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WATER WARNINGS: COMMUNICATION IN DRINKING WATER–RELATED PUBLIC HEALTH EMERGENCIES

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Abstract

The *E. coli* O157:H7 water-borne outbreak in Walkerton, Ont., in May 2000 presented to the people of the community a clear and present danger – at least in retrospect. More challenging, though, is determining at the outset when a risk is severe enough to warrant extraordinary communications and how best to persuade citizens to comply with health advisories.

Risk theory, which involves assessment, management, and communication, is a useful framework for understanding how regulators, industry, and individual citizens incorporate and act on information about risks, such as the hazards posed by *E. coli* O157:H7 in drinking water. Today it is well accepted that the three components of risk analysis cannot be separated but must be integrated, and that communication involves a multi-directional flow of information between all concerned parties.

Evidence from several water-borne disease outbreaks in the 1990s has shown the importance of timeliness in health-related warnings. Delivering risk messages at optimum times depends on how quickly a problem is identified and how messages are disseminated and received. The public can passively receive information from the media or the utility involved, or actively seek it out from sources such as the Internet, telephone hotlines, and library services.

In determining when to go public with health advisories, authorities have found that each outbreak of food- or water-borne illness must be examined individually, using factors such as severity, potential impact, and incubation time of the suspect pathogen. The health risk should be assessed and quantified by workers from diverse disciplines, including health officials, veterinarians, food-processing experts, microbiologists, medical doctors, risk analysis experts, and consumer behaviour experts. Since no one technology can reach all members of a target audience, advisories must be distributed using a variety of delivery techniques. Effective planning will establish which techniques are best for the size of the community and the existing infrastructure.

Any local efforts to protect public health must be supported by a national culture of awareness regarding deadly bacteria such as *E. coli* O157:H7, whose virulence has been well recognized since the 1980s. In the United States, outbreaks of illness caused by food- and water-borne pathogens, particularly *E. coli* O157:H7, bring a sustained policy response from the highest levels of government, including the Office of the President. In Canada, by contrast,

although there have been many private-sector initiatives to enhance the safety of the food supply, these efforts are rarely communicated to the public by government, short of admonitions to "cook hamburger thoroughly."

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E. coli O157:H7 is not regular *E. coli*. It is a highly virulent pathogen that sickens tens of thousands annually in North America. Outbreaks of this deadly bacterium have been recognized on this continent since 1982. In 1993, in the U.S. Pacific Northwest, for example, an outbreak resulted in four deaths and more than 500 cases of illness, which were linked to the consumption of undercooked hamburgers at the Jack-in-the-Box fast-food chain. A 1996 outbreak in several western states and parts of western Canada killed a 16-month-old child and sickened 70 people who had consumed unpasteurized apple cider.

In 1999, a three-year-old girl died and some 1,000 people were stricken after attending a county fair in Albany, N.Y., the worst *E. coli* O157:H7 outbreak in the state's history. Health officials suspected that the fair's water supply had been contaminated by cattle manure after heavy rains forced runoff from a nearby farm into an underground aquifer.[1]

Also in 1999, an *E. coli* O157:H7 outbreak that affected more than 90 people was linked to contact with farm animals at the Western Fall Fair in London, Ont. Five confirmed cases were children from a daycare centre, including one nine-year-old boy who was left with kidney damage after spending nine days in hospital and receiving four blood transfusions.[2]

1.1 Importance of Timeliness

In an outbreak of food- or water-borne disease, timely health advisories and recalls can have a significant effect on reducing the number of illness cases and quickly resolving the emergency. Health authorities increasingly adopt a multi-faceted approach to risk reduction, including measures such as watershed

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This paper has been prepared for discussion purposes only and does not represent the findings or recommendations of the Commissioner.

[1] United States, Centers for Disease Control and Prevention, 1999, "Outbreak of *Escherichia coli O157:H7* and *Campylobacter* among attendees of the Washington County Fair," *Morbidity and Mortality Weekly Report*, vol. 48, no. 36 (September 17).

[2] For a review of several *E. coli* O157:H7 outbreaks, see D.A. Powell and W. Leiss, 1997, *Mad Cows and Mother's Milk: The Perils of Poor Risk Communication* (Montreal: McGill-Queen's University Press), pp. 77–98.

protection, water treatment, and public education and notification.[3] In an emergency, effective communication of risk may reduce public exposure to contaminated water by encouraging people to adopt risk-reducing measures such as boiling water and drinking bottled water.

Effective risk communication requires coordinated efforts between the company or utility involved and local, provincial, and even federal health authorities. Common strategies include issuing advisories to boil water or throw out or return contaminated food products, followed by medical updates and advice on prevention such as washing hands to reduce secondary transmission of infection.

Casman et al. have determined that the morbidity of a water-borne epidemic depends on the interplay of three factors: (1) the timeliness of the warning (how soon it is issued), (2) the level of consumer compliance with the warning, and (3) the time it takes to solve the problem.[4] For instance, when consumer compliance is high, an epidemic can be avoided if the utility issues a public warning by the day following confirmation of the problem, regardless of the length of time it takes to correct it. However, when compliance is average, an epidemic can be avoided only if the utility informs the public on the first day and has the problem corrected in four days, or issues warnings by day 2 and has the problem fixed in three days. Obviously, risk communications cannot control the time it takes to solve water-quality problems, but they can influence public awareness, which is an essential component of risk reduction.

Several water-borne disease outbreaks in the 1990s illustrate the importance of timeliness in health-related warnings. In four major incidents of municipal water contamination – by cryptosporidium in Brushy Creek, Tex., in 1998,[5] Milwaukee, Wis., in 1993,[6] and Sydney, Australia, in 1998;[7] and by salmonella in Missouri in 1993[8] – residents were given boil water advisories several days or even weeks after they had first been exposed to the pathogens. The warnings were communicated to the media via press releases and daily briefings, as well

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[3] E.A. Casman et al., 2000, "An integrated risk model of a drinking-water-borne cryptosporidiosis outbreak," *Risk Analysis,* vol. 20, pp. 495–511.
[4] Ibid., 2000.
[5] C. Davenport, 1998, "Human toll higher than count by state in Brushy Creek spill," *Austin American-Statesman*, July 31.
[6] R.J. Griffin, S. Dunwoody, and F. Sabala, 1998, "Public reliance on risk communication channels in the wake of a cryptosporidium outbreak," *Risk Analysis*, vol. 18, pp. 367–75.
[7] "Olympic city gets third warning of water bugs," 1998, Reuters, September 5.
[8] F.J. Angulo et al., 1997, "A community waterborne outbreak of salmonellosis and the effectiveness of a boil water order," *American Journal of Public Health*, vol. 87, no. 4, pp. 580–84.

as delivered directly to schools, daycare centres, nursing homes, hospitals, health departments, and physicians.

Residents of Brushy Creek, Milwaukee, and Sydney later complained that they should have been notified sooner that their water was contaminated. In the first two outbreaks, hundreds of people became ill. However, whereas the delay in communication may have slowed disease control, the relatively low virulence of cryptosporidium may also have contributed to public confusion. In the Sydney outbreak, in fact, no increase in consumer illness was observed.

In Brushy Creek, a raw sewage spill occurred on July 14, 1998. The first advisory to owners of private wells was issued three days later. By July 20, health officials had discovered that three municipal wells were contaminated, but they did not consider the damage was serious enough to act on until the following day, whereupon they shut down the wells and began to purchase water from the nearby city of Round Rock. In this case, the water utility was able to fix the problem quickly, negating the need for a boil water advisory. However, the town residents had already been exposed to the contaminated water for seven days before the wells were shut down on July 21, which was about the time the number of illness cases peaked.

A final example – from a major food-borne outbreak of salmonella in Canada – is especially instructive of the danger of delay in warnings.[9] In 1998, a strong epidemiological link was established between an outbreak of *Salmonella enteritidis* infections in Canadian school-aged children and Schneider's Lunchmates, a pre-packaged lunch product aimed at that group. The link was confirmed five days after the association was reported, at which time the J.M. Schneider company issued a recall, and the Ontario medical officer of health sent out a public health advisory. The outbreak peaked 27 days after the initial link was established, indicating that the recall and health advisory were not effective in reaching all members of the public – salmonella has an incubation period of only 6 to 48 hours. In total, 805 cases were reported throughout Canada.

The fact that the company waited to issue the warning and recall until the link was confirmed meant that consumers were exposed to the risk for an extended

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[9] D.A. Powell, 1998, *Going Public: Guidelines for Public Health Officials and Journalists in Reporting Outbreaks of Foodborne Illness* [online], paper presented at the Conference on Global Outbreak Intervention: Field Epidemiology and Organized Responses to Infection, University of Iowa, April 3–5 [cited July 24, 2001], <www.plant.uoguelph.ca/safefood/micro-haz/salm-schneiders-ppr/salm-schneiders-ppr-nov98.htm>.

period. In the 1996 *E. coli* O157:H7 outbreak in the Pacific Northwest, traced to unpasteurized apple juice, the manufacturer, Odwalla Inc., responded differently. When faced with the possibility that its juices might be the cause of several cases of illness, the company immediately recalled all its products containing apple cider and took responsibility for the outbreak. Health alerts were also issued immediately.[10] In all, 70 people became ill, though the toll could have been much higher. While impossible to ethically construct an experiment that contrasts timeliness of health warnings, it is generally agreed that earlier is better, with the caveat that every outbreak has its own unique circumstances and variables, which are discussed more fully in section 2.3.

1.2 Strategies for Message Delivery

Getting a health-risk message out in time to be effective depends on how quickly a problem is identified and on how the message is delivered. For example, a routine public advisory may take a day or longer to be picked up by the media, whereas door-to-door canvassing can be more immediate. Information can be conveyed in many different forms. The public can passively receive information on health-related risks from the media or the utility, or actively seek it out from sources such as the Internet, telephone hotlines, or library services.[11]

1.2.1 Mass Media

Studies of risk communication associated with food,[12] municipal drinking water,[13] and other substances[14] indicate that consumers rely most on mass media and word of mouth for such information. Evidence from various disease outbreaks provides details about how people react to, seek out, and best receive

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[10] Powell, 1998.

[11] Casman et al., 2000.

[12] A. Fisher and Y. Chen, 1996, "Customer perceptions of agency risk communication," *Risk Analysis,* vol. 16, pp. 177–84; B. Mahon et al., 1999,"Consequences in Georgia of a nationwide outbreak of salmonella infections: What you don't know might hurt you," *American Journal of Public Health*, vol. 89, no. 1, pp. 31–35; and C.M. Velicier and B. Knuth, 1994, "Communicating contaminant risks from sport caught fish: The importance of target audience assessment," *Risk Analysis,* vol. 14, pp. 833–41.

[13] Griffin et al., 1998; and A.K. Harding and E.C. Anadu, 2000, "Consumer response to public notification," *Journal of the American Water Works Association*, vol. 92, no. 8, pp. 32–41.

[14] B. Jones and J. Andrey, 1998, *Weather Warnings and Adaptive Responses: Perceptions of Kingston, Ontario, Residents* [online], [cited November 7, 2000], <www.qsilver.queensu.ca/~icestudy/

media warnings. For example, studies have found that television and newspapers are especially useful when they provide visuals illustrating the location of a risk – such as a drinking faucet or a particular food – and means of reducing exposure to it.[15] And one study, which compared different media formats for communicating health risks, found that print was ideal for audiences that were more concerned about a risk, whereas broadcast media worked better for those less concerned about risk.[16]

It has also been found that reliance on specific forms of media and other types of communication varies widely depending on the community, the hazard, and the situation. For instance, in a study of two towns experiencing water crises, Harding and Anadu found that one town was more dependent than the other on radio and television; similarly, Freeman and French, when examining where drug addicts obtained risk information, found that sources varied widely between cities.[17]

Studies examining health warnings associated with the contamination of sport-caught fish[18] and of drinking water during the 1993 Wisconsin outbreak of cryptosporidium[19] indicated that low-income and racial minorities were more likely to rely on mass media and word of mouth for health advisory information than on other communication vehicles. The cryptosporidium study further showed that most people, regardless of income or other factors, received media information passively as a by-product of routine and habitual exposure. The study also found a correlation between how concerned people were personally about the risk and how intensely they concentrated on and sought out information in media reports. Worry not only increased the effort people put into finding information but also prompted them to pay closer attention to passive sources. Factors that influenced worry about risk included a sense of personal susceptibility, experience with the hazard, and perception of the hazard's presence in the future.

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report.htm/psr007.pdf>; and G. Predy, B. Carney, and J. Edwards, 1997, "Effectiveness of recorded messages to communicate the risk of acquiring hantavirus pulmonary syndrome," *Canadian Journal of Public Health*, vol. 88, no. 4 (July–August), pp. 275–76.

[15] N.A. Connelly and B.A. Knuth, 1998, "Evaluating risk communication: Examining target audience perceptions about four presentation formats for fish consumption," *Risk Analysis*, vol. 18, pp. 649–59; and Jones and Andrey, 1998.

[16] H. Chipman et al., 1996, "Audience responses to a risk communication message in four media formats," J*ournal of Nutrition Education*, vol. 28, pp. 133–39.

[17] Harding and Anadu, 2000; and R.C. Freeman and J. French, 1995, "What is the addicts' grapevine when there's 'bad dope'? An investigation in New Jersey," *Public Health Reports,* vol. 110, pp. 621–24.

[18] Velicier and Knuth, 1994.

[19] R.J. Griffin et al., 1998.

In their study of a salmonella outbreak in Georgia, part of a 1994 nationwide outbreak traced to Schwan's ice cream, Mahon et al. found that mass media, particularly television, were important in distributing health warnings quickly to the public.[20] However, only 6% of the media warnings clearly advised consumers not to eat the ice cream. Consistently, the question consumers most want answered is: "What can I do to reduce the risk?" Therefore, the explicitness and accuracy of media messages are important factors in how well they work. Similar results were found in a review of media stories relating to an outbreak of meningococcal disease.[21] Here, reports provided parents with a list of symptoms to watch for. The researchers found discrepancies between that information and the clinical features of actual cases, which they concluded were the result of errors in the line of communication from clinician to spokesperson to the media and, finally, to the public.

Mass media can be a powerful tool for relaying risk information and advice to the public, but it can also generate misunderstanding and confusion when conveying scientific information to a lay audience.[22] In looking at how doctors received information about an outbreak of yellow fever in Kenya in 1992, researchers found that physicians who had access to media reports heard about the outbreak significantly earlier than those without such access.[23] However, the reports were not always accurate, and the public did not always trust them.[24]

In emergency situations, public urgency and increased hazard tend to promote more co-operation between utilities, government agencies, the media, and the public.[25] And greater cooperation tends to create greater media accuracy. Training public health agents to work with the media can also improve the reliability of media messages. For instance, during a hantavirus outbreak in Edmonton in 1997, the board of health's extensive media-relations experience

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[20] Mahon et al., 1999.
[21] A.P.J. Thompson and G.K. Hayhurst, 1993, "Press publicity in meningococcal disease," *Archives of Disease in Childhood*, vol. 69, pp. 166–69.
[22] C. Jardine and S. Hrudy, 1997, "Mixed messages in risk communication," *Risk Analysis*, vol. 17, pp. 489–98.
[23] L. Louton, C. Robert, and P. Raeber, 1993, "Outbreak of yellow fever in Kenya: How doctors got the news," *The Lancet,* vol. 341, p. 1030.
[24] A. Fisher and Y. Chen, 1996, "Customer perceptions of agency risk communication," *Risk Analysis*, vol. 16, pp. 177–84.
[25] United Nations, Food and Agricultural Organization/World Health Organization, 2000, *Expert Consultation on the Application of Risk Communication to Food Standards and Safety Matters* [online], [cited July 23, 2001], <www.fao.org/es/esn/riskcomm/httoc.htm>.

was an asset when communicating risks to the public.[26] The board kept the media updated on the outbreak with daily briefings and press releases, and set up a telephone hotline with a recorded message. These measures proved highly effective. Consumer surveys and knowledge tests indicated that the board's information, delivered though the media, was accurate, and the public remembered it correctly. The hotline, however, proved more useful as a media tool for checking accuracy than as a public information vehicle. Only 3% of the population called the line, and often those who did could not get through.

1.2.2 Direct Contact

As mentioned, word of mouth is an important source of health risk information, especially in smaller communities, reaching those who may not receive information in any other way. Although people consider such information highly credible, it is difficult to control and is open to inaccuracy.[27] Conversely, individual contacts – through visits, letters, or phone calls – organized by health departments or the utilities or companies involved can effectively distribute messages to the public as well as increase the influence of word-of-mouth communication. With direct contact, accuracy can be controlled, and the information needs of the target audience can be immediately assessed and addressed. This technique also permits pre-testing of messages, which can identify potential sources of confusion that need to be corrected.[28]

The Schwan's salmonella outbreak in Georgia is a good example of direct contact in action.[29] Estimated to have potentially affected more than 200,000 Americans, this outbreak was unique in that Schwan's specialized in home delivery and did not sell to chain stores. Because of this distribution system, Schwan's had a customer list readily available. Besides setting up a hotline and issuing press releases through the media, Schwan's mailed letters directly to all customers and sent delivery trucks out to homes to pick up the contaminated ice cream.

However, only 21 % of respondents to a survey reported receiving the letter, and just 50% said a driver had contacted them. The researchers also found that

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[26] Predy et al., 1997.
[27] J. Fessenden-Raden, J. Fitchen, and J.S. Heath, 1987, "Providing risk information in communities: Factors influencing what is heard and accepted," *Science, Technology, and Human Values*, vol. 12, pp. 94-101.
[28] Chipmen et al., 1996; and Connelly and Knuth, 1998.
[29] Mahon et al., 1999.

16% of respondents reported hearing no warning at all, and of those who heard and remembered when they heard it, the median time of first hearing was five days after Schwan's had issued its initial press release. In this case, receiving the letter had no effect on consumer behaviour. When surveyed, 26% of those who reported getting the letter still had contaminated ice cream in their homes, about the same percentage (27%) that had not received the letter. Being warned by a driver had a much greater effect on behaviour – only 14% of those who had been contacted by a driver still had the product, compared to 38% who had not.

In a 1993 water-borne salmonella outbreak in Gideon, Mo., an information flyer was delivered door to door; however, residents did not receive it until ten days after a boil water advisory had been issued.[30] Despite the delay, after receiving the flyer all residents surveyed reported knowing there was a problem and understanding that ice should be made with boiled water. The earlier boil water notice had not told people what illness they could get from the water nor how boiling water could protect them. The flyer appeared to be more effective because it contained easy-to-read instructions for boiling water as well as a rationale for the advisory.

If individual messages are delivered in a context of honesty, they may also inspire consumer trust. In the water contamination incidents investigated by Lemley et al. and Harding and Anadu, the water utilities sent customers information flyers enclosed with their water bills.[31] In both cases, consumers considered the flyers to be the most reliable sources of risk information available. These findings contrast with other research showing that customers do not always trust water utilities and other industries for health information.[32] The utilities in the former studies may have circumvented this reaction by being completely open about the problem from the beginning.[33]

Direct contact can work very well for communicating risk if it is carried out early enough. And it can reach people who may have little access to media reports,

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[30] Angulo et al, 1997.

[31] A.K. Harding and E.C. Anadu, 2000, "Consumer response to public notification," *Journal of the American Water Works Association*, vol. 92, no. 8, pp. 32–41; and A.T. Lemley et al., 1985, "Nitrate contamination: Public awareness," *Journal of the American Water Works Association*, vol. 77, pp. 34–39.

[32] UN, FAO/WHO, 2000; Fessenden-Raden et al., 1987; B. Fischoff and J.S. Downs, 1997, "Communicating foodborne disease risk," *Emerging Infectious Diseases* [online], vol. 3, no. 4, [cited November 27, 2000], <www.cdc.gov/ncidod/eid/vol3no4/fischof.htm>; and Harding and Anadu, 2000.

[33] UN, FAO/WHO, 2000; and Fessenden-Raden et al., 1987.

which is especially important in many small towns. However, this method is time consuming and requires significant effort, which limits its application. It may be most appropriate for smaller areas, which could be one reason that only half the respondents in the Schwan's ice cream study remembered being contacted by a driver; in that case, the recall extended over the whole state.

All strategies for message delivery have their strengths and limitations, so variety of format is essential. (See section 2.4 for a discussion of options for message delivery.)

1.3 Compliance with Risk Messages

Consumer compliance is the second factor Casman et al. mention as influencing the morbidity of a water-borne epidemic.[34] They estimate that about 50% of consumers continue to drink contaminated water after receiving a boil water advisory. Other research confirms this estimate. And a 1982 survey of water utility managers found that 61% believed that public notifications were ineffective in eliciting public support; 23% considered them somewhat effective, and only 16%, very effective.[35]

Some studies indicate relatively high compliance. For example, results from four studies examining boil water advisories[36] and the study of the Schwan's ice cream recall indicated that 70% to 90% of those who heard the warnings took some kind of risk-reduction measures. However, such figures can be deceiving. Researchers have often found that people who say they are complying with risk-reducing advice are in fact engaging in behaviour likely to increase risk – such as brushing teeth, washing dishes, or feeding pets with water that hasn't been boiled, or not continuing to use boiled or bottled water throughout the warning period.[37] Willocks et al. reported in a study of a cryptosporidium outbreak in the North Thames region of the United Kingdom that many people who engaged in risky behaviour believed they were taking adequate safety

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[34] Casman et al., 2000.

[35] C.E. Stegman and G. Schneider, 1982, "The cost and effectiveness of public notification of MCL violations," *Journal of the American Water Works Association,* vol. 74, no. 2, pp. 59–65.

[36] Angulo et al., 1997; and Harding and Anadu, 2000.

[37] M. O'Donnell, C. Platt, and R. Aston, 2000, "Effect of a boil water notice on behavior in the management of a water contamination incident," *Communicable Disease and Public Health*, vol. 3, no. 1, pp. 56–59; L.J. Willocks et al., 2000, "Compliance with advice to boil water during an outbreak of cryptosporidiosis," *Outbreak Investigation*; and Angulo et al., 1997.

precautions.[38] This misconception may reflect either a lack of precision in the messages or the respondents' belief that they were impervious to harm.

This common belief is not, in fact, without foundation. In the 1998 water emergency in Sydney, Australia, positive water tests for cryptosporidium and giardia were first confirmed on July 24.[39] The first boil water advisory was issued five days later to small sections of the city and then to the entire city the next day. Besides media messages, signs were placed in office blocks reminding people not to drink tap water, and fountains in schools were shut down completely. The boil water advisory was rescinded and reissued twice over the next two months.[40] Anecdotal evidence suggests that throughout the alert, many Sydney residents continued to drink potentially unsafe water. A complicating factor in this outbreak was an apparent lack of human illness, lending some credibility to the claim made by observers at the scene that in some cases – especially those involving pathogens of low virulence – the ability to test has exceeded the ability to ascribe meaning to test results.

Similar findings were reported by Harding and Anadu in their examination of the Oregon towns experiencing water crises. The two communities had received different types of water warnings.[41] Town A had a long-term filtration problem and had been receiving boil water notices quarterly for several years. Town B's situation was more immediate, with the town having received a boil water advisory after flooding caused an increase in coliforms and *E. coli* contamination in the water. Researchers found that the residents of town A, although more aware of their water-quality problem, were less likely to take risk-reducing steps than were people in town B (76% versus 90% respectively). The reason that many residents of town A gave for ignoring the warnings is similar to that given by respondents in the Schwan's ice cream and Gideon, Mo., outbreak studies: they simply did not believe them.[42] The Oregon results point to the danger of the "cry-wolf" syndrome, in which repeated warnings can enhance perceptions of imperviousness to risk.

It is apparent from these studies that getting people to comply with health warnings is a difficult and complex problem. However, research also suggests means of improving compliance.

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[38] Willocks et al., 2000.
[39] "NSW: A chronology of the Sydney water crisis," 1998, Australian Associated Press, August 4.
[40] "Olympic city gets third warning of water bugs," 1998, Reuters, September 5.
[41] Harding and Anadu, 2000.
[42] Angulo et al., 1997.

1.3.1 Effective Messages

Communications have to convince people that an emergency is serious enough to warrant changing their behaviour. Evidence from the literature points to several characteristics of effective risk communication (see section 2 for a detailed discussion). Messages should

- explain the reason for the warning,
- identify the associated illness,
- list symptoms of the disease,
- describe explicit risk-reducing actions, and
- relate to people personally.

In the Gideon salmonella case, a letter encouraged compliance by identifying the associated illness and describing ways to reduce risk. It helped residents understand the seriousness of the situation, as well as pointing out less obvious sources of infection such as making ice cubes with water that hadn't been boiled.[43] In the study of the two Oregon towns, even though desensitization explained some of the difference in compliance, researchers decided that the major cause was a difference in warnings.[44] In town A, notices had not specified any risk-reducing actions, whereas advisories in town B did specify them.

As noted above, people need to relate personally to risk warnings to take them seriously. One way to make messages personally relevant is to report how many people have become ill. In the Schneider's salmonella outbreak, the first advisory failed to mention a suspected 177 cases of illness.[45] Because of this omission, the media did not pick up the story until three days later, when the figure was finally released. However, despite the usefulness of reporting illness figures, at the time of writing neither the Canadian Food Inspection Agency (CFIA) nor the U.S. Department of Agriculture includes this information in recalls or public health warnings.

A further factor that encourages compliance is consistency of information. When multiple formats are used to distribute risk information, it is vital that all messages be kept consistent.[46] Contradictory messages can cause confusion

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[43] Angulo et al., 1997.
[44] Harding and Anadu, 2000.
[45] Powell, 1998.
[46] J. Tilden et al., 1997, "Health advisories for consumers of Great Lakes sport fish: Is the message being received?" *Environmental Health Perspectives*, vol. 105, no. 12, pp. 1360–65.

and create distrust, not only in the information itself but also in the agencies disseminating it. Industries and agencies can improve public confidence – and compliance – by being open and honest about problems and by letting people know what they are doing to reduce risk.

1.3.2 A Culture of Awareness

A significant factor in public compliance is whether or not a community has a culture of awareness regarding microbial risks prior to an outbreak. This factor has been borne out in testimony at the Walkerton Inquiry. Several local waterworks employees and commissioners have reported that they did not know *E. coli* or even *E. coli* O157:H7 was a risk in drinking water. They were unaware of the risk despite the many outbreaks that have occurred throughout North America.

In the United States, outbreaks of food- and water-borne pathogens, particularly of *E. coli* O157:H7, bring a sustained policy response from the highest levels of government, including the Office of the President. The Jack-in-the-Box outbreak in 1993 prompted intense public discussion in the media as well as government policy, resulting in the implementation of a mandatory Hazard Analysis Critical Control Points (HACCP) system in U.S. slaughterhouses. The 1996 Odwalla outbreak also sparked a sustained effort to reduce pathogens in fresh fruits and vegetables and in water (particularly irrigation water). In Canada, by contrast, whereas many private-sector initiatives have aimed at enhancing the safety of the food supply, governments rarely enter into public discussion of them, short of admonitions to "cook hamburger thoroughly."

Each year since1993, a high-profile and deadly outbreak of *E. coli* O157:H7 has occurred in some corner of the developed world – for example, in Australia in 1994 (involving the related *E. coli* O111), in Scotland and Japan in 1996, and at a water park in Atlanta, Ga., in 1998. These outbreaks have been extensively covered in the international media and provided new insights for health advisers. Still, many Canadians may never have heard of them. Media coverage in Canada has been superficial at best, often focused on the hypothetical risks posed by various food-related technologies while ignoring the carnage associated with food- and water-borne pathogens. Nevertheless, health officials should be quite familiar with *E. coli* O157:H7.

2 Best Practices in Crisis Planning and Communication

Best practices in an outbreak scenario can be constructed from several lines of research, including all those mentioned in section 1 as well as several tested crisis-communication approaches, which are outlined below. This section will draw on findings from both.

Crisis-communication theory can be used as a basis for ongoing communication about the nature of risk, since the needs of the two are essentially the same. The main difference is that in a crisis, timing is much more crucial and speed is often of the essence.

A crisis can hit any organization unexpectedly and have devastating results, including prolonged harm or injury to people or the environment. Short-term damage, such as financial or business loss, can be amplified by long-term effects such as lawsuits, loss of public confidence and trust, and a damaged reputation. Whether it's an airplane crash, an accident at a chemical plant, a drug tampering case, or an outbreak of food- or water-borne illness, a public emergency generates significant media coverage, and the formation of public attitudes and beliefs is often swift and dramatic.

2.1 Developing a Crisis Response Plan

Many organizations have learned the hard way that planning is essential. Tinker et al. identified lessons learned from the experience of an agency attempting to develop a long-term plan to reduce public spraying of a home pesticide.[47] The agency had problems with both external and internal communications. Externally, the agency used familiar communication methods such as fact sheets, presentations to the public and health professionals, coordination centres using agency staff, small-group community meetings, press releases, and door-to-door visits. Internally, the agency conducted daily conference calls and held informational and planning meetings. Nevertheless, some jobs were being duplicated and others left undone, since certain employees understood their own tasks but did not fully understand the tasks of others. The agency felt it was not getting its message across and was not prepared for an emergency. The primary challenges in communicating health risks were

[47] T.L. Tinker et al., 2000, "Assessing risk communication effectiveness: Perspectives of agency practitioners," *Journal of Hazardous Materials*, vol. B73, pp. 117–27.

- limited knowledge of the magnitude of a quickly evolving health threat,
- limited scientific data,
- lack of defined staff roles and responsibilities, and
- no identified strategy for providing public communication in a crisis situation.

Eventually, agency staff realized that, in the long run, comprehensive, coordinated, systematic planning would save them time and energy and reduce stress. This case highlights the need for agencies to be fully prepared for emergency situations and to have clear lines of responsibility and communication. In some smaller towns, this kind of infrastructure could be provided by provincial or federal agencies.

2.1.1 Importance of Planning

Having a documented, workable crisis-response plan – and not simply a manual gathering dust on a shelf – is increasingly recognized as a key element in limiting the damage in food- and water-borne outbreaks. The U.S. National Food Processors Association offers the following comments about planning:[48]

- Planning is a continuous process. It only begins with the written plan.

- Planning involves attempting to reduce the unknowns in a problematical situation, attempting to anticipate problems and project possible solutions.

- Planning aims at evoking appropriate actions, with appropriateness of response far more crucial than speed of response.

- Planning should be based on what is likely to happen, adjusting the disaster plan to people and their normal behavior rather than expecting people to change their behavior to conform with emergency plans.

- Planning must be based on facts, not on myths or misconceptions about responses of people and groups under stress.

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[48] National Food Processors Association, 1988, *Manual on Pre-Emergency Planning and Disaster Recovery* (Washington, D.C.: NFPA).

- Planning should focus on principles, producing simple rather than complex disaster plans that will tend to be ignored.

- Planning is partly an educational activity, making sure that relevant persons and groups in and outside of the company know their roles in an emergency.

- Planning always has to overcome any resistance, to bring about changes in thinking and ways of doing things, so that disaster planning often must be "sold" within the company or agency.

The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) has developed a comprehensive crisis communication manual for the province's agricultural producer groups, which provides the basics of crisis planning.[49] The first steps in planning may be summarized as follows:

- Designate a group of officials and other personnel who will act as a team to see an organization through a crisis. Draw up a call list of these people, including their names, departments, office telephone numbers, home telephone numbers, and e-mail addresses.

- Determine beforehand who has the authority to initiate recalls, boil water advisories, and other preventive measures.

- Designate a spokesperson, backed up by appropriate medical, environmental, and other expertise, to whom staff should direct all immediate inquiries.

- Designate a media liaison person to handle all media inquires, and have contingency arrangements for media available on site.

Local medical health offices (with support from the provincial health ministry) and water utilities should also develop full crisis-response plans. They should regularly test and update their plans, including

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[49] Adapted from S.E. Grant and D.A. Powell, 1999, *Crisis Response and Communication Planning Manual and Workbook* [online], [cited July 24, 2001], [prepared for the Ontario Ministry of Agriculture, Food and Rural Affairs], manual at <www.plant.uoguelph.ca/safefood/crisis-manual.htm>, workbook at <www.plant.uoguelph.ca/safefood/crisis/crisis-workbook.htm>.

- conducting annual crisis simulations, trying to work out any potential barriers to communication;

- sharing critical crisis communication experience from ongoing case studies;

- providing video-based, right-way/wrong-way, situation-specific refresher programs;

- interpreting and packaging crisis management case studies so that lessons may be learned from other outbreaks; and

- using crisis prevention and exposure management processes to uncover and correct any faults or oversights in testing strategies.

The useful life of a plan is about four years, so maintaining a current plan can be a challenge. Personnel changes and business restructuring can overwhelm even the best updating process.[50] Therefore, agencies should update their plans every six months to a year to keep the information as current as possible. In updating a plan, agency personnel should remember that newly assigned spokespeople and corporate leaders often require extra help to get up to speed. Conducting the annual video-based simulations can update newcomers in a matter of hours.

In creating a plan, the following points are especially important:

- The greatest single weakness of most crisis plans is a lack of defined roles for top management personnel (and those they trust). Plans designed by low-level insiders without management input will not be implemented if the reputations, careers, or futures of high-level insiders will be defined by the crisis at hand. If the boss has not bought the plan, he or she and those he or she trusts will do something else when problems occur.[51]

- Documentation during a crisis is crucial. Meticulous documentation of events, responses, and media communication will be invaluable in assessing an outbreak during the recovery phase of crisis management. It will also aid in correcting areas of the plan that did not work.

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[50] J.E. Lukaszewski, 1994, "Keeping your crisis communication management plans current," Part I of "Crisis management/vulnerabilities," *Crisis Prevention*, January–February–March.
[51] Ibid.

2.1.2 The Crisis Communication Manual

The crisis communication manual contains the plan. Among the most important features of the manual is a current, comprehensive notification list. It should include the names and contact information of people and agencies who are to receive information relevant to an outbreak (see OMAFRA list above). Also listed should be channels through which information may be distributed, such as e-mails, faxes, news releases, and agency Web site pages dedicated to updating information in a crisis situation.

A media list is also vital. Identifying various media that should be notified or might contact an agency during a crisis will help staff anticipate what questions are likely to be asked and who will be asking them. The list should include agricultural and mainstream media, as well as a checklist to make sure all possible outlets are being covered.

The media section should also include a list of questions – and prepared answers – that reporters and consumers might ask in a crisis situation. This section should also provide templates for news releases, statements, and letters to stakeholders, geared for various outbreak scenarios.[52] The templates will have to be adjusted for specific situations.

2.1.3 Sins of Crisis Communication

Delaney has listed these "seven deadly sins" of crisis communication:[53]

- lack of preparedness – the "It can't happen to me" syndrome;
- absence – not being on site immediately;
- ignorance – not understanding the audience's needs;
- silence – not communicating;
- distance – boardroom bunker mentality;
- fabrication – anything but the truth; and
- naïveté – not knowing the standards you will be held to.

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[52] National Cattlemen's Beef Association, 1997, *BSE Response Plan – Draft 1997* (Washington, D.C.: NCBA).

[53] Adapted from B. Delaney, 1997, *The Seven Deadly Sins of Crisis Management* [online], Crisis Communication Center, Clarke & Company [cited July 24, 2001], [first appeared in the July 1997 issue of the center's newsletter, *The Crisis Counselor*], <www.clarkecrisis.com/p2.html>.

The sins of silence and distance are common in crisis communication. Failing to communicate promptly with the media and appearing defensive – even when there is no substantive information to base comments on – will lead media and critics to assume that an organization is denying or downplaying the existence of a problem.

Making any of these mistakes will diminish public trust by negatively reflecting on an agency's determination to take responsibility, manage the situation, and tell the truth.

2.2 Creating the Message

With a comprehensive crisis communication plan in place, the development of the actual information messages and advisories becomes the critical issue facing health authorities and others. Creating accurate and comprehensive risk messages is one of the most difficult, time-sensitive, and time-consuming aspects of risk communication.[54]

One key to effective message development is the recognition that individuals are unique, and that each person is going to respond to a message using his or her own filters of knowledge and experience. Risk messages need to be personalized enough to provide a framework for individual action, recognizing the practical constraints of tailoring a message to each member of a target audience.[55]

In general, risk messages should[56]

- be complete, including the nature of the risk, benefits of reducing the risk, and specific, practical risk-reducing measures;
- be couched in clear, plain language;
- seek strictly to inform the audience;

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[54] E.B. Arkin, 1989, "Translation of risk information for the public: Message development," in *Effective Risk Communication,* edited by V.T. Covello, D.B. McCallum, and M.T. Pavlova (New York: Plenum Press), pp. 127–35.

[55] C. Needleman, 1987, "Ritualism in communicating risk information," *Science, Technology and Human Values,* vol. 12, pp. 20–25.

[56] Adapted from United States, National Research Council, 1989, Committee on Risk Perception and Communication, *Improving Risk Communication* (Washington, D.C.: National Academy Press); and V.T. Covello et al., 1993, "Comments on 'the mental model' meets 'the planning process,'" *Risk Analysis,* vol. 13, p. 493.

- focus on specific issues;
- place the risk in appropriate context, avoiding overdramatizing or trivializing the concern;
- describe what is being done to solve the problem;
- be hierarchically organized so that people who only want answers can find them quickly, and people who want details can also find those;
- relate to the audience's perspectives and concerns;
- acknowledge what the audience already knows;
- be respectful in tone and recognize that people have legitimate feelings as well as thoughts and opinions;
- address the broader social dynamics in which risks are embedded;
- be honest about the limits to scientific knowledge; and
- be subjected to careful empirical evaluation and ongoing refinement.

See also sections 1.3.1 and A.4.

2.3 Deciding When to Go Public

When signs of a possible crisis begin to emerge, public health officials face a key consideration: at what point does sufficient information exist to warn the public?

J. Misumi conducted some preliminary work in an attempt to develop codified guidelines that health officials and others could use to help decide this question.[57] As part of this work, Misumi interviewed ten leading epidemiologists, health authorities, and industry officials in North America to determine state-of-the-art thinking on this issue, using the 1996 to 1998 continent-wide outbreak of the parasite *Cyclospora cayetanensis* as a starting point for the discussion.

When officials were asked what they believed would be sufficient epidemiological evidence to support a warning or ban in this situation, answers varied widely. One official, from the Laboratory Centres for Disease and Prevention Canada (LCDC), said that sufficient evidence would be results from a control study – corroborating laboratory evidence was not necessary. Conversely, an official with the Ontario Ministry of Health stated that both epidemiological information (based on questionnaires, biostatistical analyses, and control studies) and laboratory confirmation were required; neither was

[57] J. Misumi, 2000, When to go public: A case study of North American outbreaks of *Cyclospora cayetanensis*, 1996–1998, master's thesis, University of Guelph.

sufficient alone. This official added that although an organism might be isolated in a food, if it was normally found in that food without causing a problem, then lab results showing its presence were useless.

An investigator with the York Region Health Department said one should calculate the rate at which a disease was occurring compared to the base line to determine the existence of a true outbreak. However, what might look like an abnormal rate could simply be due to chance fluctuations in disease statistics or an increase in public awareness. An outbreak was not always obvious. Officials had to rely on hard scientific evidence.

According to these respondents, the amount of epidemiological evidence needed to support a warning or ban will always be a matter of dispute, regardless of the specific case. Perspectives will always differ. They agreed that currently there were no known guidelines to aid epidemiologists in making decisions. As one commented, "Every outbreak is considered on an individual basis." The critical factor in acquiring evidence, then, is simply to gather as much of it as possible as quickly as you can.

Nevertheless, they said, authorities do consider certain key factors in deciding when to go public. One is the seriousness of the risk: how deadly is the agent? The greater the health risk – especially if death is possible – the greater the urgency to inform the public. The potential health risk of microbiological hazards should be assessed and quantified by workers from diverse disciplines: farmers, veterinarians, food processing experts, microbiologists, medical doctors, risk analysis experts, and consumer behaviour experts. Microbial risk-assessment models, which account for the seriousness of a hazard and the incidence of exposure for the general population and specific, at-risk sub-populations, could be useful in this determination. Risk assessments of various microbial agents would be adapted over time as more information was gathered.

Another factor that can influence the decision includes the size of the potentially affected population: is the suspected source of contamination a common substance such as water, or is it something consumed only by a small segment of a population? Still another is the population itself: is there an exposed group that is immunosuppressed and therefore at higher risk – for example, infants or the elderly? In the latter case, the risk of death and permanent injury would be greater, as would the chances of media reporting.

Economic concerns, however, tend to be relegated to the background, since they are regarded as being in conflict with the public interest. Although public warnings and bans can have a significant economic impact, the government's primary concern is – or should be – public health.

Although outbreaks are individually evaluated, communication experts have offered the following arguments for the early release of information:[58]

- It sets the pace for resolution of the problem.
- If you wait, the story may leak anyway.
- You have better control of accuracy if you are first to present it.
- Prompt release allows more time for meaningful public input.
- People are entitled to information that affects their lives.
- It may prevent similar situations occurring elsewhere.

2.4 Delivering the Message

As noted in section 1, officials have many communication techniques available to them for alerting the public and others about a crisis. Methods that reach those most affected are especially critical.

A variety of techniques is needed to reach every person in an affected community. Commenting on the Ontario ice storm of 1998, Bruce Stock of Emergency Measures Ontario said, "Under the category of lessons learned, the most obvious was the need for robust telecommunications with full backup capabilities, including generators, batteries and supplies."[59] However, as conversations with people who experienced the Walkerton crisis indicated to the authors, whereas high-technology or electronic communication offers clear benefits, it also has limitations. When the power goes out or the number of telephone lines is limited, people must still be able to communicate. In a crisis situation, therefore, other, more traditional delivery mechanisms often play a significant role.

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[58] B.J. Hance, C. Chess, and P.M. Sandman, 1988, *Improving Dialogue with Communities: A Risk Communication Manual for Government,* report to the New Jersey Department of Environmental Protection, Division of Science and Research (Trenton: New Jersey Department of Environmental Protection).

[59] B. Stock, 1998, "Inside the ice storm: Emergency Measures Ontario," *Emergency Preparedness Digest*, October–December [also available at <www.qsilver.queensu.ca/~icestudy/report.htm/psr007.pdf>].

For comparative purposes, various delivery systems are classified below as low technology, medium technology, and high technology. This classification does not imply a value judgment; on the contrary, it recognizes that each system has advantages and disadvantages. An overall crisis communication plan should include a mix of methods to be used where appropriate.

2.4.1 Low Technology

2.4.1.1 *Door-to-Door Canvassing*

In certain circumstances, door-to-door communication is an excellent technique. It is direct, personal, and thorough. As part of the emergency plan, localities can be divided into smaller areas with sections allocated in advance to police, fire workers, council workers, or volunteers. A well-coordinated door-to-door plan including delivery of a leaflet or "tap tag" (see section 2.4.2.3) is a viable option in most areas. Costs, however, are relatively high and the method can stretch already limited human resources.

2.4.1.2 *Buddy System*

This informal system depends on word of mouth and allows for friends, neighbours, and family members to look out for one another. It is used extensively and is moderately effective. Costs are very low. However, this method may not be accurate or reliable, since it depends on citizens being proactive.

2.4.1.3 *Neighbourhood Captains*

In the planning stages, authorities should consider assigning locally responsible volunteers to communicate important public health information rapidly and correctly in their own neighbourhoods. Possible recruits include religious, social, or other community group leaders. These people could play an important role not only in door-to-door communication but also in gathering information and reporting on numbers of illness cases. They would act as familiar local sources of information and unofficial contacts for people in the community, who may have follow-up or other concerns.

Current programs such as Neighbourhood Watch may also be useful. While the organization's primary aim is crime prevention, it has a network already in place in many communities. Taking advantage of such programs is relatively inexpensive and can allow the freeing up of extra human resources.

2.4.1.4 *Mobile Megaphones*

This well-known method of communication can be effective for smaller communities. A megaphone is used to spread warnings through the streets of the community. This system is rapid, requires little labour, and can arouse public curiosity and interest, both of which are excellent first steps in message communication. Costs are relatively low. As one Walkerton citizen noted in the aftermath of the outbreak, when the local peewee hockey team won a championship, they rode up and down town streets proclaiming their victory. Given the severity of *E. coli* O157:H7, he wondered why a similar mechanism was not used to alert citizens about the boil water advisory.

2.4.1.5 *Emergency Hubsite Information Centres*

An emergency hubsite information centre (EHIC) can be identified locally and planned in advance. The chosen site might be a local corner store, library, school, or church. Hubsites can act as main information centres for an area, offering leaflets, posters, how-to lists, and referrals to other information sources. Printing will require some cost outlay. Again, this method is especially appropriate for smaller communities.

2.4.1.6 *Town Meetings*

These forums are excellent opportunities for two-way communication, allowing the public to listen and be listened to. Meetings can distribute information quickly. However, due to frequent problems in setting them up, town meetings are often held toward the end of an emergency. Having pre-established protocols for arranging meetings and preparing messages can help improve timeliness.

2.4.2 Medium Technology

2.4.2.1 *Telephone Trees*

A telephone tree can be effective in getting messages out quickly. Starting with one person, each member contacted is given a list of other people to contact, so that connections branch out like a tree. Members are expected to be persistent, calling repeatedly or even dropping by people's homes and leaving a note if necessary. Again, this technique relies on the initiative of community members and may not be practical for larger communities.

2.4.2.2 *Local Media*

Local media (radio, television, and local cable stations) should be engaged as much as possible in a crisis situation. Developing a rapport with media personnel in advance helps significantly in establishing trust in the event of an actual emergency. In a crisis, local media play a pivotal role and therefore should be heavily involved in both advance planning and practice trials. It is important to be proactive and inclusive before and during emergency communication. Costs for this section of crisis planning are relatively low.

2.4.2.3 *Tap Tag Initiative*

As noted above, delivering risk messages is one thing but initiating behaviour change with them is quite another. One example, which applied in the Walkerton case, is whether or not a boil water advisory is effective in inducing consumers to actually boil water (especially for less obvious uses such as brushing teeth). One simple technique to consider is a tap tag initiative, which is aimed at strengthening the link between the message and appropriate action.

A tap tag is a 10-cm-square, bright orange tag that can be attached to a tap, faucet, or ice machine with an elastic band or a self-adhesive strip. The tag would be printed with a warning: "Do not consume water from this outlet. Boil first." It would include further information sources such as a hotline number or Web site address.

The tags could be prepared by the water board or utility as part of its overall risk communication plan and pre-delivered to consumers for storage. Upon

hearing of a boil water advisory, consumers would tag all appropriate drinking water outlets. Alternatively, the tags could be pre-packaged in emergency orange envelopes and hand delivered to consumers by local authorities at the time of a boil water advisory.

2.4.3 High Technology

Modern technologies offer significant advantages but can leave users vulnerable. Technical glitches are likely in a crisis, especially if many users are concentrated in a single area.

2.4.3.1 *Telephone Hotlines*

Toll-free or 1-800 numbers can provide a brief message ("Don't drink the water") as well as additional information. This technique is especially effective in providing accurate details to the media and interested members of the public, but it relies on people being sufficiently concerned to actively seek out information. A hotline number must be established at the onset of a crisis and included in all public notices. These dedicated lines can be expensive and may be limited by the capabilities of the local telephone company, as phone lines can easily be overburdened.

2.4.3.2 *Conference Calls and Faxes*

Many agencies and associations have the necessary technological support to allow conference calls and fax distribution. These communication methods can dramatically reduce the time required to identify cases of illness and to survey and collect results for case-control analyses. They also allow rapid communication between experts and identification of infectious agents. If the technology is not already established, however, the cost of setting it up can be high.

2.4.3.3 *Cellphones, E-mail, and the Internet*

Cellphones, e-mail, internal networks, and the Internet can provide crucial support for the rapid dissemination of information and the creation of databases to match needs and expertise. These technologies have already improved surveillance

systems, helping to identify sources of illness, especially when they are distributed over wide areas. E-mail can be effective in delivering messages directly to consumers and, when combined with Internet databases, can be an excellent resource for people wanting to search out additional information. Although limited in their ability to reach all members of a target population, these methods can be effective additions to an existing communication strategy and can be relatively inexpensive if the networks and infrastructure are already in place.

Designated Web sites are being used increasingly as a means of communicating outbreak information. Among the information such a Web site might include are

- details of the crisis – for example, product-recall brand names, product codes;
- date(s) of production, and the level at which products have been recalled (retail, wholesale, and so on);
- a chronology of events;
- details of the agency's investigation into the source of the problem, if unknown;
- press releases;
- texts of letters sent to stakeholders and the target audience;
- consumer-information contact numbers, especially toll-free lines;
- fact sheets and/or answers to frequently asked questions; and
- links to sites providing additional information.

During the Odwalla *E coli* outbreak in 1996, the company posted extensive information about the pathogen on its Web site, explaining what Odwalla was doing to resolve the crisis. This initiative was recognized as the first time a company involved in an outbreak had used a Web site to communicate to the public. For another example of a Web site used for crisis communication, see the Belgian government's site at <http://belgium.fgov.be/en_index.htm> (search for "dioxin").

2.4.3.4 *Expert Teams*

Teams of experts who are trained in risk analysis or crisis management and who understand the importance of risk communication can be very helpful in an outbreak situation. These teams can be made up of community officials or be brought in from outside on an emergency basis.

For community teams, it is essential that the necessary background work be done in advance, not during the crisis. Strategic planning and training must be carried out so that in an emergency, all members of the team know their responsibilities and how the team operates as a whole, and all critical tasks are completed without duplication. Initial training costs can be significant, but an effective plan will save time and money in the long run.

Outside teams of experts who could move in and assist small communities might be created as part of provincial or federal emergency preparedness programs but with a focus on community needs.

2.5 Role of Water Utilties

2.5.1 Warnings Protocol

Public risk communication relies on effective internal agency communication and risk analysis to determine the nature and severity of a risk and when and how to communicate such information to consumers. Water quality should be monitored daily, using a code such as the following:

0 – no known or suspected problem
1 – a trigger event has occurred but health risk is indeterminate
2 – level I health risk possible for immunocompromised populations
3 – level II health risk possible for general population
4 – a confirmed outbreak

A trigger event would be defined in consultation with the Ministry of the Environment and the Ministry of Health.[60]

2.5.2 Community Outreach

It is imperative that agencies and groups involved in providing drinking water be proactive in communities. Community outreach is important not only to increase awareness of the role of these agencies and the problems that could arise but also to create an inclusive, empowering relationship with the public that will encourage the growth of trust. This involvement would ideally open

[60] Adapted from Casman et al., 2000.

multiple channels of communication between consumers, water providers, and government so each can learn from the other.

Such a plan would keep the public informed about risk assessment and management procedures being undertaken by water utilities and other agencies in producing a safe water supply. The relative risks associated with drinking water, how these risks were assessed, and how they are being managed should be communicated to the public on a regular basis. The United States has recently required regular disclosure of such information to all consumers of municipal water systems by means of an annual report. A similar information mechanism should be evaluated for Canadian consumers.

Appendix: Risk Theory

Risk theory is a relatively new area of study that can be defined as the science of understanding scientific and technological risk and how it is communicated within a sociopolitical structure.[61] Risk theory is useful as a basis for discussing how regulators, industry, and citizens incorporate and act on information about risks. Over the last few decades, a body of knowledge has developed about how the public perceives risk, how media translate risk information, and how government, industry, and other organizations can best communicate risk information over a wide range of disciplines.

A.1 Components of Risk Analysis

Covello and Merkhofer define risk as a combination of undesirability and uncertainty – or, more specifically, as "the possibility of an adverse outcome, and uncertainty over the occurrence, timing, or magnitude of that adverse outcome."[62]

The definition of risk analysis includes three components:

- risk assessment – the scientific process of characterizing a risk (questions that should be asked include: What can go wrong? How likely is a bad outcome? How long will it take before that occurs? What might be the importance of the loss?);
- risk management – the process of deciding what to do about a risk; and
- risk communication – the communication of a policy decision.

This three-component definition was first formalized by the U.S. National Academy of Sciences – through its National Research Council – in 1983, in a publication commonly referred to as the Red Book. The NAS-NRC model explicitly distinguished and separated these three stages. However, by the 1990s, this model was being widely criticized as unworkable and unrealistic. Covello and Merkhofer argue:[63]

> The current state of the art of risk assessment does not permit questions of science to be clearly separated from questions of policy.

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[61] C. Starr, 1969, "Social benefit versus technical risk," *Science,* vol. 165, pp. 1232-38.
[62] V.T. Covello and M.W. Merkhofer, 1994, *Risk Assessment Method* (New York: Plenum Press).
[63] Ibid., 1994.

> In practice, assumptions that have potential policy implications enter into risk assessment at virtually every stage of the process. The ideal of a risk assessment that is free, or nearly free, of policy considerations is beyond the realm of possibility.

Even using conservatism – meaning the risk assessor errs on the side of safety – is a value judgment deliberately introduced into risk assessments to deal with uncertainty. Conservatism can produce highly distorted risk assessments that affect the pattern of regulation, preventing limited resources for health and safety from being efficiently allocated.

A.1.1 Integrating Assessment, Management, and Communication

Soby et al., in a review of risk communication research and its application to the management of food-related risks, presented the concept of the risk management cycle.[64] In this model, public and other stakeholder concerns are actively sought at each stage of the management process – including assessment. One report commented that "unless the risk assessment procedure involves an element of interactive public participation and mutual questioning, the decisions and conclusions reached [are likely to be] challenged."[65]

This integrative approach to risk analysis was endorsed in a 1996 report by the U.S. National Academy of Sciences' National Research Council Committee on Risk Characterization, which urged risk assessors to expand risk characterization beyond the current practice of simply translating the results of a risk analysis into non-technical terms. The committee said this limited practice was "seriously deficient" and should be replaced with an analytical-deliberative approach that involved stakeholders from the very inception of a risk assessment. The report re-framed risk characterization to be seen not as an activity that happens at the end

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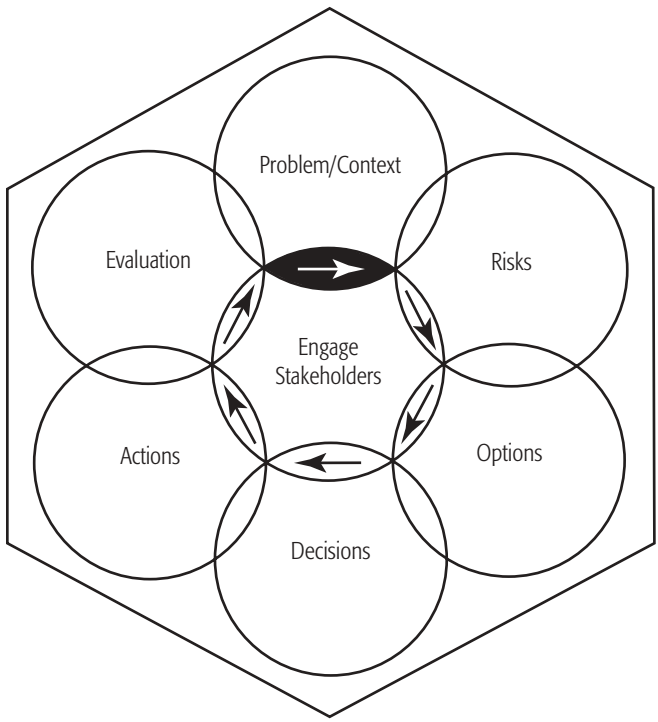
[64] B.A. Soby, A.C.D. Simpson, and D.P. Ives, 1993, *Integrating Public and Scientific Judgements into a Tool Kit for Managing Food-Related Risks, Stage 1: Literature Review and Feasibility Study* (Norwich, U.K.: University of East Anglia), ERAU Research Report No. 16, report to the U.K. Ministry of Agriculture, Fisheries and Food.

[65] A.C.D. Simpson, 1994, Integrating Public and Scientific Judgements into a Tool Kit for Managing Food-Related Risks, Stage II: Development of the Software (Norwich, U.K.: University of East Anglia), ERAU Research Report No. 19, report to the U.K. Ministry of Agriculture, Fisheries and Food.

of an assessment process, as many people understand it, but as a continuous back-and-forth dialogue between risk assessors and stakeholders.[66]

Similarly, the U.S. Presidential/Congressional Commission on Risk Assessment and Risk Management further developed the concept into an integrative framework to help all types of risk managers – government officials, private sector businesses, and individual members of the public – make good risk management decisions.[67] (See figure A.1.) The framework has six stages:

Figure A.1 The Risk Management Cycle



Source: U.S. Presidential/Congressional Commission, 1997.

[66] United States, National Research Council, Committee on Risk Characterization, 1996, *Understanding Risk: Informing Decisions in a Democratic Society,* U.S. National Academy of Sciences (Washington, D.C.: National Academy Press).

[67] United States, Presidential/Congressional Commission on Risk Assessment and Risk Management, 1997, *Framework for Environmental Health Risk Management* [online], Final Report, vol. 1[cited July 28, 2001], <www.riskworld.com/Nreports/1997/risk-rpt/html/epajana.htm>].

1. Define the problem and put it in context.
2. Analyze the risks associated with the problem in context.
3. Examine options for addressing the risks.
4. Make decisions about which options to implement.
5. Take actions to implement the decisions.
6. Conduct an evaluation of the actions' results.

Of particular importance is that these stages be conducted in collaboration with stakeholders, and that the stages be repeated if new information arises that changes the need for, or nature of, risk management. As Pollak has argued, in the face of inadequate scientific knowledge and lack of public trust in experts and governments, risk regulators should be concerned with creating institutional arrangements likely to foster trust, as well as mechanisms for providing concerned individuals with credible reassurance.[68]

A.1.2 ..... Managing Stigma

Research suggests that public trust depends partly on transparency: those responsible for food-safety risk management must be seen to be working to reduce a particular risk. They must be able to communicate these efforts to the public and prove that their efforts are, in fact, succeeding. As Slovic has noted:[69]

> We live in a world in which information, acting in concert with the vagaries of human perception and cognition, has reduced our vulnerability to pandemics of disease at the cost of increasing our vulnerability to social and economic catastrophes of unprecedented scale. The challenge before us is to learn how to manage stigma and reduce the vulnerability of important products, industries, and institutions to its effects, without suppressing the proper communication of risk information to the public.

Stigma is a powerful shortcut that consumers may use in their evaluations of food- and water-borne risks. Gregory et al. have described conditions that can lead to stigmatization:[70]

- The source [of the risk] is a hazard.

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[68] R.A. Pollak, 1996, "Government risk regulation," *Annals of the American Academy of Political and Social Science*, vol. 545, pp. 25-34.

[69] P. Slovic, 1997, "Perceived Risk, Stigma, and the Vulnerable Society," paper presented at the One-Day Conference on Risk, June 13, City University, London.

[70] Gregory et al., 1995.

- A standard of what is right and natural is violated or overturned.
- Impacts are perceived to be inequitably distributed across groups.
- Possible outcomes are unbounded (scientific uncertainty).
- Management of the hazard is brought into question.

The potential for the stigmatization of food and water risks is enormous. Well-publicized outbreaks of food-borne pathogens and the furor over agricultural biotechnology are but two current examples of stigma arising in the interactions between science, policy, and public perception.

Managing the stigma associated with food-safety issues involves the following elements:[71]

- effective and rapid surveillance systems;
- effective communication about the nature of risk;
- a credible, open, and responsive regulatory system;
- demonstrable efforts to reduce levels of uncertainty and risk; and
- evidence that actions match words.

Today it is well accepted that the three components of risk analysis cannot be separated and must, in fact, be integrated, and that communication involves the multi-directional flow of information.

A.2 A Difference of Perception

In 1969, Starr offered the first attempt at formulating a scientific basis for public thresholds of risk acceptance.[72] As concerns regarding nuclear power gained prominence in the 1970s, investigators tried to establish general principles for the public acceptance of risk. These were usually based on mortality statistics and the so-called *de minimus* risk principle, which argued that if a risk can be lowered to less than one additional fatality per million citizens, it is effectively zero.[73] Such a morbid approach was uniformly unsuccessful.

In the 1980s, several risk communication models emerged that took into

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[71] D.A. Powell, 2000, "Food safety and the consumer: Perils of poor risk communication," *Canadian Journal of Animal Science,* vol. 80, no. 3, pp. 393–404.
[72] C. Starr, 1969, "Social benefit versus technical risk," *Science,* vol. 165, pp. 1232–38.
[73] U.S. National Research Council, 1989.

account the value systems of individuals, peer groups, and societies. This work led to broad agreement that people view risks not only quantitatively (probability and size of risks) but also according to their perceived threat to familiar social relationships and practices.[74] Slovic's psychometric paradigm, for instance, described risk from a psychological perspective, drawing on various characteristics that may be important in influencing risk perception.[75] Douglas and Wildavsky proposed a cultural theory of risk, in which individuals would be allocated into groups based on shared values and beliefs.[75] Whereas the psychometric paradigm holds that risk itself can determine perceptions, the cultural theory contends that it is not the risk but the characteristics of the perceiver that are central to an understanding of risk perception. And Kasperson et al. developed the social amplification of risk theory, which suggested a way to integrate all these frameworks into a comprehensive accounting of the social, cultural, and individual characteristics that tend to magnify one risk over another.[77]

Around the same time, several researchers proposed that the public tends to pay too little attention to the hazard side of risk, whereas experts completely ignore the outrage side.[78] Since hazard and outrage are two very different starting points in a consideration of risk, it is not surprising that experts and consumers often rank the relative importance of various risks very differently.[79] Scientists generally define risks in the language and procedures of science. They consider the nature of the harm that may occur, the probability that it will occur, and the number of people who may be affected.[80] By contrast, most members of the public seem less concerned about these aspects of risk than about broader, qualitative issues.[81]

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[74] C. Vlek and P. Stallen, 1981, "Rational and personal aspects of risk," *ACTA psychologique,* vol. 45, pp. 275–300; M. Douglas, 1986, *Risk Acceptability According to the Social Sciences* (New York: Russel Sage); and P. Slovic, 1987, "Perception of risk," *Science,* vol. 236, pp. 280–85.

[75] Slovic, 1987.

[76] M. Douglas and A. Wildavsky, 1982, *Risk and Culture: An Essay on the Selections of Technological and Environmental Dangers* (Berkeley: University of California Press).

[77] R.E. Kasperson et al., 1987, "The social amplification of risk: A conceptual framework," *Risk Analysis*, vol. 8, pp. 177–87.

[78] P.M. Sandman, 1987, "Risk communication: Facing public outrage," *EPA Journal*, no. 13, pp. 21–22.

[79] Ibid., 1987; Slovic, 1987.

[80] E. Groth, 1991, "Communicating with consumers about food safety and risk issues," *Food Technology*, vol. 45, no. 5, pp. 248–53.

[81] Sandman, 1987.

According to Covello, research in the psychological sciences has identified 47 known factors that influence people's perception of risk, such as degree of control over the risk, whether the risk is voluntarily assumed, and above all, the degree of trust in the institutions, agencies, and individuals perceived to be in control.[82] If these agents have a track record of secrecy or are thought to have power over supposedly independent regulatory bodies and the public policy process, then people magnify the perceived risk.[83] These factors can help explain why consumers are concerned about food safety issues that scientists deem trivial, and vice-versa. The actual risk does not change, but the perception can; and in the domain of public policy, perception is reality.[84]

Other factors modulating risk perception include[85]

- catastrophic potential – people are more concerned about fatalities and injuries that are concentrated in time and space (airplane crashes; outbreaks of food-borne illness) than about those that are scattered or random in time and space (auto accidents, sporadic incidents of food-borne illness);

- familiarity – people are more concerned about unfamiliar risks (ozone depletion) than familiar risks (household accidents);

- understanding – people are more concerned about poorly understood risks (exposure to radiation) than about those they understand (slipping on ice);

- scientific uncertainty – people are more concerned about risks that are scientifically unknown or uncertain (recombinant DNA) than risks well known to science (car crashes);

- impact on children – people are more concerned about risks perceived to disproportionally affect children;

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[82] V.T. Covello, 1992a, "Risk communication: An emerging area of health communication research," in *Communication Yearbook 15*, edited by S. Deetz (Newbury Park and London: Sage Publications), pp. 359–73; and Covello, 1983.
[83] A. Hamstra, 1992, "Consumer research on biotechnology," In *Biotechnology in Public: A Review of Recent Research* (London: Science Museum), pp. 42–51; V.T. Covello, 1992b, "Trust and credibility in risk communication," *Health Environmental Digest*, vol. 6, no. 1, pp. 1–5.
[84] V.T. Covello, P. Sandman, and P. Slovic, 1988, *Risk Communication, Risk Statistics and Risk Comparisons: A Manual for Plant Managers* (Washington, D.C.: Chemical Manufacturers Association); U.S. National Research Council, 1989.
[85] Adapted from Covello and Merkhofer, 1994.

- dread – people are more concerned about risks that have dreaded results (Creutzfeldt-Jakob disease is perceived as an undesirable way to die);
- media attention;
- personal accident history;
- clarity of benefits offsetting the risk;
- reversibility – people are more concerned about risks they perceive to be irreversible (an environmental release of a genetically engineered organism is often characterized as such);
- personal stake; and
- attributability – is there an identifiable target or promoter of the risk in question?

A.3 Interactive Communication

In 1989, the U.S. National Research Council Committee on Risk Perception and Communication defined risk communication as "an interactive process of exchange of information and opinion among individuals, groups and institutions. It involves multiple messages about the nature of risk and other messages, not strictly about risk, which express concerns, opinions, or reactions to risk messages or to legal and institutional arrangements for risk management." In essence, risk communication must be treated as a reciprocal process – including the opinions of all stakeholders, not simply those who wish to sell their side of the story more effectively.

The growth of interest in risk communication has been driven by at least four factors:[86]

- a requirement for, or desire by, government in the participatory democracies of Western societies to inform and engage citizens about risk, from informal consultation to legislated accountability (such as the U.S. *Administrative Procedures Act* of 1946 and the "Community Right

[86] Adapted from U.S. National Research Council, 1989.

to Know" provisions of Title III of the *Superfund Amendments and Reauthorization Act* of 1986);

- desires to overcome opposition to decisions (such as the siting of waste facilities);
- a desire for power sharing between government and public groups; and
- a desire to develop effective alternatives to direct regulatory control.

Underlying these motives is a general recognition that decision making in democratic societies is becoming more public and is increasingly driven by non-experts. Thus there is a need for a paradigm such as the risk management cycle, which acknowledges this transition. The ability to apply science-based solutions to food and water safety and other food-related challenges is intricately dependent on issues of public perception, the regulatory environment, fairness, accountability, and, most important, trust.

Problems in communicating about risk originate primarily in the marked differences between the two languages used to describe risk: the scientific and statistical language of experts, and the intuitively grounded language of the public (see figure A.2.).

The expert assessment of risk is essential to the making of informed choices in everyday life. To ignore the results of scientific risk assessments (ever-changing as they are) is to merely substitute an informal deliberative process for a formal one.[87] At the same time, citizens in a democratic society cannot allow experts to dictate lessons in risk management to them; on the contrary, their informed consent must form the basis of the collective allocation of resources for risk control and risk reduction. In general, therefore, society must manage the tension between these two profoundly different ways of representing risk, rather than try to eliminate the difference itself.

Powell and Leiss have located the work of risk communication in the gap that separates the evolving scientific description of risks and the public understanding of those same risks.[88] Further, they suggest that the competing "expert" and "public" understandings of the same risks are equally legitimate and necessary.

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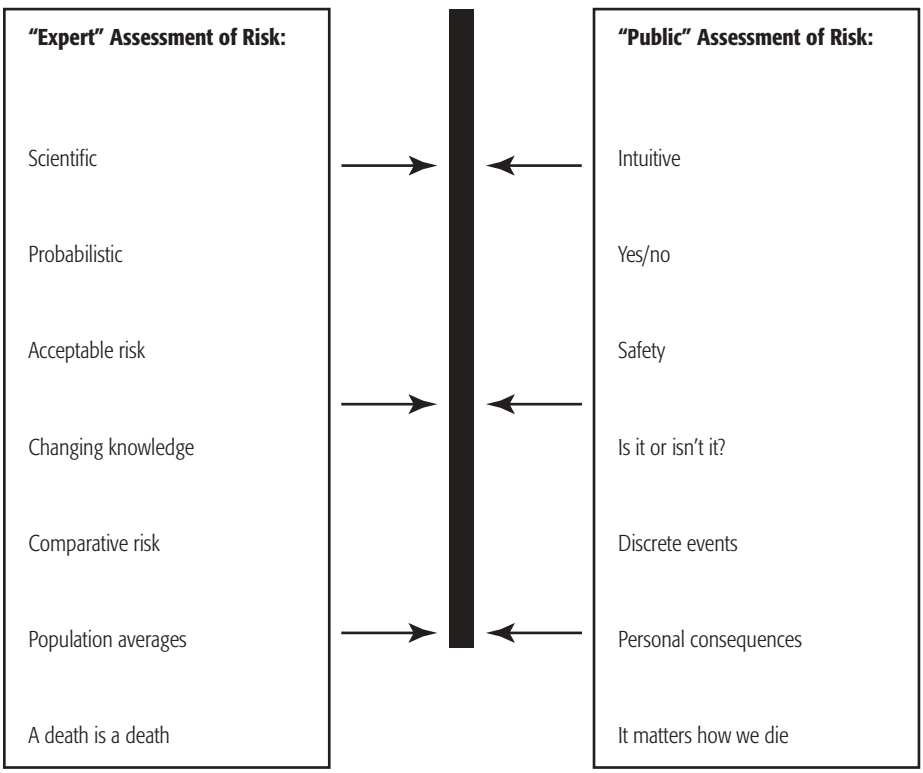
[87] Powell and Leiss, 1997.
[88] Ibid.

Confused, complex messages about scientific risk, technical uncertainty, and a prevailing climate of mistrust are just some of the factors that make effective risk communication difficult. Baruch Fischhoff of Carnegie-Mellon University says that over the past 20 years, risk communication has evolved by acquiring new skills "only to discover that there were additional, more complicated problems to solve." He offers this sardonic view of the developmental stages in risk management, which he subtitles "Ontogeny Recapitulates Phylogeny":[89]

Figure A.2 Two Languages of Risk Perception



Source: Powell and Leiss, 1977

[89] B. Fischhoff, 1995, "Risk perception and communication unplugged: Twenty years of process," *Risk Analysis,* vol. 15, pp. 137–45.

- All we have to do is get the numbers right.
- All we have to do is tell them the numbers.
- All we have to do is explain what we mean by the numbers.
- All we have to do is show them that they've accepted similar risks in the past.
- All we have to do is show them that it's a good deal for them.
- All we have to do is treat them nice.
- All we have to do is make them partners.
- All of the above.

Or, as Thomas Jefferson wrote in a letter to William Charles Jarvis, dated September 28, 1820: "I know of no safe depository of the ultimate powers of society but the people themselves; and if we think them not enlightened enough to exercise their control with a wholesome discretion, the remedy is not to take it from them, but to inform their discretion."[90]

A.4 New Guidelines

Many collections, guides, and reviews appeared during the 1990s offering advice that reflects the expanding understanding of risk communication. For example, Covello and Allen summarize seven cardinal rules of risk communication as follows:[91]

- Accept and involve the public as a legitimate partner.
- Plan carefully and evaluate performance.
- Listen to your audience.
- Be honest, frank and open.
- Coordinate and collaborate with other credible sources.
- Meet the needs of the media.
- Speak clearly and with compassion.

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[90] U.S. National Research Council, 1989, p. 14.

[91] V. Covello and F. Allen, 1988, *Seven Cardinal Rules of Risk Communication* [pamphlet], U.S. Environmental Protection Agency, OPA 87-020, Washington, D.C.

Keith Fulton's more specific guidelines for risk messages are also informed by an appreciation of public perceptions:[92]

- A communication message must be concise. For example, the conclusion should be stated in 12 to 15 words and should not contain technicalities or jargon.

- The message should be positive. Negative connotations divert attention and discourage action (for example, "Boil water and it will be safe to drink" as opposed to "Boil water before drinking or you will fall ill").

- The message must address underlying concerns, or the public will think you are not listening.

- A successful message must be repeated, ideally from different sources.

- The message must provide a source of additional information. Some individuals will want to know more in order to follow up on suggestions.

- A successful message is given in plain language, comprehensible to the target audience. The risk communication message should be memorable. If your target audience has to write it down, they probably won't remember it.

- A good message should include analogies or personal stories, something the target audience can relate to. It should involve the audience at a personal level or it will not impress them.

- The message should be qualitative, not numerical. Millions, billions, and orders of magnitude often confuse rather than clarify a risk message. It is also advisable to avoid vague terms such as *big, small, inconsequential,*

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[92] Adapted from D. Byrd and R. Cothern, 2000, *Introduction to Risk Analysis*, Government Institutes (Rockville, Md.: ABS Group). Other guides to risk communication include V.T. Covello, D. von Winterfeldt, and P. Slovic, 1986, "Communicating risk information to the public," *Risk Abstracts*, vol. 3, no. 4, pp. 1–14; Covell et al., 1988; Hance et al., 1988; W. Leiss, 1989, *Prospects and Problems in Risk Communication* (Waterloo, Ont.: University of Waterloo Press); R. Lundgren, 1994, *Risk Communication: A Handbook for Communicating Environmental Safety and Health Risk* (Columbus. Ohio: Battelle Press); M.G. Morgan et al., 1992, "Communicating risks to the public," *Environmental Science and Technology*, vol. 26, pp. 2048–56; M.G. Morgan, 1993, "Risk analysis and management," *Scientific American*, July, pp. 32–41; Powell and Leiss, 1997; and U.S. National Research Council, 1989.

minimal, because different groups will probably interpret them differently. The message should be conveyed in terms of concern for the health and welfare of the listener. Avoid making the audience feel ignorant by using numbers and jargon.

- A message should acknowledge major uncertainties. All risk estimates involve uncertainty. The more you acknowledge it honestly, the more the audience will trust you.

A.5 The Role of the Media

Risk communication often involves messages from diverse sources being translated and synthesized by media outlets. At each step of the process, journalists, just like message providers and audience members, are framing events using their own value systems, constraints, and the filters of experience and expectation.

Schanne and Meier, in a meta-analysis of 52 studies of media coverage of environmental risk, concluded that journalism constructs a universe of its own, a "media reality" that does not mirror actual reality.[93] The journalistic construction of environmental issues and risks mirrors only partially, if at all, the scientific construction of the same issues and risks. Many problems in scientist-journalist interaction can be traced to the myth of objectivity cherished by both disciplines. Scientists and journalists who acknowledge that a degree of bias is normal are likely to be better prepared to distinguish facts from value judgments in both expert statements and media accounts of food safety debates.[94]

Although the professional isolation of both scientists and journalists presents an ongoing impediment to communication, it would be wrong to view the media always as a significant, independent cause of problems in risk communication, or vice-versa.[95] Further, media analysts often fail to recognize the chaos of everyday life in newsrooms and the constraints imposed by a media industry geared for profit. More important, perhaps, they fail to

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[93] M. Schanne and W. Meier, 1992, "Media coverage of risk," in *Biotechnology in Public: A Review of Recent Research* (London: Science Museum).
[94] Groth, 1991.
[95] U.S. National Research Council, 1989.

acknowledge the critical faculties of readers. The assumption seems to be that an uncritical public is waiting to be filled with education, and that media are more influential than common sense and practical experience suggest.

The role of the media in shaping public perception in technological controversies has been well documented.[96] Yet the actual impact of media coverage on citizens' decisions with respect to a particular risk remains unclear. Protess et al. found when examining the impact of reporting on toxic waste controversies that media disclosures had a limited effect on the general public but were influential in changing the attitudes of policy makers.[97] Dunwoody argues that while the media tell people something about the risks present in a society, interpersonal channels are used to determine the level of risk to individuals. How much information these secondary sources originally receive from media stories, however, has not yet been determined.[98]

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[96] F. Molitor, 1993, "Accuracy in science news reporting by newspapers: The case of aspirin for the prevention of heart attacks," *Health Communication,* vol. 5, pp. 209–24.

[97] D.L. Protess et al., 1987, "The impact of investigative reporting on public opinion and policymaking," *Public Opinion Quarterly*, vol. 51, pp. 166–85.

[98] S. Dunwoody, 1993, "Telling public stories about risk," in *Agricultural Biotechnology: A Public Conversation About Risk* (Ithaca, N.Y: National Agricultural Biotechnology Council 5), pp. 97–106.

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