Understanding Risk Communication Theory: A Guide for Emergency Managers and Communicators

Report to Human Factors/Behavioral Sciences Division, Science and Technology Directorate, U.S. Department of Homeland Security

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About This Report

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About START

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Introduction

This document reflects the themes and concepts developed in the accompanying *Understanding Risk Communication Best Practices: A Guide for Emergency Managers and Communicators*. This report discusses and dissects theories and models relevant to federal, state, and local homeland security personnel and emergency managers faced with communicating risks within their communities. It first provides a detailed discussion on defining risk communication, followed by risk characteristics to summarize how perceived dread and familiarity can affect risk messaging. Next, relevant theories and models[1] are discussed in two parts: cross-cutting theories and models applicable across the preparedness, response, and recovery phases, and then additional theories and models that are most relevant within a specific event phase. As with the *Best Practices* document, many of the communication approaches presented were not originally designed for a specific event phase, but nevertheless offer valuable insights that make them particularly suitable for a specific event phase.

This review presents concepts from a variety of academic disciplines, including communication, sociology, anthropology, political science, and psychology. This report thus captures the diversity of the field of risk communication, including an analysis of key strengths and weaknesses of dominant theories and models, offering risk communicators and managers the opportunity to readily identify the information and research most relevant to their interests.

For decades, scholars have been working to improve risk communication practice through developing, testing, and refining communication theories and models that endeavor to explain the expected and unexpected impacts of risk communication. These efforts have led to an abundance of scientific discoveries, but there is no single theory or model that captures the full range of considerations that impact risk communication efforts. When defining event phases within this report, the following distinctions have been utilized:

- *Preparedness*: pre-event risk communication outlining practical preparedness measures, including education on likely risk characteristics of various threats (e.g., differentiating factors associated with an improvised nuclear device terrorist attack versus an earthquake);
- *Response (Imminent Warnings)*: crisis communication and guidance regarding protective actions to take immediately prior to, in the midst of, or during the hours immediately following an event;
- *Recovery*: messages communicating needs and guidance in the weeks, months, and years following an event.

The diagram below represents the relationship between the material presented in this document and material presented in the corollary *Best Practices* report. For the best and most thorough overview, readers are encouraged to read and use both the *Theory* and *Best Practices* documents.

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[1] In this document, we distinguish between theory and model where a model is an abstract representation of a system or process to help describe the consequences and interrelationships of decisions and events. A theory, then, is a set of ideas intended to explain and predict events.
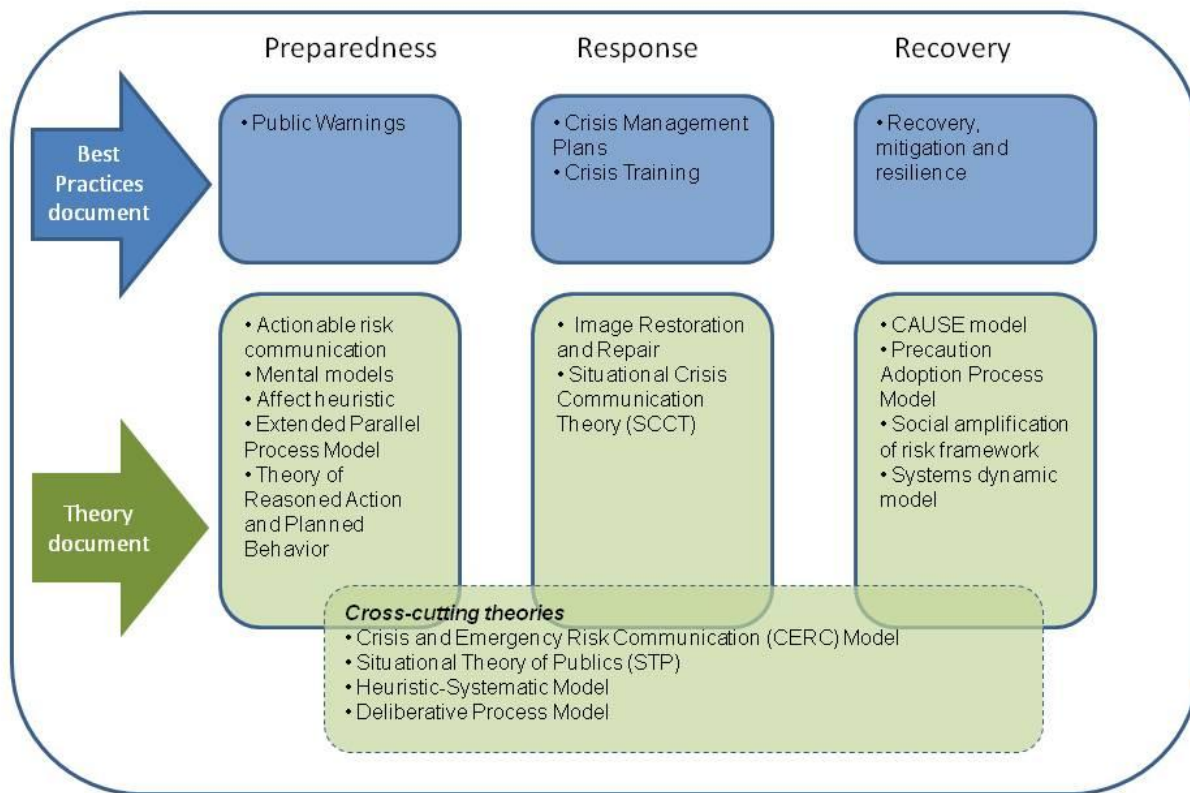
Key insights from this document include the importance of:

- Identifying the *most exigent publics for risk messages* (CERC Model; STP);

- Developing *appropriate messages* for the most exigent publics (CERC Model; STP);

- Understanding how publics *process risk messages* (STP; heuristic-systematic model);

- Understanding how to incorporate *divergent viewpoints* into risk messages (deliberative process model);

- Involving *community members* in disseminating preparedness messages (actionable risk communication model);
- Ensuring information comes from *multiple channels and is repeated often* (actionable risk communication model);
- Providing *specific response strategies* organizations and institutions can incorporate into their risk messages during crises (image restoration and repair theory; SCCT);
- Examining the following factors, which influence the effectiveness of response strategies: *crisis type, an organization or institution's crisis history, and how publics perceive* an organization or institution (SCCT);
- Understanding how publics *perceive risk* prior to disseminating risk messages (mental models; affect heuristic; extended parallel process model; theory of reasoned action; RISP model);

- Identifying *factors that affect how publics recover from risks* that can be incorporated into risk resolution messages (CAUSE model; precautionary adoption process model); and
- Understanding the *social context and secondary effects* of risks (SARF).

Taken as whole, the findings from this document and *Best Practices* provide a comprehensive overview of the current art and science of effective risk communication.

Defining Risk Communication

All communities need a way to communicate about present, emerging, and evolving risks. There is a general consensus that risk communication is a two-way process between the communicator(s) and the recipients of the messages, but beyond that, different definitions often include unique variables and understandings. Risk communication definitions are often similar to the definition offered by Covello (1992), who wrote of the "process of exchanging information among interested parties about the nature, magnitude, significance, or control of a risk" (p. 359). Other definitions emphasize the importance of risk management (McComas, 2006), the need for dialogue between communicators and stakeholders (Palenchar, 2005), and the necessity of ongoing risk monitoring (Coombs, 2012).

Organized and centralized risk communication efforts grew out of legal and regulatory mechanisms regarding community right-to-know, enforced by the U. S. Congress and state and local governments, that required organizations or institutions (specifically in chemical and manufacturing fields) to inform communities of any potential consequences of their existence (Palenchar, 2008). Congressional action followed a series of large chemical accidents in the U.S. during the 1980s (Palenchar, 2008), and government-supported research that identified 7,000 hazardous material incidents between 1980 and 1985 (Falkenberry, 1995). Legislation passed in the mid-1980s included the Emergency Planning and Community-Right-to-Know Act and Section Three of The Superfund Amendments and Reauthorization Act that mandated chemical companies to inform the public of the type and quantities of chemicals manufactured, stored, transported and emitted in each community (Palenchar, 2008).

As official risk communicators engaged with publics, interest increased in how such communication could be most effective, with initial questions focused on message creation but expanding to query how audiences process and act on messages, leading to a deep body of risk communication research. Baruch Fischhoff was one of the leading pioneers of risk communication research, which built on early risk perception work driven by Paul Slovic and Sarah Lichtenstein. Fischhoff worked in this area starting in the late 1970s, culminating in the identification of seven evolutionary stages of risk communication and best practices (1995):
    1) Get the numbers right;
    2) Tell key publics what the numbers mean;
    3) Explain what the numbers mean;
    4) Show publics they have accepted similar risks before;
    5) Explain how risk benefits outweigh the costs;
    6) Treat publics with respect; and

7) Make publics partners with risk communicators.

8) Do all the above.

Fischhoff's perspective is supported by other researchers who believe that effective communication must take into account how various publics perceive risk influenced by societal and cultural factors rather than just focusing on science (e.g., Adam & Van Loon, 2000; Campbell, 1996). However, since Fischhoff's seminal work, additional factors have been identified that contribute to effective public warnings, including information on how special needs publics respond differently than the general public to risks and the role of media in educating the public about risks (see *Best Practices*).

Historically, risk communication research tended to most frequently involve case studies and lists of best practices. The focus was often on organizational risks in the midst of a crisis, including reputation, response, and the success or failure of the organization in moving forward after the crisis, rather than on how communication impacted the public and their behaviors (Heath & O'Hair, 2010). Common case studies include Johnson & Johnson's Tylenol tampering, the Exxon Valdez oil spill, the September 11th terrorist attacks, and Hurricane Katrina (e.g., Benoit, 1995; Berg & Robb, 1992; Carey, 2003; Liu, 2007; Procopio & Procopio, 2007; Torabi & Seo, 2004). A major advancement in the academic risk communication research of the 1990s and 2000s was the development of the mental models approach, which provides a framework to understand preexisting public perceptions of less-familiar and higher-dread risks (discussed in detail later in this document).

The rise of the risk communication field also saw the emergence of studies of crisis communication. Crisis communication, often conflated with risk communication, is a separate field, with its own issues and concerns, but can include aspects of risk communication. More recently, however, crisis communication research has emphasized the importance of experiments, while still maintaining the importance of case study research (e.g., Fediuk, Pace, & Botero, 2010). While crisis communication has historically focused on image and reputation restoration, risk communication has a tradition of focusing on information presentation, persuasion, and strategic messaging. Additionally, failures at controlling or managing risk effectively can lead to a crisis, or a crisis may lead to the necessity for risk communication (Coombs, 2010). As such, Heath (2010) explained that "a crisis is a risk manifested" (p. 3). Furthermore, risk communication assists in message development prior to, during and after events, including emerging risks that are currently not of primary public concern such as biosecurity or slow-burning issues such as the safety of consuming genetically modified food. (Pidgeon, Harthorn, Bryant, & Rogers-Hayden, 2009; Renn, 2003).

The conception of risk communication is derived from multiple fields of inquiry and notably overlaps with definitions of and research on crises and disasters. In the subsequent review, the term *risk communication* is used broadly to capture research on risk and crisis communication. The term *crisis communication* is also used when discussing research explicitly on the response phase.

The next section reviews risk characteristics that affect how publics respond to risk messages, based on the psychometric paradigm.

Risk Characteristics

Effective risk communication efforts must be adapted to match the type of risk. Before delving into the details and nuanced understandings of a variety of risk communication theories and models, this report presents a discussion of two key event characteristics that impact risk perceptions and behaviors based on Slovic's psychometric paradigm:[2] the degree of dread associated with a risk and the public's familiarity with a risk.

1. Lower familiarity/lower dread (*Examples*: Rare agricultural diseases such as foot-and-mouth disease; oil terminal explosion). The public perceives lower familiarity/lower dread risks as rare and unlikely to be life threatening or cause serious injuries. In practice, these risks may not be immediately life threatening, but rather delayed, manifesting over a period of months or years. Further, in some cases the perception of risk is greater than the actual risk: Individuals tend to overreact to those risks that are hard to understand, involuntary, and invisible despite evidence and reassurances by experts that a particular risk is minimal or unlikely (Rogers, Amlot, Rubin, Wessely, & Krieger, 2007).

2. Lower familiarity/higher dread (*Examples*: Chemical, biological, radiological, and nuclear (CBRN) terrorism; nuclear power plant accidents)*.* A significant communication challenge is informing the public of lower familiarity/higher dread risk events. International risks like terrorism are a particularly complex hazard for individuals and publics to interpret, respond to, and prepare for as they involve the intentions of other people, and those are often hard to understand (Rogers et al., 2007). Compared to improvised explosive devices (IEDs), CBRN devices have lower familiarity and higher dread risk characteristics as their effects may be delayed, unknown, and remain in the environment for years (Sidell, Patrick, & Dashiell, 1998).

3. Higher familiarity/lower dread (*Examples*: Natural disasters such as earthquakes, tornados, and floods*).* The public is likely to have a general understanding of the risk characteristics of higher familiarity/lower dread risks through either personal experience or media coverage. Effects of these risks are more observable, easier to understand, and shorter term. Further, it is possible to provide warnings for these risks, making the public more likely to respond (Mileti & Sorensen, 1990; Slovic, 2000). At the same time, however, these risks contain dread attributes of being involuntary and having the potential to cause fatalities.

4. Higher familiarity/higher dread (*Examples*: IED terrorist attack; pandemic flu). Higher familiarity/higher dread risk events are those that are life threatening, less observable, and lack warning, but the public may have a greater understanding or awareness of them and ability to comprehend them

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[2] The psychometric paradigm seeks to identify, characterize, and quantify risk to enable communicators to have a baseline understanding of how their target audience might perceive and respond to risks (risk perception). This in turn provides a basis for improving dialogue with the public (risk communication) prior to an event (Slovic, 2000).

once they occur. Compared to CBRN devices such as anthrax, non-CBRN events like IEDs cause less fear as their effects are not delayed and their characteristics are easier to understand by the public (Burns, 2007), making their familiarity comparatively higher. Higher dread risk events have enormous secondary effects (also referred to as ripple effects) that extend beyond the immediate direct damage to encompass many other victims. The events of 9/11, for example, caused secondary effects such as dramatic domestic policy changes that included the creation of the Department of Homeland Security, the ratification of the PATRIOT Act, and revised airport passenger screening measures.

Risk Communication Theories and Models

Within risk communication, both theories and models are used and discussed to describe, predict, and test a multitude of variables and interacting agents. This section will include both theories and models, and aims to showcase how they can be used in conjunction to provide a broader, more in-depth picture of factors necessary for successful risk communication. The section is divided into two parts. First, cross-cutting theories and models that are applicable to the all three risk phases (preparedness, response, and recovery) are presented, given their overarching characteristics. Second, theories and models that are most applicable to a specific risk phase are discussed.

Cross-cutting Theories and Models

This section reviews theories and models that apply to communication in multiple risk phases: the crisis and emergency risk communication (CERC) model, the situational theory of publics, the heuristic-systematic model, and the deliberative process model. Below is a summary of these theories and models' key contributions, which are then discussed in greater detail.

Cumulative Guidance: Cross-Cutting

➢ Identify the **most exigent publics** for risk messages (CERC Model; STP)
➢ Develop **appropriate messages** for the most exigent publics (CERC Model; STP)
➢ Understand how publics **process risk messages** (STP; heuristic-systematic model)
➢ Understand how to incorporate **divergent viewpoints** into risk messages (deliberative process model)

Crisis and Emergency Risk Communication (CERC) Model. The Centers for Disease Control and Prevention (CDC) crafted the CERC model after the 9/11 attacks and the 2001 anthrax attacks to combine image and reputation research with persuasion and strategic messaging research (Seeger, Reynolds, & Sellnow, 2010). The model is split into five stages and each stage provides a broad set of strategies and suggestions for communication. CERC further discusses who should be seen as the most exigent public at each stage and the types of messages that should be directed to those groups (Reynolds, Galdo, & Sokler, 2002). The stages are:

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- *Pre-crisis* – Communication is directed to the public and response community to provide risk messages, warning, and guidance regarding preparation. Strategies include building alliances, developing consensus recommendations, and testing messages with specific publics.

- *Initial event* – Communication is directed to the general public and affected groups to reduce uncertainty and increase self-efficacy and reassurance. Strategies include informing in the simplest terms, establishing spokesperson credibility, and providing emergency courses of action.

- *Maintenance* – Communication is directed to the general public and affected groups to continue the communication efforts from the initial event. Strategies include providing necessary background information, listening to public feedback, correcting misinformation, and empowering decision making.

- *Resolution* – Communication is directed to the general public and affected publics to provide updates regarding resolution and discuss causes and new risks or new understandings. Strategies include examining problems and reinforcing what worked, persuading publics to support necessary policy and resource allocation, and promoting and reinforcing the identity and abilities of the organization communicating the risk resolution.

- *Evaluation* – Communication is directed to agencies and response communities to discuss the adequacy of response and work toward lessons and new understandings. Strategies include evaluating communication plan performance, documenting lessons learned, and determining specific actions to improve the crisis plan.

Planning for a major crisis is fraught with challenges, but CERC has key strengths, including facilitating decisions that must be made within severe time constraints (Palenchar, 2010) and cautioning against excessive pre-crisis communication (Reynolds, Deitch, & Schieber, 2006). Overall, CERC is a model that supports pre-crisis communication as a method to increase the effectiveness of the response stages and reduce harm in the resolution stages (Seeger, Reynolds, & Sellnow, 2010). CERC was widely used in the aftermath of Hurricane Katrina and has also been tested as a model for communicating about the avian influenza pandemic (Seeger, Reynolds, & Sellnow, 2010). When used in response to avian influenza pandemics, CERC was viewed as a successful way to counter and avoid rumors, set rules for information released to the media and involvement, engage and inform international audiences, and respond to and contain criticism of response efforts (Seeger, Reynolds, & Sellnow, 2010).

Situational Theory of Publics. The situational theory of publics (STP) aims to help institutions and organizations identify whom they should consider as publics, and then to see how those publics engage in communication behaviors such as information seeking and processing (Grunig, 2003). The three main elements of the theory are problem recognition (detection of a problem with no immediate solution), constraint recognition (identification of perceived obstacles to finding a solution), and level of involvement (extent of perceived connection to the problem) (Kim & Grunig, 2011). Taken together, these factors can determine if people will process information and then stop, or actively seek out

additional information—making STP one of the only theories to focus specifically on information seeking and processing as a way to predict behavior (Grunig, 1997). STP has since been expanded to the situational theory of problem solving by including an additional variable, communicative action in problem solving, which involves a potential problem-solver increasing active or passive information seeking, selecting, and giving (Kim & Grunig, 2011). To date, the new version of STP has been tested only through structural equation modeling based on web surveys of over 1,700 college students in the United States (Kim & Grunig, 2011).

STP offers information that is useful in understanding why publics communicate and when they are most likely to do so (Aldoory & Sha, 2007), acknowledging that problem recognition and level of involvement can be influenced by perceived shared experience with media spokespeople and their messages (Aldoory, Kim, & Tindall, 2010). For example, surveys reveal that publics that feel a connection with the spokespeople delivering messages are more likely to have increased problem recognition and involvement. With a stronger understanding of spokesperson impact, risk communicators can choose more effective ways to disseminate information and engage publics.

Heuristic-Systematic Model. While CERC and STP can help risk communicators predict and explain the behavior of publics, the heuristic-systematic model allows communicators to see and understand the connections between a person's desire for accurate and sufficient information and the motivation for processing that information (Griffin et al., 2002). Affect, or how one thinks and feels, influences how a public may judge an activity and the resulting decisions they make. The heuristic piece of the model looks at how publics use superficial cues such as the use of color, visuals, or identity of the source to process information; the systematic piece of the model looks at how publics comprehensively analyze information to understand it; and the overall model states that publics will use superficial cues and/or comprehensive strategies depending on the situation. Trumbo (2002) looked at three case studies investigating suspected cancer clusters in individuals and found that superficial cues are associated with a lower evaluation of risk; that is, publics that focus on message credibility instead of message content tend to assume there is a decreased importance of the risk presented. Additionally, being confident in one's intellectual abilities is a good predictor of using shortcuts to make risk-based decisions (Trumbo, 2002). In addition, Griffin, Neuwirth, Giese, and Dunwoody (2002) conducted more than 1,000 telephone interviews of adults living in the Midwestern United States and found that people use systematic processing when they have previous knowledge of or strongly held beliefs about the information presented. This previous interaction with the information allows individuals to further their knowledge and to increase the strength of their attitudes toward the topic. Risk communicators with knowledge of publics' processing abilities and interest can again adapt messages and determine how to best present complicated information to the public.

Deliberative Process Model. Beyond explaining and attempting to predict publics' behaviors and motivations for processing risk messages, the deliberative decision making process can guide communication development based on understanding what is required to create and sustain an atmosphere of tolerance, with plural viewpoints seen as legitimate (Pidgeon, Harthorn, Bryant, & Rogers-Hayden, 2009; Renn, 2003). The process is best suited for an ongoing risk issue at the recovery stage, for

example, persistent environmental contamination, or controversial reconstruction decisions such as implementing new flood control measures. The model consists of three major steps to understand the areas of divergences and potential for convergence among stakeholders and various publics**:** (1) elicitation of values and criteria by stakeholder groups; (2) provision of performance profiles for each policy option by experts; and (3) evaluation and design of policies by a random sample of citizens (Renn, 1999). Applying this process can inform risk communication messages to broaden the public base of consensus, acceptability, and understanding of a risk.

The deliberative process does not eliminate the prospect of perceived risk increasing (referred to as risk amplification), but it can provide better opportunity to make the audience aware of the processes behind the risk management decision and provide a platform for mutual exchange of arguments (Renn, 2003). Renn (1999) also argued that the framework reflects the need for stakeholders like government institutions to demonstrate competence, efficiency, and fair burden sharing to increase public acceptance of decisions made.

The deliberative process approach has been used in diverse settings including a European Union-funded study that assessed public information requirements following a radiological or biological terrorist attack (Dialogik, 2008). Other studies focused on deliberating the risks of nanotechnologies (Pidgeon et al., 2009) and environmental conflicts (Rauschmayer & Wittmer, 2006**;** Renn, 2003). These studies have demonstrated that the deliberative process can also identify potential perceived risks before they are regarded by the public as risk issues and become highly stigmatized by the media and other social groups (Poortinga & Pidgeon, 2003) (Poortinga & Pidgeon, 2003) such as when environmental pressure groups helped to elevate the perceived risks of growing and eating genetically modified crops in the United Kingdom (Pidgeon et al., 2009). Often studies of risk perceptions focus on perceived risks that are already prominent in the public's discourse. Over the horizon risk issues can be tackled by the deliberative process to start addressing potential misperceptions and convey the actual risks and benefits, for example, the risks from radiological contamination following the detonation of a radiological dispersal device and which residential and business districts are safe to return to, and when. For emergency managers, high dread/low familiarity events like radiation or chemical dispersion from an event are particularly suitable to this type of approach. Conducting the deliberative process prior to events can help set desired perceptual conditions through risk communication.

While there is no single guiding theory or model for effective risk communication across phases, these overarching approaches demonstrate the complexity of the relationship between a message and its impact, and how that message is affected by both the communicator and the intended audience. This richness of understanding also informs best practices in risk communication such as building trust with key publics as discussed in detail in the *Best Practices* document. While cross-cutting theories and models are necessary, there are also theories and models that are best applicable to a specific event phase (preparedness, response, or recovery). The following section discusses and synthesizes theories and models by event phase.

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Communication during the Preparedness Phase

This section reviews dominant theories and models related specifically to communication during the preparedness phase: actionable risk communication, mental models, the affect heuristic, the extended parallel process model, the theory of reasoned action and planned behavior, and risk information seeking and processing model. Risk communication at the preparedness phase is designed to understand and address the public's awareness and knowledge gaps related to risk events, to elicit desired preparedness behaviors through identifying and utilizing effective communication channels, to ensure adequate understanding, and to educate about what actions to take when messages are issued. The latter is discussed in more detail in the *Best Practices* document. Below is a summary of the key cumulative guidance from these theories, detailed further below.

Cumulative Guidance: Preparedness Phase

- ➢ Involve **community members** in disseminating preparedness messages (actionable risk communication model)
- ➢ Ensure information come from **multiple channels and is repeated often** (actionable risk communication model)
- ➢ Understand how publics' **perceive risk** prior to disseminating risk messages (mental models; affect heuristic; extended parallel process model; theory of reasoned action; risk information seeking and processing model)

Actionable risk communication. The actionable risk communication model encourages action by the general public to limit the risks they face from potential threats, and can inform education campaigns to encourage desired public preparedness (Wood et al., 2011). According to the model, the most effective communicators and motivators for preparedness are not public officials, but rather community members who share information about what actions they have taken to guard against risks with others who are less prepared (Wood et al., 2011). While there still needs to be guidance from emergency planners on how to prepare, the most effective communicators to convey that guidance are community members who themselves have followed Ready.gov's recommended actions, such as preparing an emergency kit.

The actionable risk model is supported by survey evidence that provides insights into communication channels that are effective for risk communication. Empirical studies have shown that to be effective in prompting risk-reduction behaviors, preparedness information must come from multiple sources (Basolo, Steinberg, Burby, Levine, Cruz, & Huang, 2009; Mileti & Fitzpatrick, 1992), be communicated over multiple channels (Rogers, 1985; Smarick, 2010; Turner, Paz, & Young, 1981), and be frequently repeated (Mikami & Ikeda, 1985; Mileti & O'Brian, 1992; Turner, Nigg, Paz, & Young, 1979). For example, a telephone survey of 504 residents of Los Angeles County and the vicinity impacted by an August 2009 wildfire found that people were more likely to follow evacuation messages when they received multiple warning messages over diverse communication channels; specific guidelines about what to do and when further enhanced evacuation behaviors (Smarick, 2010).

Actionable risk communication is most effective for a short period of time following an event when people are most receptive to preparedness communications having just experienced a disaster. This is often referred to as the window of opportunity, as the traumatic experience can be the strongest motivator for people to prepare for future disasters (Mileti, Bourque, Wood, & Kano, 2011). At the same time, individuals who have experienced near-miss events (escaping a risk by chance) may be less likely to prepare for a future event, viewing their good fortune as resiliency (Dillon, Tinsley, & Cronin, 2011). Communicators trying to encourage mitigation activities may need to supplement risk information such as statistics with stories of resilience that counteract lack of preparation encouraged by any near-miss experiences (Dillon et al., 2011).

Mental models. Effective risk communication requires understanding where the public is coming from in order to convince them to prepare better for risks. Mental models provide a framework to understand preexisting public perceptions of less-familiar and higher-dread risks and what communication messages can be developed and tested to improve awareness, understanding, and preparedness. These messages can then be ready to release should an event occur (Morgan, Fischhoff, Bostrom, & Atman, 2002). The model examines the choices people face, the beliefs they hold, and experts' relevant knowledge to better understand what information gaps and misperceptions need to be addressed. It also offers a way for the general public to understand how the risks they face are created and controlled, how well science understands those risks, and how significant they seem to be (Morgan et al., 2002).

Mental models are significant at the preparedness stage for two reasons. First, undertaking a mental models approach takes time (weeks or months) and can be resource intensive. It is not a rapid reaction approach. While its outputs can guide communication during the response phase by knowing upfront how the public may perceive the risk event, the process needs to be completed prior to an event so the messages are ready to release. Second, mental models can be effective in assessing the public's understanding of risks to capture the gap between how experts versus the public assess a risk and what are the areas of convergence and divergence. This information can help communicators frame their education preparedness campaigns and inform the public about what the risks are having first established what they know already and areas of misperception.

Morgan et al. (2002) outlined a five-step process for using the mental models method:
1. Review current scientific knowledge to determine the nature and magnitude of a risk to create an influence diagram that visually represents the pooled knowledge of the expert community.
2. Conduct open-ended interviews to elicit the public's beliefs about the hazard, expressed in their own terms.
3. Conduct structured interviews through a confirmatory questionnaire to estimate the populations' prevalence of those beliefs expressed in the open-ended interviews.
4. Draft messages based on the results of the interviews and questionnaire.
5. Evaluate the communications through testing and refining the messages with individuals selected from the target population using one-on-one read-aloud interviews, focus groups, and questionnaires. The last step should be repeated until the message is understood as intended.

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Empirical studies that have tested the mental models approach include a study by Decision Partners funded by the Water Environment Research Foundation (WERF) to develop strategic communications for bio-solids professionals. The WERF study mapped stakeholder perceptions (including landowners, residents, and regulators) to inform communication strategies, plans, and draft materials (Eggers et al., 2011).

Affect Heuristic. The term affect heuristic is used to explain how people make risk decisions based on what they have previously experienced and how they analyze a situation. Understanding the affect heuristic is critical for three reasons. First, it allows communicators to better understand how people perceive risk. Second, it can inform how risk communication can elicit desired perceptions of a risk and desired behavioural responses such as preparation for an event. Third, it assists in conveying probabilities of a risk in the face of uncertainty.

Risk perception research on affect heuristic has identified that people make risk judgements using two approaches.

- *First, the experiential*: Individuals recall prior experiences and recollected images (from first hand or media reporting) of a risk, which influence perceived feelings (goodness or badness) about a risk or an event.
- *Second, the analytical*: Individuals analyze the risk to inform their judgment.

Research on the affect heuristic found that when people make risk decisions, the experiential precedes the analytical. Strong emotional experiences related to hazards may increase publics' perceptions of risks (Slovic, Finucane, Peters, & MacGregor, 2004). For example, if you mention terrorism, the first thing that individuals may think of is the September 11th attacks and the World Trade Center being hit rather than analyzing the probability of terrorism impacting them.

Research on the affect heuristic research has also found that communicating the benefits of an activity such an infant receiving their mumps, measles and rubella vaccine can change the perception of risk and vice versa (Slovic et al., 2004).
- Communicating the positive benefits of an activity will lead to the message recipient inferring the risk to be low;
- Communicating the negative benefits of an activity will lead to the message recipient inferring the risk to be high;
- Communicating the risk of an activity to be high will lead to the message recipient inferring the benefits to be low; and
- Communicating the risk of an activity to be low will lead to the message recipient inferring the benefits to be high.

At the preparedness phase this can be fundamental should communicators need to elevate the perceived risk and reduce complacency towards preparing for a possible event. This is called the evocation of

negative affect (Keller et al., 2006) and can be helpful, for example, in getting the public in regions less prone to natural disasters to prepare a basic disaster supply kit so they can be more self-sufficient following a major event. Conversely communicators may need to reduce the perceived risk that may be over amplified in the public's eye. This is called the evocation of positive affect. For example, during the 2001 anthrax attacks the positive affect was evoked to reduce the perceived risk of anthrax to encourage Americans not to acquire the antibiotic ciprofloxacin unless advised by CDC that they may have been exposed to anthrax spores. At the time, there were limited supplies of ciprofloxacin and its extensive use possibly risked changing the bacteriological environment rendering some organisms resistant to ciprofloxacin (Shine, 2001).

Research has also confirmed that publics that can more easily recall particular risks are more likely to prepare for those risks than for risks that they cannot easily recall. For example, Siegrist and Gutscher (2006) found that past experience with flooding was the most important factor in predicting publics' risk perception of future floods.

When conveying the probability of an event in the face of uncertainty, research on affect suggests three possible approaches:
- *Present frequencies versus probabilities*: Problems should be formulated in terms of frequencies rather than probabilities (Gigerenzer & Hoffrage, 1995). For example, one study found that participants rated a disease that kills 24.14% of the population as more dangerous than one that would kill 1,286 people out of 10,000 even though the 1,286 rate would equal only 12.86% of the population (Yamagishi, 1997).
- *Discuss longer time periods*: Low-probability risks that are presented in the context of a longer time period are likely to elicit desired behavioral change. For example, Slovic, Fischhoff, and Lichtenstein (1978) identified that car drivers who received risk information about a 50-year period favored stronger, mandatory protection than participants exposed to the risk of a single trip.
- *Use risk comparisons:* Empirical research shows that low-probability (including lower familiarity events) can also be communicated using risk comparisons where new hazards are compared with risks that are more familiar to the public (Johnson, 2003, 2004; Roth, Morgan, Fischhoff, Lave, & Bostrom, 1990; Slovic, Kraus, & Covello, 1990). For example, the probability of becoming a victim of a terrorist attack versus being in a car accident.

Extended Parallel Process Model. The concept of preparedness as a process fits within the extended parallel process model, which deals with perceived threats and perceived efficacy of behavior change (Witte, 1992). Designing risk messages emphasize fear such as the fear of another terrorist attack cause one of two reactions in an audience: (1) A moderate or high perception of threat, which causes the individual to evaluate the efficacy of the proposed solution or (2) a low perception of threat, which negates any motivation the individual has to continue processing the message. If perceived threat is high, but perceived efficacy—that is, an individual's belief about his/her power to control the event—is low, individuals attempt to control and respond to the fear instead of to the danger itself (Witte, 1992), which often occurs when an individual is in denial about the presence of a threat or reacting against it. An

increase in threat perception coupled with high efficacy leads to message acceptance and attitude, intention, or behavior changes to control the danger.

The model has been expanded recently to include perceived collective efficacy (perceptions of how well prepared a family unit is, instead of how well prepared each individual member is) and perceived societal risk (perceptions of risk to a unit or group larger than one individual or a family unit). These types of perceptions can be seen in publics as both logic-based and emotion-based (Roberto, Goodall, & Witte, 2010). There is also evidence of a connection between social perceptions of risk and collective efficacy and how a lack of social threats can combine with a sense of efficacy to motivate intentions and actions (Smith, Ferrara, & Witte, 2007). This study looked at individuals dying from AIDS-related illnesses who had children that would be orphaned as a result. Those in the community not infected with HIV often responded to this community issue with collective efficacy, or the belief that there are effective or necessary collective actions that can be taken to address a social or public health predicament, which often took the form of adopting the orphaned children (Smith, Ferrara, & Witte, 2007). Fear appeals should be carefully monitored to ensure effective usage and to inform message construction decisions of risk communicators as fear appeals are only recommended for messages that can be cognitively, and not emotionally, processed by a public (Witte, 1992).

Theory of Reasoned Action and Planned Behavior. Ajzen and Fishbein's (1980) theory of reasoned action states that an individual's behavior is predicted by his or her behavioral intentions, which, in turn, are predicted by his or her attitudes toward the behavior and subjective norms. In other words, people determine if they will do something often based on their own views and those of society. This theory asserts that behavior is also a function of a personal risk estimate, through which an individual can determine the potential harm he or she faces from performing or not performing the prescribed behavior. Donating blood is often used as an example of the theory; individuals have behavioral intentions to donate based on their own personal desire to help, which is only strengthened by the belief that helping others and saving lives is supported by society. This combination of personal and societal acceptance increases the likelihood of the person enacting the behavior.

Ajzen (1991) went on to expand this idea into the theory of planned behavior, which adds an individual's perceived control over performing a specific behavior. For example, external factors such as a heavy workload or the inability to control terrorists' behaviors might be viewed as barriers in preparing a family disaster plan. Statistical modeling finds that perception of control helps predict both behavioral intention and behavior. Thus, risk communicators who can help publics feel more in control of their own behaviors can potentially improve the public's likelihood to prepare for risks.

The Risk Information Seeking and Processing (RISP) Model. The RISP model combines elements of the theory of planned behavior and the heuristic-systematic model to identify differences between an individual's perceived current knowledge and the knowledge needed to mitigate risk appropriately (Griffin, Dunwoody, & Neuwirth, 1999). Within this model, the focus is on information sufficiency: how much information a person has about an issue versus how much information they think they need to make an effective decision. This gap is also influenced by the perceived hazard characteristics (including

familiarity of the threat and level of dread it invokes) and characteristics of the individual facing the risk, including relevant hazard experience.

Information sufficiency will impact how individuals seek and process risk information; the public's beliefs about specific media channels and how much information they can gather before feeling overwhelmed also come into play (Griffin et al., 1999). When individuals are confident in their knowledge about a risk but there is less easily accessible knowledge about the risk, they are more likely to put additional effort into information seeking and processing (Griffin et al., 1999). In enhancing understanding of what knowledge and information are necessary for a public to have to mitigate risks, RISP provides clear insight into how information sufficiency affects risk message acceptance and processing.

In sum, theories and models of communication applicable to the preparedness phase recommend: (1) incorporating community members into planning, (2) identifying in advance multiple channels to disseminate risk messages during a crisis, and (3) understanding how publics' perceive risks prior to disseminating messages. The next section reviews theories and models that help understand effective risk communication during the response phase.

Communication during the Response Phase

There are two dominant theories and models related to communication during the response phase: image restoration and repair and the situational crisis communication theory (SCCT). Communication objectives during the response phase include issuing pretested warning messages designed during the preparedness phase and employing crisis communication best practices to effectively communicate actions the public can take to minimize harm and how organizations can maintain the public's trust. The table below summarizes the key contributions of theories and models relevant to the response phase, which are then discussed in greater detail.

Cumulative Guidance: Response Phase

➢ Provide **specific response strategies** organizations and institutions can incorporate into their risk messages during crises (image restoration and repair theory; SCCT)

➢ Examine the following factors, which influence which response strategies will be most effective: **crisis type**, an organization or institution's **crisis history**, **and how publics perceive** an organization or institution (SCCT)

Image Restoration and Repair. Organizational responses to crises often begin with a focus on how they can restore and repair their tarnished images (Benoit, 1997). Options for strategically restoring and repairing images range from denial (when the organization is not to blame for the crisis) to blame

shifting (when someone else is responsible for the crisis) to correcting the issue that caused the crisis and apologizing (when the organization is to blame for the crisis). All crisis messages and responses should be targeted and tailored directly to the salient audience(s), and if necessary, unique messages should be sent to distinct segments of that audience. For more on relevant audience characteristics relevant for risk communication see the *Best Practices* document.

One organizational crisis response strategy in particular, the apology, has received great attention because it can be viewed as scripted rather than as an honest response (Hearit & Roberson, 2010, p. 552). Thus, using an apology simply to remove the organization from an unflattering glare of media attention shows a lack of understanding of image restoration and repair. An apology should be utilized when guilt is easily established, the costs of the wrongdoing are clearly known, and continuing to speak about the issue is a logical, strategic step forward, not backward, such as the apologies offered by the White House in February 2012 after the burning of Qurans at an Air Force base in Afghanistan. If all of the facts surrounding the issue are not yet clear or known, or if the act of apologizing would put an organization out of business, an apology may be a misstep (Hearit & Roberson, 2010).

When a risk communicator is responding to criticism, highlighting positive actions taken in response to the crisis can reduce the offensiveness of the event even without an apology (Liu, 2007). This is often most effective when paired with an action that corrects the problem that caused the crisis or a discussion of what the organization will do to ensure an issue never occurs again (Benoit, 1997). Risk communicators and spokespeople should consider both public expectations of organizational crisis responsibility and the organization's ability to prevent future occurrences of the same crisis when crafting response strategies (Liu, 2007). Often, when publics have high rates of negative emotion toward the responsible organization, this can significantly decrease the effectiveness of taking corrective action (Muralidharan, Dillistone, & Shin, 2011).

Image repair and restoration is most frequently studied through qualitative case studies, with analysis of strategies utilized by a spokesperson or organization and discussion of best (and worst) practices and their impacts. These strategies can be helpful when discussed and analyzed prior to risks or crises, when communicators can determine which strategies may be effective or influential based on case studies of similar organizations, communities, and risks that they face.

Situational Crisis Communication Theory (SCCT). Beyond image repair, the situational crisis communication theory (SCCT) supports organizational efforts to select the most effective crisis response strategies based on publics' crisis perceptions and the goals of the organization. Goals can involve changing perceptions of the organization or of the crisis, and should include an understanding of the crisis type, the organization's crisis history, and its reputation prior to the crisis event, where a favorable prior reputation is often seen as an asset in a crisis (Ulmer, 2001). Coombs (2012) noted that crisis management should be a proactive function of an organization; institutions and organizations should be in a continual process of learning from previous crises to be better prepared for or to prevent future crises entirely, and this includes having a current and vetted crisis communication plan. Once this

process is understood, organizations and individuals faced with a crisis should consider using at least one of SCCT's response strategies.

These strategies are grouped into four groups, or what SCCT refers to as postures: *denial*, during which the organization attempts to distance itself from the crisis (strategies include attacking the accuser and scapegoating), *diminishment*, which aims to reduce the impact of control attributions or negative effects (strategies include excusing the organization's behavior or responsibility and justification or reduction of the perceived damage), *rebuilding*, which attempts to improve the organization's reputation (strategies include compensation toward victims and apology or acknowledgement of responsibility), and *bolstering*, which supplements the other three by aiming to improve the connection between the organization and stakeholders (strategies include reminding stakeholders of prior good works, ingratiation through praising stakeholders, and victimizing the organization as well) (Coombs, 2012). Coombs (2012) sees SCCT as identifying the most common strategies and encourages an organization to choose wisely when attempting to repair reputational damage. SCCT has mainly been tested with college students (Coombs, 2004; Coombs, 2006; Coombs & Holladay, 2002), with some attempts at reaching adult community members (Coombs, 2004), often through the use of constructed crisis scenarios and surveys aimed at evaluation of participants' perceptions of organizations and strategies utilized.

In sum, the crisis response phase can be guided by two theories that focus on organizational response strategies: image restoration and repair theory and SCCT. However, more theory development is needed to provide conceptually-strong guidance on how to encourage public safety in the midst of a crisis, though best practices independent of theories have been identified as featured in the *Best Practices* document.

Communication during the Recovery Phase

This section reviews the dominant theories and models related to communication during the recovery phase: the CAUSE model, the precaution adoption process model, the social amplification of risk framework, and the systems dynamic model. The recovery phase may last weeks or years, and risk communication objectives in this phase aim to: (1) accelerate recovery, (2) minimize adverse secondary effects, and (3) ensure that the recovery process does not create or replicate vulnerabilities that contributed to the risk in the first place such as inadequate flood protection. In this phase, successful communication engages a wide audience in a collaborative and interactive process toward recovery (Seeger & Padgett, 2010). This process values relationships with communities and publics to help with addressing the needs as a crisis evolves and is resolved. The theories and models' primary contributions are summarized below and then discussed in greater detail.

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Cumulative Guidance: Recovery Phase

➢ Identify **factors that affect how publics recover from risks** that can be incorporated into risk resolution messages (CAUSE model; precautionary adoption process model)
➢ Understand the **social context and secondary effects** of risks (SARF)

CAUSE model. This model suggests that in the face of physical hazards, publics struggle with the following factors: **C**onfidence, **A**wareness, and **U**nderstanding of a message. They also are unsure of their feelings toward **S**olutions and wait for clear **E**nactment of action. Thus, the CAUSE model postulates that effective handling of each of these factors can lead to more effective risk and crisis resolutions. This model has been applied through case studies of local emergency managers and specifically with Southeast Louisiana emergency managers prior to Hurricane Katrina. These emergency managers' concerns ranged from evacuation plans to public perceptions of vulnerability. Additionally, the model aims to increase the amount of confidence, awareness, and understanding that the publics (message recipients) have in risk communicators and emergency managers in order to produce more effective solutions and actions and to aid in moving people into action after a crisis has occurred (Rowan, Botan, Kreps, Samoilenko, & Farnsworth, 2010).

Public confidence can be bolstered through the use of established credible organizations and infrastructure as part of the crisis management team. Publics are often skeptical of those who manage risk and crisis situations (Heath & Palenchar, 2000). Therefore, linking unknown crisis managers to familiar organizations and institutions can imbue the managers with additional credibility. When it comes to awareness, emergency warnings must be detected, decoded, interpreted, and confirmed (Perry, 1988), each step of which is fraught with the potential for problems. These problems can often be overcome through simple message repetition through a variety of sources and routine testing to see if the messages have been understood and absorbed. People tend to appreciate additional information to facilitate understanding when they voluntarily seek it out.

When trying to improve public satisfaction and safe action in the aftermath of a crisis, leaders and communicators need to be willing and able to see all relevant points of view within the community in which they are working. There is also a clear relationship between message success, which is impacted by relationships with publics, and message quality, which impacts relationships with publics. Finally, publics are most likely to follow risk recommendations when the public perceives the recommended behavior as easy, quick, inexpensive, and/or more fun to do than not to do (Clark, 1984). Crisis managers should consider the frequency of message presentation and should attempt to align messages with similar behaviors that already exist in publics' routines such as helping them organize emergency kits while already out back-to-school shopping (Booth-Butterfield, 2003; Rowan et al., 2010).

Precaution Adoption Process Model. The precaution adoption process model details seven stages of public understanding and perception of a risk from the lack of awareness to adoption and/or maintenance of a behavior such as becoming attentive to and engaged in discussions. This model can guide risk communicators to understand and address an audience's information needs to help elicit desired

behavioral responses by publics. While the model can be applied to all phases of an event, it has particular value during the recovery stage by providing a systemic process for understanding the level of awareness and desired behaviors sought in the weeks and months after an event. In the first stage, an individual may be completely unaware of a hazard. The person may subsequently become aware of the issue but remain unengaged by it (Stage 2). Next, the person faces a decision about acting (Stage 3); may decide not to act (Stage 4), or may decide to act (Stage 5). The stages of action (Stage 6) and maintaining the desired behaviors such as using a previously attacked transportation system); (Stage 7) follow (National Cancer Institute, 2003). Appendix F, in the Appendices document, outlines the stages of the model. The model, however, has not been subjected to empirical testing and is conceptual in development. Thus, recommendations from the model may be updated as they are tested.

Social amplification of risk framework (SARF). This model posits that the public may overestimate risks if institutions fail to take the social context of risks into account when making decisions and conveying information to the public (Rogers, Amlot, Rubin, Wessely, & Krieger, 2007). The social context encompasses factors that may amplify or attenuate the risk, the secondary effects they may cause, and their consequences. There are four stages in SARF that emergency responders can use to better understand and anticipate the possible secondary effects of an event:

1) *The risk event*: The characteristics of an event itself.
2) *Risk amplification or reduction*: How factors such as personal experiences, opinion leaders' actions, traditional and social media coverage, social group membership and behaviours, and pre-existing trust in institutions can increase or reduce perceived risk.
3) *Ripple effects*: How the public may change their behaviours in response to the risk such as altering travel routines, where they decide to work and live, and purchasing habits in order to reduce or avoid exposure to a perceived risk. Second and third order ripple effects may also occur beyond directly affected.
4) *Impacts*: The consequences of the perceived risk and behaviour changes such as financial losses, loss of confidence in government institutions, litigation, and casualties.

The ripple effects and impacts may resonate for months or years after the original risk event as occurred after the September 11th attacks and Hurricane Katrina. SARF helps to contextualize the identification of factors that may amplify or attenuate risks; the spread of risks from one party, location, or generation, to another; and risk impacts. In turn this can inform risk communication development through better anticipating what adverse behaviors to discourage and desired behaviors to encourage during the recovery phase. For example, it may be important to discourage residents from a hard-hit hurricane area from permanently relocating elsewhere, thereby jeopardizing the vitality and long-term health of the original community.

SARF studies have focused on analysis of media and risk reporting (Freudenburg, Coleman, Gonzales, & Helgeland,1996), how public and private organizations can increase or decrease perceived risk (Kasperson, 1992; Poortinga & Pidgeon, 2003), institutional trust (Slovic, 1993, 2000), and nuclear power and stigma (Flynn, Slovic, & Kunreuther, 2001). Each of these studies employed experiments or field surveys to draw their conclusions. SARF studies show that perceived risks can be increased or

reduced depending on how emergency managers and public health authorities manage and communicate about events and that these actions can also contribute to secondary effects such as changes in people's daily routines and permanent population movements. However, there needs to be more empirical research to examine what factors collectively increase or decrease perceived risks, how communication messages can influence outcomes across an array of different publics, and the complex interactions and feedback loops that occur across society, such as among publics, the media, and government institutions.

Systems dynamic model. A prominent area of research related to SARF involves the use of systems dynamic modeling to quantify and model how perceived risk of events can increase or decrease, and what messages can be used to encourage desired behaviors in the weeks, months and years following an event. Although at its early stage of development, systems dynamic modeling could aid communicators during the recovery phase by evaluating and testing how the public may respond and what messages may be needed. Systems dynamic modelling examines how communication can increase or reduce the secondary effects from events, and how this interacts with other social institutions. The model displays the key interactions and feedback loops that influence public perceptions and behavioral responses to risks that emanate from manmade and natural disasters (Burns, 2011). Central to this approach are three interacting feedback loops that portray how the community may engage to reduce short-term and mid-term risk (protecting the community), how public response may amplify risk during a crisis (public response), and how mid-term and long-term societal impacts may be eventually mitigated.

Initial research included a study by Burns and Slovic (2007) that modelled the consequences of a terrorist attack in an urban center. The study examined three scenarios: an anthrax attack, an IED attack, and a propane tank explosion. The research showed that delays in community interventions (for example, effective risk communication) can lead to higher and more prolonged levels of fear, impeding recovery. The findings suggest the importance of employing effective risk communication as a tool to mitigate adverse secondary effects that may undermine recovery efforts through reduced public trust in the communicators and their institutions.

In sum, theories and models relevant to risk communication in the recovery phase highlight the importance of understanding factors that affect how publics recover from risks including the context of these risks and their secondary effects.

Taken as a whole, the theories and models reviewed in this document provide insights into the complicated process of developing and disseminating risk messages before, during, and after crises. Additional insights independent of theory and models are detailed in the *Best Practices* document. Read together, these two documents provide a comprehensive understanding of current art and science of communicating risk to publics.

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