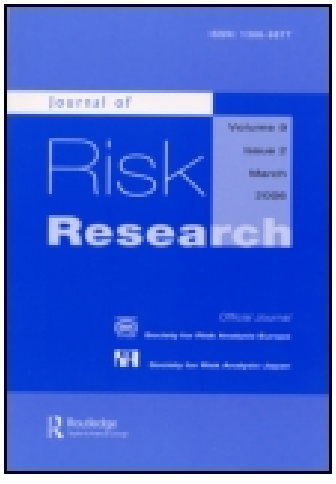

Journal of Risk Research
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/rjrr20

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Published online: 10 Sep 2010.

To cite this article: Rae Zimmerman, Carlos E. Restrepo, Alison Culpen, Wendy E. Remington, Alison Kling, Ian Portelli & George L. Foltin (2010) Risk communication for catastrophic events: results from focus groups, Journal of Risk Research, 13:7, 913-935, DOI: 10.1080/13669871003782744

To link to this article: http://dx.doi.org/10.1080/13669871003782744

Journal of Risk Research
Vol. 13, No. 7, October 2010, 913–935

Routledge
Taylor & Francis Group

Risk communication for catastrophic events: results from focus groups

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(*Received 19 August 2009; final version received 2 March 2010*)

Focus group methods are adapted here to address two important needs for risk communication: (1) to provide approaches to risk communication in very extreme and catastrophic events, and (2) to obtain risk communication content within the specific catastrophe area of chemical and biological attacks. Focus groups were designed and conducted according to well-established protocols using hypothetical sarin and smallpox attacks resulting in a chemical or biological release in a confined public space in a transit system. These cases were used to identify content for risk communication information and suggest directions for further research in this area. Common procedures for conducting focus groups were used based on an initial review of such procedures. Four focus groups – two for each type of release – each lasted about two hours. Participants were professionals normally involved in emergencies in health, emergency management, and transportation. They were selected using a snowball sampling technique. Examples of findings for approaches to communicating such risks included how information should be organized over time and how space, locations, and places should be defined for releases to anchor perceptions geographically. Examples of findings for risk communication content are based on how professionals reacted to risk communications used during the two hypothetical releases they were presented with and how they suggested using risk communications. These findings have considerable implications for using and structuring focus groups to derive risk communication procedures and types of content to be used in the context of catastrophes.

Keywords: risk communication; disasters; terrorist attacks; focus groups

Introduction

Extreme events of all kinds have been increasing in number, severity, and consequences and have come to the attention of the public to an increasing extent. This necessitates improving mechanisms to communicate the risks of these events for many reasons, such as understanding attitudes and behavior to encourage actions that reduce the consequences of such events. Focus groups are a common mechanism to begin to probe the foundations for risk communication. Focus groups are used here to develop approaches to and content for risk communication based on hypothetical scenarios involving sarin and smallpox releases in a confined space exemplified by a transit center.

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ISSN 1366-9877 print/ISSN 1466-4461 online

DOI: 10.1080/13669871003782744
http://www.informaworld.com

The growing importance of catastrophic events for risk communication

A number of studies have tracked trends in the frequency and intensity of catastrophic events and their consequences in terms of lives lost and economic loss. These events cover natural hazards, climate change, terrorism, and accidents. Major federally declared disasters of many types occurring between 1953 and 2005 in the USA were estimated to have increased by 2.7% annually by Simonoff et al. (2008, 382) based on Federal Emergency Management Agency (FEMA) data.

Catastrophic terrorism events have produced high death tolls in the last decade, for example, the sarin attacks in the Tokyo subway system, the London and Madrid transit system bombings, and the 11 September 2001 attacks on the World Trade Center (WTC). The sarin attacks in the Tokyo subway system on 20 March 1995 exemplify how terrorism can involve novel and unanticipated agents of destruction under unusual circumstances. Those attacks, as summarized by Smithson (2000), involved a deadly chemical that eventually killed 12 people, injured over 1000, and ushered in a new era of terrorism where chemical and biological agents could be easily obtained and thereby become a part of terrorist strategies. In March of 2004, in Madrid, Spain, four commuter trains were the target of the detonation of 10 bags with TNT between 7:39 and 7:42 am, resulting in 191 deaths and over 2000 injuries (Peral-Gutierrez de Ceballos et al. 2005). As summarized by Strom and Eyerman (2008, 28), the London train bombings of July 2005 were also coordinated, simultaneous attacks on several train lines and a bus – the first since World War II – that resulted in 52 deaths and over 700 injuries. The 11 September 2001 attacks on the WTC involved more players and a more sophisticated weapon that led to the deaths of almost 3000 people and untold ripple effects through the economy and psyche of the USA and the world.

Natural hazards provide important risk communication lessons broadly applicable to other catastrophes such as terrorism. The International Strategy for Disaster Reduction (ISDR) and the Centre for Research on the Epidemiology of Disasters (CRED) (2009) use country-wide estimates that show a steady rise in the number of natural disasters worldwide with declines occurring only in the early and latter part of the first decade of the twenty-first century in an otherwise increasing trend; earthquakes far exceed other natural disasters in lives lost. In the area of hurricanes, Bender et al. (2010, 454) estimate that the end of the twenty-first century will see a doubling of Category 4 and 5 hurricanes even though the overall frequency of tropical cyclones could be declining. In terms of hurricane consequences, the data from Blake, Rappaport, and Landsea (2007, Table 3a) that ranked hurricanes in terms of the magnitude of dollar damage from 1900 and 2006, suggested that three quarters of the top 12 hurricanes occurred since 2000 (cited in Zimmerman, Restrepo, and Simonoff 2009). The hazards associated with climate change include increased temperatures, sea level rise, periods of drought, and intensity of precipitation, among other characteristics. According to Jones (2010), citing Brohan et al. (2006), the global temperature record indicates that out of the 15 warmest years that occurred between 1850 and 2009, 14 of them were between 1995 and 2009. Sea level rise, another climate change outcome, now considers rapid ice melt, which implies that increases in sea level could be even greater than expected. As sea level increases, coastal areas will be threatened, and many of these areas have been increasing in population and population density over the past century, which potentially increases the consequences.

These events are but a few examples of the problems risk communication faces to support people in coping with catastrophes. Some of the examples presented above, in particular those involving chemical and biological agents in public transportation systems, directly parallel the contexts and conditions examined here.

Risk communication problems in the context of catastrophes

Understanding risk communication is a critical part of managing the risks associated with catastrophic events. Risk communication problems in the context of such events involve many different types of connections and networks. For example, communications occur among people at the scene ranging from the exposed to the injured, among public agency officials and private entities responsible for and providing emergency services, among provider organizations and the general public, and between the media and all others. In addition, secondary audiences that may not be among those exposed can play a critical role in shaping risk communication as Chess, Calia, and O'Neill (2004) concluded in the context of the 2001 anthrax incidents.

Risk communications take many forms at the time a catastrophe unfolds. Warnings of an impending event are one form of communication considered critical to imparting knowledge of when and where a natural hazard such as a hurricane or tsunami, for example, is about to strike, which can make an enormous difference in the number of lives saved assuming that compliance with the messages occurs. Little prior warning occurred, for example, of the catastrophic Asian tsunami of 26 December 2004 and the earthquake that preceded it (Subcommittee on Disaster Reduction, National Science and Technology Council 2005). Following that catastrophe, a communication network for tsunami warnings was established, the NOAA Pacific Tsunami Warning Center (PTWC) expanded its geographic authority and increased its staff (NOAA, National Weather Service, PTWC 2010a), and three other TWCs were established (NOAA, National Weather Service, PTWC 2010b). During the Chilean earthquake of 27 February 2010 with a magnitude of 8.8, the NOAA PTWC sent extensive tsunami warnings in advance of the expected tsunamis.

Assuming warnings are sent, how people react to them is very complex. As summarized by Drabek (1999), reactions to warnings can depend, for example, on initial denial of threat, the role of group context in how warnings are processed, individual experiences, and how clear messages are to those receiving them.

The effect of risk perceptions on behavior is also relevant for risk communication. In a meta-analysis of 34 studies, incorporating subjective experiences in risk perception embodied in the term 'affect', Waters (2008) found strong relationships in the studies between perceived risk and behavior. The implications for risk communication suggest that incorporating subjective elements in perceived likelihood estimates could result in such communications influencing behavior to a greater extent.

Once messages are sent, received, and presumably understood, compliance may depend on yet another set of factors. Dombroski, Fischhoff, and Fischbeck (2006) used scenarios based on a hypothetical case study of a radiological dispersion device to assess expert opinion of compliance to evacuation orders. That study identified a number of factors that affected compliance: what time warnings occurred, how much warning they had, the condition of transportation arteries to effect the evacuation, population characteristics, and organizational coordination.

Notable risk communication problems emerged in the examples of terrorist attacks given above. The 11 September 2001 WTC attacks revealed severe interoperability

problems among different transmission systems, which inhibited communications between police and fire personnel (McKinsey & Company 2002a, 2002b). Similar technical problems with interoperability were identified in connection with the London train bombings along with interpersonal and interagency communication obstacles (Strom and Eyerman 2008). Smithson (2000) noted how the sarin attacks revealed critical lessons for risk communication, in particular the rapidity with which communication technologies lose their capacity to transmit messages when a sudden spike in communications occurs, the inability to connect responders to health services and to specialists who understood how these agents behave, and the lack of training in, understanding of, and ability of responders to handle chemical and biological agents.

Scope and approach

Focus groups are a mechanism to discuss and shape ideas, information, and research directions in the area of risk communication. They are an important foundation for in-depth research especially in new areas of inquiry where knowledge is uncertain, unknown, or controversial. They also provide important insights at the outset of a research project to enable mid-course corrections to be made. Focus groups are also used to provide input into the design of formal surveys and interviews (Krueger and Casey 2009). They have been used in research since at least the 1940s, and though there are both advantages and disadvantages to the procedure, the advantages outweigh the disadvantages and they are still in common use. Focus groups have been used to study and shape risk communications in the context of disasters.

Focus group methods are adapted here to: (1) provide approaches to risk communication for very extreme and catastrophic events, and (2) obtain risk communication content within the specific catastrophe area of chemical and biological attacks. Understanding risk communication in extreme events is a particularly difficult area of investigation, given the high degree of variability of types of communicators and the uncertainty of the situation, and focus groups are particularly important in such a context. The method and the insights from its applications in this paper to chemical and biological releases aim to be transferable to other catastrophic events.

The purpose of this research is to obtain preliminary information about the elements of risk communication that professionals regard as important in the context of very extreme and catastrophic events, in particular in connection with unexpected chemical and biological attacks. Professionals drawn from transportation, health, and emergency management who are routinely involved in emergencies were the participants in the focus groups.

Risk communication approach

Focus group frameworks applied and adapted for this research primarily emphasize how information is presented in a focus group setting with the objective of shaping information for risk communication research and to some extent how the choice and combination of respondents can affect focus group design. Given the scenarios presented to the participants, the focus groups addressed how people would actually react in such a scenario, and how people should react to maximize life saving and to minimize exposure (desired behavior).

One aspect of the approach includes the importance of the structure of events over time, in particular, how finely divided the time periods are for actions, events, or

consequences. This raises the important issue of the abilities of people to make fine distinctions in information over time. Second, people anchor responses and actions to specific places. People understand where threats are and how they can escape them in terms of actions that are place-based.

Risk communication content

The research presented in this paper aims at understanding the kind of factual and other information different professionals prefer and emphasize when faced with an extreme emergency. The responses of professionals represented in the focus groups are particularly important, since they are heavily involved in emergency response activities and often interact with one another and the general public, which require communication skills. Thus, it is important to understand the information they use and feel they need to communicate. Understanding this dynamic helps shape the larger research agenda of how risk communication in catastrophes needs to be tailored to people with different professional backgrounds and different levels of familiarity with emergency response. Participants were asked to concentrate on how they thought people should and would react at different stages of a catastrophe as the events unfolded, what information is needed to influence behavior, how messages should be worded, and who should deliver the messages and when.

Background for the context and use of focus groups

Definitions

Focus groups are defined in a variety of ways, but the definitions incorporate common underlying characteristics. Some specific definitions from the literature are cited below.

One key characteristic is the qualitative orientation of focus groups in research for the purpose of identifying areas for further investigation and describing experience and explanation (Cox et al. 2010; Mcconnell 2000).

Desvousges and Smith (1988), Kahan (2001), and Mcconnell (2000) emphasize a second characteristic of focus groups, that of supporting the process of an informed and planned discussion guided by a discussion leader for the purpose of identifying participants' thoughts, knowledge, and attitudes toward a particular topic.

Origins of the use of focus groups

Focus groups have had a very long history, dating from the early twentieth century (Merton and Kendall 1946). The concept gradually diffused into other behavioral science research (Stewart, Shamdasani, and Rook 2007). They are one of many techniques for obtaining information for research as well as public engagement in general (Rowe and Frewer 2005). The design of focus groups varies widely, given that the purposes vary, and thus, the adaptation of focus groups and focus group inquiry to a particular research context is considered necessary (Mcconnell 2000). Focus groups have been used extensively in the context of disasters to understand perceptions, test messages, and conduct emergency needs assessments (Olson et al. 2005). In fact early applications of focus groups to communication date to the mid-twentieth century (Stewart, Shamdasani, and Rook 2007).

There is a continuing and growing need to apply research tools, such as focus groups, to the problem of catastrophes resulting from natural hazards, extreme accidents and terrorism, since such events and their consequences appear to be increasing, as discussed in the introduction. Consequences of terrorist attacks to infrastructure have been considerable, for example, transit systems (the context used for the scenarios in the focus groups presented here) have been attacked frequently outside of the USA (Jenkins 2001) as have oil and gas pipelines (Simonoff, Restrepo, and Zimmerman 2005). Similarly, Symantec (2009) has recently reported substantial increases in internet attacks.

A large number of focus group studies began to appear for the study of natural hazards and terrorism. The use of focus groups for risk communication applications particularly in the context of disasters was presented in a review of risk communication studies by Kling and Zimmerman (2007). These were conducted for different populations, persons with different roles in emergencies, and types of events.

First, with respect to studies that focus on roles of particular individuals and professions, Secor-Turner and O'Boyle (2006) reviewed nurses' concerns and behaviors in emergencies and identified studies that used focus groups to identify: factors affecting the ability of non-clinical workers to perform emergency functions (Thorne et al. 2004), factors that influence nurse response in disasters and educational needs for performance (Shadel et al. 2003), nurses' concerns both personal and professional following a hurricane (French, Sole, and Byers 2002), nurses' concerns in a working environment (Secor-Turner and O'Boyle 2006), and nurses' reactions to dealing with victims (Riba and Reches 2002). Quinn, Thomas, and McAllister (2005) studied postal workers' concerns and behavior using focus groups in the context of the anthrax attacks in 2001.

Second, emphasizing the role of groups and organizations, Olson et al. (2005) used a series of focus groups to identify needs to coordinate planning and response of government and public health agencies in emergencies. This work is particularly applicable to risk communication, since their initial literature review found that 'communication is arguably the most cited barrier to reaching and maintaining a high level of preparedness' (Olson et al. 2005, 77).

Strengths

The use of focus groups is considered to have a number of advantages, namely, flexibility to accommodate new information and ideas over the course of the focus group process (Seal, Bogart, and Ehrhardt 1998, citing Dawson, Manderson, and Tallo 1993; Krueger 1994; Morgan 1988); effectiveness in obtaining information from respondents (Rowe and Frewer 2005); the ability to generate information rapidly and economically (Seal, Bogart, and Ehrhardt 1998, citing Dawson, Manderson, and Tallo 1993; Mcconnell 2000, citing Cote-Arsenault and Morrison-Beedy 1999; Krueger 1994; Morgan 1988); the ability to expedite entry into new areas of knowledge and identify new research ideas through group interaction, sharing of information, and incorporating those ideas and information over the course of the process (Cote-Arsenault and Morrison-Beedy 1999). Beyea and Nicoll (2000, 897) add the advantage that a focus group provides a group setting where some participants prefer that.

Limitations

Commonly cited limitations of the focus group method compared to quantitative methods include those identified by Seal, Bogart, and Ehrhardt (1998, 254, citing

Dawson, Manderson, and Tallo 1993; Krueger 1994; Morgan 1988, 1997) as being limited in their ability to fully quantify results; introducing bias, given the limited number of participants, their lack of representativeness (also noted by Freeman, O'Dell, and Meola 2001), and the more limited influence participants may have over one another over the course of the process; and the ability to deal with complexity and depth which interview techniques may be better adapted to. Beyea and Nicoll (2000, 897) add that some participants may not like the setting and may not feel comfortable discussing their ideas in a group setting and interviewer bias may occur.

These limitations primarily focus on the advantages of other techniques, for example, interviews and participant observer methods, which can be used in conjunction with focus groups. The advantages of using focus groups outweigh the limitations as reflected in the popularity of the use of the focus group technique. The usefulness and value of focus groups has been particularly underscored for risk communication (Desvousges and Smith 1988). In the research presented here, limitations were addressed in a number of ways. To address the problem of engaging all of the participants and allowing multiple opinions to be aired, the facilitator encouraged all participants to respond, giving each participant a chance to respond, and the small size of the group also encouraged participant response. The facilitator also managed the discussion in a way to ensure that no one participant dominated the discussion. Questions were asked of the participants in a neutral way. These aspects of the focus group method are discussed in more detail below.

Methods used

Focus groups concerning two potential terrorism scenarios – a terrorist attack involving the hypothetical release of sarin and another one involving a smallpox release – were conducted for the risk communication portion of a broader project on readiness for a large-scale disaster (see acknowledgements). Both attacks were assumed to occur in a very densely populated and confined physical space, namely a train, train station, or bus depot. Understanding risk communication is vital to predicting how people are likely to respond to the medical system, the infrastructure such as transportation that provides vital services during a disaster, and security in large-scale emergencies. Three aspects of the focus group approach are emphasized: how participants respond to the definition of events over time and anticipate how the public will respond to such events, how events are defined geographically, and how variations arise in information used by participants from different professions.

Two separate focus groups were held for each of the two attack scenarios – totaling four focus group sessions. Researchers anticipated that the participants would draw upon their professional expertise in their responses. This provided insights into how professionals react to information and anticipate how people react to the attacks as a basis for refining the scenario design and factual information about the agents and message sets for the two attack scenarios.

Participant selection

Focus group participants consisted primarily of professionals from emergency planning and response and transportation infrastructure who had knowledge of the behavior and needs of both emergency responders and the general public. This emphasis on occupational groups is consistent with focus group protocols (Krueger and Casey

2009, 66). 'Snowball sampling', a technique commonly used in survey research and focus groups (Tashakkori and Teddlie 2002, 283–5) dating at least from the 1960s (Goodman 1961) and in risk communication studies in particular (Palenchar 2008, 10), was used to select participants. This approach involved making initial contact with individuals in government agencies, utilities, and the health professions with general experience in emergencies. They, in turn, suggested people who had closer connections and more experience with such events. The final participants were from medical professions (emergency services and public health), transportation (surface transportation and transit planning, management and operational levels), and security. The selection of focus group participants reflected areas of expertise relevant to the issues being examined and participants were in no way intended to be statistically representative of those populations or the general public.

Focus group design

Size

The size of a focus group depends on its purpose. Stewart, Shamdasani, and Rook (2007, 58) indicate that the size of most focus groups is 6–12 people. For marketing studies, Krueger and Casey (2009, 67–8) indicate 10–12 people, and for more complex topics, characteristic of the risk communication project covered in this paper, smaller, that is, about six to eight person groups are more appropriate to encourage discussion. Each focus group session in this study consisted of six people consistent with prevailing protocols.

Diversity

Diversity of participants in small groups is difficult to characterize (Stewart, Shamdasani, and Rook 2007, 20–35). Participants in the focus groups in this research were from different gender, racial, and age groups. Participants were not known or well known to one another, though if such familiarity exists, it is considered by some to have 'a modest at best' influence (Fern 1982; Stewart, Shamdasani, and Rook 2007).

Duration

According to Stewart, Shamdasani, and Rook (2007, 37), the duration of focus groups is typically between 1.5 and 2.5 hours, and the sarin and smallpox focus groups were consistent with that typical time frame.

Physical setting

A conference room setting was used in the offices of a university institution. The room had no distinguishing characteristics. It had plain white walls and unadorned windows to avoid distraction. Participants were seated at a single rectangular table.

Human subjects requirements

Requirements set forth in advance of the focus groups by the university's Institutional Review Board (IRB) human subjects procedures were strictly followed, and

the university approved the application to conduct the focus groups. The sessions were not recorded or videotaped, but were manually transcribed by the focus group convenors.

External conditions

External conditions were monitored just prior to and during the focus group itself to ascertain any potential influence on responses. For example, the morning of the focus group, reports of an unknown odor in Staten Island, NY, were reported, resulting in the deployment of fire and hazardous materials (hazmat) personnel to the area (Associated Press 2006; Vasquez et al. 2006). The cause of the odors was never determined. Some participants indicated knowing that this particular event had occurred at the outset of the focus group, but no discernible impact on the responses occurred.

Focus group process

The participants were convened in a university setting in two separate two-hour sessions – one for sarin and the other for smallpox totaling four sessions. The research group had convened focus groups in the past, producing guides (Howard/Stein Hudson Associates 2000) and conducting focus groups in Boston and Los Angeles in connection with infrastructure preferences and in New York City for WTC redevelopment. The moderator directed the discussion according to an agenda. The risk communication research project director (who also served as the moderator) covered the objectives and rationale of the research, the nature of risk communication and some of its challenges, and gave a brief synopsis of the characteristics and effects of sarin and smallpox over time, defined for specific time intervals depending on how each agent spreads and affects people. Brief descriptions of each of the agents of attack as presented and distributed to participants are given below, based on fact sheets from the Centers for Disease Control (CDC). These presentations were intentionally kept brief and the items included were targeted to the purpose of the research.

Presentation of the characteristics of risk agents

Characteristics of sarin (drawn from US Department of Health and Human Services, Centers for Disease Control and Prevention 2004a):

- Sarin is a synthetic chemical, not found in nature; it is a nerve agent.
- It was actually used in an attack on three subway lines in Japan in 1995.
- Its impact depends on extent of exposure, and is almost instantaneous, marked by symptoms such as convulsions, vomiting, coughing, collapse.
- It is difficult to detect since it is colorless, odorless, and tasteless.

Characteristics of smallpox (drawn from US Department of Health and Human Services, Centers for Disease Control and Prevention 2004b):

- Smallpox is a viral disease, contagious, with no known cure once contracted, but preventive vaccines exist.

- Effects appear after incubation periods of one to three weeks; no contagion exists during that time.
- Initial symptoms are fever, aches, nausea, followed by rashes, sores, and raised bumps.

Formulation and presentation of actual and desired public behaviors for participant reaction

Tables 1–4 contain the descriptions of the actual behavior and desired behavior from the attacks that were presented sequentially to the participants for their initial reactions and evaluation of how people would and should react to a release. This framework also provided the basis for group discussions.

Participants were asked to respond to the issues below, and each issue area was subdivided by population groups according to how they would be affected by the releases (potential fatalities, injured, worried well):

- How would people actually react in such a scenario?
- How should people react to maximize life saving and minimize exposure (desired behavior)?
- What information is needed to influence behavior?
- How should messages be worded?
- Who should deliver the messages and when?

At the outset of the focus group, it was assumed that participants knew that an attack had occurred and what some of its characteristics were. This assumption was considered more feasible for sarin than for smallpox, since sarin has a more immediate and visible effect.

Results

Participant responses for the first two issues – how people would and should respond summarized in Tables 1–4 – are described in more detail below. Then a discussion of the remaining three issues is presented based on insights provided by participants following the discussion of the formal focus group sessions.

How people actually react

Participants provided a number of insights about how the general public would react and their assessment of how information could best be presented to the general public.

Facts about the characteristics and effects of the agent over time

Participants discussed the time frame of events from release through exposure and later stages of response as a basis for organizing information about how people would and should react to the release over time. Participants preferred fewer time intervals, especially for the later time periods. The initial time frame presented to participants for the sarin scenario consisted of five time intervals (in minutes) that defined reactions to the release: 0–10, 10–15, 15–30, 30–60, and 60–180 minutes. The smallpox scenario also

Table 1. Actual behavior for the general public.

	Scenario: sarin attack in a confined space				
	Time (minutes)				
	0–10	10–15	15–30	30–60	60–180
Fatalities	First effects appear: severe symptoms; collapsing, convulsing, vomiting, coughing.	Most severe cases remain incapacitated on scene.	Most severe cases first to go in ambulances. Conditions may worsen in ambulance.	Deaths at hospital begin to occur.	Mobilization to remove any dead left on scene.
Injured	Collapsing, coughing, vomiting, trying to exit station.	Immediately seek on-site help or are attended to by on-site responders. If able, will start moving to hospitals.	Further on-site treatment continues. First on-foot patients start to arrive at hospitals.	Sickest will start to show up at hospitals 30+ minutes after event.	Within an hour of attack hospitals start seeing large groups of patients. Ambulances bring in more patients.
Exposed (certain/uncertain), 'worried well'	Coughing, moving out of station.	People keep moving away toward hospitals if think they are injured.	People keep moving away, some arrive at hospitals, some go home or to work.	Some stuck in subways, some leave for hospitals.	Within an hour of attack hospitals begin seeing large groups of patients (some worried well). Most people out of area; typical modes for information.
Off-site		People nearby listen to street noise and commotion, get cellphone messages. News media arrive on scene and at hospitals.	Start to evacuate proximate buildings. Some go to (drawn to) contaminated area. Live TV broadcasting used.	Proximate buildings continue to evacuate. Traffic escalates; possible panic occurs. Media giving information on situation.	Most people outside rely on typical modes for information.

Table 1. (*Continued*).

Scenario: Smallpox attack in a confined space					
	Time (days)				
	1–10	11–16	17–20	21–24	25–28
Fatalities	n/a	May be sent to hospital with high fever, etc.	In hospital.	In isolation in hospital.	In hospital. First fatalities around day 35.
Ill	n/a	May go to hospital with high fever, etc.	In hospital, in isolation if smallpox known.	In hospital, 3–4 weeks.	Exposed (certain/ uncertain).
Exposed (certain/ uncertain) 'worried well'	n/a	If no symptoms, no action taken.	Close acquaintances of those with rash consider vaccination if smallpox suspected and resources permit.	Smallpox may or may not exist: people with early symptoms may go to doctor or hospital. Some panic may set in. Small percent of vaccinated people have side effects.	Smallpox outbreak confirmed: stay home, go to doctor. Might avoid hospitals in fear of infection. Some might avoid vaccination centers.

Table 2. Smallpox attack in a confined space scenario – actual behavior for health care providers/emergency responder actions.

	Time (days)				
	1–10	11–16	17–20	21–24	25–28
Health care providers Police (trained to observe potential cases and take appropriate action)	No action	Smallpox suspected. Treat patients with high fever at hospitals. Doctors decide whether to send fever patients home.	Decide whether to vaccinate if rash develops. Trace potential exposed victims (close contacts of ill subjects) and vaccinate. Communicate with other hospitals about possible outbreak.	Exposed health care and other emergency providers who display early symptoms, are vaccinated if smallpox outbreak suspected. Coordinate response with other hospitals. Continue to trace exposed victims.	

Table 3. Smallpox attack in a confined space scenario – actual behavior for service operator actions.

	Time (days)				
	1–10	11–16	17–20	21–24	25–28
Transportation operators	No action	Look for passengers with symptoms.	Distribute information about symptoms and be on alert for possible infected.		
Telecommunications	No action	Support responders.	Enlarge support network as appropriate.	Target larger audiences.	

Table 4. Desired behavior for the general public.

	Scenario: sarin attack in a confined space				
	Time (minutes)				
	0–10	10–15	15–30	30–60	60–180
Injured, requiring treatment	Get to fresh air	Stay in-place for on-site treatment.	Get people to know what their condition is. Stay in-place for on-site treatment.	Stay in-place for on-site treatment.	Stay in-place for on-site treatment.
Exposed, condition uncertain	Fresh air, stay in touch	If moved away, stay in touch. If on-site, get treatment.	Get people to know what their condition is. If moved away, stay in touch. If onsite, get treatment.	If moved away, stay in touch. If onsite, get treatment.	Stay in touch.
Worried, but well		Move away	Get people to know what their condition is. Stay away.	Stay away	

	Scenario: smallpox attack in a confined space				
	Time (days)				
	1–10	11–16	17–20	21–24	25–28
Requiring treatment	Vaccination (but will not know they are sick)	Go to hospital for care.	Stay in isolation in hospital. Provide information on potentially infected close contacts.	Stay in isolation in hospital for treatment.	Stay in isolation hospital for treatment until no longer contagious (3–4 weeks).
Exposed, condition uncertain	Vaccination (but will not know they are sick)	Stay informed of symptoms/ transmission of disease. Go to vaccination centers (if system is set up, and if not at risk from vaccination).	Stay informed of symptoms/transmission of disease. If vaccination system set up: go to vaccination centers (if no risk from vaccination). Stay at home or go to hospital if suspect infection – do not expose others.		
Worried, but well	None	None	If no close contact has smallpox, do nothing. Be alert for fever/early onset of symptoms. Avoid hospitals and busy places.		

consisted of five time intervals (in days given the long incubation for smallpox): 1–10, 11–16, 17–20, 21–24, and 25–28 days. Although the initial time periods were retained in recording the information in Tables 1–4, participants recommended collapsing or merging some of the time periods to avoid repeating the same information for different time periods. This is taken into account in the tables as merged cells.

Participants discussed the correspondence between a more simplified timeline and the timing of the appearance of smallpox effects as a basis for designing the timelines. For a smallpox attack they indicated that, unlike a quick acting agent such as sarin, it is harder to identify the symptoms quickly, since there is a large time-lapse before symptoms emerge. Factors influencing time frames identified by participants included timeliness and effectiveness of detection, fatality rates, and the use of vaccines to reduce fatalities. Air filters may detect smallpox more quickly, speeding up detection, but participants felt that this equipment was not that reliable. Once symptoms do appear, smallpox's case fatality rate is about 30% historically, and people do die quickly after symptoms appear. Vaccines can prevent death if administered within four days of exposure. Communication problems can arise in connection with the potential dangers of vaccines. The death rate from inoculation is considered low in the case of smallpox, which affects communication for inoculation risk.

The relevance of defining the location and place of the problem

Participants indicated that individual and group behavior depends on the location of people relative to the attack or release. The physical setting of the attack is an important determinant of people's reactions. For example, participants noted that for a sarin attack, behavior is very different for a scenario defined for a train versus a train station. People in a train will try to exit onto the rails and that could be dangerous, whereas in a station there are many ways to evacuate and a wide dispersal of exposed people is possible. Participants noted also that an urban area will have a higher concentration of people and could experience a larger effect and reaction to threats. Regardless of location, participants assumed that people would panic if they found themselves in a confined location, though there is a considerable debate in the literature about whether or not panic occurs under such circumstances.

Participant assessment of reactions by type of group

Tables 1–3 give the actual reactions focus group participants anticipated for the general public, health care providers/emergency responders, and service providers. Anticipated actual reactions of the general public for both sarin and smallpox, shown in Table 1, were divided into four categories of the general public ranging from those experiencing the greatest effect to those potentially experiencing the least: individuals who ultimately would be fatalities, those injured, those exposed whose consequences are certain versus uncertain including the 'worried well', and finally those who are off-site and concerned about the general situation and people they might know who might have been exposed. These anticipated actions evolve over time, with people closest to the attack gradually being moved or moving on their own from the location. These movements occur more immediately in the case of sarin than for smallpox given the delay in time of symptoms for smallpox.

The participant assessments of the actual behavior of health care providers and emergency responders (primarily the police trained in emergency response) are shown

illustratively just for smallpox in Table 2. In the immediate 10 minutes following the attack, little is anticipated since such responders are not likely to be on the scene and symptoms for smallpox are not apparent. Then assistance is provided, and a key function is maintaining communication with hospitals and other health care facilities. In later time periods, emergency providers continue to perform these functions, however, some of the responders are likely to become victims, reducing their capacity to respond.

The participant assessments of the actual behavior of service providers are shown in Table 3 also illustratively just for smallpox. The two service providers shown are for transportation and telecommunications. Both services provide key communication functions for those potentially exposed.

How people should react

Participant assessments of how people should react are shown in Table 4 for both sarin and smallpox, illustratively for the general public, but assessments for special groups are also discussed below.

Desired behavior for the general public

For the general public, participants agreed that the first 10 minutes of a confirmed attack in a confined space (more relevant to a sarin attack scenario) would be very chaotic. In the case of sarin, the urgency pertains to removing people immediately. In the case of smallpox the decision pertains to vaccination. In order to avoid the adverse effects of potential panic, an evacuation process and quick medical and police response are considered necessary during this time period, and participants indicated that the general public should move toward these options. Participants debated whether or not people should remain in place (e.g., shelter in place) or immediately leave. There is considerable debate about the choice of shelter in place versus evacuation. An example for the advantage of remaining in place presented was that assuming people were trapped on a train, remaining in place could allow trains to be used as ambulances. A disadvantage of moving trains in an emergency is that such an action could spread hazardous conditions by moving the contaminants around. Whichever option is adopted, people need direction underscoring the need for adequate communications. If people leave the contaminated area without being directed, they might spread the contamination and increase exposure. For sarin, off-gassing of the substance from the clothing of those exposed who leave the area could occur. For smallpox, coughing could disperse the agent (though the critical period is about one to three weeks after exposure). Leaving an area is often not viable when an area is declared a crime scene. These insights reflect a strong emphasis on the concept of places – their configuration relative to potential people exposed.

Desired behavior for emergency responders

For sarin, health professionals indicated that desired behavior for emergency responders included knowledge of the use of escape hoods or masks to protect themselves, enabling them to be able to communicate to and help others. If the attack is on a train, the train crew needs to mobilize the train or get people off safely. After the scene is accurately assessed, police and emergency responders need to set up a perimeter,

triage, and decontamination post. Transportation professionals indicated the need for a decision to suspend service on other train lines especially if a subsequent or follow-up attack is considered a threat.

In the smallpox case, health professionals indicated that desired behavior for emergency responders would be to first confirm an outbreak; syndromic surveillance teams should detect that a large number of people with similar symptoms are coming in to hospitals. Responders should have people diagnosed and vaccinated if appropriate (including service providers); people who have already contracted the virus should be put into isolation wards (participants emphatically pointed out that these people need to be taken care of). Points of distribution (PODs) need to be set up throughout the city for an emergency plan for citywide vaccination to occur in four days (550 people per hour per POD) and their location communicated to the public. New York City has 200 sites at public schools near transportation systems, and plans for transportation options for the disabled are underway. Surrounding counties should be alerted, and as needed, they should set up similar response teams. Emergency responders emphasized desired behavior patterns that would prevent the public from panicking.

Thus, participants regarded desired behavior for both the general public and emergency responders as having important location and temporal dimensions or differences.

Information for message sets to influence behavior and differences by type of profession

As in the previous section, professionals differed in their assessment of the design and timing of messages. Participants all emphasized the need to provide information in the form of messages prior to an event to convey a plan of action and to coordinate messages. Participants identified as an example a Cities Readiness Initiative (US Department of Health and Human Services, CDC 2007) that is being set up where counties coordinate communication with one another.

In the sarin case, a transportation operations professional emphasized that such a plan and the design of information for it has to incorporate the train and train station environment. A hierarchy exists among train personnel, which would correspond to a communication structure. Ticket collectors should communicate problems to conductors, and conductors should communicate the problem to the control center and the engineer. A dialogue should exist about the immediate state of the train and its passengers and the Emergency Medical Services (EMS) should be contacted to help identify the attack agent or its characteristics so that the emergency responders can respond appropriately. After people are safely off the train, the chain of duty is passed along from the train operators to the emergency responders. An announcement should be made to direct affected people to decontamination posts.

In the smallpox case, relatively more time exists between exposure and the appearance of symptoms than in the sarin case. Participants who were health professionals noted the existence of information dissemination plans that are already in place. If a case is confirmed and similar cases are recognized from other hospitals, a health advisory would be sent out to all health departments and hospitals. The Office of Emergency Management and the Mayor would initiate their vaccination programs in coordination with the CDC and decide if the whole city should be vaccinated; if other cases would continue to arise, the CDC would take over.

Message content

Participants indicated that message content should be crafted in a way that conveys necessary information in a controlled and calm way, thus minimizing risk of panic and further injury and death. Immediately after an event occurs, getting a message out is important in order to prevent panic. Whether or not people do tend to panic in such attacks is a matter of debate. For example, one of the participants noted that in the WTC attack people did not panic. On the other hand, in a case outside of the USA of a false message about a bomb being planted, people stampeded across a bridge to escape and hundreds died.

Participants noted that messages need to reflect the immediate objective of the response over time and place such as having people remain in place or, alternatively, having them leave the area immediately to avoid more exposure. The rationale for remaining in place (often referred to as 'shelter in place') is to avoid further harm. People may have to stay in place where the area has been designated a crime scene to avoid potential perpetrators leaving the scene. Staying in place and evacuating may not be mutually exclusive – people can be told to stay on a train and the train can evacuate them by moving them out of the area. Ultimately, such trains would be brought to terminals far from the attack and then evacuated. The decision to either keep people in place or evacuate them is affected by the location of people relative to the attack. Trains far from the area should be evacuated to avoid panic and further exposure, once the nature of the attack is known. Very often the objective of the response for those exposed is not clear or it changes and depends on the knowledge the messengers have about the situation (e.g., a train conductor may not know if an attack agent is infectious in nature), making messages difficult to design ahead of time.

For the sarin scenario, there was some debate about what the passengers on the train should be told. If the conductor tells them the truth there may be panic, or if he or she lies to the passengers the messenger and the message may lose credibility. The final consensus was that the communication should be that a situation has occurred on the train and emphasis on what the next steps will be. The information going out from the train personnel should be as accurate as possible so that EMS/911 will know what to expect when they arrive on the scene: location, number of people involved, etc. One important objective identified was the need to decontaminate people, for example to wash their clothes, and messages need to emphasize this approach.

For the smallpox scenario, participants who were health professionals indicated that the message for the sick is to go to the hospital to the extent that they are mobile. People who think they have been exposed should go to a POD; others should neither go to hospitals nor PODs to avoid exposure but not leave the area for fear of potentially spreading the disease. People should be reassured that not everyone will die. Risks and benefits of vaccination, including the availability of the supply, when it is effective, the success rate, and the fatality rate are important message components, especially for those who believe they might have been exposed, as well as attributes of the disease such as its infection rate and the accuracy of a diagnosis of infection.

In summary, responses during the focus groups emphasized that information content needs to be as specific as possible covering such areas as:

- the seriousness of the agent and risks of exposure to it (what it can do);
- what is not known about the agent;

- the fact that it is an intentional exposure (at least in the case of sarin and smallpox);
- the significance of the event in terms of terrorism; and
- the exact location of emergency vehicles, availability of vehicles and drivers, the location of health centers and the local PODs, the capacity of each type of health center, and the fact that not everyone will go to the same place.

These findings were consistent with a larger focus group of 163 participants conducted in 2003 and funded by the CDC regarding a hypothetical nuclear attack. The CDC study found that those participants who were members of the general public expressed the most urgent concerns around specifics regarding the incident, facts about the threat agent, and information about health issues. So to be most effective, emergency messages must anticipate these questions (Becker 2004).

Participants indicated that messages should be staged over time to convey a sequence of steps and what the expectations are at each stage. In addition, messages should be tailored to different populations – special ethnic groups, the disabled, and workers. Actions and the messages used to convey them should be specific to conditions surrounding the event, such as weather and season. Solutions communicated also need to be matched to conditions and the scale of events. Given the uncertainty of information technology, face-to-face communication is important, that is, on a train this means going from car to car. Misinformation has to be managed.

The messenger: who delivers messages, when, and to whom – differences among professions

Who gives the initial information and who the official messenger is were considered critical to the success of a potential message. Are the messengers believable? Is their agency credible? There is an extensive literature on how the trustworthiness of messengers and sources of information influence whether or not people will comply. Different professionals varied in their views on this matter. Also, locational characteristics played into message dissemination. Information flow should start with the people in the immediate vicinity and flow outwards from there.

For the sarin case, according to transportation professionals, train or station operators would have to immediately announce the situation and what to do. After that, responders from all different agencies would have to cooperate and provide consistent messages with directions that can be implemented. Lead responders would need to have reliable communication equipment. At some point, after the situation is under control and information is coordinated, the mayor or a senior authority figure should announce what happened and next steps for distant and/or stranded publics. People generally want to rely on individuals in positions of authority for messages, though messages by those close to the scene, such as a train conductor, may be relied upon initially. As time passes, messages need to become coordinated, for example, by the NYC Office of Emergency Management.

In the smallpox case, participants stressed that due to the severity of the virus and the fear surrounding it, community and religious leaders would be important messengers. Public officials should communicate what the situation is, where to go, and how to get there once PODs have been established; the distant public (people far from the site of the event but emotionally tied to it) should be told to check with their local officials. What happens at the POD should also be explained. TV, radio (including ethnic), newspapers, and community leaders should also be used to spread this information.

Although the media are usually immediately on the scene as communicators, participants indicated that they often emphasize the worst scenario first.

A matrix listing the types of messengers or message senders and message recipients was presented to the participants, and it was generally agreed that the list of messengers and recipients should be the same given the complexity of communication patterns. These categories would include the injured, exposed, 'worried well', distant publics, health care providers, service operators, emergency responders (as distinct from 'first' responders), officials, community leaders, religious leaders, and ad hoc responders with more specific categories added depending on the case.

Discussion and conclusions

Revisiting initial study objectives, the conclusions below are representative of some of the results obtained from the focus groups.

Important insights were gained through the focus group mechanism about the communication of risk in catastrophes where conditions are highly variable and uncertain and directions for further research in this area. How professionals viewed actual and desired behavior was an important context for such communications, since many of these professionals are often at the forefront of action in these events.

First, the way that time is defined proved to be an important means of organizing details of the events for the purpose of communicating them, starting with the time that the release is known to the point where most of the cases are taken care of. People engaged in communication could not distinguish detailed divisions of time into many different categories. Fewer time periods were warranted in the sarin case where the time from release to the appearance of symptoms was short and where the uncertainty of the information was very high. A catastrophe evolves over time, so while risk communications change over time, they should be designed in a way that fewer time periods are targeted, and should be based on how the actual effects of the risk agent appear over time. Actions in the first few minutes after the attacks were evident in the sarin case. In the case of smallpox, which has a more delayed response, initial actions occurred later. Future research is needed to refine the time frames over which the consequences of releases of toxic chemical and biological agents occur as an input for emergency management and planning.

Second, places anchored how people framed information, whether they were members of the general public or from specific professional groups. Information regarding the location of the initial release was considered critical to shaping the message about where the problem was and what they should do. In fact, characteristics of the space, whether it was confined or whether people could easily leave it, were critical factors.

Third, different professionals who are likely to be involved in any response activity – the operator of the infrastructure (in this case trains) and the health professional – spoke different languages and emphasized different things. How close a focus group participant's profession is to emergency response activities affected what the participant emphasized in terms of information.

Acknowledgements

This research was supported by the US Department of Homeland Security through the Center for Catastrophe Preparedness and Response at New York University under grant number 2004-GT-TX-0001. However, any opinions, findings, and conclusions or recommendations in this

document are those of the authors and do not necessarily reflect views of the US Department of Homeland Security.

The Large Scale Emergency Readiness (LaSER) Project is being conducted at New York University (NYU) (http://www.nyu.edu/ccpr/projects/laser.html) and is a multi-disciplinary and multi-component effort, funded by the Department of Homeland Security (DHS) and NYU's Center for Catastrophe Preparedness and Response (CCPR). LaSER aims to improve the nation's all hazards preparedness for the public health (including organizational) and medical consequences of a mass casualty emergency. LaSER is a five sub-project effort and one of NYU's largest multi-disciplinary efforts that collaboratively encompasses seven of NYU's public health-associated departments (medicine, dentistry, nursing, law, public service, social work, bio-informatics, and mathematics) encompassing disaster-related expertise focusing on strategic, tactical, and operational research. CCPR is NYU's federally funded research center developed to investigate models to enhance preparedness and response capabilities in high threat urban areas. LaSER was created as a research consortium from a wide range of disciplines and schools within NYU.

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