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Public Perceptions of the Dioxin Crisis in Irish Pork

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Abstract

In early December 2008, a global recall of Irish pork was initiated as a result of a subset of the national pork output being contaminated with dioxin. In this study, members of a panel from an internet-based longitudinal monitor of public opinion on food and health, was used to assess public perceptions about the dioxin incident in late December. A larger proportion of respondents reported that there was a 'very high' health risk from pork (8.6 %) than any other food of animal origin. The risk posed to human health from dioxins was considered to be relatively high compared to a broad range of potential food and non-food risks. The majority of respondents (70.5 %) accepted that the way in which the authorities managed the crisis was 'adequate' or 'very efficient'. These findings should be considered in light of the following facts: the European Food Safety Authority and the Irish authorities announced that there was no risk to human health from the dioxins in pork, there was extensive media attention about the dioxin incident, and the Irish Government had to introduce a 200 million euro compensation package for the Irish pork industry which was funded by the Irish taxpayer.

Introduction

Dioxins (polychlorinated dibenzo-p-dioxins, PCDDs), furans (polychlorinated dibenzofurans, PCDFs) and polychlorinated biphenyls (PCBs) are persistent chemical contaminants in the environment (Schechter et al. 2006). Although there are natural sources of dioxins such as forest fires, dioxins are usually formed as by-products of certain industrial combustion and chemical processes. They are highly resistant to breakdown processes, and therefore persist in the environment, and can be taken up into the food chain (Food Safety Authority of Ireland 2008). These persistent organic pollutants accumulate in the fat of animal species or in plant tissue. Their persistence also means that once dioxins have entered the body, they can endure there for a long time. Their half-life in the body is estimated to be seven to eleven years (DeVito et al. 1995). When present in the environment, dioxins tend to accumulate in the food chain, with the greatest concentration of dioxins higher in the food chain (World Health Organization 2007). Approximately 90% of human exposure to these compounds results from the consumption of contaminated food (Food Safety Authority of Ireland 2008).

Short-term exposure of humans to high levels of dioxins may result in skin lesions, such as chloracne (the most notable incident is the 2004 case of Viktor Yushchenko, President of the Ukraine, whose face was disfigured by chloracne in a deliberate poisoning incident), patchy darkening of the skin, and altered liver function. Long-term exposure is linked to impairment of the immune system, the developing

nervous system, the endocrine system and reproductive functions. Chronic exposure of animals to dioxins has resulted in several types of cancer (DeVito and Birnbaum 1994).

Since the Belgium dioxin incident in 1999 there has been an increased awareness in the European Union of the dangers posed by dioxins, furans and PCBs in the food chain. At the beginning of this incident, high levels of dioxins were found in poultry and eggs from Belgium. Subsequently, dioxin-contaminated animal-based food (poultry, eggs, pork), were detected in several other countries. The cause was traced to animal feed contaminated with illegally disposed PCB-based waste industrial oil (Verbeke 2001). This dioxin incident cost the Belgian Treasury in excess of 1 billion euro, the Minister of Agriculture had to resign, followed by the Minister of Health and eventually the entire Belgian government collapsed (Buzby and Chandran). Due to this dioxin incident, the United States of America banned certain categories of food from the entire European Union. The Belgian dioxin incident, along with the previous BSE crisis, undermined EU consumer confidence in the safety of the food supply, in industry's commitment to produce safe food and in the regulators ability to police the food chain effectively. These incidents precipitated a reform of EU Food Law and led to the creation of independent national agencies and the European Food Safety Authority (EFSA). Since the Belgian incident, many countries monitor their food supply for dioxins and this has led to early detection of contamination and has often prevented impact on a larger scale.

For example, in July 2007, the European Commission issued a health warning to its Member States after high levels of dioxins were detected in a food additive - guar gum

- used as thickener in small quantities in meat, dairy, dessert or delicatessen products (Miklos, Ildiko, and Attila 2008). The source was traced to guar gum from India that was contaminated with pentachlorophenol (PCP, which contains dioxins as contamination.), a pesticide no longer in use. In another incident, elevated dioxin levels were detected in animal feed in the Netherlands in 2006 and the source was identified as contaminated fat used in the production of the feed. In 2004, a notification of elevated levels of dioxins in milk from the Netherlands resulted in the discovery of a serious contamination of feed with dioxins coming from kaolinitic clay (European Commission 2004). Another case of dioxin contamination of food occurred in the U.S. in 1997 where chickens, eggs, and catfish were contaminated with dioxins when again tainted clay was used in the manufacture of animal feed. The contaminated clay was traced to a bentonite mine. As there was no evidence that hazardous waste was buried at the mine, investigators speculate that the source of dioxins may be natural, perhaps due to a prehistoric forest fire. In March 1998, high levels of dioxins in milk sold in Germany were traced to citrus pulp pellets used as animal feed exported from Brazil. The investigation resulted in a ban on all citrus pulp imports to the EU from Brazil (World Health Organization 2007).

The most recent dioxin incident was in Ireland in December 2008.

The dioxin incident in Ireland began with the discovery, during routine monitoring, by the Department of Agriculture, Fisheries and Food (DAF) of the presence of marker PCBs (indicative of possible dioxin contamination) in pork fat. Further analysis confirmed that dioxins were present in the samples. It was estimated that approximately

10% of pig-meat from the Republic of Ireland was affected by the contamination. However, as all Irish pigs are slaughtered and processed in a small number of large processing plants, it was not possible to distinguish between potentially contaminated and non-contaminated product. Therefore, as a precautionary measure, and in the interest of protecting public health, all pork products manufactured from pigs slaughtered in Ireland between 01 September and 06 December were recalled. Risk assessments by the Food Safety Authority of Ireland (FSAI) and by EFSA concluded that there was minimal risk to health for anyone who had consumed contaminated pork products in the three months prior to the recall. However, as the toxicity of dioxins is related to 'body burden', the dioxins could be harmful to health if people were exposed to them over a significant period.

The sequence of events are summarised below.

- 19/11/08

Routine pig fat sample taken under the National Residues Programme for screening at the National Pesticides Laboratory

- 28/11/08

Preliminary laboratory result was indicative of marker PCB

- 29/11/08

The implicated farm was visited to evaluate possible sources of contamination. Additional pigs were slaughtered and animal feed samples were taken for examination.

- 1/12/08

Samples from the implicated farm tested positive. One component of the animal feed (“recycled bread meal”) tested positive for PCBs (E.U. legal limit in animal feed: 0.75pg/g, levels detected in animal feed: 5200pg/g, E.U. legal limit for pig fat: 1pg/g, levels detected: 80 – 200 pg/g). Preliminary movement restrictions imposed on farm

- 2/12/2008

More samples tested positive for PCBs. The Department of Agriculture, Fisheries and Food (DAF) visited the animal feed producer and took samples.

- 3/12/2008

Forty two samples of feed ingredient (dating back to September 2008) were taken for analysis by the producer. Seven pig producers with ten sites, and 38 cattle farms which were customers of the feed ingredient were identified

- 4/12/08 (Initial Press Statement)

Ten pig farms (mill’s client list) placed under restriction. Thirty eight cattle farms (mill’s client list) put on formal notification imposing movement restrictions on cattle farms. Six pig samples from units (slaughtered on 3/12/08) positive on screening test for NDL-PCB’s. DAF issued a press release.

- 5/12/08

The Dutch authorities alert Irish authorities that an investigation is under way in Holland into reports of dioxins in pork. The country of origin not confirmed. A Belgian rendering plant reported finding dioxins since mid-September in composite fat which was from several EU Member States. Pork samples were found to be positive in France, pork was from a Dutch processor, but the country of origin was not confirmed

- 6/12/08

Discussions with European Commission took place. Confirmation from UK reference laboratory that four pig fat samples showed Dioxin levels ranging from 80 – 200pg/g. One initial recycled bread sample showed higher levels (> 2000pg/g). FSAI advise a recall of all pork products manufactured from pigs slaughtered in Ireland between 01 September and 06 December.

- 07/12/2009

FSAI issue a statement advising on its risk assessment – that there were no adverse health effects for consumers.

- 08/12/2008

The European Commission request that EFSA carries out a risk assessment on public health. A risk assessment indicated that the risk from beef is 300 times less for beef than pork

- 09/12/2008

EFSA confirm that there is no risk to the public based on the time of exposure and the measured taken

- 11/12/2008

Irish pork products return to the market. Processors agree a compensation package with the Government and processing resumes.

The news about the dioxin incident was released publicly at a press conference in the Government's Press Centre on the night of Saturday 6 December, 2008. This was followed by an unprecedented level of Irish media coverage, for almost a week, on a single food issue. The pork crisis was headline news, both nationally and across the

globe, in a story that had the potential to significantly damage the Irish food industry in the long term. The message for consumers from the Irish authorities was clear - that they should not consume Irish pork and bacon products and that they should not be unduly concerned as short term peak exposure to dioxins and PCBs does not result in adverse health effects.

Over the subsequent days, the story moved from one about consumer protection, through to one about consumer rights, to the damage to the industry and desire for compensation, to ultimately the return of Irish pork products back to the market. Numerous voices, with a corresponding level of opinions, entered the media debate (Food Safety Authority, 2008). Speculation in the media about the long-term effects of the crisis led to headlines such as “Fears of meltdown with industry on knife edge” (Irish Independent, 09/12/2008) to “2,000 on protective notice in pig industry” (Evening Herald, 09/12/2008) appearing.

During the dioxin incident, the FSAI press office dealt with over 700 individual phone calls, as well numerous emails, from journalists. The vast majority of these were from our national media, with small numbers from the UK, France and Japan. From the initial announcement of contamination of Irish pork, through to the product going back on the shelves, there were 385 articles in national newspapers, over 200 articles in regional newspapers, over 70 radio news reports and interviews, 17 national TV news reports and interviews. From the time the recall was announced (6 December) to 10 December a total of 3,725 queries were recorded by the FSAI advice-line and over 2,660

calls were responded to that Sunday (7 December); the highest number of calls ever received by the FSAI on any one day (Food Safety Authority, 2008). Furthermore, during November 2008 (before the dioxin incident) there were 16 blogs published on the Internet about 'dioxin and pork' but for the month of December 2008 there 2,881 blogs published. Similarly to the number of blogs in November, there were 67 and 53 blogs published in January 2009 and February 2009 respectively (Google blog search).

In terms of food safety legislation, Regulation (EC) No 178/2002 of 28 January 2002 laying down the general principles and requirements of food law, establishing EFSA and laying down procedures in matters of food safety states that all food and animal feed businesses in Europe are required to establish and implement food traceability systems, which are compliant with current legislation. In the EU it is a legal requirement to have a system or set of procedures that allows food businesses to trace products one step forward and one step back in the food chain. This simply means that food businesses know who supplied them and where their product has gone. However, there is no legal requirement for food businesses to have traceability systems which can trace raw materials into particular finished products in another processor (i.e. Process Traceability). It is not a legal requirement for pork abattoirs to be able to identify exactly which pork carcass from a particular farm went into each batch of finished pork product. Regulation (EC) No 178/2002 also formally establishes the Precautionary Principle as an option where, following an assessment of available information, the possibility of harmful effects on health is identified but when scientific uncertainty persists, provisional risk management measures may be introduced.

How incidents such as the dioxin crisis in Ireland are perceived by the public is critical to the risk management of incidents in the future. Food safety risk perceptions in any given country are believed to be a function of: baseline food safety risks from domestically produced food, food safety risks from internationally imported food, access to and extent and nature of information about food safety risk levels and related topics, trust in the different sources of information, national experience with major food safety incidents, perception of science and risk assessments, current ability to avoid/control different food safety risks, and knowledge and acceptance of food technologies (Buzby 2001).

Risk perception may be influenced by a number of factors, such as unfamiliarity, lack of control, perceived consequences, and hazards being seen as catastrophic and having risk for future generations (Slovic, Fischhoff, and Lichtenstein 1980). Sparks et al. (1994) describe three variables that account for 87% of the variance observed in risk perception, these are 1) severity, 2) unknown, and 3) number of people exposed (Sparks and Shepherd 1994). Fife-Shaw used different characteristics and hazards to and found a similar structure across 19 categories to that of Sparks et al. (Fife-Shaw, 1996). Similarly a Eurobarometer study in 2006 on risk perceptions found that consumers are more likely to worry about risks caused by external factors over which they have no control than risks which they feel they can control (Eurobarometer 2005). Other studies which focused on more specific food risks such as the perceived risks associated with GMOs (Finucane 2007) (Frewer et al. 2004) (Bonny 2003) (Siegrist 1998) (Sjöberg 2004) and

biotechnology (Siegrist et al. 2007) (Frewer, Shepherd, and Sparks 1994) (Gaskell 2001) for example and found that consumers perceptions of the risks posed by such technologies were based on, for example the levels and types of media attention, trust in the scientific community and lack of knowledge.

There is less published literature on public perceptions of food risks during crises and the stability of consumer trust in food safety agencies during times of food crises. As reported by Verbeke et al. in 2001 there is a need for longitudinal studies on food risk perceptions so that changes in risk perceptions could be studied over time. Furthermore, it is important to understand the structure of public concerns for the purpose of assuaging public fears through more effective risk communication during a crisis (Fife-Schaw and Rowe 1996). This present study reports the results of a longitudinal monitor which captured the perceived risks relating to meat and pork soon after the dioxin crisis in Ireland along with levels of trust in food safety agencies in Ireland and the perceived most important consequence of the dioxin crisis.

Methods

The UCD Food and Health Survey is an online survey which began in November, 2008. It is designed to capture data on perceptions, attitudes and behavior of Irish people in relation to a variety of food risks on a monthly basis. The participants of this longitudinal risk-monitoring panel were chosen randomly from the Irish population using the GeoDirectory and invited to participate. The GeoDirectory is a database of all occupied

residences in the Republic of Ireland compiled by Ordnance Survey Ireland and An Post (the Irish postal service). At the time, December 2008, there were 350 panel members questioned specifically on the dioxin issue. Information on various socio-demographic characteristics of the respondents in the internet panel participants was collected in the initial survey rounds.

Respondents were asked about the risks posed by various foods of animal origin. They were asked to rate the risk of both pork and beef out of 100. Respondents were also asked 'What is the most important consequence of finding dioxins in Irish pigmeat? (1 = The economic loss to Irish farmers and processors, 2 = The loss of our reputation as 'Ireland the food' Island, 3 = The temporary loss of some of our favourite foods such as sausages, rashers and ham, and 4 = The health implications of illegal chemicals in our food). They were asked in an open-ended question if they had any comments about the dioxin crisis. They were asked, 'How would you rate the Irish authorities response to the recent dioxin scare in Irish pork? (1 = Very Efficient, 2 = Acceptable, 3 = Somewhat Inefficient, 4 = Incompetent. They were given a list of possible answers (food manufacturers, media, supermarkets, farmers, public authorities, consumer groups, scientists and physicians/doctors and asked who they would trust the 'most' and 'least' to inform them about the dioxins in pork. They were asked who they think is mostly responsible for the safety of the food that they eat (farmers, food companies, government, health authorities, food retailers, food service providers, yourself and all of the above). They were also asked how likely they thought that more vulnerable groups of the population would be to suffer from food borne illness on a 5-point likert scale (1 = very

likely, 5 = very unlikely). Finally they were asked to rate the risk posed to human health by a variety of food and non-food related potential risks. STATA for Windows version 9.0 (STATA Corp, Texas, USA) was used to analyse the data.

Results

In terms of age, there were 5.2 % in the 18-24 age category, 24.2 % in the 25-34 age category, 27.5 in the 35-44 age category, 37.5 % in the 45-64 age category and 5.4 % 65 + category. The average age of respondents was 41 years. There were male (29.7 %) and female (70.3 %) respondents. Most respondents (52.2 %) were married, 16.6 % were single, and approximately 8.0 % were either going out with someone, living with a long-term partner or divorced/widowed or separated¹. Respondents were from rural areas (7.8 %), small villages (11.4 %), towns (31.0 %), suburbs (31.2 %) and cities (18.6 %). About a third (31.7 %) of respondents did not have any children. More than half (58.0 %) reported that they were in a very good or good financial situation. However, 75.5 % reported that they were slightly, fairly or very worried about their financial situation and 60.8 % report never running out of money.

Few (3.8 %) of respondents were vegetarians. Most (76.9 %) of respondents reported being the main food preparer. Almost half (42.9 %) worked in the food of

¹ According to the census data from Ireland in 2006, the average age of the population in Ireland was 35 years, the ratio of males to females was 1:1 and there were 53.9 % single, 37.7 % married, 3.3 % separated and 5.0 % divorced people in the country (Central Statistics Office, Ireland, 2006). According to the Household Budget Survey in 2005, the profile of the main food shopper was gender; male (22 %) and female 78 %) and age; 18 – 24yrs (6.3 %), 25 – 34 yrs (18.8 %), 35 – 44 yrs (21.9 %), 45 – 64 yrs (40.6 %) and 65+yrs (12.5 %) (Amarach, Marketing Research, Ireland, 2008).

hospitality industry before. One third (33.1 %) had some nutrition education previously and 19.4 % had some food safety education previously. In terms of self-assessed general health the responses were excellent (19.0 %), very good (41.4 %), good (29.8 %), fair (8.3 %), and poor (1.4 %). Most (61.7 %) reported that their health was about the same as last year. Most (84.0 %) consider their diet to be healthy (45.3 %) or average (38.7 %). Respondents rated their own food safety knowledge as very good (17.1 %), good (48.8 %), fair (30.6 %) and bad (3.5 %). About a third (35.2 %) of respondents had suffered from food poisoning once before and 21.3 % had suffered from food poisoning more than once before.

Respondents were asked about the risks posed by various foods of animal origin (see Table 1). More respondents (8.6 %) reported that pork posed a 'very high' risk than any other food of animal origin. When respondents were asked to rate the health risk posed, the responses were 26 out of 100 (with 5, 15 and 40 in the 1st, 2nd and 3rd percentile respectively) for pork and 20 out of 100 (with 5, 10 and 30 in the 1st, 2nd and 3rd percentile respectively) for beef. When respondents were asked what they thought was the most important consequence of finding dioxins in Irish pig meat the majority reported the health implications (64.3 %), followed by; the loss of the reputation of Ireland as a food exporter (19.8 %), the economic loss to Irish farmers and processors (13.0 %), and finally the temporary unavailability of some of our favorite foods such as sausages (2.9 %).

When respondents were asked if they had any comments about the dioxin crisis the following quotes were reported under the themes of 'Economic loss', 'Ineffective regulation', 'Confusion' and 'Confidence'. No respondents who had health concerns completed this question. Some respondents who completed this question felt that the reaction to the dioxin crisis was overzealous.

'A big deal was made out of nothing to remove every product off the shelves was crazy',

'I accept the action taken was internationally in the best interest but felt the amount of food waste was huge given the quantity that one would have to eat to pose a real health threat '

'All products had to withdraw product even though some of them know that their products were not affected'

'A lot of fuss over nothing. I don't think that there was any real risk of anyone was getting ill and farmers lost so much – but maybe it was better that we were informed'

Some respondents reported very negative remarks about the inspection agencies and authorities.

'It's a disgrace that the premises was not inspected and the problem detected. Self-inspection is not good enough in this area'

‘A prime example of the ineffective regulatory system available in this country.

Look at the economy now’

‘I’m angry that the responsible authority had no control in place to detect or prevent the contamination of feed for animals destined for human consumption’

Some respondents were confused and did not understand why there was such a short amount of time between the mass recall of pork products and the assurances for the subsequent assurances on the safety of pork products.

‘A lot of confusion was caused’

‘There was not enough time between the “don’t eat” pork and “safe to eat pork” messages. A few days later what was thrown out, we were told was ok’

The remarks in the theme of confidence were concerned with restoration of confidence (with the assumption that it was damaged), personal loss of confidence in pork and confidence in food categories other than meat.

‘A fact based report needs to be issued so that the causes and remedial actions are clearly explained and thus confidence in the system is restored’

‘I’ve lost confidence in buying pork for a few months’

‘I’m glad that I do not eat meat’

When asked about the authorities' response to the dioxin crisis, 24.8 % thought it was very efficient, 45.7% thought it was acceptable, 16.5 % thoughts it was somewhat inefficient, 10.8 % thought it was incompetent and 2.2 % did not know. When asked who they consider is mostly responsible for the safety of food that they eat, the majority of respondents (74.4 %) reported that everyone in the food chain is responsible. However, 14.2 % said themselves, 3.1 % said health authorities, 2.9 % said food companies, 2.5 % said food service providers, 0.8% said farmers and 0.4 % said food retailers.

Respondents reported that those they trust most to inform them about the dioxin crisis in pork the responses were; scientists (32.3 %), public authorities (21.0 %), media (12.9 %), consumer groups (10.3 %), physicians/doctors (4.5 %), food manufacturers (1.6 %), farmers (1.6 %), supermarkets (0.6 %) and some respondents (7.4 %) reported that they did not know. Respondents reported that those they trust least to inform them about the dioxin crisis in pork the responses were; food manufacturers (27.5 %), media (15.2 %), supermarkets (13.6 %), farmers (12.9 %), public authorities (12.6 %), consumer groups (2.9 %), scientists (1.0 %), physicians/doctors (0.3 %) and some respondents (9.4 %) reported that they did not know.

When respondents were asked how likely a variety of subgroups of the population (people over 65 years of age, toddlers, children, pregnant women and people who are already ill at hospital) were to suffer from food borne illness 15.1 % reported that toddlers were very likely and 7.3 % reported that people who are already ill at hospital

were very unlikely. On average respondents thought that all sub-groups except people over 65 years of age were very likely or likely to get food borne illness than unlikely or very unlikely to get food borne illness. See Table 2.

Respondents were then asked to rate the risk posed to human health of 47 food and non-food related potential risks. See Table 3. Out of 47 potential risks, four had over 20% of respondents reporting 'Don't know' to the level of health risk posed. These four potential risks were food related; genetically engineered bacteria (33.2 %), PCBs/dioxins (27.5 %), irradiation (24.5 %) and BSE (22.2 %). See Figure 1.

Discussion

To be effective, risk communicators must recognize and overcome a number of obstacles that have their roots in the limitations of scientific risk assessment and the idiosyncrasies of the human mind (Slovic 1986). To the professionals this incident appeared to be a risk communication challenge and an economic issue rather than a risk to the public's health. However, communicating levels of picograms per gram (parts per trillion), the concepts of bioaccumulation and body burden of dioxin and prolonged exposure to develop adverse health effects proved extremely difficult.

In this study, a minority of respondents reported that there was a 'very high' health risk from pork than any other food product category. Conversely, in a recent study that was published just prior to the dioxin outbreak respondents noted that they had no major food safety concerns about pork except that it should be well cooked until there

was no pink meat remaining (Safefood, 2008). In this present study, the risk posed to human health from dioxins was also considered to be relatively high compared to a broad range of food and non-food potential risks. However, the majority of respondents reported that the Irish authorities response to the dioxin incident in Irish pork was ‘very efficient’ or ‘acceptable’ and few reported that they trusted public authorities or scientists the least. Thus a ‘judgmental bias’ towards dioxins being reported frequently as being a high-risk food in this study can be, at least partially, attributed to the intense media attention that was involved at the time of the Irish dioxin crisis and thus the ease with which dioxins would come to mind (the so-called availability heuristic; Tversky & Kahneman, 1973).

A majority of respondents also reported that the most important consequence of the Irish dioxin crisis was the health implication. These findings should be considered in light of the fact that EFSA and the FSAI announced that there was no risk to human health from the dioxins in pork and the economic losses the 200 million taxpayer funded compensation package for the pork industry. However, the same health-related sentiments were not echoed in the open-ended questions where those who were concerned about the economic losses and ineffective regulation were more likely to complete the open-ended question.

Out of 47 potential risks listed, four had over 20% of respondents reporting ‘Don’t know’ to the level of health risk posed to human health. These four potential risks included PCBs/dioxins and all four risks were food-related. A previous study found that

there is a direct positive relationship between perceived knowledge and perceived control (Frewer, Shepherd, and Sparks 1994) with and those who think that they have risks under their control have lower risk perceptions (Sjöberg 2000). Thus the implication for food related risk communication is that the actual risk to human health should be reported to the public in a way which is understandable, such that consumers can consider themselves competent to control the risks and react to the actual risk rather than to the level of media coverage.

On average most respondents considered that toddlers, children, pregnant women and people who are already ill in hospital were more likely to get food borne illness. However in the case of people over the age of 65 most respondents on average considered them to be unlikely to get food borne illness. Food borne illness may not cause major morbidity in robust adults but can be life-threatening in small infants, the frail elderly, or people suffering from concurrent morbidity (Kendall, Hillers, and Medeiros 2006). The elderly (Kandll et al. 2006) (Gradel et al. 2008) and the ill (Moe 1991) often have lower immunity than healthy adults and the infectious dose to precipitate an infection is lower. An understanding of public perceptions of risk (including individual and group differences) is a prerequisite for effective risk-communication practice (Sparks and Shepherd 1994).

Conclusion

Despite the media's and food authorities' assurances that there was no risk to human health from contaminated pork, it was the primary concern of most respondents in this survey. This cannot be explained by issues of trust as the majority of respondents were satisfied with the way the issue was handled by the authorities. It may however be explained by dread such as described by Slovic et al., lack of knowledge and/or a lack of perceived control. The latter may be due to the fact that the authorities had all pork products removed from supermarket shelves.

Previous studies (Schifferstein, Candel, and Trijp 1999) have shown perceptual shifts and shifts in image dimension importance regarding fresh meat over the period 1991–1997. This present study captures risk perceptions immediately after the dioxin incident but further work is merited in monitoring consumers perceptual shifts in relation to dioxins over time. The lack of consumer understanding and effects of the availability heuristic in relation to food risks during a crisis has important implications for food safety agencies. Future studies on the characterization of people who have different levels of perceived risk are merited so that future food campaigns might target those who most need food safety information. Also merited, are studies to further investigate the lack of awareness of the likelihood of food borne illness among over 65 year olds, the measurement of risk perception across a variety of domains as well as an investigation of the role that new online 'information communities' (e.g. bloggers) play in providing effective and efficient information sources for food risks/benefits.

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Table 1. Respondents rating of risk to health posed by various food categories.

	Very high	High	Neither high nor low	Low	Very low
Chicken	8.3	18.1	22.3	34.8	16.5
Beef	4	9	26.3	39.8	21
Fish	2.7	6.9	23.8	40.3	26.3
Eggs	4.6	9.4	24.2	39.4	22.5
Pork	8.6	19.5	25.6	30.7	15.7

Table 2. Respondents rating of how likely various sub-groups of the population would be to acquire food borne illness.

	Very likely	Likely	Neither	Unlikely	Very unlikely	Don't know
People over 65 years	13.8	29.6	31.7	13.5	5.6	5.8
Toddlers	15.1	23.8	15.4	17	10	4.7
Children	8.6	30.8	19.5	16.3	7	3.8
Pregnant women	9.3	20.3	22.6	20.8	6.8	6.3
People already ill at hospital	14.9	25.6	19.7	14.5	7.3	3.9

Table 3. Respondents rating of risk posed to human health by various factors.

	Almost no health risk	Slight health risk	Moderate health risk	High health risk
High fat food	0.2	7.1	40.4	51.7
Ten cigarettes a day	1	4.6	24.6	69.2
Twenty cigarettes a day	0.8	0.4	6.8	91.7
More than 20 cigarettes/day	0.6	0.2	1.2	96.9
Mobile phone	23.2	33.7	23.8	5.2
Moderate alcohol	24.6	40	31.3	4.1
Excessive alcohol	0.6	4.8	94.2	0.4
Drugs	0.6	1	4.6	92.8
Stress	0.4	3.5	30.8	64.6
Chemical pollution	1.9	9.3	29.6	55.9
Crime and violence	4.8	17.4	28.4	46.6
Tanning	0.8	9.3	37.7	51.8
AIDS	6	22.5	18.3	51.3
Motor vehicle accidents	2.9	16.1	27.1	52.6
Nuclear	4.3	11.6	10.4	70.2
Alcohol and pregnancy	1.4	10.6	23.4	62.9
PCBs/dioxins	1.9	11.8	18.4	40.4
Pesticides	2.9	17.4	36.2	38.9
Food additives	4.8	28.2	44.7	19.9

Nuclear Power Plant	9.8	17.6	22.2	46.5
Asbestos	1.5	11.6	10.4	71.2
Waste incinerators	8.3	21.4	30.3	31.3
Malnutrition	4.1	9.5	15.1	69.5
Irradiation	10.4	13.9	22.6	28.6
Prescription drugs	10.1	37.7	38.9	11.6
Genetically engineered bacteria	8.7	14.1	17	27
Heart pacemakers	38.8	23.9	12.2	21.6
Bacteria in food	5.4	23.9	30.7	35.3
Moulds	10	26.6	27	27.2
Mercury in fillings	17.5	31	24.1	13.7
Tap water	42.8	34.3	16.8	4.2
Indoor air quality	31.8	40.5	20.2	3.1
Outdoor air quality	29.7	38	23.9	5.4
BSE	13.3	20.8	14.8	28.9
Mobile phone masts	13.7	26.2	30.4	17.5
GM foods	17.5	25.6	24.5	13.9
Terrorist attack	25.6	19.3	10.2	41
Ozone depletion	4.8	18.5	28.7	41.4
Quality of school buses	14	34.4	26.9	15.6
Quality of school buildings	16.5	36	27.7	13.1
Noise levels in night clubs	15	31.4	35.8	14.6
Work-place safety	12.7	34.4	33.3	17.3

MRSA	1.7	11	22.2	58
STDs	1.9	15.8	32.7	48.5
High-fat food	5.6	35.2	58.8	0.4
Contaminated vaccines	9.4	9.2	12.3	58.3
Bird flu	17.9	21.8	16.8	36.8

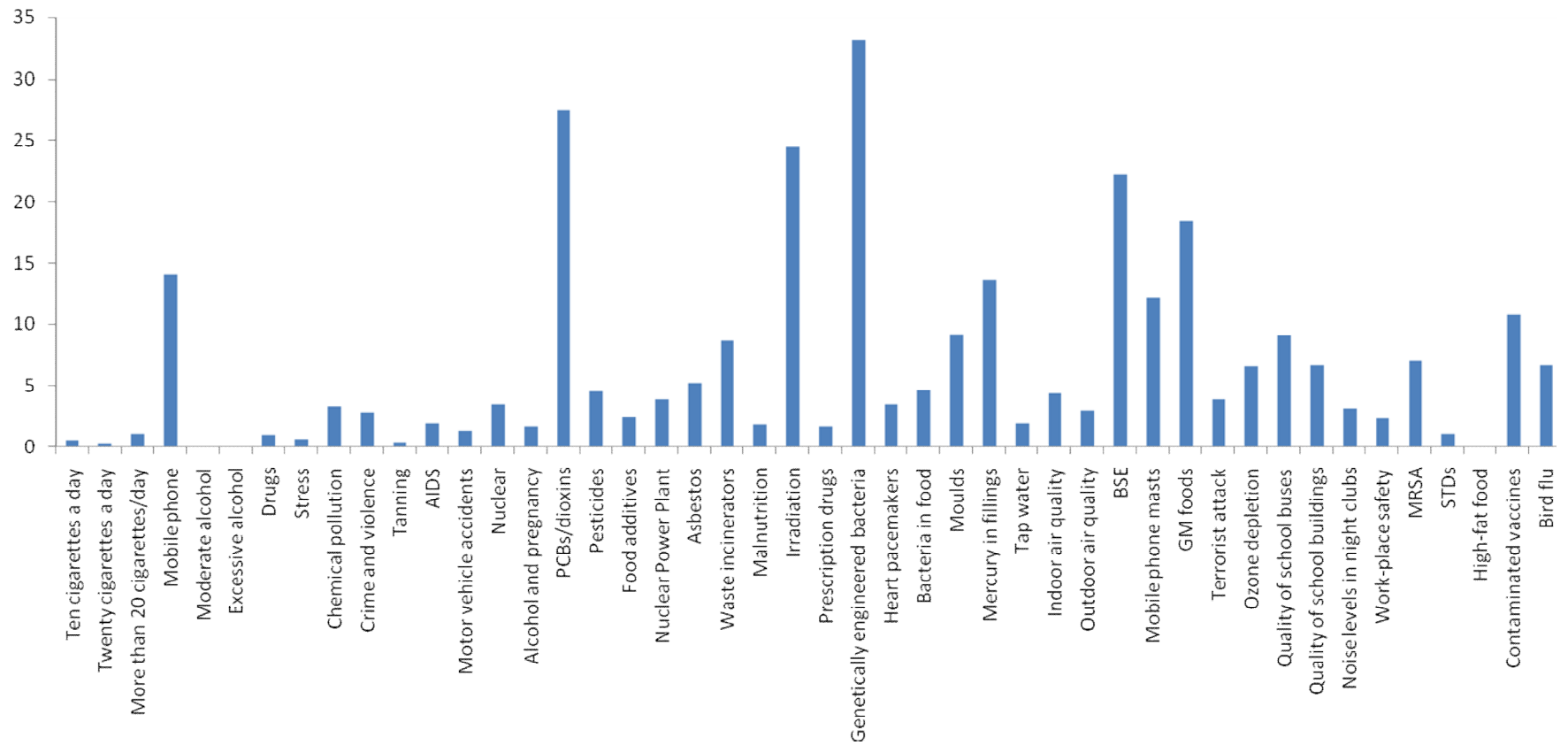


Figure 1. Respondents (%) who reported 'Don't know' when asked to rate on a 4-point scale the level of risk posed to human health from various potential risks.

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