Public Relations Review xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

Public Relations Review

Communicating crisis uncertainty: A review of the knowledge gaps

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ARTICLE INFO

Article history:
Received 1 February 2016
Received in revised form 21 March 2016
Accepted 23 March 2016
Available online xxx

Keywords:
Risk
Crisis
Communication
Uncertainty

ABSTRACT

The communication discipline offers an abundance of guidance on what, how, and when to communicate information in crisis situations. However, there is very little direction on handling crises where this knowledge is lacking including situations with a high degree of uncertainty. Indeed, best practices in risk and crisis communication emphasize acknowledging uncertainty, and crisis definitions focus on uncertainty. Yet, empirical research on the intersection of uncertainty, crisis, and communication is lacking. The purpose of this article is to review and synthesize the limited research on communicating uncertainty in crisis contexts and relevant theory development outside of crisis research. The article concludes by proposing promising directions for future research on the intersection of uncertainty, communication, and crises.

1. Introduction

There is a sizable body of research on best practices in risk and crisis communication, the vast majority of which focuses on what, when, and how information should be conveyed to at-risk publics (Janoske, Liu, & Madden, 2013; Seeger, 2006). These guidelines are invaluable in most crisis situations; however, they all require certain base knowledge about the specific crisis before any meaningful communication can take place. Crises create unique opportunities for practitioners to demonstrate the value of strategic public relations to senior leadership, which in turn can increase the support for public relations if crises are successfully resolved (Liu & Pompper, 2012). Yet the uncertainty inherent in any crisis challenges the capacity of public relations practitioners to know how to best proceed.

Indeed, crises like terrorist attacks and pandemics are often defined by uncertainty including: who/what caused the crisis; the number of human lives lost and amount of infrastructure damaged; what individuals can do to protect themselves; and when the crisis will be over. Many crisis definitions include a focus on uncertainty (e.g., Coombs, 2015; Seeger, 2006), and best practices literature often emphasizes the importance of acknowledging uncertainty in crisis communication (e.g., Covello, 2003; Heath, 2006; Janoske et al., 2013; Seeger, 2006). History also emphasizes the importance of handling crisis uncertainty properly (Lanard & Sandman, 2014; Reynolds & Seeger, 2005). Despite the well-recognized role of uncertainty in crisis communication, research has not theorized exactly how communicators should best "manage" uncertainty to help publics cope and respond appropriately. Consequently, this review provides a research roadmap for developing a strong,

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http://dx.doi.org/10.1016/j.pubrev.2016.03.003
0363-8111/

theory-driven understanding of how to effectively communicate uncertainty, with the understanding that all crises are different.

2. Literature review

This section first defines uncertainty, and then reviews existing research on communicating uncertainty under two crisis contexts: (a) when governments introduce emergency vaccines during public health crises and (b) when governments communicate about terrorist threats. These two crisis types were selected primarily because the majority of found research on uncertainty and crisis communication focused on these crisis types. In addition, findings from research on these two crisis types are likely to be applicable to other crisis types because they represent crises that are intentional (terrorism), unintentional (pandemics), or both (terrorism-related outbreaks such as the 2001 Anthrax attacks).

2.1. Crisis defined

Definitions and descriptions of the term "crisis" often reference uncertainty as a key characteristic. Seeger (2006) described this relationship by remarking, "Risks are always associated with some level of uncertainty, and crises are, by definition, high-uncertainty events, where information is often not immediately available" (p. 239–240). Seeger, Vennette, Ulmer, and Sellnow (2002) provided an alternate definition of crisis: "a targeted event that creates high uncertainty and perceived threat" (p. 2). Finally, Reynolds and Seeger (2005), in a discussion of unique communication concerns during a crisis, stated: "The immediate communication needs are to reduce uncertainty, allowing audiences to create a general understanding of what happened so that they may act appropriately" (p. 50). Overall, research indicates that uncertainty is an important and widely recognized factor in crises that practitioners need to address, but how exactly to do so has not been adequately addressed. To accomplish this objective, we must first define "uncertainty."

2.2. Uncertainty defined

The specific meaning of the term "uncertainty," when it is mentioned in crisis communication research, is seldom defined. In a wide search, we found only one study on uncertainty and crisis communication that approached a definition of uncertainty (in the context of psychological responses to crisis news): "uncertainty is an inherently uncomfortable state, and information seeking is a common cognitive strategy when uncertainty is directly related to a perceived threat" (Lachlan, Spence, & Nelson, 2010). This description came from information theory (Heath & Gay, 1997) and serves as a starting point for understanding a role of uncertainty in crisis communication.

Outside of crisis communication, research on both interpersonal communication and health communication has extensively examined uncertainty communication and offered concrete definitions. For example, in building problematic integration theory, Brashers (2001) stated "uncertainty exists when details of situations are ambiguous, complex, unpredictable, or probabilistic; when information is unavailable or inconsistent; and when people feel insecure about their own state of knowledge or the state of knowledge in general" (p. 478). An alternate definition of uncertainty, this one building on Berger and Calabrese's (1975) uncertainty reduction theory, defined uncertainty as "a cognitive state resulting from an individual's assessment of the number of alternative predictions available" (Bradac, 2001, p. 464).

In addition to these fixed definitions, a number of researchers have emphasized the importance of addressing different sources or categories of uncertainty in fields connected to crisis communication (e.g., Brashers, 2001; Markon & Lemyre, 2013; Rogers, Amlôt, Rubin, Wessely, & Krieger, 2007; Politi, Han, & Col, 2007). When taken as a group, these different sources create a quasi-definition of the relationship of uncertainty communication and crises. For example, Markon and Lemrye (2013) conducted a study analyzing the effect of different sources of uncertainty on risk communication about a new micro-organism found in tap water. This study emphasized three sources of uncertainty: lack of knowledge, contradictory data, and ambiguity (contradiction between experts). As another example, Rogers et al. (2007) analyzed the role of risk communication following a chemical, biological, radiological, or nuclear incident, and presented sources of uncertainty in the following manner:

> The majority of the public can differentiate between at least four forms of uncertainty, including: (1) opinion poll uncertainty: knowledge based on sampling is valid, but subject to error; (2) statistical uncertainty: people are also used to dealing with what they might think of as randomness or probability; (3) information uncertainty: the data on which a decision is based may or may not be true; and (4) complexity uncertainty: in theory, one can understand what is happening, but the sheer complexity means that one also has to rely on monitoring and reaction (p. 283).

However, no single list treats uncertainty the same.

2.3. Uncertainty communication: terrorism and emergency use vaccines

Incidents of terrorism and emergency use authorized vaccines are almost always shrouded in uncertainty, posing a unique challenge for risk and crisis communication. For terrorist attacks, a part of this challenge comes from the fact that terrorism is fundamentally different from other types of crisis—terrorism is a relatively new threat that breaks from the traditional

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structure or idea of an enemy in security policy; it is constantly evolving and difficult to effectively quantify or evaluate (Gray & Ropeik, 2002; Innes, 2006; Kessler & Daase, 2008).

Despite recognition of the key role that uncertainty plays in acts of terrorism, the terrorism-specific definition of uncertainty runs into the same problem as the definition of "uncertainty" in risk and crisis communication: few, if any, of the sources using the term uncertainty actually define it. The closest match to a terrorism-specific definition came from remarks made by former Secretary of Defense Donald Rumsfeld at a Department of Defense press conference in 2002. Rumsfeld broke the knowledge (and "non-knowledge") necessary for political and military decisions into three categories: "known knowns," or certain knowledge, "unknown knowns," uncertainties that can be accounted for analytically, and "unknown unknowns," uncertainty that analysts are not aware of and cannot account for (as cited in Daase & Kessler, 2007). Daase and Kessler (2007) added a fourth category to Rumsfeld's list: "unknown knowns," information that analysts could know, but choose not to.

Emergency vaccination is also frequently met with uncertainty from publics, and also suffers from the same lack of a concrete definition of uncertainty. While there is no single definition of uncertainty for public health emergencies, research has isolated a number of uncertainty sources that contribute to heightened confusion and apprehension during situations requiring emergency vaccination authorization. These sources include concern about the safety of the vaccine itself and about individual susceptibility to the disease, as well as conspiracy theories and rumors that aggravate these concerns (Quinn, Kumar, Freimuth, Kidwell, & Musa, 2009). The impact of uncertainty is particularly concerning in emergency vaccination scenarios, where rapid public acceptance of the vaccines is crucial to preserve public health and safety. Research to date indicates that the following factors can significantly impact the degree of uncertainty publics experience when evaluating emergency vaccines: trust, fear, and source credibility. These factors also consistently appear in the research on uncertainty communication and terrorism, as summarized below.

2.4. Key variables related to uncertainty communication

We review each of these factors below, first in the context of terrorism and then for emergency vaccines.

2.4.1. Trust

Most definitions of trust view trust as an interaction between two parties, in which the trusting party believes that the trusted party can do their job and will act in the best interests of the trusting party (Hosking, 2009; Shore, 2003). Trust and uncertainty interact in two main ways: the impact of publics' trust in the communicator on their acceptance of uncertainty and the impact of the communicator's admission of uncertainty on publics' trust in the communicator. When examining the impact of trust on acceptance of uncertainty through a research review, the central idea was that the more publics trust their government or the communicating official, the better they are able to handle fear in uncertain situations, particularly for highly unusual circumstances like terrorism (Gray & Ropeik, 2002; Rogers et al., 2007). Consequently, researchers concluded that it was better for public officials to admit uncertainty than to present information or assurances as certain and be proven wrong later (Rogers et al., 2007).

Freedman (2005) examined trust in a different context: Through the lens of a prospective terrorist attack, rather than a completed one. Synthesizing existing risk communication research with evidence from three well known terrorist attacks, Freedman noted that risk communication surrounding terrorism was uniquely complicated by the adaptable nature of the threat; early warning of a possible attack gave terrorists the opportunity to respond and change their plan. This factor gave terrorists some control over the extent of public trust because knowing that a government issues a warning, terrorists can choose to modify their plans to create a false alarm and thus diminish public trust in future early warnings.

Turning to emergency vaccines, trust is affected by publics' (a) perceived risk of the vaccine and/or disease, (b) perception of the information source's credibility, and (c) clarity of the vaccine risk information they receive (Gilles et al., 2011). Emergency vaccine communication cannot be successful without the public's trust in message sources and the message itself (Freimuth, Musa, Hilyard, Quinn, & Kim, 2014; Lin & Lagoe, 2013; Quinn et al., 2013). It is critical to have a reputable spokesperson to communicate uncertainty when establishing trust, recognizing that publics' preferred source of risk information varies widely (Avery, 2010; Liu, Fraustino, & Jin, 2015; Schultz, Utz, & Göritz, 2011).

Previous communication errors, like releasing false or confusing information, can decrease publics' trust in crisis communication (Taha, Matheson, & Anisman, 2013). Once a particular communicator or organization has established a poor reputation for distributing health information, publics' trust in that source is lost and publics are more likely to ignore future health and safety recommendations from that source. For example, when medical organizations were trying to send out messages about the need for emergency vaccines during the 2009H1N1 pandemic, surveys among adults showed that organizations lost credibility when they handled the dispersal of emergency vaccine information poorly.

Establishing or re-establishing trust with publics, while difficult, is crucial for effective crisis communication. Without trust, communicating uncertainty in a crisis situation becomes almost impossible (Gilles et al., 2011; Paek, Hilyard, Freimuth, Barge, & Mindlin, 2008). This trend is exemplified in an online survey that indicated that a higher appreciation of government officials' openness in sharing information was associated with higher trust in both the communicator and government actions as a whole. These results indicate that clear and open communication are essential for trust and increase the likelihood of a public complying with future crisis communication messages (Quinn et al., 2009).

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Public trust in medical personnel before a crisis is a likely indicator of willingness to follow health and safety directives during a crisis, including willingness to receive an emergency vaccine (Quinn et al., 2009). Publics' knowledge levels about the crisis may also impact their trust in public health sources communicating about emergency vaccines. Individuals who follow the news surrounding emergency health situations are more likely to possess factual information about the risk and trust official spokespersons more than those who do not (Freimuth et al., 2014). In addition to pre-crisis trust levels, existing demographics of the public receiving the emergency communication have an impact on how the public will interpret and respond to that message. For example, Blacks and Hispanics were more likely to trust the government's response to the H1N1 crisis, and less likely to trust their own physicians than their white counterparts. This trend runs contrary to the behavior of the population as a whole, where data indicated that the general public trusted their own physicians more than government spokespersons (Freimuth et al., 2014).

Finally, media play a large role in keeping the public informed about vaccines and health crises (Dudo, Michael, & Dominique, 2007 ; Lee, 2014; Lin & Lagoe, 2013). The media are often the first source of information for publics, and it is crucial that this information is truthful and trustworthy. For example, a survey of Canadian adults showed that relatively low levels of vaccination intention were related to low threat perception, mistrust of the media's H1N1 information, and using avoidant coping strategies (rather than problem-focused coping) (Taha et al., 2013). However, it can be difficult to accurately gauge publics' levels of trust because publics can be susceptible to worry, vulnerability, and conspiracy ideas (Gilles et al., 2011).

2.4.2. Fear

Terrorism represents a dread risk: an incident that, despite a low probability of actually occurring, inspires a high degree of fear because it could cause a large number of casualties at once (Gigerenzer, 2004; Göritz & Weiss, 2014). This escalated fear level is exacerbated by the inherent uncertainty of terrorist attacks because the more uncertain people are, the more pronounced their fear (Gray & Ropeik, 2002; Sheppard, Rubin, Wardman, & Wessely, 2006). Heightened levels of fear are particularly concerning because they have a confirmed impact on human behavior. For example, Göritz and Weiss (2014) conducted a simulation measuring emotional and behavioral responses to an escalating terrorist threat. They noted that, as the threat of a terrorist attack escalated, research participants experienced progressively higher levels of fear, with most participants expressing more fear for others than for themselves. Government action and perceived social norms had no impact on the escalating fear, and participants showed an increasing likelihood to change their plans around the threat as the levels of fear escalated. This simulated result is echoed in the real-world data analyzed by Gigerenzer (2004) who determined that, as people chose to drive rather than fly following the September 11 terrorist attacks, more people died in traffic accidents than in the plane crashes.

While uncertainty cannot be eliminated, there are actions that can be taken to mitigate many of its effects, including fear. For example, Wray and Jupka (2004) determined that even the knowledge that emergency responders were addressing the situation (in the case of their study, a simulated bioterrorism event) reduced fear in subjects, even if more information about the actual situation could not be provided. Fear also plays a significant role in whether publics choose to follow emergency vaccination messages (Goodall, Sabo, Cline, & Egbert, 2012; Taha et al., 2013). Often these messages are the main source of the fear (Goodall et al., 2012). Information that is new or unfamiliar leads to uncertainty. For example, in news stories, H1N1 was most commonly referred to as "swine flu;" this label was often followed by how the severity of the virus impacts individuals most at risk to the virus. This phrase used in the news incited unnecessary fear and uncertainty (Goodall et al., 2012). Furthermore, death-related news stories were disproportionately emphasized, which distorted public perception of the disease's lethality. Meanwhile, the Centers for Disease Control (CDC) were posting clear, informative messages on their website and social media channels about the rarity of death from H1N1 influenza, which did not adequately penetrate into media coverage of the pandemic (Goodall et al., 2012).

Members of the public tend to seek out news with positive messages, emotion, and ways to prevent harm (Lee, 2014). For example, in a study that looked at messages about the H1N1 emergency vaccine that used fear appeals, participants found these messages to be persuasive because they assigned agency to the virus, which increased the perceived fear and susceptibility of publics (McGlone, Bell, Zaitchik, & McGlynn, 2013). Making the virus an active participant in its own spread made participants perceive themselves to be at a higher risk, and consequently more likely to intend to receive a vaccine. However, fear appeals must be used responsibly to prevent negative backlash. When people perceive a threat as high, but their self-efficacy as low, they will engage in emotional fear control processes that result in message rejection (Gordon, 2003; Witte, Meyer, & Martell, 2001).

An individual's perception of the severity of the threat is a particular aspect of fear relevant to uncertainty communication. As with trust, demographics affect threat perception. For example, in a study about H1N1 threat perception using the trust determination and health belief models, higher income and higher education were associated with lower perceived personal consequences (Quinn et al., 2009). The group that reported the most worry about H1N1 and the new vaccine also had the highest likelihood of vaccine refusal; this group also included a large representation of racial and ethnic minorities and less educated people (Quinn et al., 2009).

2.4.3. Source

The information sources publics use to obtain risk information have an impact on their response to uncertainty. People are increasingly using non-traditional news outlets, like digital and mobile media, instead of traditional ones, like televi-

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sion and newspapers, to seek out health risk information (Pew Research Center, 2015). The preferred sources for different demographic groups and generations vary.

Unfortunately, not all sources relay credible information. Depending on their preferred source of news, certain publics may not be exposed to important crisis information. For example, a study of healthcare workers' knowledge of emergency vaccines revealed that many held misconceptions about the topic, including believing the vaccine could cause influenza or was ineffective at preventing disease (Clarke & McComas, 2012). This result is concerning for two key reasons: (a) healthcare workers were not exposed to and did not seek out accurate information about an ongoing public health crisis and (b) healthcare workers, who should have been a source of accurate medical information, may have been disseminating false information to the public. This result further shows the need to take care identifying and utilizing knowledgeable, credible sources of information, particularly during a public health crisis (Clarke & McComas, 2012).

As with the concept of trust, interactions between information source and uncertainty are grouped into two main categories. The first category centers on how uncertainty impacts the relationship between information source and publics, and is heavily related to trust. The message source must be known if a public is to trust the information it contains. The identity of the source will impact the degree to which a public trusts the information being presented (Gray & Ropeik, 2002; Wray & Jupka, 2004). Markon and Lemyre (2013) noted that how a source handles uncertain information impacts how a public perceives risk; a source that acknowledges uncertainty can reduce risk perception. This risk perception can be further reduced if the source discloses from where the uncertainty results.

The second category of source/uncertainty interaction concerns how uncertainty impacts the source itself. Organizations are often ill-equipped to handle uncertainty; organization structure, communication policy, and expert analysis are often dependent on having sufficient information. Without this information, organizations and experts are forced into unfamiliar situations that they may not be prepared to handle (Fischhoff, 2002; Innes, 2006). In these unfamiliar situations, organizations and experts must coordinate their communication to prevent further uncertainty resulting from conflicting or confusing information (Seeger, 2006).

Additionally, authoritative organizations must give timely responses to ensure the distribution of correct information. Uncertainty creates an information vacuum, and an organization that waits too long to reply runs the risk of having to focus on rumor management (Freedman, 2005; Robinson & Newstetter, 2003).

2.5. Theory on communication and uncertainty

As evidenced by the research reviewed above, the minimal research we have on uncertainty and crisis communication is largely atheoretical. Research to date may predominately lack theory because no known crisis communication theory explicitly deals with uncertainty. Several crisis communication theories touch on and/or relate to uncertainty, but do not clarify how communicators can/should integrate uncertainty into their work. For example, chaos theory (Sellnow, Seeger, & Ulmer, 2002) and complexity theory (Gilpin & Murphy, 2008) seek to "advance understanding of systems that are nonlinear, complex, and unpredictable" (Liu & Fraustino, 2014, p. 544). In addition, situational crisis communication theory (SCCT) recognizes the importance of organizations in crisis helping at-risk publics manage uncertainty through providing instructing and adjusting information (Coombs, 2015). Specifically how to provide instructing and adjusting information remains under-theorized, particularly compared to the large quantity of specific reputation response strategies recommended and empirically validated by SCCT research (Liu & Fraustino, 2014). Outside of crisis research, communication scholars have extensively researched uncertainty, which we briefly summarize below.

2.5.1. Uncertainty reduction theory

Berger and Calabrese's (1975) uncertainty reduction theory has received the most support in communication scholarship, perhaps because of its longevity and simplicity (Bradac, 2001). Uncertainty in this theory refers to the number of possible outcomes of a situation. A primary assumption of uncertainty reduction theory is that humans are motivated to decrease uncertainty about themselves and others (Berger & Calabrese, 1975). Furthermore, when people perceive a large number of alternatives they are driven to reduce uncertainty (Bradac, 2001). In this process, they make judgments about others' behaviors and their own behaviors as they attempt to reduce uncertainty. Consequently, uncertainty is viewed as negative, and something that should always be mitigated. A common critique of uncertainty reduction theory is that its simplicity prohibits modelling "unusual, multifaceted communication situations" (Bradac, 2001, p. 460), which characterizes crises. However, researchers have answered this call by adding moderating variables such as culture (Goldsmith, 2001). While risk and crisis communication scholars have referenced uncertainty reduction theory in their work (Boyle et al., 2004; Palenchar & Heath, 2007; Procopio & Procopio, 2007) no found research directly tested this theory in a crisis communication context.

2.5.2. Uncertainty management theory

Uncertainty management theory (Babrow, Hines, & Kasch, 2000) proposes that people experience uncertainty differently, and not simply as a negative tension that requires reduction. Instead, uncertainty can be positive, neutral, or negative, and people can seek information to strategically increase (rather than reduce) uncertainty (Bradac, 2001) or can chose to avoid information altogether to maintain hope and optimism (Rains & Tukachinsky, 2015). Information seeking can be interactive, active, and passive (Berger & Kellermann, 1994). Alternatively, information seeking can be evaluated on depth or "the degree to which a search is relatively focused or broad" (Rains & Tukachinsky, 2015, p. 341). For example, in an experiment examining

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skin cancer information-seeking behaviors, participants who positively appraised uncertainty displayed great information depth behaviors in terms of spending more time per webpage visited and visiting fewer webpages than those who displayed less depth. To date, no found research has directly tested uncertainty management theory in a crisis communication context.

2.5.3. Problematic integration theory

From the perspective of problematic integration (PI) theory, uncertainty emerges when publics and/or organizations are uncertain about the quality of new information and how to integrate this information into their existing knowledge and beliefs (Babrow, 2001; McPhee & Zaug, 2001). Specifically, uncertainty exists when "details of situation are ambiguous, complex; unpredictable, or probabilistic; when information is unavailable or inconsistent; and when people feel insecure in their own state of knowledge or the state of knowledge in general" (Brashers, 2001, p. 478).

Like other uncertainty theories, PI theory emphasizes that information seeking can resolve uncertainty, but adds that information may be unavailable (Babrow, 2001). Furthermore, we may not know when information will be available, whether the desired information will be available by when we need it, and whether knowing the information will matter to us personally (Babrow, Kasch, & Ford, 1998). Similar to information management theory, PI theory posits that uncertainty is not always bad. In PI theory, reconciling an unpleasant uncertainty is not the "final punctuation" (Babrow, 2001, p. 564), meaning that uncertainties can change over time among various publics. Finally, PI theory focuses on individual uncertainty orientations (Sorrentino & Roney, 2000), which are connected to how publics emotionally respond to information (Brashers, 2001; Mishel, 1990). To date, no found crisis communication research has applied PI theory.

3. Future research recommendations

Uncertainty is central in crisis definitions (e.g., Coombs, 2015; Seeger, 2006), but it is not central in existing crisis communication research and theory development. More often than not, researchers study crisis information-seeking behaviors and then make conclusions linking these behaviors to uncertainty reduction, without actually measuring uncertainty (e.g., Boyle et al., 2004; Holladay & Coombs, 2013; Lachlan et al., 2010; Procopio & Procopio, 2007). Consequently, public relations practitioners do not have empirically-validated guidance on how best to communicate about uncertainty to help at-risk publics cope with crises.

Indeed, this review has crystalized that crisis communication researchers have barely scratched the surface when it comes to understanding the roles that uncertainty can play in how organizations and publics communicate about crises and respond to crisis information. Here we present our recommendations for research directions building on the research reviewed in this article.

3.1. Causes of crisis uncertainty

Research empirically identifying the causes and consequences of crisis uncertainty is sparse. This research gap may be because definitions of uncertainty communication as it relates to crises also are sparse. In terms of causes, the research record references a relationship between (a) the trust level people have for crisis information sources and (b) the level of crisis uncertainty they experience (e.g., Paek et al., 2008; Quinn et al., 2009; Rogers et al., 2007), but does not empirically test this relationship. Instead, people's risk and crisis knowledge levels are measured, which is not quite the same as uncertainty level. Similarly, risk and crisis communication best practices emphasize acknowledging uncertainty in all situations (e.g., Covello, 2003; Heath, 2006; Janoske et al., 2013; Seeger, 2006), but research has not provided insights into how exactly to accomplish this goal through empirically-validated message strategies.

Another tentative connection made in existing scholarship is a relationship between fear and crisis uncertainty (e.g., Sheppard et al., 2006), but here again uncertainty is presumed rather than directly tested. Furthermore, some research indicates that how organizations handle uncertainty internally affects how they communicate about crises (e.g., Innes, 2006), but more research is needed on how organizations in crisis successfully manage uncertainty (McPhee & Zaug, 2001). Finally, uncertainty management theory posits that uncertainty comes from situations and from individual uncertainty orientations, and is not necessarily bad (Bradac, 2001). Yet, in the crisis communication literature uncertainty is treated solely as a negative crisis characteristic. Similarly, in any given crisis, uncertainty may result from different sources and take different forms for at-risk publics (Rains & Tukachinsky, 2015), and yet crisis research has not examined how crisis uncertainties vary and why.

Therefore, we recommend that future research answer the following questions: (a) In a crisis, what predicts what level of uncertainty at-risk publics will desire and why? (b) How does uncertainty relate to publics' trust in the crisis information source? (c) How can organizations best address uncertainty in their crisis communication? (d) What are the primary sources and topics of crisis-related uncertainty and how do these vary for at-risk publics? (e) How are crisis uncertainties interconnected over time? (f) What are crisis-independent characteristics of publics who experience higher vs. lower uncertainty orientations during crises? (g) What information sources and forms are most likely to generate uncertainty, why, and how does this vary by public and crisis types? and (h) Are certain information forms like the web better suited for managing crisis-related uncertainty?

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3.2. Consequences of crisis uncertainty

To date, research has alluded to various potential consequences of uncertainty related to crises including: increased emotional reactions like fear (e.g., Goodall et al., 2012); lower trust in government information sources (Gilles et al., 2011); increased information seeking (which may or may not be productive) (Babrow et al., 2000); intentions to obtain emergency vaccines; and threat perceptions (McGlone et al., 2013). Existing uncertainty and communication theories (i.e., uncertainty reduction theory, uncertainty management theory, and PI theory) predict that information seeking and/or avoidance is the primary communicative response to uncertainty. Yet, other outcomes commonly studied in crisis communication research likely also relate to uncertainty such as attribution of crisis responsibility (Benoit, 1997; Coombs, 2015) and crisis information sharing (Liu, Jin, Briones, & Kuch, 2012; Stephens, 2007). Indeed uncertainty may be an independent, dependent, moderating, or mediating variable, and it is too soon to know exactly what role uncertainty plays in crisis communication.

Therefore, we recommend that future research first operationalize crisis uncertainty through qualitative inductive research methods and then move toward measuring the impacts of uncertainty on how publics and organizations respond to crises through their behaviors (including communication) and non-behaviors (e.g., uncertainty rejection). Specifically, we recommend researching: (a) What are at-risk publics' crisis-related information goals and how does uncertainty management fit, if at all, within these goals? (b) What are "acceptable" levels of uncertainty and how do these levels predict crisis-related outcomes like taking protective actions? (c) How are crisis emotions related to uncertainty? and (d) What uncertainty acceptance behaviors are related to crises outcomes like information sharing and seeking and attribution of crisis responsibility?

4. Conclusion

We know that crises are inherently uncertain, and that all crises are different. This uncertainty means that crisis communicators will rarely manage a crisis where addressing uncertainty is unnecessary. What we do not know is how to effectively communicate crisis-related uncertainties to publics, taking into consideration variations among crises. The only "best practices" guidelines provided to crisis communicators direct them to acknowledge uncertainty so as to avoid being caught in a lie or exaggeration down the road. This review identifies significant gaps in existing research beyond reputation management, and provides a road map for broadening the knowledge base. The research questions posed here provide a starting point for generating empirically-grounded knowledge about how at-risk publics react to crisis uncertainty, and the potential role of organizational crisis communication in alleviating uncertainty. Uncertainty will remain a hallmark of crises, and with additional research we can better understand how communication can help publics manage uncertainties.

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