

Article

Young People's Views on Food Hygiene and Food Safety: A Multicentre Qualitative Study

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Abstract: Foodborne diseases are a global burden, are preventable, and young people are a key population for behaviour change as they gain autonomy. This study aimed to explore young people's needs across several European countries in relation to learning about and implementing food hygiene and food safety. Qualitative focus groups and interviews were conducted in rural and city regions across England, France, Hungary and Portugal. Data were collected to attain data saturation, transcribed, thematically analysed, and mapped to the Theoretical Domains Framework. Twenty-five out of 84 schools approached (29.8%) participated, with data collected from 156 11–18-year-old students. Students had good knowledge of personal hygiene but did not always follow hygiene rules due to forgetfulness, lack of facilities or lack of concern for consequences. Students had limited understanding of foodborne microbes, underestimated the risks and consequences of foodborne illness and perceived the “home” environment as the safest. Young people preferred interactive educational methods. Addressing gaps in young people's food safety knowledge is essential to improve their lack of concern towards foodborne illness and motivate them to follow food hygiene and safety behaviours consistently. Findings have been used to develop educational resources to address gaps in knowledge, skills, attitudes and beliefs.

Keywords: food hygiene; food safety; qualitative research; schools; education; adolescents; behavioural science

1. Introduction

Foodborne diseases are preventable and a global burden, with 600 million worldwide cases annually and 420,000 deaths, including 30% of deaths in children under 5 years [1]. Antimicrobial resistant foodborne pathogens are increasing, and becoming harder to treat [2,3].

Previous research with children, young people and university students across Europe, Australia, Canada and USA suggest a lack of knowledge, concern and perceived susceptibility to foodborne illness [4–8]. While findings report risky behaviours of young

people, there is a distinct lack of qualitative research exploring the determinants of young people's behaviour, as well as interventions designed to change behaviour. School education of young people allows for targeted education to facilitate a future population of food safety conscious consumers, helping to reduce rates of foodborne illness. e-Bug [9] (www.e-bug.eu) (accessed on 1 April 2021) is a free educational resource operated by Public Health England (PHE), with teaching materials for 4–18-year-olds about microbes, hygiene, infection prevention and antibiotics, for classroom and home use. The e-Bug resources on food hygiene are available for 7–11-year-olds only, meaning a gap in targeted food safety education for 11–18-year-olds. This is an important group to target, as older students may be cooking for themselves, family and friends, and developing life-long food hygiene habits.

A survey of 1049 adults in Ireland and Northern Ireland, found that cooking and food safety skills were learnt primarily as adolescents from their mothers, as well as relatives, friends, secondary school teachers or from reading food packaging [10]. As shared cooking at home diminished, mothers were less able to transfer skills to children [9], which supports a school-based food hygiene educational approach. Furthermore, a survey of primary food preparers in the USA found a false sense of confidence in food safety knowledge and practices, increasing risk of foodborne illness in the home [11].

British teachers reported that young people benefited from practical demonstrations of food hygiene during food preparation lessons in educational establishments [12]. Food safety experts in Canada reported that secondary school students viewed food safety as an essential employability and life skill, and to improve healthy food choices [8]. Experts rated high school as an ideal time and place to instil good life-long habits and concluded that education using age-appropriate interventions is needed to improve safe food handling practices [8].

This study was part of SafeConsume [13] (<https://safeconsume.eu/>) (accessed on 1 April 2021), an EU-funded transdisciplinary project (2017–2022) involving 32 organisations across 14 countries, which aims to decrease foodborne illness by changing consumer behaviour to reduce exposure to food associated hazards. The aim of this study was to explore students' (11–18 years) needs across four European countries, in relation to learning about food hygiene and food safety to inform development of educational resources to improve food hygiene behaviours. Exploratory research questions included:

1. What are students taught about food hygiene and safety in schools?
2. What are the experiences and attitudes of young people towards foodborne illness?
3. What are the determinants of young people's food hygiene behaviours?

2. Materials and Methods

This was a qualitative study design with semi-structured focus groups (FGs) and interviews in educational settings (schools or vocational colleges). The design followed an inductive approach where knowledge and theory were built through direct observations of natural phenomena and aimed to deeply explore the behaviours, attitudes and knowledge of the participants. Data collection occurred in England, France, Hungary and Portugal; countries involved in the SafeConsume project that expressed interest and expertise to be involved. Standardised protocols were developed, reviewed and agreed between the project team, which included teachers, psychologists, microbiologists and scientists.

A school national curriculum analysis in the same four countries with three additional EU countries involved in SafeConsume (Greece, Denmark and Spain) was completed to support the development of interview schedules and to make recommendations for educational resources. This analysis was undertaken in 2017 by a researcher in each of the seven European countries, collecting details of what food hygiene education was nationally recommended for 11–18-year-olds in schools/colleges. Information was collected from government websites, ministries of education or other professional bodies and included age groups covered, subjects taught, and qualifications gained.

For the qualitative study, purposive recruitment of participants included selective and non-selective schools attended by 11–18-year-olds in England (rural Gloucestershire and Bristol city region); France (city schools in Nice and rural schools outside Nice); Hungary (schools in rural Szabolcs-Szatmár-Bereg County and Budapest Metropolitan Area); and Portugal (schools from the Greater Lisbon (cities of Sintra and Loures) and from a rural area in the district of Évora). Researchers in each country followed an agreed recruitment, data collection and analysis strategy (Figure 1), where schools in the chosen region were stratified by rural and city regions and by high and low socioeconomic status.

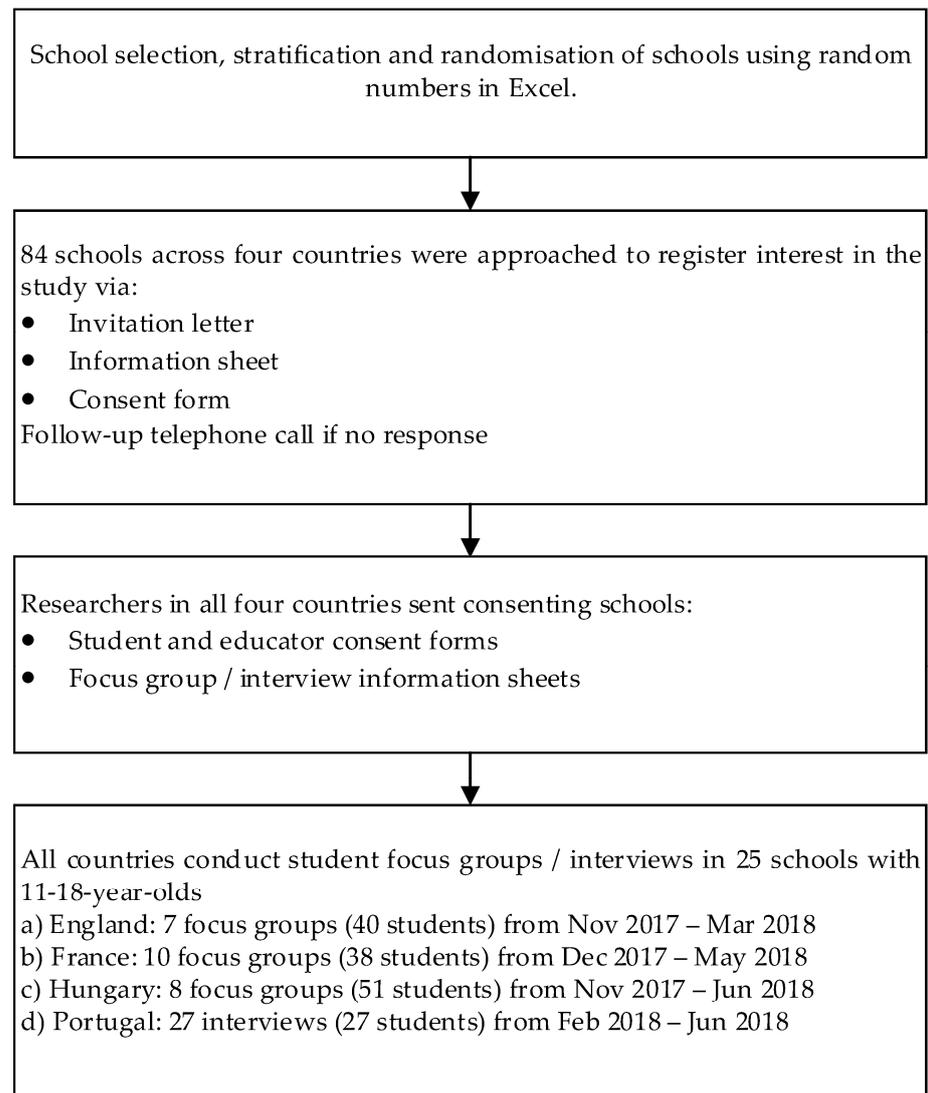


Figure 1. Recruitment flowchart.

Within each consenting school, 11–18-year-old students studying food, health or science subjects were selected by their educators to take part, with guidance from the project team, to ensure that students of mixed ability and gender participated. Each country aimed to recruit 24 students in total, or until data saturation [14] was reached, where researchers agreed that no new themes were emerging in the interviews and FGs. Researchers within each country liaised with school staff to arrange FGs and interviews at the schools. Participants were given a detailed information sheet and provided written and verbal consent for data to be recorded and anonymised quotes to be used for reporting. Participants were incentivised in England, France and Hungary with a GBP 5 high street gift voucher; e-Bug pencil; drawstring bag, lunchbox and drinks bottle, respectively.

The project team collaborated to create an interview/FG schedule (Supplementary File 1) informed by the Theoretical Domains Framework (TDF) [15], a framework to identify determinants of behaviour change, designed to inform interventions and evaluation frameworks [16]. In this context it was appropriate to support an in-depth exploration of students' knowledge, skills, attitudes and beliefs of food hygiene. The schedule was piloted in England with a Food Technology teacher, and minor modifications were made. Researchers within each country translated the schedule into their native language for data collection. The schedule was modified iteratively during data collection.

Semi-structured interviews and FGs, dependent on school and participant preference, were conducted in each country by 2–3 researchers experienced in qualitative research and employed by public health or academic institutions. All researchers except one were female and were not familiar with participants prior to data collection. At the end of each FG or interview, researchers made reflective notes.

FGs and interviews were recorded, transcribed verbatim and checked for accuracy against the recordings by researchers. Transcripts were not returned to participants for comments. NVivo Pro 11 software was used to sort data, including analysis of codes, quotes and themes. One researcher from each country analysed the country's dataset and a second researcher double coded 20% of the data (RS/CH in England, VLH/NF in France, AK/TI in Hungary and MT/CN in Portugal). Data were analysed using an inductive six-stage thematic analysis [17], a rigorous approach whereby patterns of meaning were identified and coded within the data. Emerging themes were agreed by researchers at monthly teleconferences and then mapped to the TDF so that each theme was aligned with domains in the framework, and this final coding framework was revisited and agreed by all. There are several strengths to this; it supports interpretation of the rich analysis in the context of behavioural determinants, and it could be subsequently used to support development of interventions. In Section 3, the thematic analyses are presented under corresponding TDF domains. Researchers from each country provided examples of participant quotes, in English, that were representative of the themes to help illustrate their meaning.

3. Results

3.1. National Curriculum around Food Hygiene and Safety

Curriculum analysis (Table 1) showed that several food hygiene topics were common for the 11–18-year age bracket in England, France, Hungary and Greece: food spoilage and contamination; microorganisms and enzymes; buying, storing and cooking food; personal hygiene; keeping work areas clean; and food storage and preparation. Common topics across the countries were covered in focus group schedules.

Table 1. National curriculum analysis for food hygiene and food safety education in seven European countries. Detail can be found in Table S1.

Topic in Curriculum	England	Hungary	Greece	France	Portugal	Spain	Denmark
Spoilage and contamination	✓	✓	✓	✓		✓	✓
Microorganisms and enzymes	✓	✓	✓	✓	✓		
Buying, storing and cooking food safely	✓	✓	✓	✓	✓	✓	✓
Personal hygiene	✓	✓	✓	✓	✓		
Keeping work areas clean	✓	✓	✓	✓			
Food storage and preservation	✓	✓	✓	✓	✓		

3.2. Focus Group/Interview Participants

Between November 2017 and June 2018, 25/84 schools approached across all countries (29.8%) agreed to participate in focus groups/interviews lasting approximately 30–90 min

(Figure 1). Reasons for non-participation of schools across countries, if given, included lack of time in the school timetable, and food safety not a school priority.

3.3. Key Themes Identified within Prominent TDF Domains

The key themes that emerged from inductive qualitative data analysis mapped to the TDF are presented in Table 2 (more detail in Table S2). Other themes, not as prominent to the research questions, are also available (Table S3).

Table 2. Summary of relevant TDF domains, themes and sample quotes from focus groups and interviews with students. Detail in Table S2.

TDF ¹ Domain	Main Themes	Example Quotes
Knowledge	Cross contamination Definition of food hygiene Food microbiology Food storage Food safety Personal hygiene Use-by dates	"Green is for vegetables, blue for fish and red for meat ... [chopping boards]". (Student in Portugal) "[cross-contamination] ... when you touch meat and then touch vegetables". (Student in England)
Skills	Cooking skills Reheating foods Source of skills—mother Washing up	"You just kind of guess when it's [chicken] not pink, it's done". (Student in England)
Beliefs about capabilities	Ability to cook	"... it's my parents who cook and when I'm alone, I cook, but the most basic possible". (Student in France)
Social and professional role and identity	Work experience Family dynamics Role as student	"I usually cook at my home. I don't like to cook in another place because I'm afraid of something going wrong". (Student in Portugal)
Social influences	Perceived cultural influence Family influence Media influence	"Yeah, I'd rinse it off [raw chicken] before I chop it ... because my mum told me to". (Student in England)
Beliefs about consequences	Food hygiene concerns High-risk foods Low-risk foods Importance of handwashing Beliefs about foodborne illness Home being a safe environment	"It's not that severe, it's just puking and having a bit of a headache ... I've never really been worried about it [food poisoning]". (Student in England)
Environmental context and resources	Barriers to learning about food safety Ideas for future resources School environment and resources	"We should make presentations, we shouldn't just be sitting and listening to the teacher and making notes, because nothing will stick. And we can't prepare for life". (Student in Hungary)
Reinforcement	Negative reinforcement Positive reinforcement Classroom routines Reminders	"When we're cooking, my mum usually says that we have to wash our hands and food". (Student in Portugal)

¹ TDF—Theoretical Domains Framework.

3.3.1. Knowledge

Across countries, students generally had good knowledge of personal hygiene rules such as handwashing. Students were unclear about the risks, causes and consequences of microbial cross-contamination between foods, and lacked knowledge of foodborne microbes and the consequences of infection.

3.3.2. Skills

Across countries, students had gained basic cooking skills at home, generally from mothers and grandmothers. Most students reported that they could follow a simple recipe,

and cook for themselves when alone, or for family and friends. Students reported skills to check that food was safe to eat during cooking by checking the colour of chicken, checking that scrambled eggs were not runny (Hungary), and using a fork to check that cakes had been cooked in the middle (England).

3.3.3. Beliefs about Capabilities

Across all countries, regardless of age, students felt capable of making “easy parts” of full meals, such as pasta for spaghetti Bolognese. Students in France reported being less capable of handling meat safely. In Hungary, students varied in their perceived capability to cook food safely; some reported awareness of food hygiene, whilst others believed that they could cause others to become ill from their cooking. Students in vocational cooking schools in France and Portugal, and English students with food-related part-time jobs reported greater perceived capability to cook.

3.3.4. Social and Professional Role/Identity

Many students in England over the age of 14 had work experience in kitchens, including fast-food restaurants or cafes, or had worked in family food businesses. These students reported strictly following food hygiene rules at work, including handwashing and wearing an apron, but were less likely to follow these rules outside of work. In France, fewer students reported food-related work experience and had not received any specific food hygiene training for work in fast-food establishments, and rarer still for students in Portugal and Hungary.

3.3.5. Social Influences

Across countries, the family environment had the greatest influence on students' knowledge, skills and behaviour, and a major factor in deciding what and when students cooked and how they followed food hygiene practices. Cultural differences were observed; students in England and Portugal reported washing chicken, and French students reported preferring the taste of meat cooked rare. Some students were influenced by celebrity chefs, social media videos, and cookery programmes. English students believed that celebrity chefs might not teach good food hygiene practices. Generally, all students across countries preferred to find recipes online, rather than follow a physical recipe book.

3.3.6. Beliefs about Consequences

All students across countries reported that they perceived “home” as a safer environment to eat and cook, while buffets, restaurants, school canteens, roadside vendors and takeaways were regarded as riskier for contracting foodborne illness. Most students in England reported that they had never experienced foodborne illness, and therefore lacked concern. French students expressed more concerns about ecological dangers, including pesticides and antibiotic use. Students in Hungary and Portugal believed foodborne illness was expected, and for some, an acceptable part of life. Most students who had experienced foodborne illness commented that this was always outside their own home.

3.3.7. Environmental Context and Resources

English students reported access to school kitchens, and practical cooking activities were the main focus of the food curriculum. In other countries, kitchens for student use were available in a small minority of schools, or only vocational cooking schools in France and Portugal. Across countries, all students enjoyed learning about food hygiene using interactive activities, games, apps and videos. Reported barriers to learning about and maintaining good food hygiene included lack of food topics in school teaching, unavailable or inadequate handwashing facilities (Portugal and France) and internet restrictions (England). Across all countries, most schools displayed food hygiene posters, especially for handwashing, but students commented that they did not always pay attention to them.

3.3.8. Reinforcement

Students across all countries usually followed personal hygiene rules and routines during their food lessons if practical cooking was involved but commented that they often forgot to do these and needed reminding of handwashing rules and to tie up hair before cooking. Students reported that teachers usually gave them negative reinforcement in the form of warnings or examples of shocking images if they did not follow food hygiene rules. Positive reinforcement often came from parents and teachers who praised them for cooking meals at home or school.

4. Discussion

4.1. Main Findings

To our knowledge, this is the first qualitative study to explore food hygiene education, knowledge and skills in a student population across England, France, Hungary and Portugal. The curriculum analysis identified that there are several similarities in what is taught between the countries for food hygiene and food safety, especially for personal hygiene and keeping work areas clean. Food hygiene can be covered in a range of different subjects, including biology, natural sciences and health education. Students in our study were aware of the importance of food hygiene behaviours, but often forgot to follow these; this was magnified by a lack of concern and knowledge about the consequences of foodborne illness. Students perceived that home was the safest environment to eat and cook and distrusted the food hygiene of takeaways, fast food restaurants and buffets. Students had learnt some basic cooking skills, and perceived cooking and food hygiene as important skills for later life and employment. Students enjoyed interactive activities, videos and games to learn about food hygiene. However, practical and interactive food hygiene lessons will be difficult in many schools that do not have educational kitchens for students.

4.2. Comparison to Other Research

Previous research with UK school children aged 5 to 7 years found that students did not always remember to wash hands when needed, and misconceptions were established from a young age [18]. Teenagers in Turkey had knowledge gaps in buying, cooking and storing food safely [19], and UK and Australian teenagers had lower food hygiene knowledge compared to university students [6]. Young adults in Poland and Turkey have reported varying views on the perceived safety of food eaten outside of the home [20]. This echoes the findings of this study and the importance of food safety education from a young age. Parents may instil a belief in their children that food cooked at home is always safe [11]. With the increasing popularity of consuming convenience foods, students may perceive they do not need to develop cooking or food hygiene skills, and students in our study reported basic cooking skills. This can facilitate outbreaks from convenience foods which are not cooked or stored correctly, including *Escherichia coli* O121 [21] and *Listeria monocytogenes* [22]. Counteracting student “invincibility” may be achieved by age-appropriate educational resources that cover the consequences of foodborne illness and prevention [8].

Educational interventions should seek to influence a range of behavioural determinants. The authors of a study exploring food hygiene practices of middle school students noted that behaviour, self-efficacy and knowledge need to be measured and understood together to change behaviour [23]. In our study, students reported needing reminders to improve behaviour. In other studies, perceived behavioural control, referring to an individual’s perception of their ability to perform a behaviour [24], was found to be the strongest predictor of intentions to use food thermometers when cooking poultry and handwashing for 20 s after handling chicken or meat [25].

Evaluation of an educational intervention with Canadian high school students found poor hand hygiene and use of temperature probes pre-intervention, and risky practices remained post-intervention [26], eliciting the need for reinforcement to build good food hygiene habits post-education. Habit strength can improve food safety behaviours, which

can be strengthened by providing cues to action and reminders [27]. A cross-sectional study investigating self-reported knowledge, attitudes and behaviour of 1178 students found that older students and those studying science subjects were more knowledgeable on food hygiene and foodborne disease [28]. Researchers concluded that further educational programmes are needed for youth education on food safety, particularly because learning at home may not be enough to develop good food safety habits [28].

4.3. Future Research Directions

The findings of our study, along with complementary research completed with educators [29], have informed the development of a suite of educational resources for students and educators (available at www.e-Bug.eu [9]) (accessed on 1 April 2021) on food hygiene and food safety. Future steps include implementation of the resources across Europe, and an evaluation to explore the effect of learning on students' knowledge and behavioural intentions around food hygiene.

Other research could focus on students' intentions and habits around food hygiene, and implementation intentions [30] to improve food safety behaviours and look at the links between establishing habits for safe food practices and developing habits for healthy diets. In our study, students discussed learning skills and habits from family members and further research could explore the transfer of knowledge from students to family members. Students also discussed the influence of social media on food hygiene beliefs, and this should be explored further similarly to researchers in China who explored social media emotions of Chinese Weibo users about genetically modified food [31]. Our study was completed before the 2019 coronavirus (COVID-19) pandemic and future research is needed to explore the impact of the pandemic on hygiene behaviours and attitudes to infectious diseases, especially the effect of public handwashing messages.

4.4. Implications for Schools and Student Food Hygiene Resources

Overall, this work indicated that age-appropriate, up-to-date and evidence-based food hygiene resources are needed that encompass a range of different activities to engage students [32]. Earlier research in England and Wales has highlighted that teachers require educational material aligned to the national curriculum to educate on food production [33]. It may be difficult to motivate students to comply with hygiene practices if they lack concern about the consequences; therefore, greater awareness will need to be drawn to this, using rules and reminders in resources, such as recipe books and other ways to combine advice with practical training. Resource developers should work with students, policy-makers, and educators to optimise resources and maximise their dissemination.

Investing in a whole-school approach to implement appropriate food hygiene and handwashing behaviours will help to address student forgetfulness, social influences and environmental barriers identified in our study. As students reported being influenced by social media and key market actors, endorsement of resources by celebrities and promotion through social media may be important for widespread use of resources. Considering the COVID-19 pandemic, hand hygiene will become a higher priority in schools, and therefore access to handwashing facilities will become ever more important.

4.5. Strengths

The study included students from four European countries, rural and urban localities, and high and low socioeconomic status, so results may be applicable to a range of similar student populations. A relevant behavioural theory was used to underpin the research so that findings could be analysed using the same behavioural determinants across all four countries. The use of both focus groups and interviews resulted in rich and detailed information on knowledge, skills, attitudes and beliefs of food hygiene and foodborne illness. A rigorous analysis methodology was used and double coding by a second researcher for each country's dataset meant that any differences in analysis were resolved, until a final coding framework was established.

4.6. Limitations

As several different researchers were involved in conducting focus groups and interviews, style, beliefs and background or language used may have affected the data collection and analysis. However, the effect of this was minimised by use of the same interview schedules translated within countries, and researchers attended regular teleconferences to compare and agree on findings. The schools, teachers and students willing to participate may have been more interested in food hygiene and their experiences may not be typical of other students across Europe. However, the aim of the study was to inform development of resources around food hygiene, and as we reached data saturation gaining a range of student views, any slight bias in student or school selection is outweighed by the insight we gained by any greater interest or experience in food handling through work or courses covered.

5. Conclusions

Adequate food safety education should become part of the basis for health literacy in later life, linking learning, behaviour, habits and choices with health and wellbeing. By working closely with ministries of health and education, food safety and hygiene should be further embedded into the national curriculum in more countries. This will make teaching on the subject accessible for more young people, which is prudent for knowledge transfer between home and school settings.

Supplementary Materials: The following are available online at <https://www.mdpi.com/article/10.3390/educsci11060261/s1>, Supplementary File 1: Focus Group/Interview Topic Guide for students, Table S1: Detailed national curriculum analysis for food hygiene and food safety education in seven European countries, Table S2: Detailed relevant TDF domains, themes and sample quotes from focus groups and interviews with students, Table S3: Summary of less prominent TDF domains, themes and sample quotes from focus groups and interviews with students.

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Institutional Review Board Statement: In England, Public Health England approval was granted by the Research Ethics and Governance Group. In France, ethical approval was not required (according to Article R1121-1-1 of French Public Health Code) and data protection authority's approval was obtained from the Centre Hospitalier Universitaire de Nice. In Hungary, law compliance of the research and ethical issues was ensured by the Legal Department with the official approval of the National Food Chain Safety Office President. In Portugal, approval was granted by the Comissão Nacional de Protecção de Dados. Participants provided written informed consent for participation in the research, audio recording and the publishing of anonymised quotes. A letter with study information was sent to parents or guardians of children under the age of 16 to provide informed consent. Data were collected in line with the Data Protection Act 1998 and Caldicott 1999 regulations on handling and distributing sensitive participant information.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The thematic analyses generated during this study are included in full in this published article and its supplementary information files. The corresponding author can be contacted for further study materials on reasonable request.

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