Qualification [NVQ] or Business and Technology Education Council [BTEC] qualification, or Irish Further Education and Training Awards Council [FETAC] or Foras Áiseanna Soathair [FAS] qualification)	84	16.8
Undergraduate degree or nursing qualification	166	33.2
Postgraduate degree	73	14.6
Occupation status		

Full time paid work	205	41.0
Part-time paid work	104	20.8
At school or in full time higher education	28	5.6
Retired	72	14.4
Unemployed	56	11.2
Full-time homemaker	35	7.0
Marital Status		
Married	220	44.0
Living with partner	70	14.0
Single	158	31.6
Widowed, divorced or separated	52	10.4
Living situation		
Living with parents	50	10.0
Living with parents and siblings	30	6.0
Living with partner	132	26.4
Living with partner and child(ren)	165	33.0
Living with friends or roommates	18	3.6
Living alone	105	21.0

General beliefs and behaviours relating to preprepared convenience food products

Participants' mean score for "belief of the use-by dates" on preprepared convenience foods was above the midpoint (mean = 5.06) on a scale of 1, meaning "not at all believable", to 7, meaning "extremely believable".

The majority (75.0 per cent) of participants claimed to adhere strictly to storage instructions of preprepared convenience foods. Further, 46.0 per cent of participants claimed to abide by the use-by date and 73.4 per cent claimed to follow the heating or cooking instructions completely.

Food safety understanding, knowledge and behaviours relating to specific preprepared convenience food products

Understanding of on-pack and manufacturer-provided information relating to specific preprepared convenience food products

Table 8: Understanding of on-pack and manufacturer-provided information on specific preprepared convenience foods, and overall food safety behaviour scores, among participants in an online survey to investigate consumer purchasing, attitudes and understanding of preprepared convenience foods on the island of Ireland

Variable	Range	Beef Stroganoff	Chicken curry	Roast beef meal	Roast chicken meal	Overall score
Number of participants (n)		250	250	250	250	500
		Mean				
Understandability of cooking instructions	1 to 7	5.34	5.39	5.55	5.45	
Understandability of storage instructions	1 to 7	5.38	5.44	5.52	5.44	
Food safety behaviour score	0 to 8 (0 to 16)	2.26	2.32	2.47	2.35	9.39

Cronbach's alpha		0.87	0.88	0.90	0.89	

Cronbach's alpha is a measure of internal consistency, that is how closely related a set of items are as a group. It is a measure of scale of reliability. A high score (over 0.70) reflects a good reliability.

Differences between genders and age groups in understanding on-pack information and in behaviours relating to specific preprepared convenience food products

There were no differences between genders on individual behavioural scores for each product or for the overall behavioural score, meaning that males and females behave in a similar way when using these products.

There was a significant difference between males and females for understanding cooking instructions and understanding storing instructions for chicken curry, with females reporting a greater understanding of both.

Additionally, there was a significant difference between males and females for understanding cooking instructions and understanding storing instructions for the roast beef dinner, with females reporting a greater understanding of both.

Females had significantly greater food safety knowledge scores than males.

Younger participants understood the storing instructions for the roast beef less than middle- and older-aged participants. Apart from this, there were no differences between age groups on the understanding of heating or storing instructions on any of the products. Additionally, little differences were found between age groups on safe behaviours around these products.

Older participants had the safest behaviours for the roast chicken dinner and they also had higher overall safe food behaviours compared with younger participants (Table 9).

Table 9: Differences between age groups for safe food behaviours and food safety knowledge relating to specific preprepared convenience meal products in an online survey to investigate consumer purchasing, attitudes and understanding on the island of Ireland

Variable	Younger age group (18 to 35 years)	Middle age group (36 – 55 years)	Older age group (56 – 80 years)
	Mean (SD)	*Mean (SD)*	*Mean (SD)*
Storing roast beef meal	5.09 (1.64)[a]	5.76 (1.31)[b]	5.69 (1.47)[b]
Behaviour with roast chicken* meal	2.13 (2.54)[a]	2.15 (2.50)[a]	2.87 (2.88)[b]
Overall behaviour score	8.80 (2.94)[a]	9.38 (2.67)[ab]	10.07 (2.61)[b]

**Welch ANOVA and Games-Howell post-hoc analysis testing used. The superscript letters indicates where the significance between the groups was found in the posthoc analysis in each row of the table. For example, if two figures have a superscript a, no difference was found between these, whereas if it is an 'a' and a 'b' a significant difference was shown.*

Differences between age groups in potential influences on safe food behaviours around preprepared convenience foods

An exploration of potential influences on participants' safe food behaviours is provided in Table 10. An overview of the sample averages for the IOI, differences between age groups and where the significance lies are shown.

Middle-aged participants had higher cooking and food skills confidence than both younger and older participants. They also had a higher food chain engagement than older participants. Younger and middle-aged participants believed they were healthier than older participants. Older participants had a greater food safety knowledge than younger participants.

Additionally, middle- and older-age participants had a greater trust in preprepared convenience food products than younger participants. They also believed the consequences of getting food poisoning would be more severe than younger participants. However, they

believed you were less likely to get food poisoning from preprepared convenience foods than younger participants.

Table 10: Differences between age groups in potential influences on safe food behaviours in an online survey to investigate consumer purchasing, attitudes and understanding around preprepared convenience foods on the island of Ireland

Variable	Range	Overall score	Younger age group (18 –35 years)	Middle age group (36 – 55 years)	Older age group (56 – 80 years)
		Mean	*Mean*	*Mean*	*Mean*
Cooking skills confidence*	0 to 98	66.83	65.51	69.52	64. 51
Food skills confidence	0 to 133	91.38	89.77	95.89	86.82
Food chain engagement	10 to 50	35.64	35.56	36.78	34.15
General health interest*	8 – 56	33.97	33.39	34.13	34.40
Perceived health	1 to 5	3.41	3.49	3.52	3.16
Food safety knowledge	1 to 13	6.37	6.08	6.32	6.76
Trust in preprepared convenience food products	10 to 70	49.14	46.71	50.50	49.93
Perceived food poisoning susceptibility	6 to 30	22.00	22.24	21.91	21.86

Perceived food poisoning severity	6 to 30	23.42	22.63	23.69	23.94
Perceived likelihood of food poisoning from preprepared convenience meal products *	1 to 5	2.38	2.67	2.32	2.13
Believability of use-by dates on preprepared convenience food products	1 to 7	5.06	4.92	5.13	5.12

**Welch ANOVA and Games-Howell post-hoc analysis testing used. The superscript indicates where the significance between the groups was found in the posthoc analysis in each row of the table. For example, if two figures have a superscript a, no difference was found between these, whereas if it is an 'a' and a 'b' a significant difference was shown.*

Table 11 summarises the results of predicting safe food behaviour in relation to the preparation of preprepared convenience foods. Predictions of potential effects are made using different proposed sets of characteristics, or "models".

Model 1, the baseline hierarchical multiple regression model that investigated the contribution of participants' sociodemographic characteristics as potential predictors of safe food behavior, accounted for 4 per cent of the variance explained, with a significant independent contribution ($p<0.01$).

Model 2, which included cooking and food skills confidence, engagement with the food chain and perceptions around health, did not add a significant contribution to the variance explained.

Model 3, which included participants' perceptions around food poisoning susceptibility and severity, the likelihood of getting food poisoning from preprepared convenience foods, their food safety knowledge, their trust in convenience food products, and their belief in the use-by date, explained a total of 22 per cent of variance ($p<0.001$). The variables contributing significantly to the final model included food safety knowledge, believability of the use-by date, perceptions around food poisoning susceptibility, the likelihood of getting food poisoning and food poisoning severity, and age.

The results of Model 3 showed that individuals who had a higher food knowledge, a greater belief in use-by dates, perceived a higher susceptibility to food poisoning, believed they were less likely to get food poisoning from preprepared convenience foods, perceived the consequences of food poisoning to be more severe and were older, had safer food behaviours than those who had less food knowledge, did not believe use-by dates, did not believe they were highly susceptible to food poisoning, believed that they were more likely to get food poisoning from convenience foods, believed that food poisoning would not be that severe and were younger.

Table 11 – Hierarchical multiple regression models showing contribution of 452 participants' sociodemographic characteristics as potential predictors of safe food behaviour in an online survey to investigate consumer purchasing, attitudes and understanding around preprepared convenience foods on the island of Ireland-

Variables	Model 1		Model 2		Model 3	
	Beta (followed by standard error, "SE")	**Beta (β)**	**Beta (followed by standard error, "SE")**	**Beta (β)**	**Beta (followed by standard error, "SE")**	**Beta (β)**
Age	.030 (.009)	.171**	.028 (.009)	.160**	.016 (.008)	.092*
Gender	.538 (.265)	.096*	.434 (.273)	.077	.182 (.250)	.033
Jurisdiction	-.040 (.285)	-.007	.045 (.291)	.007	.069 (.266)	.011
Education	-.441 (.270)	-.079	-.461 (.276)	-.082	-.259 (.253)	-.046
Income	.531 (.281)	.095	.564 (.290)	.100	.381 (.265)	.068
Living situation	-.050 (.345)	-.007	-.024 (.355)	-.004	.062 (.322)	.009
Cooking skills confidence			-.002 (.011)	-.015	-.006 (.010)	-.036
Food skills confidence			.009 (.010)	.070	.008 (.009)	.061
Food chain engagement			.010 (.031)	.020	-.012 (.029)	-.026

General health interest			.030 (.018)	.086	.015 (.016)	.042
Perceived health			-.265 (.154)	-.089	-.246 (.141)	-.082
Food safety knowledge					.303 (.067)	.202***
Trust in products					-.005 (.012)	-.021
Perception of food poisoning susceptibility					.116 (.034)	.164**
Perception of food poisoning severity					.072 (.035)	.099*
Perceived likelihood of food poisoning from preprepared convenience foods					-.346 (.118)	-.131**
Believability of use-by date on preprepared convenience foods					.382 (.098)	.187***
F	**3.692****		**2.806****		**8.411*****	
Adjusted R-squared (R^2)	**.035****		**.042**		**.218*****	

** P<0.05, ** P<0.01, *** P<0.001; Adjusted R^2 explains the variations in the dependent variable accounted for by the independent variables and adjusts for the number of independent variables in the model; F –test assess the null hypothesis that the change in R^2 is zero.*

5 Project modifications and food waste reduction

Project modifications

Some modifications were made to this project because of the COVID-19 pandemic. Most notably, the project was paused for 6 months from July 2020. The project recommenced in January 2021. Other key modifications include:

- The sequence in which the researchers had planned to conduct the studies was changed due to restrictions being put in place limiting movement and access to participants. The tasks were finally conducted in the order
    1. Literature review (completed before the project was paused)
    2. Online survey
    3. Audit survey
    4. In-home observations
    5. Interviews (replacing planned focus groups)
- To limit participant interactions and contact with multiple people, planned focus groups were changed to individual interviews conducted directly after the in-home observations, and with the same 50 participants, to limit interaction with the researcher to a single time point.
- In line with the literature review, researchers categorised participants for the in-home observations as “older” at 60 years and above. Additionally, due to ethical concerns and the time frame for conducting observations, participants above the age of 70 years were not included in the observations as they are considered a “vulnerable” group during the COVID-19 pandemic.

Food waste reduction

To prevent as much food waste as possible, after all necessary information was retrieved from the packaging, the convenience food products sampled for the audit survey were donated to local food banks and researcher networks.

Participants in the in-home observations and interviews were offered the food products they used during the observation task.

Changing from planned interviews with focus groups to interviews with individuals meant the number of products required increased; however, the products used for the interviews were used for multiple participants where possible (sanitised in between each participant).

6 Discussion

This project aimed to audit, the on-pack and manufacturer-provided instructions on preprepared convenience foods and explore consumer purchasing, attitudes, understanding (including the instructions) and behaviour around the handling, storage and preparation of preprepared convenience foods.

Researchers used a “mixed methods” approach, using both quantitative and qualitative studies to investigate whether these behaviours were safe. This research also assessed the level of detail and clarity of the instructions provided on these products relating to their handling, storage and preparation and investigated consumers’ perceptions around them.

The results from the different studies of the research project are brought together here.

Literature review of consumer knowledge, behaviours and attitudes around preprepared convenience foods

Given there is relatively little literature published on preprepared convenience foods on the IOI, a global perspective was taken in searching the literature. However, even with this broad approach, limited literature was obtained. The most relevant articles were sourced and closely analysed for information.

The research in this area highlights the need for further research, as varying levels of knowledge and food handling practices were evident among consumers in relation to convenience foods. Numerous studies found that sociodemographic factors such as age, gender, level of education and income influenced food safety knowledge (Cates et al., 2006; Tomaszewski et al., 2018; Almanza et al., 2007). Numerous reports citing the need for education activities to elevate consumers’ knowledge and awareness of appropriate food handling (Hessel et al., 2019; Evans and Redmond, 2015; Tomaszewska et al., 2018).

While education is beneficial, increased knowledge of food safety does not always reflect ‘good behaviour’, as studies found that neutral attitudes towards food safety is evident amongst consumers (Evans and Redmond, 2016). This lack of concern or prioritisation towards

food safety may lead to risk-taking behaviours. Some adverse behaviours found among consumers include the incorrect storage of home-delivered meals (Almanza et al., 2007), storage and consumption of deli and 'ready to eat' products past the recommended time frames (Cates et al., 2006; Evans and Redmond, 2015) and consumption of leftover food outside the recommended instructions (Almanza et al., 2007).

Moreover, the malpractices among consumer groups highlights the need to have a deeper understanding of the knowledge, attitudes and behaviours of food handling in relation to convenience foods. Given the increased consumption of convenience foods coupled with existing malpractices reported in the home environment and limited studies focused on food handling practices of convenience foods in the domestic kitchen, this research project aimed to obtain a deeper understanding of consumers' knowledge, behaviours and attitudes towards preprepared convenience foods.

Audit survey of on-pack and manufacturer-provided instructions on preprepared convenience foods available on the island of Ireland

The audit was conducted after a 6-month pause to the project due to Covid-19. It is unclear the impact of the Covid-19 pandemic and Brexit may or may not have had on the availability of products. However, a broad range of products were included for the audit from 3 rural areas and 3 urban areas across the IOI. There was a relatively even distribution of products from across these areas. Products from different types of cuisine and from different risk categories were included. Additionally, products from different types of sellers including independent shops and business, as well as different-sized sellers, were included.

The audit raised some genuine concerns around information provided on preprepared convenience foods across the IOI. While not a specific focus of this research, we noted that 5.3 per cent of products did not have an ingredient list and 10.5 per cent of products did not have allergens highlighted. This is a particular concern as around 10 per cent of adults have a food allergy (Gupta et al., 2019). The consequences of this missing information could be severe or even fatal. It is a legal requirement in both jurisdictions to provide an ingredient list and allergen labelling (FSAI, 2021; FSA, 2021). Therefore, there is a need for monitoring of these products to ensure they reach the required labelling standards for food products. It is essential that allergen information is provided on all food products, including preprepared convenience foods.

The UK FSA reports that up to 64 per cent of foodborne illness in the EU originates from the home environment (FSA, 2018). The level of guidance provided for storage and preparation of the convenience food products sampled in our study was low and the lack of this vital information has the potential to result in food safety incidents in the domestic environment. For example, 5.3 per cent of the audited preprepared convenience food products did not provide cooking instructions, which could lead to unsatisfactory product heating to the correct temperature, leading to possible food poisoning. This of a greater concern for older adults who are more vulnerable to food poisoning effects and who have been shown to use ready-meals due to a decline in motor functioning and a lack of desire to prepare a meal for one (Whitelock & Ensaff, 2018). While the majority of preprepared convenience foods provided excellent refrigeration instructions, 12.4 per cent of products provided poor information. Improper storage of the food products may lead to bacterial growth and contamination (FSA, 2018b).

The majority of preprepared convenience foods did not provide information on their suitability for freezing, or guidance on whether the products could be reheated. The storage of leftovers is to be encouraged to reduce food waste; however, it is important to take into consideration the potential food safety risks associated with chilling, freezing, defrosting and recooking leftovers from convenience food. The FSA (2018b, 2020) acknowledges that it is acceptable to freeze a product only if it is within the use-by date, it is defrosted properly in a fridge or microwave and cooked thoroughly so it is piping hot all of the way through, within 24 hours of defrosting. Partially defrosted food may not cook evenly, meaning that harmful bacteria could survive the cooking process. Both the UK National Health Service (NHS) and FSA recommend that leftover products containing meat and poultry should only be reheated once (FSA 2018b; NHS, 2020). Refreezing of products should be avoided as the more times you cool and reheat food the higher the risk of food poisoning, because bacteria can multiply when cooled too slowly or reheated insufficiently (NHS, 2020).

In-home observations to determine consumer behaviours around preprepared convenience foods on the island of Ireland

Direct in-home observations were conducted with 50 participants across the IOI. Participants were given 5 selected preprepared convenience foods and asked to prepare them as they would usually do.

The majority of participants did not wash their hands before starting the task or between preparing the different products. While the participants did not have direct contact with the food during the task, if consuming some of the products after preparing there is potential to touch some of the food (for example, bread that accompanied some of the meals). A number of studies have shown the potential for hand transfer of bacteria from contaminated food products (Cogan et al., 1999; Evans et al., 1998) and that hand washing can prevent or curtail the transference of pathogenic bacteria from hands to food (Fischler et al., 2007).

A minority of participants in the in-home observations checked the “use-by” date of the products. Additionally, only a small minority identified the food safety hazard deliberately added by the researchers, such as a hole in the food packaging. While it was noted by a few people that these behaviours are more common to conduct in a shop, a product can go out of date in the home, and packaging can get damaged or torn in transit or in the home. Out-of-date food products or packaging damage can lead to the rapid multiplication of pathogenic bacteria, which can lead to food poisoning. Following use-by dates is often reported as a food safety behaviour that is not in line with guidance (Prior et al., 2011). Additionally, as purchasing of food products with damaged packages is now encouraged as a food waste reduction strategy (do Carmo Stangherlin et al., 2019), it is essential to highlight the difference between superficial damage (minor imperfections) and damage that breaks the seal, which is a potential safety hazard (White et al., 2016).

In addition, while the majority of the participants read the cooking and storage instructions on the pack, there were some discrepancies in behaviour. In some instances, the detail in the instructions was limited or unclear to the participants. A minority of participants stated that they would store products in the freezer, despite any instructions for storage of the products in the freezer. Furthermore, approximately one fifth of the participants did not set sufficient time for the heating of the products in line with the guidance, risking the potential for the products to not be thoroughly heated for safety. The incorrect storage and heating of the products could lead to food poisoning (Marriott et al., 2018).

Most participants disposed of food leftovers correctly (46% to 72%, depending on the product meaning some were willing to reheat and consume the leftovers (28 per cent to 54 per cent, depending on the product). Whether they would consume leftovers did depend on the product for some participants, with less participants willing to consume leftover chicken, and the highest amount willing to reheat food cooked in the oven. This finding is similar to

Almanza et al's 2007 study, where 41 per cent of participants reported consuming leftovers outside the recommended period. However, it is worth noting that the vast majority of products supplied to the participants did not provide guidance around whether products could be reheated (i.e., heated more than once).

Interviews to explore consumer attitudes and understanding around preprepared convenience foods on the island of Ireland

The interviews with the participants were conducted directly after the in-home observation. Interestingly, there were some differences found between their perceived behaviours and their actual behaviours in relation to the use of preprepared convenience foods.

The main reason given for using preprepared convenience foods was "convenience". All participants highlighted that they were simple and straightforward to use regardless of how often they used convenience food products. Despite one-fifth of participants *not* adhering to cooking instructions in the in-home observation study, in interviews the majority of participants reported complying with them. Some participants saw the instructions as a minimum requirement and would go beyond the stated heating times. Again, differences were seen regarding use-by dates. In the observations the majority did *not* check the dates; however, in interviews the majority of participants reported being strict on use-by dates. Those participants that reported being less strict about complying with use-by dates usually would allow a day or 2 beyond the use-by date and would employ the "smell test" to assess whether the product was still fit for consumption. These behaviours have been shown previously, where consumers rely on their sensory judgement and suspect that dates are set ahead of the risk of real "danger" (Meah, 2014). However, participants were still cautious around particular foods such as chicken.

Some participants highlighted the dangers of reheating preprepared convenience foods, again seeing some products as more hazardous than others, such as chicken. Similar to the behaviour seen in the in-home observations, in interviews the most leniency for reheating products was given to products cooked in the oven. Some participants employed strategies such as pre-dividing bigger portions to prevent having to reheat the product or eating leftover products cold. However, a lack of instructions on reheating the products was noted by the participants and a desire for this information was expressed.

While some products containing chicken, rice and dairy were identified as potentially the more 'risky' products, overall the general consensus was that preprepared convenience foods were safe. The responsibility was both on the producer to follow safety guidance in the preparation of these products, and on the consumer to store the products correctly, and follow the use-by date and cooking instructions. However, these can only be followed by the consumer if the instructions on the products are clear. The majority of the participants noted the small font size making it difficult to read the instructions. Additionally, further details was suggested such as timings for microwave wattages, whether the lid should remain on the product while heating, and whether products could be frozen and reheated. Further, the importance of allergen information was highlighted by participants. While all products provided during the observation study contained allergen information, 10 per cent of the products in the audit did not contain this information. In addition, participants were frustrated that the cooking instructions were located on the underside of some products as this had the potential to ruin some dishes while trying to read the instructions. Finally, it was noted that further nutritional information would be beneficial on preprepared convenience foods such as the traffic light system and that it may influence their choice of product, which has been found in previous research in relation general food products (Sonnenberg et al., 2013).

Online survey to investigate consumer purchasing, attitudes and understanding around preprepared convenience foods on the island of Ireland

Supporting the findings from the in-home observations and interviews conducted with a convenience sample of participants, the majority of the representative sample of participants in the online survey reported acceptable compliance with storage and heating instructions and less with the use-by date on preprepared convenience foods. Additionally, they reported relatively high understanding of the instructions, which was similar to the observation study participants. However, although the online survey participants reported acceptable behaviours when asked about preprepared convenience foods, when they were questioned about specific products their scores for safe behaviour were relatively low. This was similar to what we found between the in-home observations and interview results: in the interviews the participants stated that they performed the correct behaviours, such as following cooking instructions, but in the observations some participants did *not* always follow the

instructions. This suggests that participants believe that they complete safe practices in the kitchen; however, participants' actual behaviours do not match with this belief. Participants may answer questions in a manner that is considered more socially acceptable, known as "social desirability". This difference between reported high understanding of instructions in contrast to relatively low safe behaviour scores is a challenge. As participants do not see their behaviours as "risky", they are less likely to engage with food preparation safety messages and therefore more likely to continue with poor behaviours increasing the likelihood of food poisoning.

No differences were found between genders in their behaviour around the use of preprepared convenience foods. However, there was a difference between the older participants and the youngest participants on their overall safe behaviour score and food safety knowledge, with the older participants having better scores on both. It is a positive finding that the older generation appears to be engaged in good food preparation behaviours as they are considered a vulnerable group, and previous studies have showed that this is not the case (Tomaszewski et al., 2018). However, this finding also contrasts with the observation study, where younger participants showed higher food safety knowledge. The difference could be attributed to the sampling process. The in-home observation participants may have had a higher level of education than the online survey sample as they were not a nationally representative sample and higher education has been associated with higher food knowledge (Cates et al., 2006; Tomaszewski et al., 2018). Lower food safety knowledge and behaviour scores reported in the younger population may be due to their life stage, where young adults are moving out of their family home and for the first time being responsible for food preparation and storage. Previous limited exposure to food preparation in the family home may partially explain the limited understanding of food safety practices in the younger group. With food knowledge and practices being low in this group, future strategies should target younger population to educate them and improve their awareness of food safety, as numerous studies have demonstrated that raising awareness is reflected in improved behaviour (Ellinda-Patra et al., 2020).

Overall, safe behaviours in the use of preprepared convenience foods were predicted by food safety knowledge, belief in use-by dates, perceived food poisoning susceptibility, the perceived likelihood of getting food poisoning and food poisoning severity, and age. This implies that education around food safety, such as the importance of compliance with use-by

dates, would help in achieving better behaviours around storage, preparation and use of leftovers of preprepared convenience foods. An individual's *perceptions* of their susceptibility to food poisoning and the likelihood of them getting food poisoning, as well as their belief in the severity of food poisoning, also influence safe food behaviours. Therefore, future strategies to educate consumers and improve food behaviours should continue to emphasise the importance of good – correct – food storage and preparation behaviours and adherence to "use-by" labelling information in the domestic setting.

7 Conclusions

The results from the research studies showed that on the IOI:

- Key information relating to ingredients, allergens, cooking instructions, reheating and freezing is missing from some preprepared convenience foods.
- Consumers *perceive* their behaviours to be safer than their *actual* behaviours.
- Greater consumer compliance with product use-by dates is required.
- Cooking instructions should be followed in the preparation of preprepared convenience foods. However, it is noted that it is currently difficult for consumers to fully comply because of a lack of detail in the instructions, the size and clarity of the font, and the location of the instructions.
- Some consumers reheat leftovers of preprepared convenience foods, especially if it is heated for the first time in the oven in their home.
- Consumers generally see preprepared convenience foods as “safe”. Consumers understand that manufacturers should be complying with safety regulations and they are aware of their own role in following the guidance provided to ensure the safety of the product.
- Older consumers have a higher food safety knowledge and safer behaviours relating to storage, heating and use of leftovers of preprepared convenience foods than younger consumers.
- A number of variable factors explained the variance in overall behaviour relating to storage, heating and use of leftovers of preprepared convenience foods. Better (safer) food behaviours were reported by participants with
    - Higher levels of food safety knowledge
    - Greater belief in the use-by dates
    - Greater belief in their susceptibility to food poisoning
    - Lower belief in the likelihood of getting food poisoning from preprepared convenience foods
    - Greater perception of the severity of food poisoning

- Higher age

8 Recommendations

Recommendations for consumers

- Check and comply with the product use-by date
- Check for damage to the packaging that may have broken the seal on product
- Store products in the fridge unless specific instructions are provided for freezing
- Follow the provided cooking instructions
- Do not reheat and consume leftovers unless specific instructions are provided for the safe reheating of the product

Recommendations for manufacturers of preprepared convenience foods

- Clearly state the ingredient list and all allergens on all preprepared convenience food products
- Use larger writing (in bold print and capitals) for the instructions
- Provide clear freezing and reheating instructions, or information that the product is unsuitable for these processes
- Place the cooking instructions on the front, top or side of the container or packaging, rather than on the underside
- Place use-by dates in a clear and obvious place on the front or top of the container
- Provide further detail on the cooking instructions, for example times for different microwave wattages, and whether the product needs to be left to stand before consumption
- Where possible, provide nutritional information, such as the “traffic light” labelling system

Recommendations for educators and policy makers

- Increase consumer food safety knowledge
- Change consumer perceptions on food poisoning, potential food hazards, and possible severe consequences of and susceptibility to food poisoning

9 Added value and anticipated benefits

The preprepared convenience foods research project has added value and benefits in a number of different areas. These are classified using the impact taxonomy (classification system) developed by the European Science Foundation (ESF, 2012).

Scientific impact: Advances in understanding, method, theory and application

The preprepared convenience foods project produced the first audit on the IOI providing an overview of products available and the level of information provided on the on-pack and manufacturer-provided instructions. The project is the first study to conduct behavioural observations on preprepared convenience foods on the IOI, advancing knowledge around the safe use of these products in this growing food sector. The project has also identified influencers of safe behaviour relating to the use of preprepared convenience foods on the IOI.

Cultural impact: Contribution to understanding of ideas and reality, values and beliefs

The preprepared convenience foods project has gathered insights into consumers' beliefs about their behaviours and highlights potential gaps between their perceived behaviours and their actual behaviours. This publicly available report can increase consumer awareness on the IOI around differences in their perceived and actual behaviours, providing opportunities for consumers to implement safer behaviours.

Educational impact: Contributing to education, training and capacity building

The preprepared convenience foods project has identified areas where education should be provided around safe behaviours relating to the storage, preparation and use of leftovers of these products.

Social impact: Contributing to community welfare, quality of life, behaviour, practices and activities of people and groups

Behavioural insights produced by the preprepared convenience food project highlight gaps between perceived and actual safe behaviours around these products. They also highlighted the willingness of consumers to follow the guidance provided as well as identifying areas of difficulty with font size, level of detail and location of instructions.

Technological impact: Contribution to the creation of product, process and service innovations

The preprepared convenience foods research project has produced additional recommendations and guidance for producers and manufacturers of these products. These aim to ensure their on-pack product information and instructions follow legislation, are clear and easy for consumers' use, and potential marketing tools for increased sales of products, while providing added benefits to the consumers such as increased nutritional information.

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11 Appendices

Appendix 1 Observation behaviour checklist

Participant No: _____ Observer No: _____

Category	Action	Product 1	Product 2	Product 3	Product 4	Product 5	Notes/Comments
	Observer Insert						*Order will be varied throughout the observations to reduce order bias*
General	Washing Hands *Note: How long? Soap/no soap*						
Use-by	Check Use-by date						
	Identify Out of date product/hole						
Storage	Reading Storage/heating instructions						
	Where would you store this product?						
	How long would you store this product?						
Heating of product	Correct heating appliance chosen						
	Correct temperature set						
	Removal of product packaging in line with instructions						
	Correct time						
	Leaving product to stand in line with instructions						
Leftovers	*Storage of left overs?*						

Appendix 2 Interview topic guide

Aim: To elicit participants' perceptions in relation to each meal and explore decision making processes to ascertain how the instructions impact on behaviour

Welcome (3 mins)

- That is the physical preparation of the food all done, so I just have a few questions for you about the whole experience, if that is ok with you? It won't take long to get through them and we are just gathering opinions about the preparation of the different products. We really want to know about the clarity of the instructions.
- I will be using a voice recorder to save me taking lots of notes. Don't worry, you won't be personally identified in any of the research outputs or reports. Is that all ok with you?
- Ok, so an easy first question is to tell me how did you find that whole preparation experience?

Views about products in general (8 mins)

Just to continue about the different meal products.

- Would you usually use these types of food products?
    - *If needed prompt – how often, differences in frequencies between different products.*
- Why do you *(or why don't you often)* use these types of products?
    - *If needed prompt – taste, ease of use, time, living situation, waste*
- Would you consider these products different? If yes, what are the differences?
- Would you find there are differences in the clarity of preparation instructions between the different products?
- In general, how safe would you consider prepared convenience foods?
- Whose responsibility is it to ensure the safety of these products?
    - *Prompt – is there anything you can do as the consumer can do to ensure the safety*

Individual products (15 mins – 3 minutes per product)

So, we are just going to go through each of the products now, to get a better understanding about the differences in the products.

Product 1

- How would you describe the instructions for storage and heating of this product?
    - *Prompt – clarity, ease of understanding*
- Do you think (for this product) that the instructions have to be followed exactly? Why/Why not?
- If you did not finish the meal, what would you do with the leftovers? Why?
- How strict would you be with the use-by date on this product?
    - *Prompt – Are there circumstances you would eat it past the use-by date, how many days past the use-by date would you consider eating it*

Product 2

- H How would you describe the instructions for storage and heating of this product?
    - *Prompt – clarity, ease of understanding*
- Do you think (for this product) that the instructions have to be followed exactly? Why/Why not?
- If you did not finish the meal, what would you do with the leftovers? Why?
- How strict would you be with the use-by date on this product?
    - *Prompt – Are there circumstances you would eat it past the use-by date, how many days past the use-by date would you consider eating it*

Product 3

- How would you describe the instructions for storage and heating of this product?
    - *Prompt – clarity, ease of understanding*
- Do you think (for this product) that the instructions have to be followed exactly? Why/Why not?
- If you did not finish the meal, what would you do with the leftovers? Why?
- How strict would you be with the use-by date on this product?
    - *Prompt – Are there circumstances you would eat it past the use-by date, how many days past the use-by date would you consider eating it*

Product 4

- How would you describe the instructions for storage and heating of this product?
    - *Prompt – clarity, ease of understanding*
- Do you think (for this product) that the instructions have to be followed exactly? Why/Why not?
- If you did not finish the meal, what would you do with the leftovers? Why?
- How strict would you be with the use-by date on this product?
    - *Prompt – Are there circumstances you would eat it past the use-by date, how many days past the use-by date would you consider eating it*

Product 5

- How would you describe the instructions for storage and heating of this product?
    - *Prompt – clarity, ease of understanding*
- Do you think (for this product) that the instructions have to be followed exactly? Why/Why not?
- If you did not finish the meal, what would you do with the leftovers? Why?
- How strict would you be with the use-by date on this product?
    - *Prompt – Are there circumstances you would eat it past the use-by date, how many days past the use-by date would you consider eating it*

Comparing the products (10 minutes)

So now just thinking about all five of those meals…

- Would you handle/store those meals any differently? Why?
- What about following the instructions, would you follow any of the instructions more carefully than others? Why?
- And then the use-by date, do you feel it is more important to follow the use-by date on any of those products? How come?
- And finally, in terms of safety, would you think any of those products are more risky or more likely to cause poisoning than others?

Is there any additional information/labels you would find useful on the products?

Interview close (2 mins)

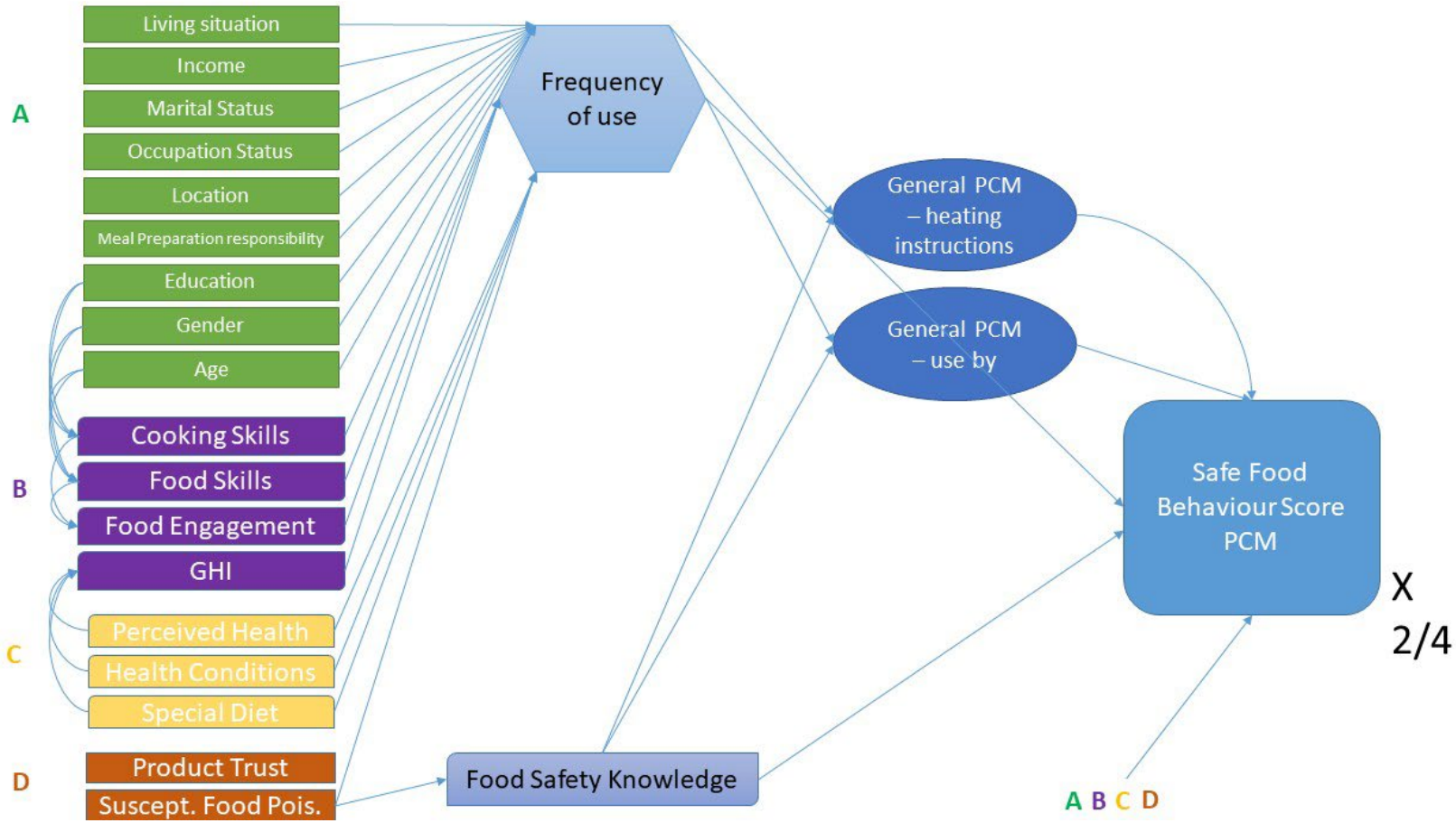
Summarise and clarify key points from the discussion.

- Is there anything else you would like to add, about these products that you don't think we have covered?

Session close (1 min)

- Thank participant for taking part

Appendix 3 Online survey



Q1. What is your age? *(under 18/Over 80 – close)*

Q2: Do you or does anyone in your household work in any of the following occupations? Select all that apply.

Teaching		
Banking/finance		
Science		
Farmers and growers/manufacturers/wholesale/retail of food and/or drinks		
Food safety		*close*
Food processing or manufacturing		*close*
None of these		

Q3. How frequently do you use preprepared convenience foods?

Almost every day (5-7 days a week)	
2-4 times a week	
Once a week	
Two to three times a month	*close*
Once a month	*close*
Every 2-3 months	*close*
Once or twice a year	*close*
Never	*close*

Q4. Please look at the following list. If you **do it** please **say how good you are at it** on a scale of 1-7 where 1 is very poor, 7 very good, if you don't do a skill tick 'Never/rarely do it':

	Never/ rarely do it	**1 Very Poor**	**2**	**3**	**4**	**5**	**6**	**7 Very Good**
1.Chop, mix and stir foods, e.g., chopping vegetables, dicing an onion, cubing								

	Never/ rarely do it	1 Very Poor	2	3	4	5	6	7 Very Good
meat, mixing and stirring food together in a pot/bowl								
2. Blend foods to make them smooth, like soups or sauces (using a whisk/blender/food processor etc.)								
3. Steam food (where the food doesn't touch the water but gets cooked by the steam)								
4. Boil or simmer food (cooking it in a pan of hot, boiling/bubbling water)								
5. Stew food (cooking it for a long time (usually more than an hour) in a liquid or sauce at a medium heat, not boiling) e.g., beef stew								
6. Roast/bake food in the oven, for example raw meat/chicken, fish, vegetables etc.								
7. Fry/stir-fry food in a frying pan/wok with oil or fat using the hob/gas rings/hot plates								
8. Microwave food (not drinks/liquid) including heating ready meals								
9. Bake goods such as cakes, buns, cupcakes, scones,								

	Never/ rarely do it	1 Very Poor	2	3	4	5	6	7 Very Good
bread etc., using basic/raw ingredients or packet mixes								
10. Peel and chop vegetables (including potatoes, carrots, onions, broccoli)								
11. Prepare and cook raw meat/poultry								
12. Prepare and cook raw fish								
13. Make sauces and gravy from scratch (no ready-made jars, pastes or granules)								
14. Use herbs and spices to flavour dishes								

Q5a. Please look at the following list of questions relating to **food practices. If you do it, please say how good you are at it** on a scale of 1-7 where 1is very poor, 7 very good, if you don't do a skill tick 'Never/rarely do it':

	Never/ rarely do it	1 Very Poor	2	3	4	5	6	7 Very Good
1...plan meals ahead? (e.g. for the day/week ahead)								
2...prepare meals in advance? E.g. packed lunch, partly preparing a meal in advance								
3...follow recipes when cooking?								

	Never/ rarely do it	1 Very Poor	2	3	4	5	6	7 Very Good
4…shop with a grocery list?								
5…shop with specific meals in mind?								
6…plan how much food to buy?								
7…compare prices before you buy food?								
8…know what budget you have to spend on food?								
9…buy food in season to save money?								
10…buy cheaper cuts of meat to save money?								

Q5b. Please look at the following list of questions relating to **food practices. If you do it, please say how good you are at it** on a scale of 1-7 where 1is very poor, 7 very good, if you don't do a skill tick 'Never/rarely do it':

11…cook more or double recipes which can be used for another meal?								
12…prepare or cook a healthy meal with only few ingredients on hand?								
13…prepare or cook a meal with limited time?								
14…use leftovers to create another meal?								

15... keep basic items in your cupboard for putting meals together? E.g. herbs/ spices, dried/tinned goods?								
16...read the best-before date on food?								
17...read the storage and use-by information on food packets?								
18...read the nutrition information on food labels?								
19...balance meals based on nutrition advice on what is healthy?								

For the next sections, please consider a 'preprepared convenience food' as a chilled meal that requires little preparation/cooking in the home, but requires some form of heating, e.g. a roast chicken dinner with 2 veg and gravy, lasagne, etc.

Q6. Have your food preparation behaviours changed since the COVID-19 pandemic?

Yes	
No	

[Show Q7 if Yes selected at Q6]

Q7. Do you cook more from fresh ingredients?

Yes	
No	

[Show Q8 if No selected at Q7]

Q8. Do you use more preprepared (convenience) food products?

Yes	
No	

Q9. In your opinion, on a scale of 1 to 7, with 1 meaning 'strongly disagree' to 7 'strongly agree,' how far do you agree that the following stakeholders are responsible for ensuring the food safety of the food supply chain (incl. preprepared convenience foods)

Stakeholder	**1 'strongly disagree'**	**2**	**3**	**4**	**5**	**6**	**7 'strongly agree'**
Government							
Farmers							
Food manufacturers							
Supermarkets							
Small businesses that sell meal products (e.g. cafes)							
Consumers							

Q10. To what extent do you agree or disagree with each of the following statements based on a scale of 1 to 7, where 1 means strongly disagree and 7 means strongly agree?

	1 Strongly disagree	2	3	4	5	6	7 Strongly agree
I trust that preprepared convenience foods are high quality							
preprepared convenience foods are reliable							
I trust that preprepared convenience foods are safe							
I trust that preprepared convenience foods are fully traceable back to their origins							
I trust that preprepared convenience foods are authentic							

I trust that preprepared convenience foods are accurately labelled							
Preprepared convenience foods are trustworthy							
Preprepared convenience foods are honest							
Preprepared convenience foods are truthful							
Preprepared convenience foods have integrity							

Q11. On a scale of 1 to 5 where 1 indicates that you strongly disagree and 5 indicates that you strongly agree, please say how much you disagree or agree with each of the following statements?

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
If I don't follow 'use by' instructions I will be more likely to develop food poisoning					
If I don't follow 'best before' instructions, I will be more likely to develop food poisoning					
If I don't use leftovers within 2-3 days I will be more likely to develop food poisoning					
If I don't follow the current advice for defrosting food I will be more likely to develop food poisoning					
If I don't maintain my fridge temperature					

within 0-5°C I will be more likely to develop food poisoning					
If I don't clean my oven regularly (at least once a month), I will be more likely to develop food poisoning					
If I don't clean my fridge regularly(at least once a month) I will be more likely to develop food poisoning					
If I don't store raw and cooked foods separately I will be more likely to develop food poisoning					

Q12. On a scale of 1 to 5 where 1 indicates that you strongly disagree and 5 indicates that you strongly agree, please say how much you disagree or agree with each of the following statements?

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
Food poisoning could be serious for me and my household					
Food poisoning could affect my health/health of my household in the long-term					
Food poisoning can result in hospitalisation					
Food poisoning can be fatal					
Developing food poisoning would **NOT** have a major effect on my life					
Developing food poisoning would have serious financial consequences for my household					

Q13. On a scale of 1 to 5, where 1 means very unlikely and 5 means extremely likely, how likely, in general, do you think you are to get food poisoning?

1 'Very unlikely'	2	3	4	5 'Extremely likely'

Q14. On a scale of 1 to 5, where 1 means very unlikely and 5 means extremely likely, how likely do you think you are to get food poisoning from food you have fully prepared from basic ingredients in your home?

1 'Very unlikely'	2	3	4	5 'Extremely likely'

Q15. On a scale of 1 to 5, where 1 means very unlikely and 5 means extremely likely, how likely do you think you are to get food poisoning from a preprepared convenience food that you are heating in your home?

1 'Very unlikely'	2	3	4	5 'Extremely likely'

Q16: On a scale of 1 to 7, 1 being strongly disagree and 7 being strongly agree, please rate your agreement with the following statements:

	1 – Strongly Disagree	2	3	4	5	6	7 – Strongly Agree
1. The healthiness of food has little impact on my food choices.							
2. I am very particular about the healthiness of food I eat.							
3. I eat what I like and I do not worry much about the healthiness of food.							
4. It is important for me that my diet is low in fat.							

	1 – Strongly Disagree	2	3	4	5	6	7 – Strongly Agree
5. I always follow a healthy and balanced diet.							
6. It is important for me that my daily diet contains a lot of vitamins and minerals.							
7. The healthiness of snacks makes no difference to me.							
8. I do not avoid foods, even if they may raise my cholesterol.							

Q17. On a scale of 1 to 5, with 1 meaning 'never,' and 5 meaning 'always,' How often do you…

	1 Never	2 Rarely	3 Occasionally	4 Often	5 Always
1) … buy fresh food to cook from scratch?					
2) … plan meals ahead of time? (E.g. deciding what dinners you will make for the week)					
3) … prepare meals for yourself or others?					
4) … try to reduce food waste? (E.g. by eating or using up food that is about to expire)					
5) … make an effort to use up leftover food? (E.g. using leftovers in another meal or eating leftover dinner for lunch)					
6) … dispose of your food waste in an appropriate way? (E.g. using the appropriate bin or washing contaminated containers)					
7) … read about food? (E.g. social media, magazines, cookbooks)					
8) … watch any food-related media? (E.g. documentaries, TV shows, videos on social media)					
9) … talk to others about food? (E.g. friends, family, work colleagues)					
10) … attend any food-related events? (E.g., food markets, food festivals, agricultural shows)					

Q18. When you buy a preprepared convenience food, how do you generally store this product before eating it?

In the cupboard (until the use-by date)	
In the fridge for 0 days (buy and eat on the same day)	
In the fridge for 1-3 days	
In the fridge for 4-7 days	
In the fridge for up to two weeks	
In the fridge for more than two weeks	
In the freezer – I keep these products in the freezer and defrost it, I will cook it within 24 hours	
In the freezer - I keep these products in the freezer and defrost it 1-3 days before I will cook it	
Other, please specify	

Q19. Generally, how strictly do you respect the use-by-date of a preprepared convenience food?

Strictly	When a preprepared convenience food has passed the use-by-date, I will no longer eat it and throw it away	
Moderately	When a preprepared convenience food has surpassed the use-by-date by a couple of days (2-3 days) I will still eat it, but not if it's more than 3 days over the date	
Limited	Even if a preprepared convenience food has surpassed the use-by-date with more than 3 days I will still eat it. Only after ___ days I will no longer eat it and throw it away. *(Please enter the number of days)*	
I don't	If the product still looks and smells good, I will still eat it	

Q20. On a scale of 1 to 7 where 1 means not believable at all and 7 means extremely believable, to what extent do you believe the use-by date on a preprepared convenience food?

1 'Not at all believable'	2	3	4	5	6	7 'Extremely believable'

Q21. Generally, how strictly do you follow the cooking instructions on the package of a preprepreprepared convenience food? Below are some examples of such instructions

e.g. - 800 W for 4 min, stir halfway through

e .g. - put on a plate and heat for 10 min at 180 °C

Completely	"I will do all the steps listed on the package"	
Partially	"I will respect the time and the microwave power setting (Watt), but I will not stir the product halfway through." Or "I will respect the time, but don't know how to change the power setting (Watt)."	
I don't	"If it is warm enough to eat, that is good for me."	

(RESPONDENTS TO ANSWER THE FOLLOWING SECTION OF QUESTIONS FOR TWO FOOD PRODUCTS. PRESENTATION OF FOODS TO BE RANDOMISED.)

INSTRUCTIONS: YOU WILL NOW BE SHOWN PHOTOGRAPHS OF A SERIES OF FOODS. PLEASE CONSIDER EACH PRODUCT CAREFULLY AND ANSWER THE QUESTIONS THAT FOLLOW **BASED ON HOW YOU WOULD USE THAT SPECIFIC PRODUCT**. IF YOU HAVE NEVER SEEN OR USED THE PRODUCT BEFORE, WE ARE INTERESTED IN YOUR THOUGHTS BASED ON HOW YOU THINK YOU WOULD USE IT.

(Products not visible while answering questions)

Q22a. Did you check the date?

Yes	
No	

[Show Q23a if Yes selected at Q22a]

Q23a. If yes, what was the date?

7th Feb 2021	
8th Feb 2021	
9th Feb 2021	
1st March 2021	
21st March 2021	
Don't know	

FROM HERE, PLEASE ACT AS IF THE PRODUCT IS IN DATE

Q24a. If you just bought this meal and were going to eat it in 3-4 hours, where would you store this item?

Countertop/bench	
Cupboard/Press	
Fridge	
Freezer	
Cold oven	
Don't know	
Other: (Please specify)	

Q25a. If the fridge was full, where would you store it, if you are going to eat it in 3-4 hours?

Countertop/bench	
Cupboard/Press	
Remove something from the fridge and put the product in	
Freezer	
Cook it and reheat it later	
Cold oven	
If it was cold, leave it outside	
Don't know	
Other: (Please specify)	

Q26a. It is time to eat the food, would you read the heating/cooking instructions?

Yes	
No (Skip next Q27a)	

[Show Q27a if Yes selected at Q26a]

Q27a. Would you follow the heating instructions of this meal fully?

Yes	
Partly	
No	

[Show Q28a if "Partly" or "No" selected at Q27a]

Q28a. If partly or no, why not? _____

Q29a. How would you heat this product?

Turn on oven, place food in the cold oven for the recommended time at the recommended temperature	
Turn on the oven, place food in the cold oven for the recommended time at a higher temperature	
Turn on the oven, place food in the cold oven at the recommended temperature for a longer time period	
Preheat the oven, and place the food in the oven at the recommended temperature until the food looks cooked	
Preheat the oven, place the food in the oven for the recommended time and temperature	
Preheat the oven, and place the food in the oven at a higher temperature for a shorter time	
Put in the microwave, and heat for 3 minutes	
Put in microwave, and heat for recommended time but don't let stand after the time	
Put in microwave, and heat for recommended time and allow to stand	
Put in microwave, heat for 3 minutes, stir or shake, heat for further 3 minutes and allow to stand	
Put in microwave, heat for 3 minutes, stir or shake, heat for further 3 minutes and don't allow to stand	

I wouldn't heat it (eat it cold)	
Don't know	

Q30a. If you had some of this meal left over, what would you do with it?

Leave it out on a bench and eat later that day cold	
Leave it out on a bench and eat later that day after reheating	
Put it in the fridge and reheat it later that day	
Put it in the fridge and eat it cold later that day	
Throw it in a general waste bin	
Leave it out on the bench and eat the next day after reheating	
Leave it out on the bench and eat the next day cold	
Put it in the fridge, reheat it and eat the next day	
Put it in the fridge and eat it cold the next day	
Throw it in a food waste bin	
Leave it out on the bench and eat it up to the use-by date after reheating	
Leave it out on the bench and eat it up to the use-by date cold	
Put it in the fridge, reheat it and eat it up to the use-by date	
Put it in the fridge and eat it cold up to the use-by date	
Don't know	
Other: (Please specify)	

(Products visible while answering next two questions)

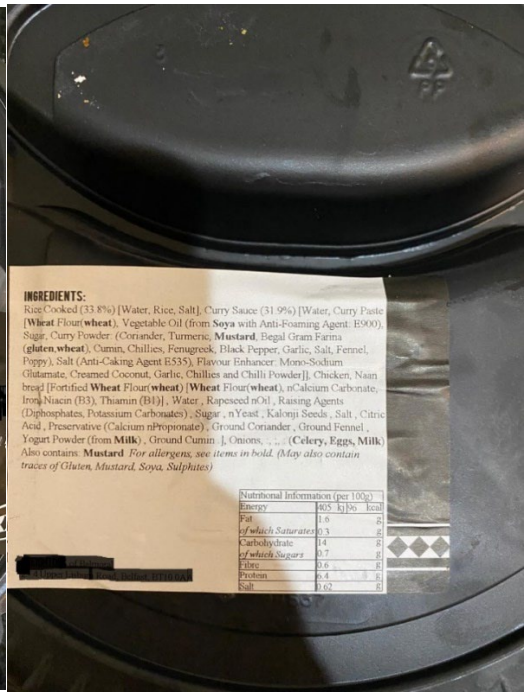
Q31a: Thinking about this product, on a scale of 1 to 7 where 1 means extremely difficult to understand and 7 means extremely easy to understand, how easy is it to understand the cooking instructions of this product?

Extremely difficult to understand	1
	2
	3
	4
	5
	6
Extremely easy to understand	7

Q32a: Thinking about this product, on a scale of 1 to 7 where 1 means extremely difficult to understand and 7 means extremely easy to understand, how easy is it to understand the storing instructions of this product?

Extremely difficult to understand	1
	2

	3
	4
	5
	6
Extremely easy to understand	7



Q22b. Did you check the date?

Yes	
No	

[Show Q23b if Yes selected at Q22b]

Q23b. If yes, what was the date?

7th Feb 2021	
8th Feb 2021	
9th Feb 2021	
1st March 2021	
21st March 2021	
Don't know	

FROM HERE, PLEASE ACT AS IF THE PRODUCT IS IN DATE

Q24b. If you just bought this meal and were going to eat it in 3-4 hours, where would you store this item?

Countertop/bench	
Cupboard/Press	
Fridge	
Freezer	
Cold oven	
Don't know	
Other: (Please specify)	

Q25b. If the fridge was full, where would you store it, if you are going to eat it in 3-4 hours?

Countertop/bench	
Cupboard/Press	
Remove something from the fridge and put the product in	
Freezer	
Cook it and reheat it later	
Cold oven	
If it was cold, leave it outside	
Don't know	
Other: (Please specify)	

Q26b. It is time to eat the food, would you read the heating/cooking instructions?

Yes	
No (Skip next Q)	

[Show Q27b if Yes selected at Q26b]

Q27b. Would you follow the heating instructions of this meal fully?

Yes	
Partly	
No	

[Show Q28b if Partly or No selected at Q27b]

Q28b. If partly or no, why not? _____

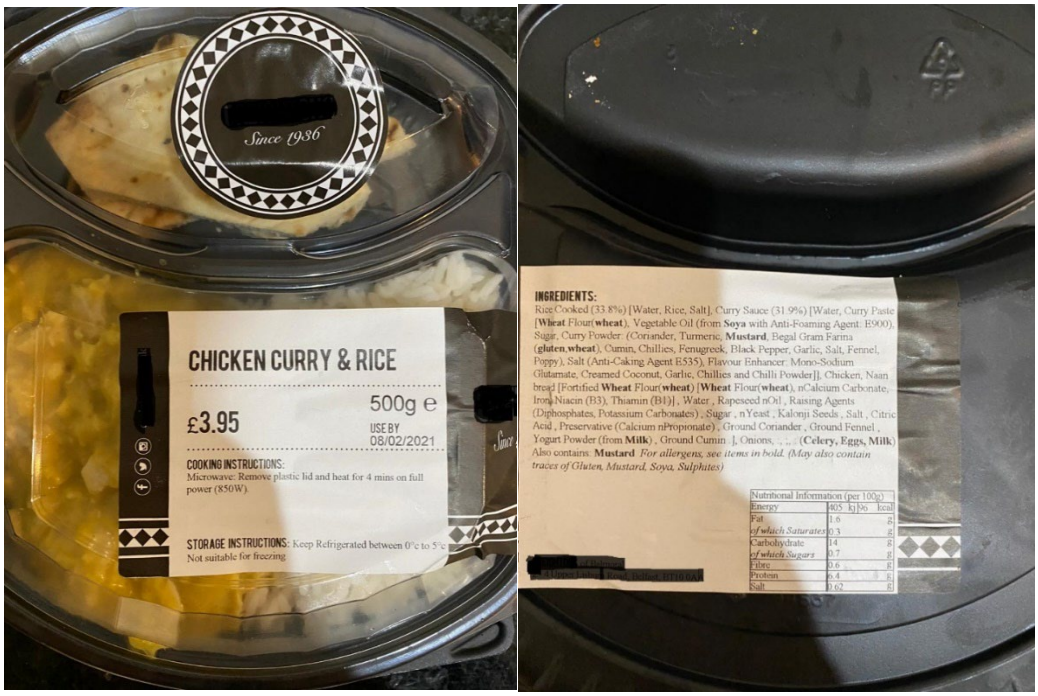
Q29b. How would you heat this product?

Turn on oven, place food in the cold oven for the recommended time at the recommended temperature	
Turn on the oven, place food in the cold oven for the recommended time at a higher temperature	
Turn on the oven, place food in the cold oven at the recommended temperature for a longer time period	
Preheat the oven, and place the food in the oven at the recommended temperature until the food looks cooked	
Preheat the oven, place the food in the oven for the recommended time and temperature	
Preheat the oven, and place the food in the oven at a higher temperature for a shorter time	
Put in the microwave, and heat for 3 minutes	
Put in microwave, and heat for recommended time but don't let stand after the time	
Put in microwave, and heat for recommended time and allow to stand	
Put in microwave, heat for 3 minutes, stir or shake, heat for further 3 minutes and allow to stand	
Put in microwave, heat for 3 minutes, stir or shake, heat for further 3 minutes and don't allow to stand	
I wouldn't heat it (eat it cold)	
Don't know	

Q30b. If you had some of this meal left over, what would you do with it?

Leave it out on a bench and eat later that day cold	
Leave it out on a bench and eat later that day after reheating	
Put it in the fridge and reheat it later that day	
Put it in the fridge and eat it cold later that day	
Throw it in a general waste bin	

Leave it out on the bench and eat the next day after reheating	
Leave it out on the bench and eat the next day cold	
Put it in the fridge, reheat it and eat the next day	
Put it in the fridge and eat it cold the next day	
Throw it in a food waste bin	
Leave it out on the bench and eat it up to the use-by date after reheating	
Leave it out on the bench and eat it up to the use-by date cold	
Put it in the fridge, reheat it and eat it up to the use-by date	
Put it in the fridge and eat it cold up to the use-by date	
Don't know	
Other: (Please specify)	



Q31b: Thinking about this product, on a scale of 1 to 7 where 1 means extremely difficult to understand and 7 means extremely easy to understand, how easy is it to understand the cooking instructions of this product?

Extremely difficult to understand	1
	2
	3
	4
	5
	6
Extremely easy to understand	7

Q32b: Thinking about this product, on a scale of 1 to 7 where 1 means extremely difficult to understand and 7 means extremely easy to understand, how easy is it to understand the storing instructions of this product?

Extremely difficult to understand	1
	2
	3
	4
	5
	6
Extremely easy to understand	7

Q22c. Did you check the date?

Yes	
No	

[Show Q23c if Yes selected at Q22c]

Q23c. If yes, what was the date?

7th Feb 2021	

8th Feb 2021	
9th Feb 2021	
1st March 2021	
21st March 2021	
Don't know	

FROM HERE, PLEASE ACT AS IF THE PRODUCT IS IN DATE

Q24c. If you just bought this meal and were going to eat it in 3-4 hours, where would you store this item?

Countertop/bench	
Cupboard/Press	
Fridge	
Freezer	
Cold oven	
Don't know	
Other: (Please specify)	

Q25c. If the fridge was full, where would you store it, if you are going to eat it in 3-4 hours?

Countertop/bench	
Cupboard/Press	
Remove something from the fridge and put the product in	
Freezer	
Cook it and reheat it later	
Cold oven	
If it was cold, leave it outside	
Don't know	
Other: (Please specify)	

Q26c. It is time to eat the food, would you read the heating/cooking instructions?

Yes	
No (Skip next Q27c)	

[Show Q27c if Yes selected at Q26c]

Q27c. Would you follow the heating instructions of this meal fully?

Yes	Skip Q28c
Partly	
No	

[Show Q28c if Partly or No selected at Q27c]

Q28c. If partly or no, why not? _____

Q29c. How would you heat this product?

Turn on oven, place food in the cold oven for the recommended time at the recommended temperature	
Turn on the oven, place food in the cold oven for the recommended time at a higher temperature	
Turn on the oven, place food in the cold oven at the recommended temperature for a longer time period	
Preheat the oven, and place the food in the oven at the recommended temperature until the food looks cooked	
Preheat the oven, place the food in the oven for the recommended time and temperature	
Preheat the oven, and place the food in the oven at a higher temperature for a shorter time	
Put in the microwave, and heat for 3 minutes	
Put in microwave, and heat for recommended time but don't let stand after the time	
Put in microwave, and heat for recommended time and allow to stand	
Put in microwave, heat for 3 minutes, stir or shake, heat for further 3 minutes and allow to stand	
Put in microwave, heat for 3 minutes, stir or shake, heat for further 3 minutes and don't allow to stand	
I wouldn't heat it (eat it cold)	
Don't know	

Q30c. If you had some of this meal left over, what would you do with it?

Leave it out on a bench and eat later that day cold	

Leave it out on a bench and eat later that day after reheating	
Put it in the fridge and reheat it later that day	
Put it in the fridge and eat it cold later that day	
Throw it in a general waste bin	
Leave it out on the bench and eat the next day after reheating	
Leave it out on the bench and eat the next day cold	
Put it in the fridge, reheat it and eat the next day	
Put it in the fridge and eat it cold the next day	
Throw it in a food waste bin	
Leave it out on the bench and eat it up to the use-by date after reheating	
Leave it out on the bench and eat it up to the use-by date cold	
Put it in the fridge, reheat it and eat it up to the use-by date	
Put it in the fridge and eat it cold up to the use-by date	
Don't know	
Other: (Please specify)	

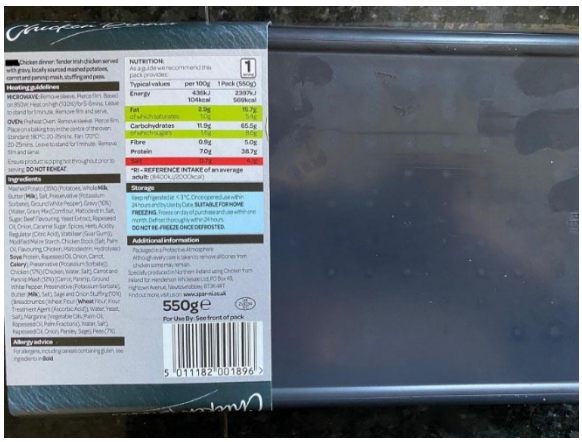
Q31c: Thinking about this product, on a scale of 1 to 7 where 1 means extremely difficult to understand and 7 means extremely easy to understand, how easy is it to understand the cooking instructions of this product?

Extremely difficult to understand	1
	2

	3
	4
	5
	6
Extremely easy to understand	7

Q32c: Thinking about this product, on a scale of 1 to 7 where 1 means extremely difficult to understand and 7 means extremely easy to understand, how easy is it to understand the storing instructions of this product?

Extremely difficult to understand	1
	2
	3
	4
	5
	6
Extremely easy to understand	7



Q22d. Did you check the date?

Yes	
No (Skip next Q23d)	

[Show Q23d if Yes selected at Q22d]

Q23d. If yes, what was the date?

7th Feb 2021	
8th Feb 2021	
9th Feb 2021	
1st March 2021	
21st March 2021	

Don't know	

FROM HERE, PLEASE ACT AS IF THE PRODUCT IS IN DATE

Q24d. If you just bought this meal and were going to eat it in 3-4 hours, where would you store this item?

Countertop/bench	
Cupboard/Press	
Fridge	
Freezer	
Cold oven	
Don't know	
Other: (Please specify)	

Q25d. If the fridge was full, where would you store it, if you are going to eat it in 3-4 hours?

Countertop/bench	
Cupboard/Press	
Remove something from the fridge and put the product in	
Freezer	
Cook it and reheat it later	
Cold oven	
If it was cold, leave it outside	
Don't know	
Other: (Please specify)	

Q26d. It is time to eat the food, would you read the heating/cooking instructions?

Yes	
No (Skip next Q)	

[Show Q27d if Yes selected at Q26d]

Q27d. Would you follow the heating instructions of this meal fully?

Yes	Skip Q28d
Partly	
No	

[Show Q28d if Partly or No selected at Q27d]

Q28d. If partly or no, why not? _____

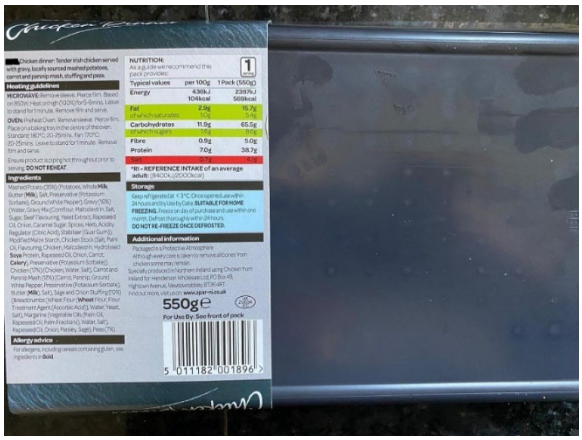
Q29d. How would you heat this product?

Turn on oven, place food in the cold oven for the recommended time at the recommended temperature	
Turn on the oven, place food in the cold oven for the recommended time at a higher temperature	
Turn on the oven, place food in the cold oven at the recommended temperature for a longer time period	
Preheat the oven, and place the food in the oven at the recommended temperature until the food looks cooked	
Preheat the oven, place the food in the oven for the recommended time and temperature	
Preheat the oven, and place the food in the oven at a higher temperature for a shorter time	
Put in the microwave, and heat for 3 minutes	
Put in microwave, and heat for recommended time but don't let stand after the time	
Put in microwave, and heat for recommended time and allow to stand	
Put in microwave, heat for 3 minutes, stir or shake, heat for further 3 minutes and allow to stand	
Put in microwave, heat for 3 minutes, stir or shake, heat for further 3 minutes and don't allow to stand	
I wouldn't heat it (eat it cold)	
Don't know	

Q30d. If you had some of this meal left over, what would you do with it?

Leave it out on a bench and eat later that day cold	
Leave it out on a bench and eat later that day after reheating	
Put it in the fridge and reheat it later that day	
Put it in the fridge and eat it cold later that day	

Throw it in a general waste bin	
Leave it out on the bench and eat the next day after reheating	
Leave it out on the bench and eat the next day cold	
Put it in the fridge, reheat it and eat the next day	
Put it in the fridge and eat it cold the next day	
Throw it in a food waste bin	
Leave it out on the bench and eat it up to the use-by date after reheating	
Leave it out on the bench and eat it up to the use-by date cold	
Put it in the fridge, reheat it and eat it up to the use-by date	
Put it in the fridge and eat it cold up to the use-by date	
Don't know	
Other: (Please specify)	



Q31d: Thinking about this product, on a scale of 1 to 7 where 1 means extremely difficult to understand and 7 means extremely easy to understand, how easy is it to understand the cooking instructions of this product?

Extremely difficult to understand	1
	2
	3
	4
	5
	6
Extremely easy to understand	7

Q32d: Thinking about this product, on a scale of 1 to 7 where 1 means extremely difficult to understand and 7 means extremely easy to understand, how easy is it to understand the storing instructions of this product?

Extremely difficult to understand	1
	2
	3
	4
	5
	6
Extremely easy to understand	7

Q33: In general, would you say your health is...?

Excellent	1
Very good	2
Good	3
Fair	4
Poor	5

Q34: Are you currently on any of the following diets?

Diabetic diet	1
Cholesterol lowering diet	2
Vegetarian diet	3
Vegan diet	4
Slimming diet prescribed by a health professional	5
Slimming diet you decided for yourself	6
Other medical diet. PLEASE SPECIFY:	7
None of the above	8

Q35: Which of the following are high risk in terms of food poisoning risk? Select all that apply

Raw meat/poultry	
Milk	
Cooked meats	
Fruit and vegetables	
Yogurt	
Fruit Juice	
Ready to eat salads	
Cheese	
Leftover rice	
Ready meals	
Smoked Fish	
None of the above	

Q36: When a cooked chicken that will be served cold tomorrow, which one of the following should you do?

Put it in the refrigerator while still hot	
Cover it and put it in a cool place for 1-2 hours and then put it in the refrigerator	
Turn off the oven and leave the chicken there for 1-2 hours and then put it in the refrigerator	
Cover it, leave it to cool overnight on the kitchen counter and the put in the refrigerator	

Q37: How often should the inside of a refrigerator be cleaned?

Once a week	
Once a fortnight	
Every month	
Every 3 months	
Every 6 months	
Only if there is a spill	
Other (Please specify):	

Q38: What are the safest two ways to defrost raw meat?

In the sink covered in water	
On the top/ bottom shelf of refrigerator	
On the kitchen counter	
In a microwave oven immediately before cooking	
Don't know	

Q39: How long is it safe to cook raw meat / cooked foods after it has been defrosted (thawed)

Within 24 hours	

Within 48 hours	
Within 72 hours	
Within 96 hours (four days)	
Don't know	

Q40: Where is the safest place to store raw meat in your refrigerator?

Top shelf	
Middle shelves	
Bottom shelf	
Where there is space	
Don't know	

Q41: How long is it safe to eat refrigerated food that was left over from cooked meal?

Within 24 hours	
Within 48 hours	
Within 72 hours	
Within 96 hours (four days)	
Don't know	

Q42: Please select up to two correct responses to the following statement…

'After the 'use by' date a refrigerated food is……'

Still safe to eat if it looks and smells ok	
No longer safe to eat and should always be discarded	
Safe to eat if it was frozen before the 'use by' date and used within 24 hours of being thawed	
Safe to eat if it was frozen before the 'use by' date and used within 48 hours of being thawed	

Q43: Please select one correct response to the following statement…

'After the 'best before' date a refrigerated food is……'

Still safe to eat but it may begin to lose its flavour and texture	
No longer safe to eat and should always be discarded	

Q44: A perishable refrigerated food should be always be thrown away if it is left at room temperature for longer than…….

30 minutes	
1 hour	
2 hours	
3 hours	
Don't know	

Q45: After a food with a 'use by' date has been opened which two of the following are most important in determining if the food is safe to eat

'Use by' date	
Look and Smell of the food	
Storage instructions on the label e.g. number of days to be consumed once open	
'Display until' date	
Don't know	

Q46. Are you/do you identify as?

Male	
Female	
Non-binary conforming	
Other (please specify):	

Q47: What is your marital status?

Married	
Single (never married)	
Widowed	
Divorced	
Separated	
Living with partner	

Q48: What is your current living situation?

Living with parents	
Living with parents and siblings	
Living with partner	
Living with partner and child(ren)	
Living with friends	
Living with roommates, I didn't know before moving in	
Living on my own [Hide option if "living with partner selected at Q47]	

[Show Q49, Q50 if "Living on my own" not selected at Q48]

Q49: How many children aged under 16 live in your household?

Q50: Including you, how many adults aged over 16 live in your household?

Q51: Are you responsible for the food and grocery shopping in your household?

Yes – I do most of the food and grocery shopping	
Yes – I am jointly responsible/share responsibility with others	
No – Someone else does it	

Q52: What is the highest level of education you have attained?

None	
Primary school	
Secondary school to age 15/16 or junior cycle certificate, GCSE or O'Level	
Secondary school to age 17/18 or leaving certificate or A'Level, HNC	
Additional training (e.g. NVQ, BTEC, FETAC, FAS, other)	
University undergraduate / nursing qualification	
University postgraduate	

Q53. What is your current occupation status?

If you are currently furloughed or receiving support from a Coronavirus Job retention Scheme, please select your normal occupation status.

Full time paid work (30+ hours per week)	
Part-time paid work (8-29 hours per week)	
Part-time paid work (under 8 hours per week)	
Retired	
At school	
In full-time higher education	
Unemployed (seeking work)	
Unemployed (not seeking work)	
Full-time homemaker	

Q54: What is the total annual income of your household from all sources before any tax and national insurance contributions? If you share your household with individuals unrelated to you (not a family member or your partner), please count only your personal income.

If anyone in your household is currently furloughed or receiving support from a Coronavirus Job retention Scheme, please select your normal household income.

Include all income from employment and benefits.

If you are not sure of your household income, please estimate.

NI

Under £10,000 per annum	
£10,001 - £20,000 per annum	
£20,001 - £30,000 per annum	
£30,001 - £40,000 per annum	
£40,001 - £50,000 per annum	
£50,001 - £60,000 per annum	
£60,001 - £70,000 per annum	
£70,001 - £80,000 per annum	
£80,001 - £90,000 per annum	
£90,001 - £100,000 per annum	
£100,001 - £150,000 per annum	
£150,001 - £200,000 per annum	
£200,001 - £500,000 per annum	
£500,001 or more	
Prefer not to answer	

Ireland

Less than €20,000 per annum	
€20,001 – €40,000 per annum	
€40,001 – €60,000 per annum	
€60,001 – €80,000 per annum	
€80,001 – €120,000 per annum	
€120,001 – €160,000 per annum	
€160,001 - €200,000 per annum	
€200,001 - €400,000 per annum	
€400,001 - €800,000 per annum	
€800,001 or more per annum	
Prefer not to answer	

Q55. How many people (including yourself and other adults and children), do you typically prepare/cook a main meal for?

Mostly for myself	

Mostly for 2 people	
Mostly for 3-4 people	
Mostly for 5-6 people	
Mostly for more than 6 people	

Q56. Which county do you live in?

Ireland

Carlow	
Cavan	
Clare	
Cork	
Donegal	
Dublin	
Galway	
Kerry	
Kildare	
Kilkenny	
Laois	
Leitrim	
Limerick	
Longford	
Louth	
Mayo	
Meath	
Monaghan	
Offaly	
Roscommon	
Sligo	
Tipperary	
Waterford	
Westmeath	
Wexford	
Wicklow	

NI

Antrim	
Armagh	
Derry/Londonderry	
Down	
Fermanagh	
Tyrone	

safefood, 7 Eastgate Avenue,
Eastgate, Little Island,
Co. Cork, T45 RX01

safefood, Ascaill an Gheata Thoir,
An tOileán Beag,
Co. Chorcaí, T45 RX01

safefood, Aistyett Avenue,
Aistyett, Wee Isle,
Co. Cork, T45 RX01