

The Elaboration Likelihood Model and Communication About Food Risks

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Factors such as hazard type and source credibility have been identified as important in the establishment of effective strategies for risk communication. The elaboration likelihood model was adapted to investigate the potential impact of hazard type, information source, and persuasive content of information on individual engagement in elaborative, or thoughtful, cognitions about risk messages. One hundred sixty respondents were allocated to one of eight experimental groups, and the effects of source credibility, persuasive content of information and hazard type were systematically varied. The impact of the different factors on beliefs about the information and elaborative processing examined. Low credibility was particularly important in reducing risk perceptions, although persuasive content and hazard type were also influential in determining whether elaborative processing occurred.

KEY WORDS: Risk communication; food hazards; elaboration likelihood model.

1. INTRODUCTION

The need to develop effective methods of risk communication has been emphasized in the risk perception literature, by policy formulators and by risk managers. Informed public debate about risk issues will also be facilitated by the development of effective communication strategies.⁽¹⁾ Trust in information source and risk regulators,⁽²⁾ perceptions of hazard characteristics⁽³⁾ as well as informational content are likely to be important determinants of effective risk communication. However, the processes of effective risk communication are far from being well understood, and there is a need to systematically examine the impact of different potential influences such as source credibility, informational content and hazard characteristics on reactions to risk information. The current research aimed to examine the effects of source credibility, persuasive content and personal risk relevance on risk perception and source credibility.

The research was driven by a theoretical social psychological model of persuasion, the elaboration likelihood model.⁽⁴⁾ Two different consumption-related hazards were investigated, microbiological food poisoning and excessive alcohol use.

1.1. Requirements for Risk Communication

The National Research Council⁽⁵⁾ has proposed that risk communication may serve two purposes, that of providing information, and that of influencing behaviors. While such a clear distinction may be inappropriate in some hazard areas where it is desirable to both inform and influence, it forms a useful context in which to study risk communication for health-related hazards. Effective communication about lifestyle hazards will fall into the categories of information and education, and behavior change and protective action—here the goal is to get members of the public to alter lifestyles in such a way as to reduce exposure risks. Other hazards in this lifestyle category might include smoking behavior or safe sexual practices.

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The wider social context in which the risk communication is embedded must also be taken into account. One of the most important determinants of public responses to incoming risk information is likely to be whether the information source is perceived to be credible. In the case of food-related hazards, trust in information is dependent on two factors. Public perceptions of source knowledge alone do not lead to trust. Sources which are moderately accountable are seen to be the most trusted.⁽⁶⁾ However, some credibility effects tend to disappear when actual information is provided.⁽⁷⁾ It is important to test credibility effects in realistic and ecologically valid contexts if the true effects of information source credibility are to be assessed.

1.2. The Elaboration Likelihood Model

Developments in the field of persuasion and attitude change are appropriate for use in the development of effective risk communication. There is a very extensive and long-standing literature relating to this area. Recent contributions have included the work of Petty and Cacioppo⁽⁸⁾ who have developed a theory of persuasive communication called the "Elaboration Likelihood Model" (ELM). This basically posits that there are two routes to persuasion: one route is via a careful and thoughtful assessment of arguments (central route) and the other is based on some cognitive, affective or behavioural cue in the context of the persuasion which allows a simple inference about the merits of the argument without recourse to complex cognitive processing (peripheral route). Despite extensive work on this model in the area of attitude change, it has not been extensively applied to the communication of messages on risk, although its applicability to other health-related areas has been noted.⁽⁹⁾

It is known that people tend to engage in effortful information processing activity only when it is deemed necessary.⁽¹⁰⁾ However, the extent to which individuals engage in complex cognitive processing may depend on individual and situational factors.⁽¹¹⁾ Individual factors include the "need for cognition," or the tendency for individuals to engage in complex cognitive processing of incoming information. Perceived personal relevance, or salience, of the information is also likely to act as an important peripheral cue in the extent to which people internalize risk information. Information which is perceived as being highly personally relevant is more likely to be processed in depth than that which is believed to be irrelevant. Finally, persuasive content has been found to increase complex cognitive processing. However,

given the importance of perceptions of "vested interest" within the context of source credibility, it is hypothesized that persuasive information from a highly distrusted source may have the effect of reducing trust in the information. Research using the ELM has indicated that perceived honesty was found to be the source characteristic most highly associated with providing accurate message contents.⁽¹²⁾

One of the most important determinants of public responses to incoming risk information is likely to be whether the information source is perceived to be credible. Eagley, Wood and Chaiken⁽¹³⁾ have inferred two types of communicator bias that message recipients might infer—these are knowledge bias and reporting bias. Knowledge bias refers to a recipient's belief that a communicator's knowledge about the truth is inadequate, whereas "reporting bias" refers to a belief that the communicator is distorting the information in order to promote a particular view. The importance of factors like source credibility will be dependent on particular circumstances surrounding the communication.⁽¹⁴⁾

Source knowledge and perceptions of expertise appear to have little impact if not accompanied by trustworthiness⁽¹⁵⁾ and may even reduce persuasiveness by emphasising the remoteness of expert sources from ordinary people.⁽¹⁶⁾ Expertise will have a negative effect if the source is perceived to be personally involved and so less objective.⁽¹⁷⁾ A message will have maximum effect if the person is seen to be arguing against personal self-interest.

The current research examined the relationship between factors likely to be salient to internalisation of risk message within the context of two different types of consumption-related hazards. The first hazard was excessive alcohol use and the second hazard was microbiological food-borne risk. The impact of source credibility, hazard type, and persuasive content of risk information on the different factors which determine trust in the risk information were examined, as well as and the extent to which respondents engaged in elaborative processing of the risk information. Hazards were selected where there was likely to be minimal perceptions of vested interest by sources in providing information. This enabled examination of the effects of credibility upon risk information under circumstances where persuasion about risk-related behaviour could only be perceived as positive in terms of public benefit.

Previous research has indicated that the two hazards included in the study are differentiated by the extent to which people think that they personally are at risk from the hazards.⁽¹⁸⁾ Alcohol use is rated as less risky to the self than the average person, whereas there is less "op-

timistic bias”⁽¹⁹⁾ for food poisoning risks.⁽¹⁸⁾ Greatest personal risk is associated with food poisoning. In both cases, it is difficult to see what perceived benefits could be associated with the occurrence of either hazard either to individuals affected or society overall.

2. METHODS

2.2. Experimental Design

Previous research has shown that government sources are one of the most distrusted providers of information about food-related risk, and the medical profession one of the most trusted sources, at least in the U.K.⁽⁶⁾ Both the government and the medical profession have produced information about microbiological hazards and excessive alcohol use, adding to the ecological validity of experiment. The experiment was conducted in two stages. The first was the selection of messages of high and low risk relevant content, for each of the two hazards under consideration. The second was the systematic examination of the interaction of hazard salience, persuasive content, and source credibility on elaborative processing and perceptions of informational credibility.

2.3. Selecting Risk Relevant Messages

Thirty “risk messages” about food-poisoning risks, and 30 “risk messages” about excessive alcohol use risks were selected from a variety of information pamphlets and textbooks. While all referred to the relevant hazard in some way, an attempt was made to vary the risk relevance of the messages from high to low. Respondents (all of whom had participated in IFR research on a previous occasion) were recruited by telephone and asked if they would like to participate in a survey about food risks. Fifty respondents were recruited, and randomly assigned to one of two groups, either “food poisoning” or “excess alcohol.”

2.3.1. Food Poisoning—Assessment of Persuasive Content of Messages

The mean age of respondents in this group was 33 \pm 15.7 years. Twelve of the 25 respondents were male. Each respondent in the food poisoning group was sent a questionnaire headed by the following information: “The following statements are about risks and other in-

formation relevant to food poisoning. Please indicate, by marking the appropriate box, the extent to which you think they are arguments relevant to the consumer who is concerned about food poisoning, or might persuade people who are taking risks with food poisoning to take appropriate precautions. Please make sure you answer ALL the questions.” They were then required to rate each statement on a 7-point scale anchored at one pole by “extremely persuasive” and at the other by “extremely unpersuasive.” The mean ratings are given in Table I.

A comparison to assess the perceived persuasiveness of the high and low rated risk statements was performed. A *t*-test comparing the perceived mean persuasiveness ratings of the ten highest and lowest rated statements was significant ($t = 33.0$, $p < 0.001$), indicating differences in perceived persuasiveness of the information.

2.3.2. Excess Alcohol—Assessment of Persuasive Content of Messages

The mean age of respondents in this group was 37 years, \pm 16.9. Twelve of the 25 respondents were male. As before, respondents were required to rate risk messages about excessive alcohol use for persuasiveness. The results are summarized in Table I. The difference between the perceived mean persuasiveness ratings of the ten highest and lowest rated statements was again significant ($t = 27.8$, $p < 0.001$).

Inspection of Table I indicates that the total number of words in the high and low risk relevance categories, and between the different hazards, is not identical. This is because different types of statements resulted from the rating procedure, although word totals in the original pilot were very similar. The experimental design used in the main experiment means that this is not relevant to the results, as data were collected under combinations of experimental conditions.

2.4. Interaction of Hazard Type, Persuasive Content, and Source Credibility

A second group of 160 respondents were recruited from the consumer panel of a market research company. They were asked if they would like to take part in a study about food risk and consumer attitudes. The mean age of the sample was 41.7 years \pm 15.3. 59% of the sample were female. Respondents were recruited from a range of different occupations. Twenty respondents were

Table 1. Assessment of Persuasive Risk Messages—Results of Pilot Work

Ten most persuasive risk statements about food poisoning (mean, standard error)	
1	In 1964, 4000 cases of food poisoning were reported. By 1992, this figure had risen to 64,882 cases (5.7, 0.1)
2	Symptoms of food poisoning include abdominal pain, diarrhea, vomiting, nausea and fever (5.7, 0.2)
3	Pregnant women are particularly at risk from <i>Listeria</i> , which is sometimes found in soft cheeses and pates (6.0, 0.2)
4	Bacteria which cause food poisoning grow most quickly at temperatures between 5 degrees Celsius and 67 degrees Celsius (6.1, 1.8)
5	The easiest way to spread harmful bacteria (microorganisms) is through handling food with dirty hands. It is important to wash hands regularly using hot water and soap (6.1, 0.2)
6	Inadequate heating of ready prepared foods has led to an increase in domestic food poisoning, which reduced by consuming food products within the recommended time, and following the manufacturers cooking instructions (6.1, 0.2)
7	Appropriate hygiene measure in the home can reduce the probability of experiencing food poisoning (5.7, 0.2)
8	Many cases of domestic food poisoning are caused by bacteria transferring from raw food to cooked food, and care should be taken to keep the two separate at all times, including inside the refrigerator (5.9, 0.2)
9	Particular care should be taken to defrost frozen chicken and large pieces of meat, as otherwise harmful bacteria may not be killed in the cooking process (6.1, 0.2)
10	To prevent food poisoning in the home, it is important to clean utensils and work surfaces adequately using an appropriate cleaning agent (5.9, 0.2)
Ten least persuasive risk statements about food-poisoning (mean, standard error)	
1	Cases of food poisoning have been recorded in ancient civilisations (3.4, 0.3)
2	Preventing food poisoning may cost the taxpayer money (3.6, 0.2)
3	Information about the risks of food poisoning is available from many different sources (4.4, 0.2)
4	The link between food poisoning and bacteria came in 1888, when a German doctor called Gaertner isolated the bacteria which caused a fatal food poisoning outbreak (3.8, 0.3)
5	Food poisoning caused by the micro-organism <i>Campylobacter</i> exceeded that caused by the micro-organism <i>Salmonella</i> in the period 1980–1988 (4.2, 0.3)
6	Food poisoning was originally thought to be caused by chemicals found in proteins, although it is now known that it is caused by bacteria, a micro-organism (4.0, 0.3)
7	Research money has been spent to determine effective ways to prevent food poisoning (4.3, 0.3)
8	Some animals which can spread food poisoning bacteria (micro-organisms), for example, mice and rats, have no symptoms of the disease (4.3, 0.3)
9	Many working days are lost due to food poisoning in the U.K. every year (4.3, 0.2)
10	During the last 100 years many different groups of micro-organisms have been implicated in food poisoning, and new types have been accidentally imported from abroad (4.0, 0.3)
Ten most persuasive statements about excessive alcohol use (mean rating, standard error)	
1	While excessive alcohol use can lead to death, it can also cause unpleasant and weakening illnesses (5.6, 0.2)
2	Pregnant women are particularly at risk from excessive alcohol use (5.8, 0.2)
3	Physiological damage caused by excessive use of alcohol can be fatal (5.9, 0.2)
4	Consumption above 50 units a week for men and 35 units for women significantly increases the risks of psychological dependence or alcohol-related diseases (5.6, 0.3)
5	Excessive alcohol use can lead to heart disease, obesity, high blood pressure, ulcers and liver disease (6.2, 0.1)
6	Some fatalities from excessive drinking are indirect, for example alcohol-related accidents (5.4, 0.3)
7	Many serious illnesses can result from excessive alcohol use (5.7, 0.2)
8	It is estimated that deaths resulting from excessive alcohol use have increased dramatically in the U.K. in the last 20 years (5.3, 0.3)
9	Driving "over the limit" can result in fatal accidents, as well as loss of driving licence. 50% of car accidents are alcohol related (5.9, 0.3)
10	The proportion of women drinking more than the recommended safe levels rose by 2% from 1984 to 1992 (5.9, 0.3)
Ten least persuasive risk statements about excessive alcohol use (mean rating, standard error)	
1	Excessive alcohol consumption is increasing in the United Kingdom (4.2, 0.3)
2	Cases of excessive alcohol use has been recorded in ancient civilisations (3.1, 0.3)
3	The average alcohol consumption of people working in different occupations differs widely (4.3, 0.3)
4	Spirits are distilled drinks, whereas beers are fermented, and have a lower alcohol content (4.3, 0.3)
5	Preventing excessive alcohol use may cost the taxpayer money (3.7, 0.3)
6	Information about the risks of excessive drinking are available from many different sources (4.2, 0.2)
7	There are many different types of alcohol available in the supermarket. Wine consumption is increasing, beer consumption decreasing (3.5, 0.3)
8	Research money has been spent to try to prevent excessive alcohol use (3.9, 0.2)
9	Excessive alcohol use results in many lost working days every year (4.4, 0.23)
10	During the last 100 years, many new drinks have become available or have been imported to the U.K. from different parts of the world (3.9, 0.4)

Hazard	Source credibility - Information Attribution	Persuasive strength of statements (number of respondents)
Food poisoning	High Committee of Medical Doctors	High (n=20) Low (n=20)
	Low Government	High (n=20) Low (n=20)
Excessive alcohol use	High Committee of Medical Doctors	High (n=20) Low (n=20)
	Low Government	High (n=20) Low (n=20)

Fig. 1. Experimental design used in the main experiment.

assigned to each of eight experimental groups according to the experimental design summarized in Fig. 1.

A full factorial 2³ design was used. The first factor was hazard type—either “high” (food poisoning) or “low” (excessive alcohol use). The second factor was “source credibility,” again either high (an information leaflet attributed to a committee of medical doctors) or low (an information leaflet attributed to a government source). The third factor was that of persuasion—either “high,” or “low.” These had been selected in the pilot work as being highly persuasive and risk relevant to the hazards, or low in persuasive content and risk relevance. All respondents were interviewed in their own homes, and received £5.00 (approximately U.S. \$7.50) upon completion of the interview.

All respondents were provided with the information according to the experimental condition to which they had been assigned. After reading the information, they were asked to complete a “thought-listing procedure” to assess elaborative processing of the information and rate perceived personal risk, and risk to the average person in the U.K. from the two hazards.^(7,18) They were also required to rate their perceptions of informational quality and trust in the attributed source of the information.⁽⁶⁾ The questions used, and the associated rating scales for each item, are given in Table II. All respondents completed a “need for cognition” scale, to assess if there were any differences in respondents tendency to engage in elaborative cognition between the different experimental conditions.⁽²¹⁾

2.4.1. Results

2.4.1.1. Quantitative Analysis. The results of the analyses of variance are given in Table III. For main effects, appropriate means comparisons are given in Table IV. No differences in need for cognition were identified between the different conditions. Medical sources were rated as being more expert and knowledgeable about

the risks, and as having greater freedom to present information to the public. Medical sources were also seen to have greater concern with public welfare, greater responsibility in providing information, and a better track record of information provision. Information about food poisoning was rated as being more factual overall, and was seen as being correctly provided in the past. It produced greater thought listing activity, and the hazard was rated as riskier overall.

Highly persuasive information was rated as being more accurate and factual, and respondents were more in favor of using it. The information was seen to have greater perceived relevance, both to the self and other people. The source providing the information was seen as having greater freedom to provide the information and perceived as being more knowledgeable about the risks, less likely to have been proven wrong in the past, more concerned with public welfare, more responsible in the transmission of risk information, having a better track record, and being more trustworthy and less likely to withhold information, independent of attribution.

Respondents were more favorable toward the information about excessive alcohol use if the source was medical (Fig. 2a). Information about alcohol use from the government was perceived to be less factual than that from the medical source (Fig. 2b). Medical doctors were less likely to be perceived as having been proven wrong in the past in the provision of information about alcohol use (Fig. 2c). Trust in information about excessive alcohol use was reduced if the persuasive content was also low (Fig. 2d), an effect not observed for food poisoning.

Overall, the number of words written by respondents in the thought listing procedure was greater for food poisoning risks (Tables III and IV). However, attributing the information to a medical doctor increased thought-listing activity if the information was low in persuasive content (Fig. 2e). Thought-listing was reduced if the information was highly persuasive but about excessive alcohol use, although persuasive content was not important for food poisoning risks (Fig. 2f).

Analysis of variance was used to compare ratings of personal risk against ratings of risk for the average person, by source credibility, hazard type, and persuasive content of messages. Potential interactions between the independent variables were also examined. Results of the analysis are given in Table III. Optimistic bias was observed for both information sources, although reduced for government sources (Fig. 2g). Perceptions of risk were greater for food poisoning, regardless of the attributed source. However, for excessive alcohol use, perceived risk was lower if the information was attributed to the government (Fig. 2h).

Table II. Questions Used in Assessment of Risks and Attributes of the Information

Part 1. Ratings of risk and risk relevance (respondents asked to rate their agreement or disagreement with each statement (9-point scale anchored at one pole by *agree strongly* and at the other by *disagree strongly*)

1. I think that the information I have just read is very relevant to me personally.
2. I think that the information I have just read is very relevant to other people.
3. I think that I am personally at risk from food poisoning.^a
4. I think that the average person is at risk from food poisoning.^a

Part 2. Thought listing procedure—For explanation, see text.

Part 3. Informational qualities (7-point scales)

1. To what extent do you think information was trustworthy? (*Anchored by not trustworthy at all to extremely trustworthy*)
2. To what extent do you think the information was accurate? (*Anchored by not accurate to extremely accurate*)
3. To what extent do you think information was factual? (*Anchored by not factual to extremely factual*)
4. To what extent do you think the information source is likely to withhold information about the risk from the public? (*Anchored by not likely to withhold information at all to extremely likely to withhold information*)
5. To what extent do you think the information was distorted? (*Anchored by not distorted at all to extremely distorted*)
6. To what extent do you think the information was truthful? (*Anchored by not truthful at all to extremely truthful*)
7. To what extent do you think the information was biased? (*Anchored by not biased to extremely biased*)
8. To what extent do you think the information source had the freedom to provide information to the public? (*Anchored by no freedom at all to a great deal of freedom*)
9. To what extent do you think the information source had a vested interest in promoting a particular view about the risk? (*Anchored by no vested interest at all to a great deal of vested interest*)
10. To what extent do you think the information source has been proven wrong in the past? (*Anchored by not proven wrong in the past at all to always proven wrong in the past*)
11. To what extent do you think the information source is knowledgeable about the risks? (*Anchored by not knowledgeable at all to extremely knowledgeable*)
12. To what extent do you think the information source feels a responsibility to provide accurate risk information to the public? (*Anchored by no responsibility at all to an extremely great responsibility*)
13. To what extent do you think the information source is expert in the area of the risk? (*Anchored by not expert at all to extremely expert*)
14. To what extent do you think the information source provides sensationalized information about the risks? (*Anchored by not sensationalized at all to extremely sensationalized*)
15. To what extent do you think the information source has a good track record of providing information about the risk? (*Anchored by not good at all to extremely good*)
16. To what extent do you think the information source provides accurate information about the risk only to protect themselves and their own interests? (*Anchored by does not provide accurate information at all to provides extremely accurate information*)
17. To what extent do you think the information source is accountable to others if mistakes are made in the information provided? (*Anchored by not accountable at all to extremely accountable*)
18. To what extent do you think the information is trustworthy? (*Anchored by not trustworthy at all to extremely trustworthy*)
19. To what extent do you think the information source is concerned about public welfare? (*Anchored by not at all concerned to extremely concerned*)
20. To what extent are you personally in favor of using the information source to obtain information about the risk? (*Anchored by not at all in favor to extremely in favor*)

^a Or excessive alcohol use.

Similarly, analysis of variance was used to compare ratings of relevance of information to the self against ratings of information relevance for the average person, by source, hazard and persuasive content of messages (Table III). Perceptions of information relevance were less for excess alcohol use overall, but particularly for the self (Fig. 2i). Persuasive content was also influential in determining perceptions of overall information relevance, with persuasive information was seen as more relevant than nonpersuasive information (Tables III and IV).

2.4.1.2. Qualitative Analysis. The qualitative analysis attempted to extract the key constructs relevant to

risk perception used by respondents in the thought listing procedure. In this case, classification was based on the identification of risk-relevant thoughts pertaining to the hazard under consideration. Whilst a predetermined category system was used, this was subsequently modified during the course of the analysis, with some categories being dropped, and some added, according to what was written in the thought listing procedure by the respondents. The final categories are given in Table V, together with the number of respondents who were identified as fulfilling the category criteria under each condition. A binomial model⁽²²⁾ was fitted to each category, to com-

Table III. Summary of Significant Effects Resulting from the Analysis of Variance: No Three-Way Interactions were Significant

Dependent variable	Independent variables (<i>f</i> (<i>df</i>), <i>P</i>)					
	Credibility (attributed source Government vs. medical)	Hazard (micro- biological vs. food poisoning)	Persuasive content (high vs. low)	Credibility × hazard	Credibility × persuasive content	Hazard × persuasive content
Thought listing procedure						
Number of words	ns	7.5 (1,153) <i>p</i> <0.002	ns	ns	11.9 (1,138) <i>p</i> <0.001	6.2 (1,151) <i>p</i> <0.02
Credibility factors						
Accountability	8.7 (1,150) <i>p</i> <0.005	ns	ns	ns	ns	ns
Accurate	ns	ns	22.1 (1,152) <i>p</i> <0.001	ns	ns	ns
Biased	ns	ns	ns	ns	ns	ns
Distorted	ns	ns	ns	ns	ns	ns
Expert	6.5 (1,152) <i>p</i> <0.05	ns	ns	ns	ns	ns
Favor	ns	ns	11.0 (1,152) <i>p</i> <0.001	6.22 (1,152) <i>p</i> <0.05	ns	ns
Factual	ns	4.5 (1,151) <i>p</i> <0.05	19.2 (1,152) <i>p</i> <0.001	3.9 (1,152) <i>p</i> <0.005	ns	ns
Freedom	6.6 (1,152) <i>p</i> <0.01	ns	7.0 (1,150) <i>p</i> <0.01	ns	ns	ns
Knowledgable	4.29 (1,151) <i>p</i> <0.05	ns	10.9 (1,151) 0.001	ns	ns	ns
Proven wrong in the past	ns	5.1 (1,149) <i>p</i> <0.05	14.0 (1,149) <i>p</i> <0.001	4.3 (1,149) <i>p</i> <0.05	ns	ns
Public welfare	7.1 (1,152) <i>p</i> <0.01	ns	4.9 (1,152) <i>p</i> <0.05	ns	ns	ns
Responsibility	7.6 (1,152) <i>p</i> <0.01	ns	11.48 (1,152) <i>p</i> <0.001	ns	ns	ns
Self protection	ns	ns	ns	ns	ns	ns
Sensationalism	ns	ns	ns	ns	ns	ns
Trackrecord	12.5 (1,151) <i>p</i> <0.001	ns	8.5 (1,151) <i>p</i> <0.005	ns	ns	ns
Trustworthy	7.3 (1,152) (<i>p</i> <0.01)	ns	18.6 (1,152) <i>p</i> <0.001	ns	ns	4.8 (1,152) <i>p</i> <0.05
Truthfulness	ns	ns	8.25 (1,152) <i>p</i> <0.005	ns	ns	
Vested interest	ns	ns	ns	ns	ns	ns
Withholding information	ns	ns	5.46 (1,152) <i>p</i> <0.05	ns	ns	ns
“Optimistic bias” and perceived risk						
Perceived risk (main effects)	6.5 (1,151) <i>p</i> <0.02	32.7 (1,151) <i>p</i> <0.001	ns	4.7 (1,151) <i>p</i> <0.05	ns	ns
Personal risk × risk for others (within subjects effects)	10.1 (1,151) <i>p</i> <0.005	ns	ns	ns	ns	ns
Perceived relevance of information						
Relevance (main effects)	ns	18.2 (1,151) <i>p</i> <0.001	13.5 (1,151) <i>p</i> <0.001	ns	ns	ns
Personal relevance × relevance for others (within subjects effects)	ns	15.7 (1,151) <i>p</i> <0.001	ns	ns	ns	ns

Table IV. Means Comparisons for Significant Main Effects (Standard Errors in Brackets)

Dependent variable	Independent variables					
	Credibility		Hazard		Persuasive content	
	Medical high	Government-low	Food poisoning	Alcohol	High	Low
Thought listing						
Number of words	—	—	51.3 (3.3)	26.9 (0.86)	—	—
Credibility factors						
Accurate	—	—	—	—	5.2 (0.1)	4.5 (0.1)
Accountable	4.3 (0.2)	3.6 (0.2)	—	—	—	—
Biased	—	—	—	—	—	—
Distorted	—	—	—	—	—	—
Expert	4.8 (0.2)	4.2 (0.2)	—	—	—	—
Favor	—	—	—	—	5.0 (0.1)	4.3 (0.2)
Factual	—	—	4.9 (0.1)	4.4 (0.1)	5.1 (0.1)	4.3 (0.2)
Freedom	4.9 (0.1)	4.4 (0.2)	—	—	4.9 (0.1)	4.4 (0.2)
Knowledgable	5.1 (0.1)	4.7 (0.1)	—	—	5.2 (0.1)	3.7 (0.1)
Proven wrong in the past	—	—	3.6 (0.1)	3.2 (0.1)	3.7 (0.1)	3.1 (0.1)
Public welfare	5.1 (0.1)	4.6 (0.2)	—	—	5.1 (0.1)	4.6 (0.1)
Responsibility	4.9 (0.1)	4.4 (0.2)	—	—	5.1 (0.1)	4.3 (0.2)
Self-protection	—	—	—	—	—	—
Sensationalism	—	—	—	—	—	—
Trackrecord	4.5 (1.1)	3.8 (0.2)	—	—	4.5 (0.1)	3.9 (0.1)
Trustworthy	7.5 (0.1)	7.3 (0.1)	—	—	5.0 (0.1)	4.3 (0.1)
Truthfulness	—	—	—	—	5.1 (0.1)	4.6 (0.1)
Vested interest	—	—	—	—	—	—
Withholding information	—	—	—	—	3.5 (0.2)	4.0 (0.2)
Perceived risk and perceived relevance (main effects)						
Perceived risk	—	—	5.9 (0.2)	4.3 (0.2)	—	—
Perceived relevance	—	—	—	—	6.9 (0.2)	6.2 (0.9)

pare the proportion of respondents mentioning that type of thought in each experimental group. Analysis of changes in the model deviance was used to identify factors producing significant differences in responses.

Microbiological risk was associated with increased thoughts about preventative actions ($p < 0.005$) and was also associated with increased perceptions that the hazard was out of the control of the individual ($p < 0.01$). Inspection of the original manuscripts obtained from respondents indicated that this was largely attributable to thoughts linked to contracting food poisoning outside of the home (that is, in restaurants or canteens). Food poisoning risks were more often mentioned as applying to both one's self ($p < 0.001$) and others ($p < 0.01$) than the risks of excess alcohol consumption. Food poisoning was also associated with perceptions of need for more information ($p < 0.001$). Respondents were less likely to mention hazard consequences in the case of food poisoning ($p < 0.001$) and there was a reduced perception that the hazard applied to younger people in particular

($p < 0.001$). The nature of the experimental design may mean that these effects were uniquely associated with the particular hazards under consideration, (that is, people may really be more knowledgable about food poisoning risks) and care should be taken not to overinterpret the data.

Increased persuasive content reduced thoughts about causation of risks ($p < 0.01$). Information attributed to medical sources resulted in increased thought about the consequences of alcohol use ($p < 0.05$). Persuasive information resulted in increased need for information regardless of source ($p < 0.01$). Failure to respond was increased for food poisoning where the information was provided by a medical source, whereas for alcohol use it was higher where the information was provided by the government ($p < 0.01$). Statements about the relevance of the risk to other people were higher for the medical source except where they were highly persuasive ($p < 0.01$). Thoughts that the risks affected young people in particular were greatest if the

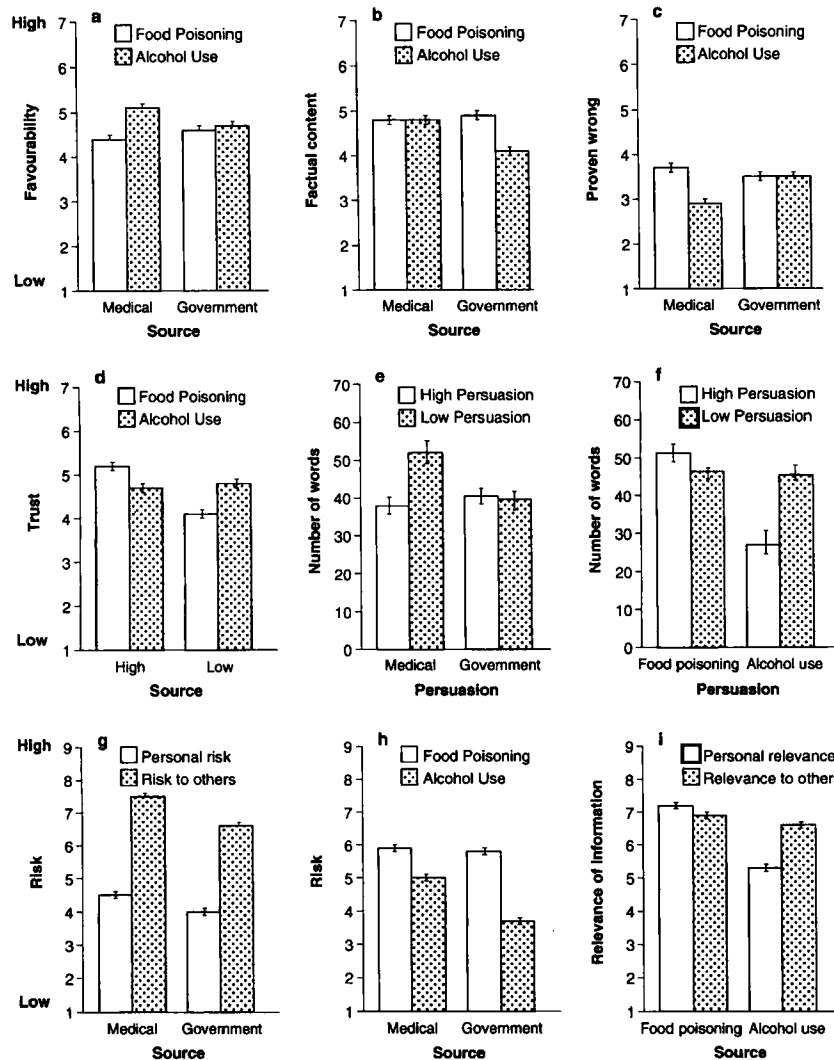


Fig. 2. Interactions between the different experimental factors on specific dependent variables: (a) The effect of source credibility and hazard on favorability toward use of information. (b) The effect of source credibility and hazard on perceived factual content of the information. (c) The effect of hazard and persuasion on perceptions that the source has been proven wrong in the past. (d) The effect of hazard and persuasion on trust in information. (e) Effect of source credibility and persuasive content on thought listing. (f) Effect of hazard and persuasive content on thought listing. (g) The impact of source credibility on "optimistic bias." (h) Effect of source credibility and hazard on perceived risk. (i) The impact of hazard type on the perceived of information about the hazard.

information about food poisoning was provided by a government source ($p < 0.01$).

3. DISCUSSION

Increased credibility alone does not necessarily influence the psychological impact of information provision about risks—other factors, such as perceived hazard characteristics and informational content are likely to be important. Due consideration of these factors, and how

they are likely to interact with other salient cues such as source credibility, should be taken into account in the design of risk communications.

Perhaps one of the most interesting findings was the impact of source credibility on perceived risk. Perceptions of risk were lower if information came from a government source, although the magnitude of the "optimistic bias" effect was reduced if the information attribution was from the government, the low credibility source. This may represent a lower limit effect in risk ratings—that is, the perceptions of personal risk were as

Table V. Results of the Qualitative Analysis

Risk category	Independent Variables							
	Food poisoning				Alcohol use			
	Credibility HIGH-medical		Credibility LOW-government		Credibility HIGH-medical		Credibility LOW-government	
	Persuasive content	Persuasive content	Persuasive content	Persuasive content	Persuasive content	Persuasive content	Persuasive content	Persuasive content
	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW
Actions to prevent risks	7	6	5	8	2	1	0	1
Causes of risks	0	7	9	9	2	9	2	6
Consequences of hazards	0	3	1	1	15	12	4	9
Control by self not possible	5	6	3	4	1	2	2	1
Disagreement with information	1	1	1	1	1	0	1	1
Information or education needed	10	8	15	7	4	8	5	7
No response	4	2	0	4	0	1	4	2
Risks apply to other people	11	8	14	2	6	4	6	2
Risks apply to self	2	4	1	4	0	0	2	1
Regulation required	4	4	2	1	2	5	4	5
Young people specifically mentioned	1	1	6	5	5	13	3	10
Other	1	5	3	2	4	4	3	6

low as they were likely to get, but there was still room to reduce perceptions of risk for other people.

Optimistic bias may represent one of the biggest barriers to the impact of effective risk communication—if people believe that the information is directed towards a vulnerable other person, rather than the self, they are unlikely to pay attention to the risk information itself. Information from a trusted source results in greater perceived risks, but also a greater optimistic bias effect. Thus it is suggested that people will fail to heed messages from a highly credible source as they are seen to apply to other people. Information sources which have high credibility might target “individualised information at high risk population groups.” Information from a distrusted source reduces risk perceptions, and is equally likely to be disregarded, this time because the hazard is not seen to be threatening. In this case, the source might be better advised to focus on improvements in credibility, as well as targeting the information.

Differences in risk perceptions associated with credibility were not the result of elaborative processing, or perceptions linked to perceived informational relevance. If credibility was an important determinant of risk perceptions following information provision, it did not seem to reflect either increased message internalization as would be predicted by the ELM, nor differences in the direct informational relevance of the information. This is supported by the results of the qualitative analysis, where credibility had little impact on the extent to which respondents produced risk-relevant thoughts.

There are some credibility effects which are important determinants of respondents tendency to elaborate the information, although other factors such as hazard type and informational content also appear to be important. In this experiment, while source credibility appeared to facilitate factors associated with trust in the information, the impact on the types of thoughts that respondents had, and their tendency to use elaborative thought processes after receiving the information, was much more dependent on the type of hazard. In general, increasing persuasive content resulted in a greater tendency to process the thoughts in an elaborative manner, possibly because the information was perceived to be more risk relevant.

Overall, it may be useful for a distrusted information source to increase its credibility in order to increase risk perceptions associated with risk messages, if changes in risk-taking behaviour is the ultimate goal of risk communication. In this experiment, factors which differentiated the low credibility source (other than perceived trustworthiness of the information) were associated with accountability as restrictions in being able to present actual information, lower expertise and knowledge, a lower concern with public welfare and responsibility, and of having a worse track record of information provision in the past. Emphasis on redressing these aspects of credibility may be effective in developing more effective communication strategies in the future.

The qualitative analysis supported the notion that the highly relevant hazard (food poisoning) was seen to

affect both the self and other people to a greater extent than excessive alcohol use, and was associated with expression of an increased need for information and education about the risk. This implies that people require information for risks by which they feel more threatened.

The failure to list thoughts at all was greater for food poisoning from the high credibility source, and for excessive alcohol use from the low credibility source. Perhaps under the high credibility condition, the information was actually internalized and accepted, and no further elaboration deemed necessary? However, both source characteristics and perceived characteristics of the hazard must be taken into account in the design of information—for example, a low credibility source might be better off subcontracting to, or collaborating with, a high credibility source if the hazard is perceived as low in perceived personal relevance.

There is no ethical expectation that members of the public should not be advised about the potential health dangers associated with excessive alcohol consumption and food poisoning, and both are hazards where it is reasonable to influence members of the public to avoid exposing themselves to the health risks. There are no benefits to either food poisoning or (unless you include hedonism) excessive alcohol use. However, for other types of hazard (for example, the use of genetic engineering in food production), credibility may have a greater influence, as perceptions of “vested interest” in promoting a particular view may be important. The relative importance of trust is likely to be highly dependent on hazard characteristics—for example, consider the case of genetic engineering in food production. Foreman⁽²³⁾ has noted that communication about genetic engineering may result in conflict if the risks and benefits resulting from the technology do not accrue equally between different groups within the population. For example, if the public believe that the benefits are only applicable to industry, but the risks will impact on the environment and effect the whole population, then low public acceptance of, and indeed public resistance to, the technology might result. Trust in information originating from sources with perceived “vested interests” in promoting the technology is likely to be a greater determinant of public responses than in cases where there is no perception of vested interest in promoting a particular view, particularly if there are perceptions that the source has an interest in differentially dispersing risks and benefits to different segments of the population.

Persuasive impact of sources high in expertise is short-lived.⁽²⁴⁾ Unless longitudinal follow-up work is conducted to examine the long-term effects of persuasive

communication, the true impact of source credibility cannot be assessed. The long-term effect of information interventions must be assessed. Systematic study of the temporal persistence of attitudes has been rare, and there are different models to predict the long-term effects of information provision on attitudes. The “sleeping effect” refers to the situation where attitude change is delayed, because an unfavourably evaluated external cue (such as distrust in the source) becomes dissociated from it over time.⁽²⁵⁾ Against this, the concept of associative interference would predict that while attitude change reduces over time, this effect is likely to be highly dependent on the contextual cues surrounding the initial message.⁽²⁶⁾

In conclusion, the elaboration likelihood model appears to offer a useful tool for investigating the determinants of effective risk communication. The importance of trust in information source and informational content cannot be discounted, but it is also important to examine these effects within the context of the perceptual characteristics of the hazard itself.

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