BIOSECURITY AND BIOTERRORISM: BIODEFENSE STRATEGY, PRACTICE, AND SCIENCE
Volume 2, Number 3, 2004

Emergency Communication and Information Issues in Terrorist Events Involving Radioactive Materials

STEVEN M. BECKER

ABSTRACT

With the threat posed by terrorism involving radioactive materials now high on the nation's agenda, local, state, and federal agencies are moving to enhance preparedness and response capabilities. Crucial to these efforts is the development of effective risk communication strategies. This article reports findings from an ongoing study of risk communication issues in nuclear/radiological terrorism situations. It is part of a larger CDC-funded effort that aims to better understand communication challenges associated with weapons of mass destruction terrorism incidents. Presented here are formative research findings from 16 focus groups ($n = 163$) in which a multi-part, hypothetical radioactive materials terrorism situation was discussed. Twelve of the focus groups were carried out with members of the general public (drawn from a variety of ethnic backgrounds and geographic locations), and four groups were composed of first responders, hospital emergency department personnel, and public health professionals. One aim of the focus groups was to elicit detailed information on people's knowledge, views, perceptions, reactions, and concerns related to a nuclear/radiological terrorism event, and to better understand people's specific information needs and preferred information sources. A second aim was to pretest draft informational materials prepared by CDC and NIOSH. Key findings for the public and professional groups are presented, and the implications of the research for developing messages in radiological/nuclear terrorism situations are explored.

THE THREAT POSED BY TERRORISM involving radioactive materials is now high on the nation's homeland defense agenda, and local, state, and federal agencies are moving rapidly to enhance their preparedness and response capabilities. Crucial to these efforts is the development of effective strategies for providing information to the general public and to frontline professionals involved in managing an incident. Whether providing members of affected communities with vital health protection information or responding to questions from first responders, communication efforts play a central role in determining whether crisis and consequence management actions are a success or failure.[1]

This article reports key findings from an ongoing study of communication and information issues in terrorist situations involving radioactive materials. It is part of a larger effort sponsored by the Centers for Disease Control and Prevention (CDC) and the Association of Schools of Public Health (ASPH) that aims to better understand communication challenges in weapons of mass destruction (WMD) terrorism situations. The "Pre-Event Message Development Project," as the multiyear study is known, is being led by four universities: the University of Alabama at Birmingham (radiological and nuclear terrorism issues); St. Louis University (biological agents); the University of California at Los Angeles (biological

Steven M. Becker, PhD, is Associate Professor, Department of Environmental Health Sciences, University of Alabama at Birmingham School of Public Health. This article was prepared on behalf of the Pre-Event Message Development Team, University of Alabama at Birmingham School of Public Health, and in collaboration with the U.S. Centers for Disease Control and Prevention (CDC), the Association of Schools of Public Health (ASPH), and the Pre-Event Message Development Teams at St. Louis University, University of California at Los Angeles, and the University of Oklahoma.

agents); and the University of Oklahoma (chemical agents).

The project seeks to identify people's information needs and concerns vis-à-vis various threat agents and then use the results to develop pre-crafted informational messages that are responsive and scientifically accurate and that have been carefully tested. The term "pre-event" is used because the messages are to be prepared in advance and kept for later use. This approach is seen as essential, because in the context of a major unconventional terrorism event, agencies may face unprecedented public demands for information, even as resources are stretched thin attempting to manage the incident. In such a situation, preparing information during the event would not only be difficult, it would likely be too late.

The first phase of the Pre-Event Project, carried out in 2003, involved conducting formative research to better understand communication and information issues associated with WMD agents. A series of focus groups was conducted in several geographic locations with various population segments in order to better understand people's attitudes and perceptions, concerns, information needs, preferred information sources, and views of existing informational materials. This article presents the findings from the formative research conducted on nuclear/radiological terrorism issues.

THE GROWING THREAT OF TERRORISM INVOLVING RADIOACTIVE MATERIALS

In recent years, concern about nuclear/radiological terrorism has grown substantially, and preparedness for such events has moved high on the nation's homeland defense agenda. The apprehension stems from a constellation of interrelated developments. Because radioactive sources have numerous beneficial uses and are vital for a wide range of applications, they are now ubiquitous. Around the globe there are literally millions of radiation sources in use in government facilities, military facilities, clinics, hospitals and other medical institutions, research and educational laboratories, power plants, waste facilities, and industrial manufacturing facilities. In the developing world, for example, more than 16,000 sources are used annually for industrial radiography alone.[2,3] Although security for radioactive sources around the world has improved, serious vulnerabilities remain. According to a 2003 report, although nuclear weapons and nuclear weapons materials are generally well guarded, protection for radiological sources is often minimal: "[T]he world of radiological sources developed prior to recent concerns about terrorism, and many of the sources are either unsecured or provided, at best, with an industrial level of security."[4]

Every year, numerous radioactive sources are lost or stolen.[2,5] While many are small and pose relatively little risk, and while some missing sources are eventually recovered, significant numbers of potent radioactive sources have been completely lost from regulatory control. Furthermore, it is clear that there is an active global market involving the trafficking in radioactive materials. According to the International Atomic Energy Agency (IAEA), between 1993 and 2001 there were "175 cases of trafficking in nuclear material and 201 cases of trafficking in other radioactive sources (medical, industrial)."[6] To make matters worse, there is also an active market in technology and weapons information. Equipment and know-how for radiological devices and even for nuclear weapons is available in a way that was never the case before. "There is a sophisticated worldwide network," IAEA Director General Mohamed El Baradei has warned.[7]

Further adding to concerns are reports of known terrorist organizations attempting to acquire radioactive materials. A Monterey Institute database that tracks such activities includes various examples, including a report of al-Qaeda trying to secure strontium-90 and another report of Islamic Jihad attempting to acquire plutonium and uranium.[8] Beyond that, there is information indicating that radiological weapons have already been assembled and tested. Iraq reportedly exploded a test device in 1987, and al-Qaeda is reported to have tried unsuccessfully to build a radiological device in Sudan in the late 1990s. Perhaps the best-known example took place in 1995, when Chechen rebels reportedly placed a functioning "dirty bomb" using dynamite and cesium 137 in a Moscow park but did not detonate it.[9,10]

The final factor in the rising concerns about terrorism involving radioactive materials relates to the aims and motivations of terrorist organizations. A wide range of expert assessments, from United Nations panels to think tanks to the intelligence community, have all concluded that terrorists are willing to use such weapons.[11,12] "We know beyond a shadow of a doubt," concluded U.S. ambassador-at-large for antiterrorism Cofer Black, "that a number of these groups, if they had it, would use it." If al-Qaeda "were to put together a radiological device, they're going to use it. We know they have the determination."[13]

The actions and the proclamations of terrorist organizations themselves appear to support this conclusion. A statement appearing in December 2002 on one of the main websites frequented by supporters of al-Qaeda warned: "The coming days would prove that Qa'idat al-Jihad is capable, with Allah's help, of turning the United States into a lake of lethal radiation. . . ."[14] While there is no way of knowing whether this particular posting was propaganda or a specific statement of intent, the cluster

of factors described above has produced a threat picture that is clearly sobering.

The seriousness with which the radioactive materials terrorism threat is taken was evident during the December 2003 holiday season. The Department of Homeland Security raised the threat level to "orange," and, according to numerous media reports, "one of the U.S. officials' main fears was of a dirty bomb." Dozens of specialists "with sophisticated radiation detection equipment hidden in briefcases and golf bags" were reportedly sent to scour five major U.S. cities (Washington, New York, Las Vegas, Los Angeles, and Baltimore), and radiation detectors and monitors were sent out to police in other cities.[15]

The U.S., the IAEA, and others are currently devoting substantial efforts and resources to preventing terrorists from acquiring and using radioactive materials.[16] For example, in November 2003, a joint operation by the IAEA and authorities from France and Côte d'Ivoire succeeded in securing a highly dangerous, disused cesium 137 source that had been abandoned in Abidjan.[17] Successful recovery operations and related measures undoubtedly help to reduce the likelihood that powerful radioactive sources will fall into the hands of terrorists. Nevertheless, terrorism involving radioactive materials will remain a serious and continuing threat for the foreseeable future, making it essential for local, state, and federal agencies to be fully prepared should an attack occur.

THE IMPORTANCE OF COMMUNICATION AND INFORMATION ISSUES

One of the most crucial components in radiological/nuclear terrorism preparedness efforts relates to information and risk communication. Even under normal, nonemergency circumstances, effective communication "undergirds almost all of public health practice."[18] During normal operations, state public health agencies spend more time responding to requests for information than on initiating dialogues with interested constituencies or alerting the public to risk.[19]

In disaster and emergency situations, effective communication is even more critical. The timely and effective flow of information between agencies and the public is vital for facilitating and encouraging appropriate protective actions, reducing rumors and fear, maintaining public trust and confidence, and reducing morbidity and mortality. But as the 2001 anthrax attacks made clear, the communication difficulties posed by a WMD terrorism incident can be enormous. An attack can occur without warning, the threat may be invisible, and the agents may be unfamiliar and especially frightening to people.[20–22] Under such circumstances, authorities may face unprecedented public demands for information, even as agency resources are stretched thin attempting to assess and manage the incident.

Research and historical experience suggest that incidents involving radiation can pose especially difficult challenges for information and risk communication,[23–25] because situations involving radioactive materials have a remarkable capacity to produce widespread fear, a profound sense of vulnerability, and a continuing sense of alarm and dread. As Flynn and colleagues have noted, "Nuclear science and its technologies are among the great achievements of the 20th century—at once magnificently impressive and greatly feared. The fear emanates from the massive destructive power of nuclear weapons and from the dangers of other sources of man-made radiation."[26]

A large body of research carried out over the past several decades by Slovic, Fischhoff, Lichtenstein, and others has demonstrated that nuclear technology, radioactive waste, and the like are perceived by the public as being extremely risky.[27,28] Slovic has suggested that people assess the risks of technologies and activities on the basis of two broad dimensions or sets of factors: "dread risks" and "unknown risks." Among the perceived characteristics of dread risks are catastrophic potential, fatal consequences, uncontrollability, inequitable distribution of risks and benefits, involuntariness, and a high risk to future generations. "Unknown risks" are perceived to be new, unobservable, unknown to those exposed, with delayed effects. Nuclear power, nuclear weapons fallout, and radioactive waste score high on both of these dimensions.[29]

When various groups of people were asked to rate the risk associated with 30 activities and technologies, and when the overall results were ordered, nuclear power was seen as the most risky.[30] When an expanded set of 90 activities, substances, and technologies were assessed, and when perceived risks and benefits were taken into account, "nuclear weapons" topped the list for overall adjusted risk, followed by "warfare," "terrorism," and "nuclear power."[31] Finally, when researchers surveyed people to find out what images they connect with a high-level radioactive waste repository, they found overwhelmingly negative associations. "The most arresting and most important finding is the extreme negative quality of those images," noted the researchers. Frequent associations included danger, death, sickness, pollution, war, and radiation. "Positive images were rare." Indeed, noted the researchers, the images "demonstrate an aversion so strong that to call it 'negative' or a 'dislike' hardly does it justice. What these responses reveal are pervasive qualities of dread, revulsion, and anger. . . ."[32] Drawing on the work of Slovic and colleagues, Rosa and Freudenburg concluded: "[N]uclear risks are perceived to be the riskiest—and are the most dreaded."[33]

"Fear," as Gray and Ropeik have pointed out, "has powerful public health implications."[34] Particularly in situations where information is scarce, unavailable, or confusing, fear can translate into responses that put people at risk and make managing the incident even more difficult. As noted in *NCRP 138*, a comprehensive report on radiological/nuclear terrorism prepared under the auspices of the National Council on Radiation Protection and Measurements, real-world experience with radiation incidents clearly demonstrates the potential for such behavioral reactions as mass flight, psychological stress, the seeking of health care in massive numbers, and powerful social stigma.[24]

The September 1987 accident in Goiania, Brazil, is often cited as the quintessential example of how radiation incidents can produce profound and widespread fear. The accident began when scavengers found a metal container in an abandoned radiotherapy clinic and took it to a junkyard, where it was then broken open. Inside was a metal capsule, which was sawed open, containing 100 grams of luminescent material (later identified as cesium 137). Children played with the glowing substance, workers took samples home to show to friends, and the radioactive substance was spread to buses, homes, animals, and even some currency. Ultimately, the accident resulted in 4 deaths, about 260 people showing some signs of contamination, 49 needing medical treatment, and some 800 acres being contaminated.[35–38]

"When measured in terms of fatalities and injuries alone," Petterson observed, the event "hardly seems to be of international significance—certainly no more than any other industrial accident."[35] But because radiation was involved, ripples of worry and attendant secondary impacts extended far from the epicenter of the event. More than 112,000 people, concerned about potential exposure, voluntarily sought examinations. "The fear was so intense that some people fainted in the queues, as they approached the moment of monitoring," wrote psychologist Ana Bandeira de Carvalho. Some people exhibited stress-induced symptoms that mimicked radiation exposure: vomiting and diarrhea, blisters, burns, or reddened skin. "Even people who lived far from the affected areas or in other states of Brazil and did not need to be screened, went."[39]

The event "sparked fears throughout Brazil."[40] Local agricultural products would not sell, and throughout the country "Goiania was regarded as a place to be avoided." There were "significant drops in visitation and cancellations of virtually all conventions planned for the city."[41] Even two regional medical association conventions were cancelled.[40] Most dramatically, people from Goiania faced far-reaching discrimination: "Hotels in other parts of Brazil refused to allow Goiania residents to register. Some airline pilots refused to fly airplanes that had Goiania residents aboard. Cars with Goias license plates were stoned in other parts of Brazil."[42] Because discrimination against Goiania residents was so bad in other regions, some 8,000 residents requested and received official certificates saying that they were not contaminated.[37]

Such reactions would not necessarily be outcomes of a radiological/nuclear terrorism situation. But as a recent Department of Homeland Security report concluded, "[P]ublic fear of a terrorist attack involving radioactive materials is likely to be high and could produce responses that endanger physical and mental health as well as the economic viability of affected communities."[43] In such a setting, information and risk communication will be absolutely central to the success or failure of consequence management. As the National Research Council report titled *Improving Risk Communication* points out, "[E]ven though good risk communication cannot always be expected to improve a situation, poor risk communication will nearly always make it worse."[44]

In the domain of nuclear accidents and radioactive materials incidents, historical experience surely bears this out. At the Three Mile Island (TMI) nuclear accident in 1979, for example, risk communication failures greatly exacerbated the human impact of the emergency. Because information needs were not adequately addressed, "residents around TMI were unduly confused and alarmed. . . ."[45] In the words of risk communication specialist Peter Sandman, " . . . what went wrong at TMI—really, really wrong? The communication."[46]

In a radiological or nuclear terrorism situation, communication and information will have "a profound impact on the public's reaction to the event and the government response."[24] A well-planned and well-executed effort could help to provide the public and key responder groups with understandable, scientifically accurate information; positively influence the responses of target populations to terrorist-initiated incidents so that people can take appropriate steps to protect themselves; prevent or reduce psychological effects; enable health authorities to be proactive in their communications; build trust and confidence with the public; and reduce morbidity and mortality. In short, "an effective and consistent communications strategy could reduce the impact" of the event and "also diminish the terrorists' success."[43]

THE PRE-EVENT MESSAGE DEVELOPMENT PROJECT

A fundamental part of an effective WMD crisis communications strategy is the development of "pre-event messages."[47] Developed in advance and kept at the ready, such messages can enable public health authorities to be more proactive in communicating with the public when

an incident occurs. Because communication technology has made media coverage virtually real time, having a repertoire of audience tested, scientifically grounded "pre-event" messages available means that vital information can be released almost immediately.

Recognizing the crucial importance of such advance preparation, the CDC launched the Pre-Event Message Development Project in 2002. From the outset, a guiding principle of the project has been to involve the audience and empirically ground all phases of message development.[48,49] All too often, the public's views have been left out of the construction of risk messages. As Fischhoff has noted, "[M]ost risk messages are just some experts' ad hoc determination of what people ought to know. As a result, communications waste recipients' time and trust, by saying things that are already known or are not worth knowing."[50]

To ensure that the message development process is as responsive and effective as possible, the first phase of the Pre-Event Message Development Project (2003) involved carrying out formative research to learn more about people's WMD-related views, perceptions, and needs. Some relevant information from survey research was already available. For example, a Marist College Institute for Public Opinion survey provided useful information on the extent to which people thought government could protect them from various threats, and who people would trust to provide them with information during a terrorist attack.[51] Similarly, the Pew Internet and American Life Project and Federal Computer Week Survey provided information on people's preferred information medium.[52]

To establish a fuller, more in-depth understanding of current knowledge, attitudes, and beliefs surrounding specific WMD agents, interests, and concerns, and to better identify preferred, trusted sources, validators, possible sources of misinformation, and appropriate channels for message dissemination, the four universities conducted a multiregion series of 55 focus groups. Because focus groups produce extensive interaction, open-ended discussion, and rich amounts of data in people's own words, and because they enable the researcher to interact directly with participants and ask follow-up questions, they are widely considered to be an effective research method for gathering the kinds of information noted above.[53,54]

With nuclear/radiological terrorism having been identified as a priority area by CDC, ASPH, the four participating universities, and the National Institute for Occupational Safety and Health (NIOSH), it was jointly decided to devote 16 of the focus groups to a "radioactive materials" terrorism scenario. One aim was to elicit detailed information on people's views, perceptions, knowledge, reactions, concerns, information needs, and preferred information sources related to radioactive materials terrorism. A second aim was to pretest draft informational excerpts prepared by CDC and NIOSH.

METHODS

Across all 16 radioactive materials focus groups, a total of 163 people participated. Of the 16 focus groups, 12 were carried out with members of the general public and 4 were carried out with professionals groups likely to have a frontline role in managing a WMD incident. The breakdown of the 12 general population groups was as follows: 3 focus groups with African Americans (2 urban groups, 1 rural); 3 focus groups with whites (2 urban groups, 1 rural); 3 focus groups with Hispanics (2 urban groups, 1 rural); 1 focus group with Asians (urban); 1 English as a second language group; and 1 Native American group. In terms of geographic distribution, 3 of the 12 general public focus groups were conducted in the southeastern United States, 4 were carried out in the Midwest, 3 were held in the West, and 2 were conducted in the Southwest.

The 4 professional groups were made up of first responders (police, fire, EMT), emergency department personnel (doctors, nurses), and public health professionals (epidemiologists, environmental health workers, laboratory workers, public health nurses). Two professional groups were conducted in the Southeast, and 2 were carried out in the Midwest.

Focus group participants were recruited through neighborhood and community-based organizations and professional networks. Small cash stipends or gift certificates were given to participants to help defray transportation and other related costs incurred in attending the focus group. All focus group participants read and signed an informed consent document, and all work was conducted in accordance with Institutional Review Board guidelines.

Analysis of the demographic characteristics of participants in the 16 radioactive materials focus groups showed the following: 48% of participants were male, 57% of participants reported that they were married or living with a partner, and 69% of participants reported having children. Participants ranged in age from 18 to 84, with a mean age of 42.6 years. Seventeen percent of focus group participants reported being African American, 36% reported being Caucasian, 26% indicated they were Latino/Hispanic, 10% reported being Asian, and 8% indicated they were American Indian or Alaskan Native.

Eighty-seven percent of participants had a high school education or better, with almost 38% reporting having completed a college or graduate degree; 71% said that English was the language spoken most in their homes; 79% of the participants reported being currently employed; and 43% of the focus group participants reported

a family income of less than $30,000 for 2002, while 13% reported incomes over $90,000 for the same year.

CDC had earlier carried out 3 exploratory focus groups (in Chicago, Los Angeles, and Philadelphia) involving a hypothetical "dirty bomb," or radiological dispersal device (RDD), scenario. To effectively follow up and build on this earlier work, CDC, NIOSH, and the Pre-Event Team determined that it would be useful to use a broader hypothetical scenario involving the detonation of a small, improvised nuclear device (IND). The scenario was chosen to build on earlier work and to allow a wider range of issues to be explored (e.g., radiation concerns, protective actions, internal vs. external contamination, radioprotective agents, mass casualty management, etc.).

For the 12 focus groups with members of the public, a three-part discussion guide with a progressively unfolding hypothetical scenario was used. In the first part, participants were told that the Homeland Security Advisory System had been raised to red due to a credible threat that a terrorist group might be planning an attack in this area. Participants were then told that although the threat was not specific, officials suspected it "may involve radiation or nuclear materials." In the second part, focus group participants were told that when they turned on the radio, they learned that there had been an explosion in the area and that "radiation has been detected by initial emergency responders." They were told that hundreds of people had been injured and that people were being "advised to 'shelter in place' until more is known about whether radiation was involved." In the third portion of the focus group guide, participants were told that about an hour after hearing the radio report, they see a local government official issue a statement on television. The official confirms "that a small nuclear explosion has gone off and that people in the area may have been exposed to radiation." The official also reports that health and emergency personnel are working to contain the problem, seriously injured people are being taken to the hospital, and others who believe they might have been exposed are being referred to assessment centers near the hospitals. In addition, the official advises that "residents who were not close to the bomb should listen for information about which way the plume is spreading and evacuate or shelter in place according to emergency officials' recommendations."

Following each of the progressively unfolding sections, focus group participants were asked about their emotional reaction to the news, what their immediate concerns were, what they would do, what they would want to know, and where they would turn for information. In addition, following the second and third parts of the unfolding hypothetical scenario, focus group participants were presented draft informational materials that had been prepared by CDC. After reading the materials, the participants were asked how believable they found the information, what if anything might make it more believable, whether they felt that anything was not being disclosed, whether they were confident that following the action recommendations would keep them safe, whether they were confident they could carry out the recommendations, and whether they had any recommendations to make the fact sheets better or more useful. The same progressively unfolding scenario was also used in the 4 focus groups with professionals. However, in those focus groups, no draft CDC informational materials were pretested. Instead, at the end of the three parts, a series of NIOSH draft fact sheets for professionals were presented for feedback.

All 16 radioactive materials focus groups were carried out between May and August 2003. Each session lasted approximately 90 minutes and was led by a trained facilitator. Also present was a notetaker/quality control observer. Discussions were recorded, transcribed, and coded using a unified set of constructs/domains developed by the four Pre-Event teams. The constructs/domains included knowledge and beliefs, perceived risk, emotional response to threat, intended actions, confidence in the government and public health response to a potential attack, information needs, and information-seeking behaviors. For pretesting of materials, domains included comprehension, emotional response, believability, self-efficacy and response-efficacy, intention to follow advice, and recommendations for improvement. Intercoder reliability, which was assessed by the four universities, was considered acceptable when it equaled or exceeded 70%. Code-recode reliability was considered acceptable when it equaled or exceeded 80%.

Transcripts that had been coded using the unified set of constructs/domains were further analyzed using computer-based thematic analysis. Thematic analysis, which is a commonly used strategy in qualitative research, involves making repeated passes through the data in order to categorize them. As the analysis proceeds, a progressive "funneling" of the data takes place. As more and more evidence is classified, categories and subcategories become more clear and refined, and regularities and patterns become evident. Key themes that emerged from the thematic analysis are discussed below.

FINDINGS: GENERAL PUBLIC

Reactions

Not surprisingly, many people in the general public focus groups used words such as fearful, worried, scared, and upset to describe their likely reactions to the hypothetical scenario. As might be expected, people's con-

cerns often centered around the safety and well-being of family members. "I would be worried about my family" and "I would start rounding up my family" were typical comments. Particularly within minority communities, it was also common to hear repeated references to prayer. As one person noted in a representative remark, "I would pray for protection, that would be the first thing I would do."

Another reaction in evidence across various population groups was a sense of helplessness, confusion, fatalism, or futility. While in no sense a majority reaction, it was not uncommon.

> "I think as far as a radioactive emergency like that, there's really not much you can do. . . ."

> "If it's radiation, if it's very close to you, you're not going to have to worry about any of this—you're going to be dead."

Information seeking

Beyond immediate emotional reactions, one common action response across all population groups was to seek information needed for self-protection and survival.

> "I think you've got to just stay level-headed and make sure that you can account for everybody that's in your house or that you care for and start getting the information, and then start making an educated decision on what you need to do. . . ."

The kinds of information sought by people fell into three broad categories: specifics regarding the incident, facts about the threat agent, and information about health issues. With respect to the incident, people wanted to know who had carried out the attack, why it had happened, and whether it could happen again. In addition, people wanted to know where the terrorist incident had occurred, how big an area was affected, how much devastation had been caused, and how long the emergency would last. With respect to the threat agent, people had many questions: "What is radiation?" "What is the difference between x-rays and radiation?" "What radiation is—how it works," and the like.

Health issues

But people's primary information concerns centered on health issues, self-protection, and the protection of family members. In the most immediate sense, this translated into wanting to know which direction the wind was blowing and whether it was carrying radioactive contaminants in their direction. More generally, people wanted to know what should be done with pets and whether food and water would be safe to use. People also wanted to know what they should do if they were in a car at the time of the incident, rather than at home or in the office.

Another emphasis was on understanding, detecting, and avoiding potential health effects. People wanted to know how much radiation was involved and how far away was considered safe. Typical questions included, "How much radiation are we talking about?" and "How far away do I need to get?"

A major focus of concern involved knowing how people could tell if they had been exposed, and what the signs or symptoms (if any) would be: "How are we going to know that we are exposed to radiation? Is it a powder?" Linked with this was a desire to know when it was appropriate to seek medical attention.

> "I'm just wondering at what point do they tell you to go to the doctor?"

> "When do they need to get medical help, or what can they do at home to alleviate these symptoms?"

Likewise, people wanted to know what the potential health implications of the incident could be years later: "You need to know the long-term effects."

Problematic terms

One of the most important findings from the first round of pre-event research is that key terms found in many current radiological/nuclear terrorism emergency information sheets or other materials can be confusing or unclear for some people. One such term is "shelter in place." Some focus group participants understood the meaning of this often-used phrase, and others were able to derive the meaning from context, but some were unclear or confused as to the term's meaning.

> "Who provides shelter, the Red Cross?"

> "Shelter in place. What does it mean? Does it mean stay where you are?"

> "I assume shelter in place means to go to the place that affords you the greatest protection."

> "The word shelter sounds a little confusing. I think people hear shelter first thing and think, time to interpret that. If shelter means stay where you are at and stay covered, that would be more clear."

The word "plume," which is commonly used in emergency information materials, may have been somewhat less of a problem. Nevertheless, it was still unclear to some individuals: "That word plume, what is that?"

Sheltering versus flight

In discussing their expected reactions to a recommendation to "shelter in place," people were influenced by how they felt they could best protect their loved ones. For those who believed that the best way to protect family members was to gather them together and perhaps flee, the option of sheltering in place was rejected.

> "Well, I don't shelter in place—I would be gathering my kids and stuff up."

> "I would still go get my children no matter what. Because to me that is everything."

> "I think I'd probably be a little selfish and grab my immediate family and hit the road as fast as I could."

However, for people who believed that moving around outside would put people at greater risk, shelter in place was seen as the correct strategy.

> "This is radiation. This is so completely different from a tornado. And so, your children might be safe if they stay in their place. And if you leave you expose yourself, and if you take them you expose them too."

> "My first reaction would be flight, but I also know that in radiation you need to stay under cover regardless."

With respect to another protective action—that people remove outer clothes with potentially contaminated dirt or dust—people generally agreed that they would do so if it would help protect them. In a typical comment, one person put it this way: "If I'm contaminated anyway, I'm going to do whatever I can to try to keep myself as safe as I can." But a few people said they might disregard the recommendation because of modesty concerns: "I'm not going to take my clothes off outside. I'm not going to do that."

More generally, with respect to all recommended protective actions, there was a sense that if the measures "have been tested" and were "tried and true," they would be more likely to be seen as something that could really help keep people safe. As one person explained, a recommended protective action would carry far more weight if it were seen to have been "tested or practiced somewhere, where it . . . proved itself to be effective. . . . It is not this theory we have. . . . [I]t was something that showed us that it was actually used and is effective in use."

Perceptions of government and the color alert system

Some participants expressed confidence that government was trying hard and doing its best to deal with the terrorism threat. Others were still concerned about preparedness and the ability of authorities to act quickly during an event. Critical comments about the Homeland Security color alert system were not uncommon. Some participants indicated that they didn't know what the various colors stood for or how the system really worked. "I have no clue what those mean," said one person, while another complained, "You can kind of speculate on your own. Oh, it is orange, well I guess that is one up." Still other participants suggested that the vagueness of the warnings reduced their value: "I have always thought it was so vague that I didn't understand what went into them changing the color anyway, so it didn't have any meaning." Said one participant, "First of all the color changes, there are so many colors, okay, nobody pays attention anyway." Said another, "What is the point?"

Some focus group participants also worried that complete information might not be provided during a terrorist incident involving radioactive materials. Here comments such as "I trust the government but I think they're not going to tell you" or "I doubt I'd get the full story from what's reported" were heard. Concerns were also expressed about whether information would be available in multiple languages. Overall, people emphasized the importance of being given as much information as possible and without the use of jargon.

> "If you start using a lot of jargon that people don't understand, it's just going to cause more panic and more hysteria because people don't understand what's going on."

> "They'll ignore it if they don't understand it."

Sources of information

In discussing who they viewed as good sources of information about the incident, some focus group participants identified agencies and authorities thought to have an understanding of the local situation. These included the fire chief, the police chief, the sheriff's department, emergency management and civil defense officials, the military/national guard, and the county health department. Others chose national-level figures or agencies with expertise on health matters, such as the CDC or the Surgeon General of the United States. "That's who you need because everybody that is going to be affected is going to wonder how this is going to affect my body and my life. . . ."

In terms of where people would go to find information during an event, the results were consistent with recent survey research: The media were mentioned most frequently. This was the case in the focus groups even though concerns about sensationalism were sometimes

expressed: "They can oversimplify things a lot or they can make things way out of proportion. . . ." For people seeking information, television was the clear first option. Radio, however, was seen as useful in an emergency, particularly if the power were knocked out as a result of the incident: "I think radio is ideal. . . . You may have electricity knocked out, so radio is going to be best." Also mentioned as places to go for information were the emergency broadcast system, computer/internet, cellphones, and word of mouth. With respect to the media, national media outlets were often mentioned because of their extensive resources and because of the national implications of a terrorist attack. However, many people indicated that they would also turn to outlets closer to home because these would have more detailed information about the local situation.

FINDINGS: PROFESSIONAL GROUPS

Newness of the threat

Some professionals were concerned about what they perceived as the "newness" of the radiological/nuclear terrorism threat and the challenges it poses. A first responder put it this way: "This one is going to involve radiation or nuclear materials, this is a new one." Likewise, there were concerns about preparedness. Said one professional, "I just wonder if the training and equipment is up to it." Similarly, a health-care professional commented, "Although we have drilled on this, I would be concerned about how prepared we are to take this on."

Protection of family

Like members of the general public, professionals were concerned about their families. "The first thing that comes to my mind is my family," said one. Commented another, "I guess right off the bat, you know, if something happens, it would be my family." Concerns were also expressed about the welfare of fellow professionals who might be in harm's way: "Was anybody that I work with involved? That would be my biggest concern after my family." At the same time, first responders and others felt and expressed a clear sense of duty: "Family first, but I know in my capacity, it is time to work." As one professional put it: "That is what we do, after family, we go to work."

Self-protection

Consistent with other recent research on responder needs (e.g., the RAND "Lessons Learned" Study[55]), professionals in the focus groups saw it as vital to have appropriate information on self-protection. "How can I do my job and help other people, and protect myself from getting hurt or killed? There is always that safety issue you've got in the back of your head." In addition, there were concerns about becoming a target. For first responders, secondary devices were the focus: "You're also concerned about . . . one being set somewhere . . . waiting for us to come in and start doing work and detonating it to get us." For doctors and nurses, the focus was on the hospital: "How do we know, is there somebody detecting a bomb here in our facility?"

The role of information

Professionals described information as crucial, both to carry out professional duties and to reduce the overall terror of the situation. In a typical comment, one health-care professional explained: "I think information is essential for us, but it's also essential for us to try to control the terror and the havoc, for us to give other people the calming that we would need to deal. We would need to have as much information as we could possibly acquire."

A potential role for local meteorologists

Speaking as professionals but also as members of the community, a number of focus group participants specifically mentioned the local weather person as an excellent source. Local television news meteorologists were seen to be apolitical and without an axe to grind: "Why would he tell us something he didn't believe in? It's not like he will be voted out of office." In addition, news meteorologists were seen as well known, familiar figures that people regularly watched for daily weather information or, more important, for updates on weather emergencies: "Usually, if something bad happens, it is weather. So when you go to the TV, there he is giving us the information."

Concern about 911 breakdown, population flight, being deluged with worried individuals

Professionals expressed a concern that phone lines and the broader 911 system could rapidly overload. A hospital emergency room professional commented, "I think the phone lines would tie up really fast. If those phone lines do tie up, we're so dependent on that piece of equipment that we're going to be stymied." A first responder put it this way: "People are going to get paranoid and they are going to start calling 911 over everything." Professionals also saw population flight as a potential problem. "That's going to be a drain on manpower. We can expect accidents. We can expect road rage out of that kind of thing, because people are going to get cut off as they're trying to move." In addition, there was concern that health-care facilities could be flooded with worried

people, walk-ins, people self-reporting, and people fearing that they may have been exposed. "Those that are being brought by ambulance is one thing, but you're going to have a deluge . . . brought here by private vehicle, or they're going to walk in here. . . ."

Concerns about potassium iodide

Many concerns were expressed regarding potassium iodide. Known as KI, potassium iodide can confer some protection to the thyroid when radioactive iodines are released (e.g., in a nuclear power plant accident). However, many radioactive materials terrorism scenarios are unlikely to involve radio-iodines. Health department and hospital personnel were concerned that they would have to deal with demands for potassium iodide even when its use was not indicated. Said one health professional, "Everybody's going to want it." Commented another, "It doesn't matter that it's not recommended. They're not going to care."

Responders and health personnel also had their own concerns. One such concern was how they would know whether radio-iodines were involved: "How are we going to know whether or not the radioactive cloud contained iodine?" In addition, professionals asked how they would know when to take KI and where they would get it. Said one responder, "Like the KI, where can I get this, because right off the top of my head I wouldn't have a clue." Another responder remarked: " . . . should I take potassium iodide? . . . . where can I get it? . . . ." Finally, other professionals felt it was important to have full information about contraindications. As one public health worker commented, "A list of contraindications would be helpful to people. If you have this, don't take this."

DISCUSSION

The first phase of the Pre-Event Message Development Project provides a variety of useful insights into the communication issues associated with radioactive materials terrorism events. With respect to the general public, it is clear that *health issues* are at the very center of people's expressed concerns and information needs. Questions about potential long-term effects, signs and symptoms of exposure to radiation or radioactive contamination, and when someone should seek medical attention were common. Emergency messages, therefore, need to clearly emphasize very early that authorities' primary concern is people's health and safety, and the content of messages needs to anticipate and answer the aforementioned types of health questions. Given the salience of health concerns, consideration should be given to including spokespersons with high credibility on health issues in emergency messages. Message developers also need to remember that people will not always be in their homes or offices when an incident occurs. To be fully effective, messages also need to include content advising people how to protect themselves when they are in a car, outside, or in other places during an incident.

While fatalism was not the majority response to the hypothetical radioactive materials terrorism scenario, it was a common enough response to make it clear that many people are prone to believe that "there is nothing you can do." It will be crucial for emergency messages to tackle this head-on so that people undertake the protective measures needed to safeguard health. One of the findings from the first round focus groups is especially useful in this regard: People will take messages and protective actions more seriously if they believe the steps being advised are "tried and true" rather than just theoretical. Whenever possible, therefore, it may be beneficial to provide people with information confirming that protective measures work.

A key finding with the general public is that the phrase "shelter in place" is confusing or unclear to some people. It may be advisable to re-think the use of this term, which is currently found in most local, state, and federal emergency messages. Either greater effort needs to be made to ensure that people genuinely understand the phrase, or the term needs to be replaced. More generally, if special terms must be used, they should be simply and clearly explained so as to avoid confusion that impedes protective actions. It is important to ensure that messages are straightforward, use easily understood words, employ pictures and graphics, and are available in multiple languages.

Given the favorable light in which television meteorologists are viewed, their possible role in emergency communications needs to be further explored. In addition, having suitable messages available for radio will be important, since many people view this as an important back-up source. This may not be an easy task given that relatively little radio programming originates locally today in many markets.

With respect to professional groups, it is apparent that communication in a radiological/nuclear terrorism event will need to address a range of issues: the "newness" of the threat, self-protection, the threat of being targeted, and concerns about such problems as 911 system overload and the flooding of health-care facilities by worried individuals. In addition, it will be crucial for messages to take into account the fact that professionals have many concerns related to potassium iodide. Some of those concerns relate to expectations that the public will demand KI regardless of whether it is appropriate, while other concerns center around a need by professionals for more

information on whether, when, and how they should use potassium iodide themselves.

CONCLUSION

A carefully planned, empirically grounded, and well-executed risk communication program is a vital part of any effort to address the threat of terrorism involving radioactive materials. Given the enormous potential of incidents involving radiation to generate fear, effective risk communication may be one of the most important actions that health, safety, and emergency management agencies can take to help people take appropriate self-protection measures, limit adverse social and psychological effects, maintain trust and confidence, and reduce morbidity and mortality.

Results from the Pre-Event Project's first round of focus groups are already being used to improve message development at CDC and elsewhere. Meanwhile, the next phase of the Pre-Event Project research is underway. For example, an expanded set of focus groups with the public health workforce was recently completed, and additional focus groups with other professional groups are planned. In addition, the Pre-Event Project team is working with CDC to develop improved web content, CDs, fact sheets, and television and radio spots for the general public. These, in turn, will undergo preliminary audience testing in 2004. Results will be released as soon as they are available.

It is hoped the findings presented here, and future Pre-Event findings, will prove useful not only to federal agencies, but also to state and local health departments, emergency management agencies, first responder organizations, hospitals, and other bodies with responsibility for managing a terrorist incident involving radioactive materials.

ACKNOWLEDGMENTS

This research was supported by the U.S. Centers for Disease Control and Prevention (CDC) and the Association of Schools of Public Health (ASPH). Special thanks are due to Betsy Mitchell, CDC's Pre-Event Project Coordinator, and the following specialists at CDC, NIOSH, and ASPH who provided invaluable assistance: Marsha Vanderford, Charles Miller, Carol McCurley, Robert Whitcomb, John Cardarelli, Greg Lotz, Cheryl Lackey, Rita Kelliher, Stephaine Goad, and Karen Sauers. Thanks also to the members of the UAB Pre-Event Message Development Team. Additional appreciation goes to Angela Becker, who provided helpful feedback on the manuscript. Finally, thank you to the editors and anonymous reviewers at *Biosecurity and Bioterrorism* for their helpful comments and suggestions.

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Address reprint requests to:
Steven M. Becker, PhD
Department of Environmental Health Sciences
The University of Alabama at Birmingham (UAB)
530 Ryals Building
1665 University Boulevard
Birmingham, AL 35294-0022

E-mail: smbecker@uab.edu

Published online: August 30, 2004