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LAND ECONOMY WORKING PAPER SERIES

Number: 60 **Consumer clusters and food safety information needs**

Corresponding Author:

Clare Hall
Land Economy Research Group
SAC Research Division
SAC Edinburgh

EH9 3JG
Tel: 0131-535-4124
Email: Clare Hall@sac.ac.uk

CONSUMER CLUSTERS AND FOOD SAFETY INFORMATION NEEDS

Clare Hall

ABSTRACT

The work presented here was conducted as part of an EU-funded five year project investigating pathogens in the food chain, called "Control and prevention of emerging and future pathogens at cellular and molecular level throughout the food chain". Using a questionnaire, research was carried out with consumers in four countries to investigate food safety information needs and information source preferences. The work combined cluster analysis with a social marketing approach. Cluster analysis revealed that the majority of respondents can be allocated to one of eight clusters based on their information needs relating to food safety behaviour and pathogen knowledge. The respondents associated with each of the clusters can be described in terms of characteristics such as whether they have had any formal food safety education, the frequency with which they discuss food safety issues, their preferences for types of food safety messages, and a range of socio-demographic characteristics. The results provide potentially useful information for bodies designing food safety information dissemination strategies, and provide an approach for providing targeted dissemination programs that are directly connected to information needs.

Introduction

Illnesses from food-borne pathogens are one of the most widespread public health concerns worldwide (Mahon *et al*, 2006). As an important contribution to this, it is believed that there are significant microbiological risks associated with poor consumer food-handling behaviours (Redmond & Griffith, 2005). In Europe and north America, more than half of registered food infections appear to be contracted in the home (Beumer & Kusumaningrum, 2003). Other sources claim that perhaps 25% to 40% of reported food-poisoning outbreaks are because of inappropriate food handling and preparation behaviour in the home (Mahon *et al*, 2006). Difficulties arise in establishing accurate figures because of under-reporting and a lack of diagnoses. Despite a lack of consistent figures, it is clear that there is a need for safe food shopping practices, food storage, preparation and handling practices by consumers (Kennedy *et al*, 2005). Thus while food manufacturers and catering outlets have responsibilities to ensure safe food, the individual at home and their handling of food has been described as the 'last line of defence' (Mahon *et al*, 2006). Despite this, it is believed that most consumers under-estimate the contribution of their own domestic food storage and preparation to incidences of food-borne illness (Kennedy *et al*, 2005). Thus, it is argued, there is a need to educate individuals regarding improved food handling and preparation in the home (Mahon *et al*, 2006). Effective consumer food safety education strategies are required to reduce the prevalence of unsafe behaviours used during food preparation in the home (Redmond & Griffith, 2005). It is recognised that there is a requirement for the provision of information for a variety of target audiences in different settings, and thus diverse strategies are required for different groups of consumers (Redmond & Griffith, 2005). Providing better education depends on a better understanding of the modes and channels of communication that people use, thus promotion of safe food handling should be based on the analysis of the specific needs of the target audience (Redmond & Griffith, 2005). This understanding has led to the application of social marketing to areas such as consumer food safety information programmes. Use of the social marketing approach facilitates the development of a consumer-oriented strategy whereby the needs and wants of consumers are investigated and acted upon (Redmond & Griffith, 2005). Consumer perceptions of, and preferences for, different food strategy interventions are likely to affect the potential effectiveness of a consumer food safety education strategy (Redmond & Griffith, 2005).

The work reported here draws on and combines approaches used in two previous studies. The first is work by Redmond and Griffith (2005) investigating consumer perceptions of food safety education sources using the social marketing approach. The second is a survey by Kennedy *et al* (2005) into consumer food safety knowledge whereby home-based food preparers were segmented using factor analysis (Principle Components Analysis) and cluster analysis (Hierarchical Cluster Analysis). The survey designed for this study draws heavily on the work conducted in these two studies. The survey aims are as follows:

- To provide a deeper understanding of consumers' awareness and knowledge of food safety issues, their food safety-related behaviour, and exposure to food safety information
- To provide an evidence-base for formulating recommendations for targeted food safety-related media messages.

Method

A questionnaire was distributed by post to 1000 households in both the UK and Denmark and was carried out by telephone using CATI (Computer Assisted Telephone Interviewing) in Spain and Poland. The questionnaire survey was designed following four focus groups and a review of existing literature and asked questions relating to:

- Food safety behaviour (e.g. relating to meat storage and cooking)
- Knowledge of micro-organisms and food safety
- Knowledge and experience of food poisoning
- Sources of food safety information - experiences and preferences
- Food safety education and training
- Discussions about food safety
- Frequency of exposure to food safety information
- Cooking habits
- Opinions of social changes in food production, supply and cooking
- Newspapers commonly read
- Socio-demographics (age, sex, household structure, employment etc).

Statistical analysis
Data were analysed using SPSS (Statistical Package for the Social Sciences) Version 15. There were four main stages to the statistical analysis

- Descriptive statistical analysis;
- Principal components analysis (PCA) of a number of the response variables to identify underlying patterns of responses in the data;
- Hierarchical cluster analysis (HCA) to identify groups of respondents based on their factor scores from the PCA;
- Definition of each of the clusters following non-parametric statistical testing between clusters and various survey questions

Results

Responses
In the UK and Denmark respectively, 190 and 281 usable surveys were returned. In Spain and Poland respectively, 204 and 200 telephone surveys were successfully completed. These represent response rates of between 22% and 28%.

Respondents
The survey asked for the person responsible for the majority of cooking in the household to complete the questionnaire. Thus, unsurprisingly, the majority of respondents in all countries were female. Table one provides data relating to respondents' socio-demographic characteristics. A greater percentage of Danish respondents live alone, compared to the other countries, but in all four, more than 70% live with other people. In all countries 80% or more respondents have children, although in Spain and Poland these were more likely to be living at home than in the UK and Denmark. Danish respondents were most likely to be working full-time, and in Spain respondents were more likely to be housewives/husbands.

Table 1: Respondents

Characteristic		UK	Denmark	Spain	Poland
Sex					
	Male	26	32	10	10
	Female	74	68	90	90
Residential status					
	Live alone	16	28	11	20
	Live with others	84	72	89	80
Any children?					
	Yes	80	82	82	88
	No	20	18	18	12
Any children under 16					
	Yes	37	34	46	35
	No	63	66	54	65
Any children at home					
	Yes	54	41	71	66
	No	46	59	29	34
Age					
	15-24	5	1	1	4
	25-34	9	8	11	9
	35-44	21	20	29	25
	45-54	23	24	27	21
	55-64	20	24	12	24
	65 and over	22	23	21	19
Occupational status					
	Working full-time	39	54	36	36
	Working part-time	20	10	46	4
	Student/ training	3	2	1	3
	Retired	28	29	10	39
	Not currently working	0.5	2	7	4
	Housewife/ husband	9	4	36	10
	Other	-	-	-	5
Occupational class					
	Professional	14	-	11	6
	Managerial and technical	43	-	32	11

Non-manual skilled	25	-	24	19
Administration/ service sector	-	-	-	38
Manual skilled	7	-	7	12
Partly/ Unskilled manual	8	-	27	6
No occupational classification	2	-	0	10
Education level				
Basic education	-	12	-	-
Further education - vocational	-	26	-	-
Further education - academic	-	7	-	-
HND equivalent	-	22	-	-
First degree (bachelors)	-	32	-	-
Second degree (masters/ PhD)	-	12	-	-

Pathogen knowledge

Respondents were asked about their knowledge of food sources associated with 11 micro-organisms. In the UK there are three key pathogens for which people identified a correct source (salmonella, ecoli 0157 and listeria monocytogenes) (figure one). Respondents had very little knowledge of the other eight pathogens. In Denmark, Spain and Poland there is only one key pathogen for which a large percentage of respondents identified a correct source (salmonella). In Denmark, reasonable levels of knowledge of an additional four pathogens were demonstrated by the respondents but there was very little knowledge of the other six. Likewise in Spain and Poland, respondents demonstrated some familiarity with only one other pathogen (clostridium botulinum and ecoli 0157, respectively).

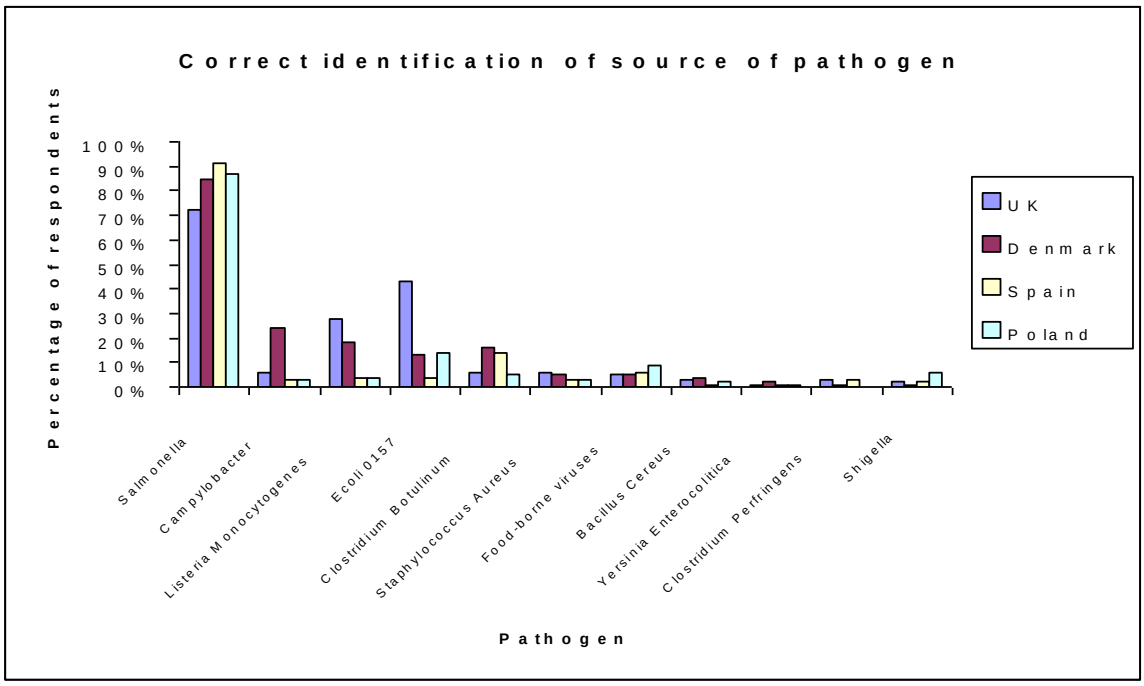

Figure 1: Pathogen knowledge

Behaviour Respondents were asked a range of questions about their food safety-related behaviour. Questions included those related to cross-contamination issues such as the one shown in figure two. This demonstrates a large degree of consensus between the four countries, suggesting that some food safety messages have been successfully disseminated. Almost all respondents in all four countries claim to wash their chopping board with hot water and detergent after using it to cut raw meat and before using it again. Other questions referred to meat storage and cooking. In the case of the latter topic, as shown in figure three, messages appear not to have been so successfully provided to householders across Europe as there is a large variation in approaches taken by individuals to test whether or not poultry meat is cooked.

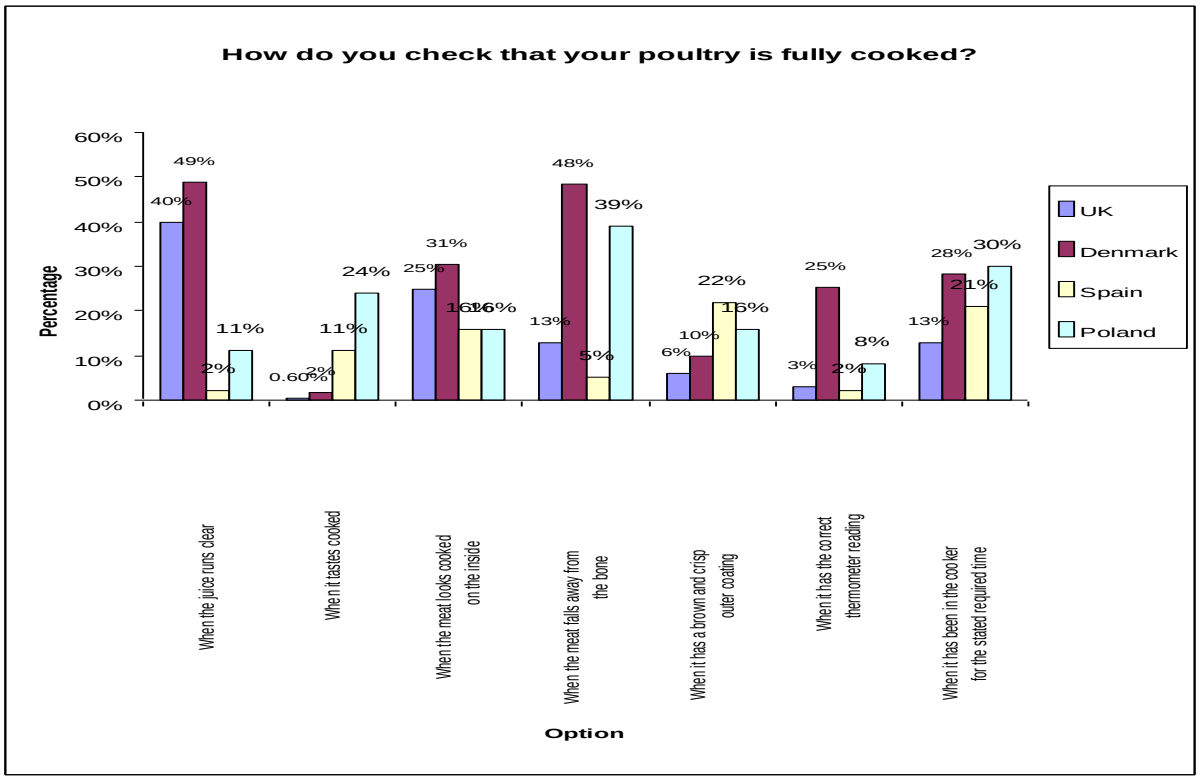

Figure 2: Behaviour relating to cross-contamination

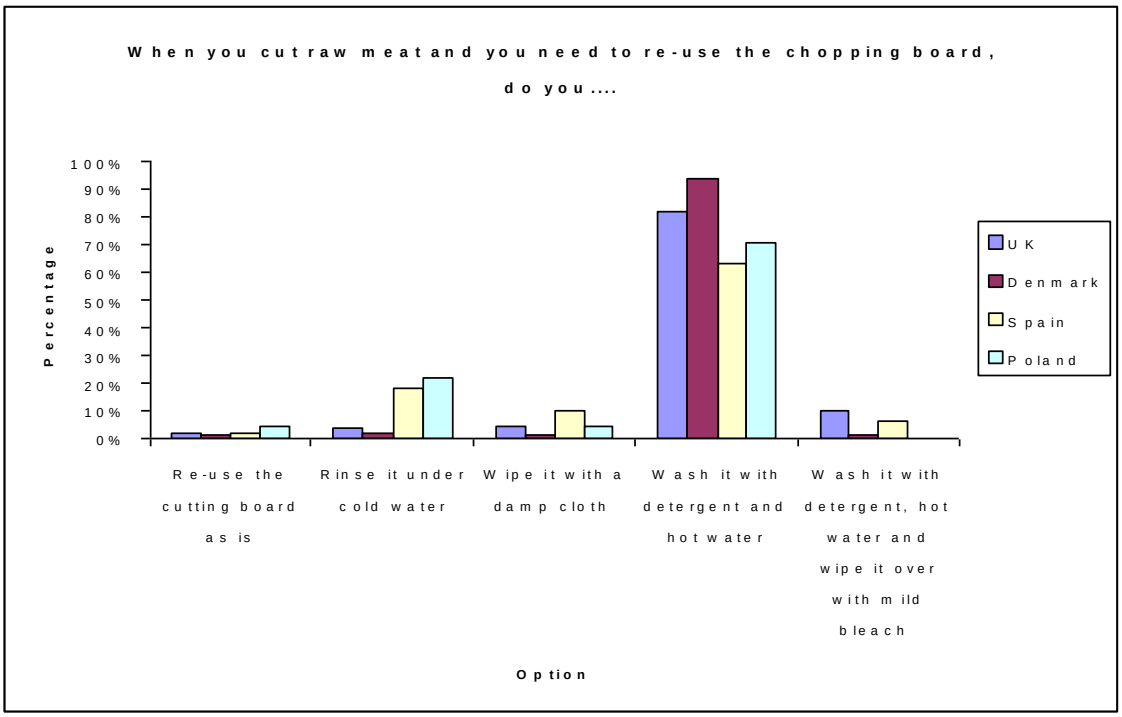

Figure 3: Behaviour relating to meat cooking

Descriptive statistics: Behaviour and experience

Respondents in the UK and Denmark were more likely to agree with the statement "I am likely to act upon food safety-related information" than those in Spain and Poland (table two). Respondents in the UK, Denmark and Spain were more likely than respondents in Poland, to have had some formal food safety training or education. UK respondents were least likely to say that they cooked from scratch at least three times per week. In most countries it is a minority who discuss food safety issues on a weekly basis,

although, particularly in Denmark, a reasonable percentage discuss the topic monthly. Likewise, the majority of respondents in all countries hear or listen to food safety information only monthly or less frequently.

Table 2: Behaviour and experience

Question	UK	Denmark	Spain	Poland
I am likely to act upon food safety-related information				
Agree	80	85	64	61
Neutral	13	13	18	17
Disagree	4	1	11	23
Don't know	3	0	6	0
Had any formal food safety training or education?				
Yes	48	45	35	15
No	52	55	65	85
Frequency of food safety discussions with friends and family				
Never	28	9	18	18
1 or 2 times per year	25	29	33	35
1 or 2 times per month	27	45	23	4
1 or 2 times per week	16	13	17	30
3 to 7 times per week	3	4	6	12
More than 7 times per week	0.5	0.5	2	2
Frequency of listening to food safety information				
Never	12	3	4	4
1 or 2 times per year	27	22	25	45
1 or 2 times per month	47	55	32	7
1 or 2 times per week	11	16	26	15
3 to 7 times per week	3	4	6	28
More than 7 times per week	-	1	2	0.5
How often do you cook from scratch?				
Never	3	1	1	1
Less than once a week	-	-	-	2
1 or 2 times per week	23	13	12	16
3 or 4 times per week	28	24	14	29
More than 4 times per week	46	62	74	54

Opinions and attitudes

Across all four countries high levels of agreement were found with the statement "People's changing lifestyles (involving less 'cooking from scratch') mean that, in general, levels of food-safety knowledge are decreasing" (table three), suggesting that similar social changes are underway. There was also strong support in all four countries for the idea that children should learn about food safety issues at home, but even stronger agreement that schools should teach children about such issues. Generally there was agreement that modern methods of food production have lead to safer food although less certainty about whether supermarkets provide safer food than smaller independent shops or vice versa.

Table 3: Opinions and attitudes

Statement	UK	Denmark	Spain	Poland
People's changing lifestyles (involving less 'cooking from scratch') mean that, in general, levels of food-safety knowledge are decreasing				
Strongly disagree	3	4	9	7
Disagree	9	9	9	17
Neutral	19	21	19	11
Agree	28	27	19	30
Strongly agree	41	40	41	31
Smaller, independent food shops such as butchers, green grocers and fishmongers provide safer food than do large supermarkets				
Strongly disagree	6	9	10	6
Disagree	16	18	13	7
Neutral	38	40	25	11
Agree	22	21	15	24
Strongly agree	18	11	32	50
Children should learn more about cooking and food safety-related issues at home				
Strongly disagree	2	1	0.5	4
Disagree	4	2	2	3
Neutral	15	12	12	6
Agree	34	28	21	34
Strongly agree	46	57	62	53
Modern methods of food retailing (e.g. large supermarkets) have, in general, led to improved levels of food safety				
Strongly disagree	3	4	12	27
Disagree	14	21	16	28
Neutral	43	36	27	17
Agree	34	31	20	13
Strongly agree	5	8	18	12
Schools should provide children with greater levels of cooking-related and food safety-related education				
Strongly disagree	0.5	2	1	3
Disagree	1	2	4	2
Neutral	12	19	7	5
Agree	32	27	18	29
Strongly agree	54	50	68	60
Modern methods of farming and food production have, in general, led to improved levels of food safety				
Strongly disagree	9	5	9	9
Disagree	13	17	17	13
Neutral	27	25	27	15
Agree	40	35	21	39
Strongly agree	12	18	23	23

Information source preferences

Table four shows the average preferences of respondents from the four countries for different media as a source of food safety information. The table shows the average percentage of respondents from across the four countries who rated the information source as ‘5’ on a five point scale that ran from ‘1 - not preferred at all’ to ‘5 - highly preferred’. Thus, 38% of respondents indicated that TV documentaries were a highly preferred source of food safety information while only 14% indicated that leaflets in magazines were a highly preferred source of food safety information. Broadly speaking there are three groups of preferred media sources (based on percentage of respondents ranking the media source as highly preferred). First, television (documentaries and cookery programmes) is the most popular media source. Second, leaflets in supermarkets and articles (either in newspapers or magazines) are the next most popular media sources.

The third group of preferred media sources (those least popular) includes radio, websites and leaflets in newspapers and magazines.

Table 4: Information source preferences – Percentage rating the information source as 5 (Highly preferred as a source of food safety information)

Media source	Four country average
TV documentaries	**38 (1)**
TV cookery programmes	**36 (2)**
Newspaper articles	**22 (3)**
Supermarket leaflets	**21 (4)**
Magazine articles	**20 (5)**
Radio	**17 (6)**
Websites	**15 (7)**
Leaflets in newspapers	**15 (7)**
Leaflets in magazines	**14 (9)**

Information needs

Following completion of the questionnaire in the four EU countries, cluster analysis was conducted in order to identify respondents' food safety information needs. The cluster analysis resulted in four clusters of respondents in all four member states (UK, Denmark, Spain, Poland).

The clusters can be defined in terms of a combination of two things: **knowledge** (of pathogens) and **good practice** (in food safety-related behaviour). The latter is based on a number of questions from the questionnaire, and thus relates variously to some or all of the following food safety behaviour topics:

- Storage location of raw meat within the fridge at home
- Cleaning practices when re-using a knife that has cut raw meat
- Cleaning practices when re-using a chopping board that has had raw meat on it
- The way(s) in which red meat is checked to establish if it is cooked
- The way(s) in which poultry is checked to establish if it is cooked

Having identified clusters at the country-level, the aim was to define cross-country clusters with similar information needs. Twelve different clusters with different knowledge and behaviours are identifiable and 784 respondents are represented by eight of those (excluding clusters representing <25 individuals), as shown in table five (shaded cells represent a cluster with >25 individuals).

Table 5: Twelve clusters

	Has knowledge of familiar pathogens only	**Has knowledge of both familiar and unusual pathogens**	**Has knowledge of unusual pathogens only**	**Does not have knowledge of either familiar or unusual pathogens**
Demonstrates good behaviour in relation to food storage	Poland (C2/n=51)			
Demonstrates good behaviour in relation to food preparation				Spain (C1/n=85); Denmark (C1/n=113); UK (C2/n=101)
Demonstrates good behaviour in relation to meat cooking		Denmark (C3/n=21)		
Does not demonstrate good behaviour	Poland (C1/n=27); UK (C1/n=20)	Spain (C3/n=13)	Spain (C2/n=78)	Denmark (C4/n=16)
Demonstrates good behaviour in relation to food storage and preparation	Poland (C4/n=86)			

Demonstrates good behaviour in relation to food preparation and meat cooking			Spain (C4/n=28)	Poland (C3/n=33); Denmark (C2/n=122)
Demonstrates good behaviour in relation to food storage, preparation and meat cooking	UK (C3/n=58)	UK (C4/n=8)		

This means that in terms of information needs there are eight different 'types' of people, as shown below (for example, UK cluster 1 and Poland cluster 1 have the same information needs – both lack knowledge of the more unusual pathogens and neither demonstrate any good practice relating to food storage, preparation or cooking (cluster 7):

1) Needs information about both more familiar and unusual pathogens and advice on food storage and meat cooking
2) Needs information about both more familiar and unusual pathogens and advice on food storage
3) Needs information about more unusual pathogens and advice on meat cooking
4) Needs information about more familiar pathogens and advice on food storage, preparation (cross-contamination issues) and meat cooking
5) Needs information about more unusual pathogens
6) Needs information about more unusual pathogens and advice on food preparation (cross-contamination issues) and meat cooking
7) Needs information about more unusual pathogens and advice on food storage, preparation (cross-contamination issues) and meat cooking
8) Needs information about more familiar pathogens and advice on food storage

Defining the clusters

Another aim of the research was to identify, not just clusters of consumers and their information needs, but certain characteristics of those clusters. It is usual for consumer clusters to be defined in terms of socio-demographic characteristics and this has been attempted in this case. However, in addition, this study has attempted to describe the clusters based on other characteristics including information preferences, where possible. The findings reported in the cluster descriptions below were all found to be statistically significant at defining the individuals associated with that cluster.

CLUSTER ONE (n=299)

Needs information about both more familiar and unusual pathogens and advice on food storage and meat cooking

Cluster one respondents are likely to be young. They are unlikely to have had any formal food safety training and are likely to hear food safety messages only one or two times a month. Because they lack formal food safety training they are likely to say that family and friends have made a significant contribution to their knowledge of food safety issues. It is likely that they cook from scratch only three or four times per week (this is less frequently than average). In line with their own source of food safety information, they are likely to agree with the statement "children should learn more about cooking and food safety-related issues at home". Interestingly they are unlikely to agree with the statement that supermarkets have led to improved food safety and correspondingly are likely to agree with the statement that smaller shops provide safer food than supermarkets. In terms of news media readership they are likely to read both quality daily newspapers online and daily tabloids. They are also likely to read Sunday tabloids and are therefore unlikely to read Sunday broadsheets. However, there were differences between countries. Usefully, it is possible to say that 'general' food safety information is a highly preferred 'type' of message for this group, rather than messages about specific types of food, specific hygiene issues, or food poisoning symptoms.

CLUSTER TWO (n=155)

Needs information about both more familiar and unusual pathogens and advice on food storage

A considerable amount of information is available to help describe the characteristics of those associated with cluster two. First, they are likely to be female, to live with a partner or spouse, to have children and to

be in part-time work. That part-time work may well have been in the catering industry as they are likely to have received some food safety education in the workplace. It is probable that they cook from scratch more than four times per week. It seems that they favour informal ways of learning about food safety as they are likely to agree with the statement that children should learn about food safety at home. They demonstrate a reasonable level of interest in the topic of food safety and are likely to discuss food safety issues one or two times per month. Further, it is possible to say something about the information sources likely to be useful to them. They are unlikely to read quality newspapers on-line and accordingly are likely to indicate that receiving food safety information through websites is not a preferred source. Further they are likely to have a neutral opinion about receiving food safety information through articles in newspapers.

CLUSTER THREE (n=86)
Needs information about more unusual pathogens and advice on meat cooking

The people associated with cluster three are likely to live with a partner or spouse and to have children living at home. Of relevance here is the fact that they are likely to indicate that articles in newspapers are a preferred source for receiving food safety information.

CLUSTER FOUR (n=78)
Needs information about more familiar pathogens and advice on food storage, preparation (cross-contamination issues) and meat cooking.

Those represented by this cluster are likely to be the oldest of the respondents and thus are most likely to be 45 years or older and most likely to be retired. They are unlikely to have had any food safety training and thus are likely to say that school, college, cookery classes or job training had only a minimal amount of importance as a contribution to their knowledge of food safety issues. Importantly, they are likely to express a preference for leaflets in supermarkets as a source of food safety information and likely to say that 'general' food safety information is a highly preferred 'type' of message.

CLUSTER FIVE (n=58)
Needs information about more unusual pathogens

There is no indication of the socio-demographic characteristics of those associated with cluster five, but there is information about their opinions, their likely response to food safety information and about preferred information sources and messages. First, they are likely to agree that smaller shops provide safer food than supermarkets. In terms of news media readership, those associated with this cluster are unlikely to read only daily tabloids and are likely to read news online. Importantly they are likely to agree with the statement "I am likely to act upon food safety-related information". This suggests they are likely to be responsive to such information. In line with this, they appear very responsive to different kinds of messages and are likely to express a preference for food safety information about specific types of food, about specific hygiene issues, and about symptoms of, and medical details about, food poisoning. In terms of trusted organisations they are likely to express a preference for food safety information provided by local authority officers.

CLUSTER SIX (n=51)
Needs information about more unusual pathogens and advice on food preparation (cross-contamination issues) and meat cooking

There was a lack of statistically significant findings allowing the description of those associated with this cluster. However, they are likely not to have had any formal food safety training. There is also some indication about their preferences for information sources. Specifically, they are likely to indicate that leaflets and articles in newspapers are a preferred source for receiving food safety information.

CLUSTER SEVEN (n=47)
Needs information about more unusual pathogens and advice on food storage, preparation (cross-contamination issues) and meat cooking

The people represented by this cluster are likely to be single and male. Although they may have received some food safety education at university, it is more likely that they have not had any formal food safety education or training. Accordingly, they are unlikely to say that a cookery class or job training has contributed to their knowledge of food safety issues. They cook from scratch least frequently, are likely to

agree that supermarkets have led to safer food and are therefore unlikely to agree that smaller shops provide safer food than supermarkets. Importantly, they are unlikely to agree with the statement “I am likely to act upon food safety related information”.

Despite having the greatest need for food safety information, this group is unlikely to express any interest in food safety information. They are likely to have a neutral opinion about receiving food safety information through leaflets or articles in newspapers. Similarly, they are likely to indicate a neutral opinion about receiving food safety information through websites and are unlikely to express a preference for food safety information provided through television cookery programmes (although, note that this is not quite statistically significant). In addition, they are unlikely to express a preference for food safety information provided by local authority officers. In terms of types of food safety messages, they are unlikely to express a preference for food safety information about specific hygiene issues, or food safety information in general or about symptoms of, and medical details about, food poisoning. All in all, this group appears to have no interest in food safety messages of any kind, through any source.

CLUSTER EIGHT (n=28)

Needs information about more familiar pathogens and advice on food storage

Those represented by this cluster are likely to be among the older respondents, and are therefore likely to be retired. They are unlikely to have had any food safety training and, accordingly, are likely to say that school, college, cookery classes or job training had only a minimal amount of importance as a contribution to their knowledge of food safety issues. Further, they are likely to only listen to (or to hear) food safety information one or two times per month. However, they do express some preference about the type of food safety message they would welcome. Specifically, they are likely to say that ‘general’ food safety information is a highly preferred ‘type’ of message, and further, that leaflets in supermarkets are ‘slightly preferred’ as a source of food safety information.

Conclusions

Knowledge of pathogens and the food sources with which they may be associated was found to be poor in all countries. However, it could be argued that this is not particularly important and that what is important is that people routinely utilise good behaviour to avoid food poisoning. It is therefore significant that the standard of stated food safety-related behaviour was found to be variable between issues and between countries. This suggests that some food safety messages have been successfully disseminated but that others have not.

It has been shown that it is possible to identify cross-country consumer clusters based on their food safety-related information needs. Further, these clusters have been described in terms of socio-demographic characteristics, information source preferences, opinions, behaviours, news readership and regularity of food safety-related discussions (among other things). This provides a considerable amount of information that could be of use to those designing food safety information strategies. However, practitioners would need to consider the practicalities of disseminating information to targeted groups such as those identified here. Whether or not it would be desirable, or indeed feasible, to disseminate food safety information that is so specifically focussed on the needs of particular groups is a point for debate.

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