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## From Cancer to Diarrhea: The Moving Target of Public Concern about Environmental Health Risks

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**Abstract:** Public concern about the environment can be unpredictable because it is influenced by numerous factors. Environmental health issues often emerge as important because the public is worried about their health especially when it comes to cancer. Public fear of cancer from environmental exposures is reinforced by many of the US regulations that set pollutant limits based on reducing the risk of cancers rather than other health outcomes. While fear of cancer will never dissipate, recent foodborne outbreaks are contributing to raising public awareness of the health effects from microbes. This paper adds to the dialogue about the challenges of enhancing public understanding of environmental health issues. Internal factors, such as worry, that contribute to public outrage are sometimes more important than external factors such as the media. In addition, relying on the media to inform the public about imminent public health risks may be an ineffective approach to enhancing understanding. In the end, scientists and risk communicators are forced to compete with politicians who are often very effective at manipulating public understanding of risk.

**Keywords:** environmental health, risk perception, environmental communication, framing risk

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## Introduction

On January 4, 2011, President Obama signed the Food Safety Modernization Act (FSMA), the first new food safety legislation in more than 70 years. Prior to this signing, the Federal Food, Drug, and Cosmetic Act, which was ratified in 1938 and amended in 1996 with the Food Quality Protection Act, was the last federal law that addressed food safety in the United States. Since then, the safety of the country's food supply has been managed through a series of guidance and policy documents, including voluntary practices, such as recalls and enhanced inspections.

The FSMA addresses many of the shortcomings of the food safety management system in the US and prioritizes prevention as a mechanism to address outbreaks. The law requires the Food and Drug Administration (FDA) to develop regulations pertaining to new preventive controls in food facilities as well as a focus on addressing risks from contaminated produce. Increased frequency of inspections and access to records are identified as key components to compliance with the law. A significant component of FSMA is the authority it gives FDA to mandate recalls—a provision that became effective immediately upon signing. Prior to January 4, 2011, recalls were voluntary on the part of the food producer.

The events that led up to signing FSMA included a series of high profile outbreaks, involving foods such as peanut butter and spinach that directly affected the health of thousands and the economic health of the food industry. While these outbreaks led to many preventable illnesses and deaths, thanks in part to the media, one additional outcome was a nationwide focus on the risks associated with microbiological contamination. For many years, health officials have been warning the public that microbes are the leading cause of foodborne illness, and that most of these illnesses are preventable. In 1997, the Partnership for Food Safety Education was formed with a focus on educating the public about safe food handling practices in order to prevent foodborne illness. Their main educational campaign is Fight Bac™ which emphasizes steps for consumers to take to minimize the risk of microbiological contamination of the food they prepare.

Federal governmental food safety efforts began to shift from public education to policymaking in 2009, when President Obama created the Food Safety Working Group (FSWG), chaired by the Secretaries

of the Departments of Health and Human Services and Agriculture. In his weekly address, the President specifically pointed to the peanut butter outbreak as one factor in his decision to target food safety.

When I heard peanut products were being contaminated earlier this year, I immediately thought of my 7-year old daughter, Sasha, who has peanut butter sandwiches for lunch probably three times a week. No parent should have to worry that their child is going to get sick from their lunch.<sup>1</sup>

The FSWG laid the foundation for the FSMA, which clearly focuses on minimizing bacteria, viruses, and parasites in food. The explicit goal of FSMA is to curb the “significant public health burden” caused by foodborne illness.<sup>2</sup> The announcements related to FSMA cite this burden as 48 million cases of foodborne illness in the US every year. Informational materials that the FDA produced for consumers specifically address “high-profile outbreaks related to various foods, from spinach to peanut products”.<sup>3</sup>

CDC conducts active and passive surveillance of foodborne diseases and data from 2000–2008 indicate that a group of viruses known as Noroviruses are the leading cause of foodborne illness in the United States resulting in about 60 percent of the cases of diarrhea.<sup>4</sup> *Salmonella*, *Clostridium perfringens*, and *Campylobacter* are the leading bacterial causes of illness, all three of these include diarrhea as a symptom. In quantifying the public health burden of foodborne illness, it becomes clear that it is an economic issue as much as it is a public health issue. One economist estimates that diarrhea and other health outcomes related to consuming unsafe food costs about \$152 billion per year<sup>5</sup> Exposure to *Salmonella* alone could cost society almost \$3 billion per year. These costs include acute medical care as well as quality of life costs.

From 2006 through 2010, food safety became an environmental health issue that generated government action and, as the discussion below indicates, one of the main prerequisites for this action is public interest and concern. Public concern is an important factor in environmental policymaking, and it likely had an impact on strengthening and redefining the US food safety system. Furthermore, the national dialogue about food safety has drawn attention to the practice of environmental health (EH) and presents practitioners with an opportunity for raising public awareness about the role of EH in prevention. In order to



seize this opportunity, it is important and necessary to develop communication skills.

## Environmental health communication

As a segment of public health, environmental health focuses on understanding and assessing the relationship between the environment and the health of populations. The realm of environmental health is broad and includes environmental problems such as waste management and air pollution, as well as very specific issues such as tattoo parlors and swimming pools. EH emphasizes prevention by controlling the sources and modes of transmission of three main types of pathogens: microbiological, chemical, and physical.

While a significant portion of EH is compliance monitoring, in many real-world situations, EH professionals are risk and crisis communicators, attempting to educate the public and influence behaviors in order to reduce environmental risk. The communications component of the job is critical and perhaps the most important preventive tool available. However, effective risk communication requires more skill than just creating and delivering a message. Developing effective communication strategies involves assessing levels of public understanding of EH problems and being cognizant of the role that factors not in control of the communicator play in this understanding.

When it comes to communicating about the risks of microbiological contaminants in food, EH professionals face competition getting the attention of a public who may be fixated on chemical or radiological risks. This fixation is reinforced by both research and policy that focuses on minimizing public health risks from chemical exposures. Research that identifies significant public health impacts from both voluntary and involuntary exposures to chemicals in the environment serves to raise public concern.<sup>6</sup> Furthermore, when public perception of risk is heightened due to emerging research, government and industries act. One example, is found in scientific studies that suggested a chemical (Bisphenol A) in plastic bottles and canned food could leach into food and water causing adverse health effects in children and developing fetuses.<sup>7-9</sup> Public reaction to these studies was swift and even in the face of significant uncertainty, the food industry began looking for alternative packaging techniques and so they could promote that their products are “bisphenol-free”.<sup>10</sup>

Many environmental laws and regulations focus mainly on reducing cancer risk. Risk assessment, the cornerstone of much environmental health policy is defined by US Environmental Protection Agency (EPA) as seeking to identify the “types of health problems that may be caused by environmental stressors such as chemicals and radiation”.<sup>11</sup> In addition, a major focus of Food Quality Protection Act<sup>12</sup> was to minimize pesticide residues on foods by requiring the EPA to set maximum levels of pesticide residues on foods. Because of the focus on cancer risks, US environmental laws and regulations send a message to the public that they probably should be concerned about chemicals in the environment and in their food. However, public perception of the risks from chemicals has perplexed some scientists who note that there are numerous benefits to the use of chemicals that are overlooked by the public.<sup>13,14</sup> Although there appears to be little research that quantifies perceived differences in comparing risks from chemicals in foods to microbes, one survey indicated that pesticide residues on food worried people more than bacterial contamination of food.<sup>15</sup>

## Public concern and environmental protection

A focus on chemical risks has defined environmental protection in the United States which has largely been built on reacting to public perception of environmental issues.<sup>16</sup> Environmental decisions are often based on levels of public concern, and when concern is high, decision makers often take the precautionary approach to address scientific uncertainty by eliminating as much risk as possible.<sup>17</sup> The most active period for environmental policymaking in the US occurred during the 1970s in the face of outcry over the possibility that pollution was affecting public health. Conversely, a lack of concern about the environment related to other problems, such as the economy, can also influence public policy, putting environmental protection in the company of programs that are perceived to contribute to societal harms.

In January, 2011, a national opinion poll showed that Americans ranked the environment as the least important problem out of 15 problems facing the country.<sup>18</sup> Another poll in March 2010 indicated that Americans were becoming increasingly unconcerned about many environmental issues, a trend that may be



influenced by the state of the economy.<sup>19</sup> Because the US public is currently more concerned about the economy than the environment, it is challenging to get their attention about important environmental issues. However, food safety is different than other environmental health issues such as oils spills, climate change, and natural gas exploration, because of the magnitude and potential for immediate public health consequences.

EH professionals who work in the field of food safety, need to draw the public's attention to the risks from microbiological contaminants in their food in order to address the data related to foodborne illness in the US. The passage of FSMA is one indicator that the time might be ripe for emphasizing the importance of controlling microbes in foods. This emphasis will require a strategy that compels the public to view common foodborne symptoms such as diarrhea as important health concerns, similar to concerns about the relationship between chemicals and cancer. Even though microbes in foods are a significant cause of diarrhea, and public concern related to food safety has been heightened in the wake of numerous outbreaks of foodborne illness in the past few years, EH professionals will still face some challenges in risk communication. While media coverage of these microbial outbreaks can contribute to public awareness, translating this awareness into concern and action must be examined in the context of the foundation of risk perception.

Public concern and perception can influence public understanding, and the factors that affect how the public understands environmental health risks are multifaceted.<sup>20</sup> These factors are both internal such as psychological aspects and personal experiences, and external, such as the media and other sources of information. When confronted with the complex scientific questions related to environmental health science, internal and external factors may work together to frame public understanding. In some cases, it may be the internal forces that are more important to public understanding, and often these forces are so strong that it may seem hopeless for EH professionals to strive to provide additional information.

## Internal Factors Related to Understanding

Public understanding of societal issues is often a function of past experiences, culture, demographics, and psychology, these are internal factors that can-

not be addressed by public education campaigns that focus on information delivery alone. Even when there is tangible evidence related to environmental health risks, if this evidence is contradictory to their own feelings about the issue, the public may not accept what the science says.<sup>21</sup> Furthermore, feelings of uncertainty about the health risks from environmental exposures can augment emotions such as worry and anger which may affect public understanding.<sup>22</sup> Food safety, which is an environmental health issue that affects all members of the public, provides the opportunity to delve into the role that psychology plays in the outrage component of risk.

Peter Sandman is credited with defining risk as "hazard plus outrage".<sup>23</sup> This definition encompasses the probability that harm will take place (hazard) and how worried people are about the harm (outrage).<sup>24</sup> Sandman argues that there are issues that are perceived by people to be risky only because they are very worried about them even though the probability of actual harm is low. The probability of being exposed to anthrax in the mail is one example of this type of issue; public outrage was very high during this event in 2001, even though the hazard (as defined by Sandman) was extremely low. On the other hand, some environmental health issues are identified by officials as clearly hazardous, but public concern is remains relatively low. This was the case with the H1N1 influenza pandemic in 2009, as evidenced by vaccination rates that were much lower than public health officials had hoped for.<sup>25,26</sup>

Analyzing the outrage component of risk is no less scientific than risk assessment; however it is fraught with even more uncertainty. It is likely that when faced with weighing the risk of diarrhea with the risk of cancer, there are few people who would say that they are more afraid of getting diarrhea. Both of these health outcomes can be related to the safety of the food supply; diarrhea is mostly associated with consuming microbiological pathogens, whereas worries about cancers are often related to chemicals and pesticides. There is a wealth of research that focuses on the exploring the relationship between pesticides and cancer, and evidence of the relationship between exposures to microbes in food and water and gastrointestinal distress has been around for hundreds of years. The difference between these two bodies of research is with the scientific certainty; it is still rare for researchers to explicitly state that pesticides cause cancer; instead





they focus in identifying correlations between the two. On the other hand, the likelihood of an acute health outcome such as diarrhea with exposures to high levels of pathogenic microbes is more certain.

The challenge for EH professionals is to raise the outrage level for diarrhea so that the public will view this illness as seriously as cancer. Addressing outrage starts by examining the differences between diarrhea and cancer based on their psychological characteristics. Environmental psychologists identify the “outrage” factor as “the affect heuristic” which explains how people use their intuition and feelings rather than logic to evaluate risk.<sup>27</sup> It may seem irrational, but one reason people are likely to be more scared of cancer than diarrhea is because cancer is less familiar than diarrhea. Other aspects that contribute to fear of cancer include beliefs that it is related to manmade sources, including chemicals, rather than natural sources such as bacteria. Cancer is often irreversible and death rates are higher than diarrhea (in developed countries), and exposures to cancer-causing agents in food are involuntary and out of individual control. The internal factors of choice, control, reversibility, and others were identified in the 1970s as contributing to how people perceive environmental risks.<sup>28</sup>

Overall, outrage and hazard are often unrelated, especially when it comes to environmental health issues such as bioterrorism, chemical and nuclear accidents, and safe food. That is, when science does not support the public’s fears, a gap develops between scientific assessment of risk and public perception of risk. One of the first studies to quantify the differences in perception between different groups of stakeholders and experts was published in 1979.<sup>29</sup> The researchers examined ratings of risk from 30 environmental issues among four distinct groups of people. Three of the groups were considered laypersons and the fourth group was a panel of national experts in risk assessment and environmental science. The results of this ratings exercise were quite remarkable, especially in terms of how nuclear power was rated. Laypersons rated nuclear power as the most risky issue, higher than motor vehicles and smoking, while experts rated nuclear power 20th on the list of 30 issues. Although this study is more than 30 years old, it still serves as the foundation for research about why there is a divide between public perception of risk and scientific assessment of risk.

The scientific approach to risk assessment does not include public opinion, or the outrage factor. As such, risk assessment has contributed to the gap between scientists and the public when it comes to environmental health risks. When there is a clear gap between the results of risk assessment and public outrage, scientists often try to bridge this gap by explaining the science and providing more facts and data to the public. When it comes to environmental health, this strategy has often proves futile, and in some cases can be inflammatory especially when there is mistrust involved.

## External Factors of Understanding

Gauging public understanding of environmental health risks is complicated by the interplay between the internal and external forces that contribute to this understanding. External factors are those that are outside of the realm of culture, experience, and psychology; however, these factors include information that is interpreted based on the internal factors discussed above. Among the most important external factors are information sources such the media, friends and neighbors, government agencies, and special interest groups. The critical aspect in the effectiveness of these sources of information is whether they are perceived as trustworthy.

## Media and environmental health risk

When it comes to role of the media as an external factor, a 2011 Gallup poll found that Americans’ attitudes toward the media is showing some improvement since 2007, when trust was at an all-time low.<sup>30</sup> Even so, only 28 percent of Americans surveyed indicated that they had “a great deal” or “quite a lot” of confidence in the media, situating newspapers and television news 10th and 11th on a list of 16 institutions. The military, small business, police, churches, and the medical system ranked the highest in overall confidence.

There is little debate that mass media can be influential in framing societal issues and it is arguably the most important source of scientific information for many members of the general public. Because the media have such a tremendous impact on public understanding of science, the only way for scientists to effectively educate the public is address the issues of “media literacy.”<sup>31</sup> This type of literacy focuses on identifying the extent of bias in the media, critically



evaluating the message, and assessing the credibility of the source of the information. Furthermore, scientists should focus on engaging the public in understanding scientific issues and the first step in the process of engagement is to build trust.

The manner in which the media has portrayed climate change is instructive about how external factors influence public understanding. Even though climate change is accepted by most scientists around the world, some media continues to report “both sides” of this issue. Furthermore, it is possible to compare media accounts of “climategate” to “tobaccogate” which, in the early 1950s, was how the link between smoking and lung cancer was framed in the media. Because there were a few scientists who did not agree with the overwhelming majority, the relationships between cigarettes and cancer was contextualized as debatable in the press.<sup>32</sup> This type of framing can lead to delay in addressing many important environmental health problems because of the importance of public outrage to motivate politicians. The number of headlines related to climate change in Britain increased between 2001 and 2006, even though coverage of this issue was “modest” at best.<sup>33</sup> Such modest coverage creates challenges to solving the problem because of the relationship between policymakers, the public, and the media.

Outrage is affected by media involvement, and sometimes is even elevated because of the uncertainty that is inherent in stories about the relationship between the environment and health. Media coverage of the anthrax attack in 2001 suggests that there are aspects of media coverage that contributed to public outrage.<sup>34</sup> When media accounts include speculation for example, and opinions are expressed rather than data, public outrage is heightened. Additional characteristics of media coverage that contribute to outrage are conflicting reports, hoaxes, and the use of unnamed sources. Finally, vague advice on how to protect oneself from the risk can influence the amount of trust that the public has in all actors in the situation.

The media may complicate activities of officials because they can underscore uncertainties and uncertainty forces the public to rely on internal factors to assess risk. Scientists are often frustrated with journalists because of the need to report news quickly, and speedy deadlines and brevity are contradictory to explaining many complex environmental

issues.<sup>35</sup> Furthermore, until an environmental health issue becomes a dominant news story that is framed as having minimal uncertainty of occurring, the public may continue to either doubt the imminence of the threat or inflate the risk. This doubt competes with other important issues and may lessen concern about and motivation to act on the issue.

## The media and food safety concerns

Thanks in part to the prevalence of large scale, multi-state outbreaks that are eventually linked to specific foods, food safety has become a significant media issue. However, in examining two of these prominent outbreaks in the context of media coverage, it may not be the actual incidence of illness that has contributed to public outrage, rather it may be the fact that reports of these outbreaks emerge after the number of illnesses is already beginning to subside.

In early September, 2006, cases of *E. coli* O157:H7 began emerging in Wisconsin, and the state public health officials contacted the CDC to report the activity.<sup>36</sup> At the same time, public health officials in Oregon were tracking a similar outbreak. *E. coli* O157:H7 is one of the more serious foodborne pathogens in that the bacterium produces a toxin that can lead to kidney failure. In the course of interviewing people who were sick, Wisconsin and Oregon officials were able to identify spinach as the probable source. As this information was shared with other states, it was clear that a multi-state outbreak was occurring. When the outbreak ended on October 6, 2006, more than 200 people in 26 states were reported ill, 102 people were hospitalized and 3 people died. In the course of investigating how bagged, pre-washed spinach became contaminated with the pathogen, scientists presented some evidence that feral pigs living around spinach farms in California could have been the source.<sup>37</sup>

CDC reported that the first cases associated with consumption of fresh spinach were documented on August 19, 2006.<sup>38</sup> As Figure 1 shows, the epidemic curve for this outbreak indicates the most active period for case reports from August 27 through September 1, 2006; more than one-half of the cases occurred during this 6-day period. By the time public health officials were able to point to spinach as the source of the pathogen, the number of reported cases was waning. The fact that the outbreak came and went so quickly can be partially attributed to the short shelf-life of fresh spinach.



As documented cases of illness subsided, the media picked up the story and Figure 1 also provides some exploratory data about the role of the media in the spinach outbreak. In order to get a sense of the impact that the media may have had in educating and alerting the public about this outbreak, headlines from major US newspapers were examined. LexisNexis was the source of this data, and headlines from US newspapers were searched from August 22 through October 6, 2006 using “spinach” and “*E. coli*” as search terms. This search resulted in 839 unique headlines related to the outbreak.

While 839 headlines is significant number, the timing of these news accounts tells a different story. During the height of the outbreak, August 27 through September 7, there were only 7 headlines related to the situation. Media coverage increased dramatically beginning on September 15th, about the same time that public health officials announced that spinach was the likely source of the illnesses. The problem with the timing is that the outbreak was already subsiding and it was likely that the new cases were not going to be discovered because the tainted spinach was no longer in the hands of consumers. The timing also raises some questions about the efficacy of using mass media to educate the public about an evolving environmental health emergency.

The 2008–09 peanut butter outbreak lasted much longer than the spinach outbreak and more people were sickened by the strain of *Salmonella* in the peanut butter. As Figure 2 shows, the case count for this outbreak began climbing in October 2008 and the number of cases reached its peak in November and December 2008. When the outbreak was officially over in April 2009, almost 700 people across the country had documented cases of salmonellosis linked to peanut butter consumption. Even though the nature of the food was different, as with the spinach outbreak, media coverage of this event lagged. From September through December 2008, there was not one headline in LexisNexis that included the terms “peanut butter” and “*Salmonella*” despite the fact that almost 71 percent of the documented cases occurred during this period. Media coverage spiked in January 2009, with 553 of the 915 headlines noted during that month. The last month of the outbreak, April 2009, there were only 4 headlines in the LexisNexis database.

Aside from being an interesting look at the relationship between case counts and media coverage, the spinach and peanut butter outbreaks raise questions about the importance of external factors on influencing public understanding. Both outbreaks peaked well before the media began publishing stories about the

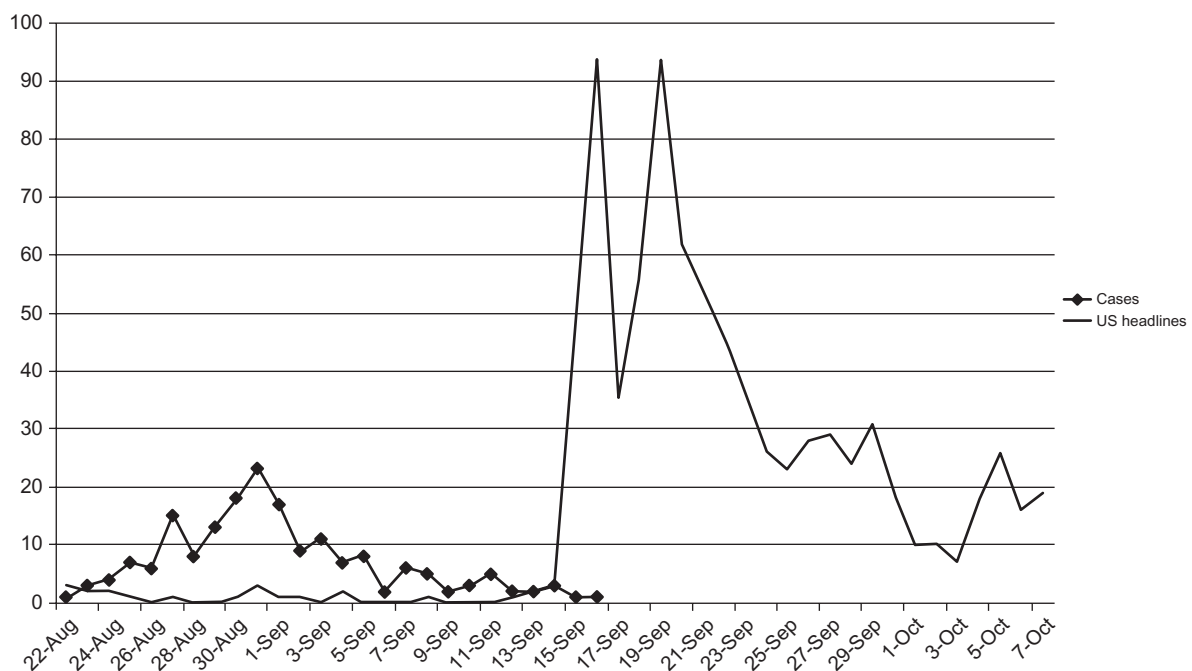
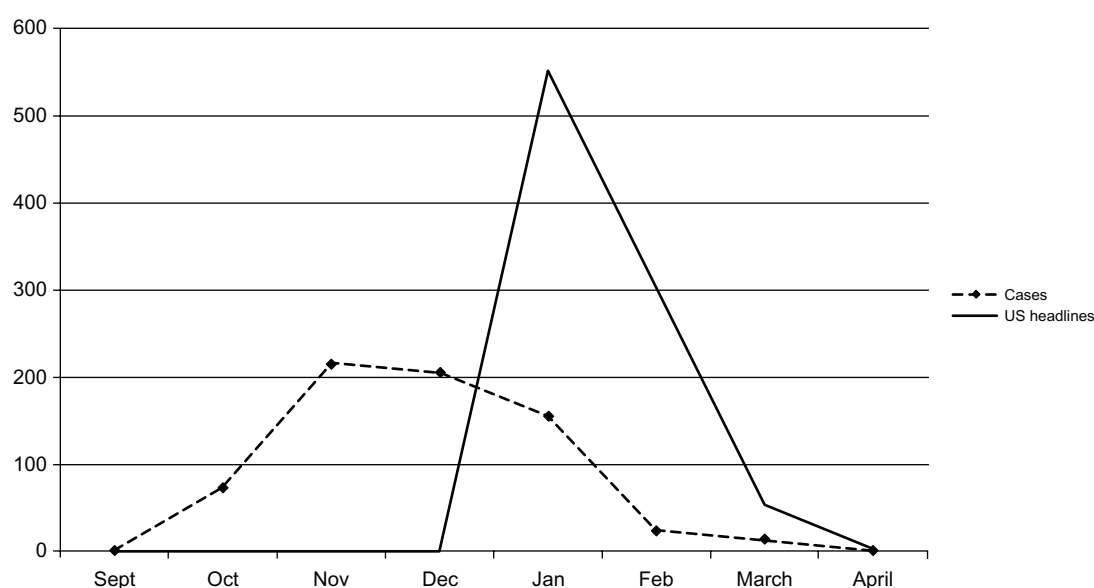


Figure 1. Spinach outbreak (August–October 2006).





**Figure 2.** Peanut butter outbreak (Sept 2008–April 2009).

events. Although the timing of coverage could be affected by many factors, it is likely related to official announcements from public health professionals about the outbreaks. The timing of the headlines is important because it suggests that public health professionals may need to consider alternative means of alerting the public that do not extensively rely on mass media such as working with local health officials with personal access to susceptible individuals. Messages about discarding peanut butter were clearly important during the height of the outbreak, but when the case count has decreased to just a few, these messages seem irrelevant.

The spinach and peanut butter outbreaks raise an additional issue related to the lack of connection between the epidemic curves and the number of headlines, and this has to do with the impact that this might have on public trust. As stories about hundreds of people being sick from eating peanut butter emerge after the case count is declining, people may be left wondering why they were not alerted in the midst of the outbreak. This may fire up the internal factors that contribute to public concern, especially those that influence trust in public health officials. Ultimately, the effect of these two outbreaks likely contributed to evidence from recent surveys suggesting that American's lack confidence in the food safety system has grown in recent years.<sup>39,40</sup>

Additional surveys have focused on assessing public understanding and concern about food safety, and these studies suggest that people are becoming

increasingly concerned about microbiological contamination in specific.<sup>40,41</sup> To put these finding in another way, perhaps Americans are becoming more concerned with diarrhea than cancer when it comes to the food supply. There are still concerns with pesticide residues, genetically modified organisms, and irradiation of food, but the enhanced worry about bacteria and viruses in foods has created an unprecedented condition for education and action.

Public concern about microbes affecting the safety of food translated into public support for new government programs. A 2009 survey conducted for the Pew Charitable Trusts (Hart survey research) indicated that 89 percent of Americans support more government oversight of food safety.<sup>42</sup> This support may be related to the fact that the majority of those surveyed believed that food in the US has become more risky in recent years.

## Understanding and Action

Because of the interplay between internal and external factors, public understanding of environmental health risk is often unpredictable. This unpredictability underscores the importance of assessing both public outrage and scientific hazards of environmental exposures. EH professionals who are responsible for empowering and engaging the public as one of their essential services must understand the context of the risks before designing strategies for this engagement. In some cases, focusing on the internal factors that



contribute to outrage might be the most appropriate approach to promoting public health; in other cases, an emphasis on external factors might be better choice.

Public understanding of environmental health risks contributes to social change, especially in the realm of policymaking. How an environmental issue moves from the bottom of the policymaking pile to the top has been the subject of a body of research related to agenda-setting. In order for the issue to become a policy priority several conditions must exist including: (1) the opportunity for a feasible solution; (2) public concern; and (3) “political conditions” that “are amenable to change”; when these conditions exist, “a policy window opens”.<sup>43</sup> As noted above, the first US food safety legislation in more than 70 years was passed by Congress and signed by the President in January 2011. The historic moment likely came about because the internal and external factors that contribute to public concern merged creating conditions that allowed elected officials to act. The incidence of high profile outbreaks involving hundreds of people contributed to public concern about food safety, creating this key condition for successful policymaking.

The next step in improving the food safety system in the US is to implement the FSMA. There appears to be support for implementing the new law with almost 75 percent of Americans stating that they would be willing to pay more for their food to execute the food safety measures outlined in the law.<sup>44</sup> Public support for the food safety legislation is interesting because it comes at the same time that many politicians are arguing that environmental regulations are contributing to the country’s economic woes. Politicians are generally skilled when it comes to raising outrage, contributing to the challenges that public health officials face as in creating effective communication strategies that will enhance public understanding. This is particularly the case with environmental health issues; because of the scientific nature of environmental health risks, communicators must take into consideration both internal and external factors that contribute to public perception of these issues. It is important to be aware of what the public is worried about and why they are worried because both of these aspects contribute to public understanding.

Currently, EH professionals who work in the field of food safety have an unprecedented opportunity to promote the importance of their work;

however, this promotion must be strategic because there is no “one size fits all” approach to EH risk communication.<sup>45</sup> The first step is to clearly understand the internal and external factors that may contribute to public perception of risks from foods. There will be additional foodborne outbreaks—this is certain—so, time spent preparing risk communication plans now could serve the profession well. These plans must focus on addressing outrage as well as hazard in order to ensure that the messages are not only delivered to the public, but received and acted on as well.

## Disclosures

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