CONVERGE COVID-19 Working Groups for Public Health and Social Sciences Research

Research Agenda-Setting Paper

This paper was written to help advance convergence-oriented research in the hazards and disaster field. It highlights areas where additional research could contribute new knowledge to the response to and recovery from the pandemic and other disasters yet to come. Questions about the research topics and ethical and methodological issues highlighted here should be directed to the authors who contributed to this paper.

Working Group Name:

Risk Communication in Concurrent Disasters

Working Group Description:

As the COVID-19 pandemic unfolds, for many, it is not the only unfolding disaster. Tornadoes, earthquakes, fires, floods, and others are simultaneously affecting millions of people. Others recovering from recent disasters are also considering adjustments to prepare for potential events related to seasonal and year-round hazards. This Working Group focuses on understanding how people affected by sequential and concurrent disasters make decisions to protect themselves and others.

Theoretical Challenges:

The current public health crisis of COVID-19 presents several challenges for people dealing with other disasters or preparing for other possible hazards. Disasters can be defined as "processes involving the combination of a potentially destructive agent from the natural, modified, and/or constructed environment and a population in a socially and economically produced condition of vulnerability, resulting in a perceived disruption of the customary relative satisfaction of individual and social needs for physical survival, social order, and meaning" (Oliver-Smith, 1998). Effective risk communication may function as a disaster mitigation strategy at the interface of social vulnerability and "potentially destructive agents," whether they are from the "natural, modified, and/or constructed environment." However, there is a need to rethink risk communication and how we conceptualize situations of concurrent disasters to effectively support informed protective action decisions and hazard adjustments among those who are entangled in multiple disasters.

Here we focus in particular on the impact of the underlying assumptions about what constitutes risk (Douglas, 1992:58) and what are appropriate protective actions in an environment of (1) sequential and concurrent

disasters and of (2) frequently changing information and messaging regarding protective action recommendations. Before considering the empirical gaps concerning risk communication and concurrent disasters, we define the concept. *Concurrent disasters* refer to a situation in which a society is navigating through multiple disaster cycles simultaneously. Therefore, social actors in the context of concurrent disasters may be engaged in different phases or the same phase of the disaster cycle related to different hazard events.

Tierney (2014:227) elaborates on how risk is linked to the social fabric of societies as "a latent feature of social structure at multiple interacting levels-that is until it reveals itself in the form of disasters." In the context of COVID-19, ongoing observations of community response suggest that in places where residents were engaged in a recovery process, the current situation may have precedence. For example, community leaders who were actively involved in disaster recovery processes are now the same individuals who are enabling social support systems to face the crisis posed by COVID-19 (e.g., distributing groceries to elders and residents who lost their jobs).

There is no single definition of what we mean by risk communication. Risk communication has been built off theoretical frameworks borrowed from psychology, communication, sociology, and other disciplines (Chess, 2001; Tierney, 2014). *Risk communication* is defined as the "interactions and exchanges among individuals, groups, and institutions in the process of determining, analyzing, and managing risk (National Research Council, 1989)" (Cho et al., 2015, p. 1). Arvai and Rivers (2014) contend that risk communication should be approached as "a dialogue among people conducted to help facilitate a more accurate understanding of risks and, related, the decisions they may make to manage them." However, the risk communication process is more complex, often misinformed by faulty logic, and lacking balance between actors with different interests and concerns located at different levels of society.

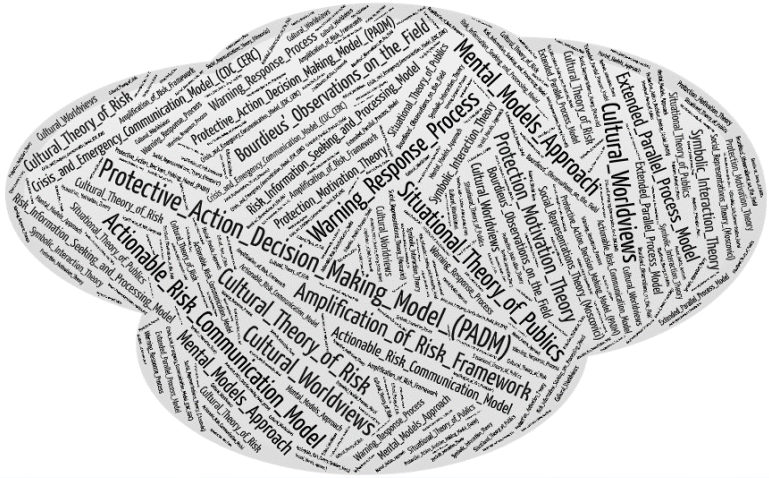
Previous research on *multiple hazards* have tended to focus on hazard chains and cascading hazards, or when one hazard triggers a second, as mentioned by Kappes et al. (2012). Others who have attempted to study multi-hazard scenarios have done so in a way where efforts centered on comparing the physical characteristics of each hazard, or the comparability between hazard nature, intensity, magnitude (Carpignano et al. 2009) or their interactions (Kappes et al. 2012). These studies concentrate on the physical dimensions of each hazard or their physical impacts, but not on the social effects of these interactions, nor on how interactions affect preparation, response, and recovery. Exceptions are multiple hazard scenarios that integrate triggered and co-occurring hazards into estimates of infrastructure damage and injuries, touching upon societal implications for mitigation, preparedness, response, and recovery. One of those exceptions is the scenarios of multiple hazard earthquake, winter storm, and tsunami events produced by the U.S. Geological Survey (e.g., Ross and others, 2013).

Other studies in this arena focus on multi-hazard scenarios where the risk is similar: avalanche and landslide or rocks-falling (Moran et al. 2004). There is a breadth of research assessing the probabilities of occurrence, such as the study completed by Chiesa and colleagues (2003) in which they developed a matrix as a classification scheme for the determination of hazard levels and the spatial and temporal likelihood of overlap. The efforts made by this group help compare hazards but do not explore the management of multiple, co-occurring risks/hazards and their impact on society. This research is similar to the Hazard Scores developed by Odeh Engineers (2001). Their modeling of hazards is based on frequency, the extent of the geographical area potentially affected, and the intensity level to generate a value of likelihood of occurrence.

Similarly, Dilley and his colleagues (2005) propose a Simple Multi-hazard Index. Likewise, El Morjani's group (El Morjani et al. 2007) studied potential hotspots for multi-hazards in the West Bank and the Gaza Strip and produced a multi-hazard index distribution map. Still more, the U.S. Department of Homeland Security (DHS 2011) developed the Integrated Rapid Visual Screening, a methodology to quantify the risk and resilience of infrastructure to hazards capable of causing catastrophic losses. Other studies have identified the

interactions that may occur where anthropogenic processes are contributing factors (Gill and Malamud 2016). Delmonaco and colleagues (2006) assessed and mapped the potential occurrence of different types of natural hazards in a given area. Though a non-exhaustive list, these studies highlight a focus on the possible multi-hazards event occurrence, frameworks used to study this potential, or the driving forces behind the interaction, such as human-induced processes that contribute to this potential. Altogether, while there is a broad set of literature on multi-hazard research, studies seldom focus on the modeling of simultaneous, overlapping distinct hazards, on the usefulness of hazard models for practitioners (Komendantova et al. 2014 notwithstanding). Even more seldom, on the impacts that occur and the decisions that people make during overlapping risk situations.

Numerous frameworks have been used to study risk and risk communication. Those include the situational theory of publics (Major, 1998; Aldoory, L., Kim, J., Tindall, N., 2010), warning response process (Mileti, 1995), actionable risk communication framework (Wood, et. Al., 2011), cultural theory of risk (Douglas, 1970, 1992; Douglas and Wildavsky, 1982), the social amplification of risk framework (Kasperson, R. E., et. Al.,1988), cultural worldviews (Palmer, 1996; Peters, Burraston, and Mertz, 2004) and the influence of language and discourse on sense-making (van Dijk 2014; Quinn 2005; Strauss 2005; Strauss and Quinn 1997), protection motivation theory (Westcott, R., et. Al., 2017; Babcicky and Seebauer, 2018), extended parallel process model (Witte, K., 1992), interaction and relational approach (Boholm 2015; Boholm and Corvellec 2011; Goffman 1967, 1959), mental models approach (Leiserowitz, A., Smith, N. & Marlon, J.R., 2010; Johnson-Laird, 2005; Morgan, M. G., Fischhoff, B., Bostrom, A., & Atman, C. J. (2002); Norman 1983), social representations theory (Joffe 2003; Maidl and Buchecker, 2019), risk information seeking and processing model (Griffin, Dunwoody, and Neuwirth, 1999), crisis and emergency communication model – CERC (Seeger, et. Al, 2018), and the protective action decision model (Becker, et. Al., 2019; Lindell and Perry, 2011; Perry, R.W., Lindell, M., 2007), among others. When it comes to concurrent disasters, social scientists are only beginning to explore the cumulative effect of multi-hazard exposure, and few have explored the social effects of multiple hazards, layered onto one another (Laska et al. 2015, Lindell and Hwang 2008; and Mohammad and Peek 2019 are notable exceptions). More research is needed to determine how these frameworks apply to scenarios of concurrent or consecutive disasters.



Priority Research Topics and Specific Research Questions:

Our Working Group held several meetings to discuss the unfolding global COVID-19 pandemic. In this section, we outline some questions that were raised by our group members and may be of interest to others.

Priority Research Topics and Questions
1. Defining Concurrent Disasters and Advancing Our Understanding of Disasters
How different or amplified are the impacts of concurrent disasters vis-à-vis-catastrophes?

What are the different impacts and implications of various disaster interactions? How does the relation between disaster processes influence their effects? How may the consequences of concurrent disasters be similar or different from those described as cascading/triggering and compounding?
2. Theoretical Challenges in Risk Communication Research
How do people understand, make sense of, and perceive the risks respectively and collectively of concurrent disasters? How do people respond by accessing and interpreting information and making protective response decisions? What does knowledge on concurrent disasters reveal about risk messages that must be developed accordingly? How do cultural worldviews (e.g., individualism vs. egalitarianism) influence information access, risk perceptions, and adopted protective measures? What gaps in resources prevent people from taking appropriate action (either physical, financial, or social)? How do varying risk communication models account for different time scales of COVID-19 and more rapid onset hazards, like earthquakes or hurricanes, in comparison to COVID-19?
3. Conflicting Protective Action Recommendations
How are people making sense of contradictory protective action recommendations? How do changes in recommended protective actions affect trust in their effectiveness? How has otherwise consistent risk messaging for a variety of hazards had to be modified to account for COVID-19? What are the unintended consequences of contradictory protective action recommendations? How are protective actions recommended for different hazards prioritized or negotiated? What protective actions are people prioritizing? What protective actions do “experts” believe should be prioritized? Where are there similarities and mismatches between experts and the public? What are the best channels to communicate changes in protective action recommendations in a situation of physical and social distancing?
4. Contextual Issues
How may information needs change among actors engaged in response and recovery roles in different contexts? How are emergency managers and public safety officials making decisions about crafting new protective action messaging? How are people able to socialize protective actions if they cannot participate together? Best practices/evidence-based practice: successes and failures. What does it take to build trust for risk communication about slow unfolding and uncertain process?

5. Risk, Blame, and Outrage

How do attributions of responsibility (individual, societal, government, and others) shape how people respond to concurrent disasters, especially if there are conflicting attributions of responsibility for the different hazards (e.g., hurricane vs. COVID)?

Our cultural and political worldviews shape perceptions of responsibility. How do these worldviews shape our responses to risk?

How does media use influence perceived attributions of responsibility?

How do cultural worldviews (e.g., individualism vs. egalitarianism) influence information access, perceptions of trust, attribution of blame, beliefs about uncertainty and deep uncertainty (or ambiguity) of a disaster, lag variable/data--impact perspective and response?

How do changes in data reported may affect trust, inform risk perception, and protective action decisions over time? How is the data to be reported selected?

How has the framing of the risk posed by COVID-19 and its impacts changed?

How do levels and types of outrage influence people's levels of trust in novel advice regarding protective actions?

6. Case Studies

What is characteristic about the confluence of social, health, and weather-related disasters?

How have different countries approached the surge in COVID-19 cases? How has the risk communication process been facilitated over time?

How is risk amplified by the confluence of disasters rooted in public health, social, economic, and political issues?

How does the availability of financial assistance informs risk acceptance?

What assumptions about society have public officials made when crafting protective action advice?

Risk messages sent by the World Health Organization regarding COVID-19 assume homogeneous societies that must "stay at home," "continually wash their hands," and "maintain social distancing." However, what differences can be observed among and within countries and across diverse population groups?

How and why have international and national risk communication systems for preventing the spreading of COVID-19 failed to take into account the social vulnerability differences (e.g., lack of access to water and technology, poverty, and illiteracy) among different social groups? What channels were used to communicate with hard to reach groups?

How does communication of information on risks associated with a disaster disadvantages some social groups for being better prepared and responding to another type of disaster (e.g., stay home vs. evacuate)? How does disseminating information to prevent and manage one disaster (e.g., COVID19) potentially undermine the preventive actions of other simultaneous disasters or crises (e.g., drought). Does this conflicting messaging ultimately generate higher risk in the face of another crisis?

How are local community emergency managers risk communication influencers/enablers managing concurrent disasters?

Ethical / Methodological Considerations:

Research on the experiences of people exposed to concurrent disasters has many ethical implications that must be taken into account. Researchers are obliged to **maintain the highest standards when it comes to scientific rigor, integrity, and respect for others**. Moreover, as social scientists, we are expected to **ensure accuracy** in our research. Ethically, by not considering these converging disasters that people must assess and respond to, we cannot adequately serve subjects well, e.g., by generating valid research instruments and models, by devising effective protective policy decisions, by designing risk messages to inform them of risks and decision-making, among others.

Researchers, students, journalists, and practitioners should seek to **establish the benefits of their research clearly to participants**. One example is research that seeks to build "local capacity." First, we must clearly define what 'capacity' means and whether it coincides with the needs identified by locals. If not, we must reflect upon our intention, **establish collaborations with local researchers who are actively engaged in the field**, **and explore how to contribute to advance research that ameliorates the impacts of disasters**.

Researchers must **be cognizant and profoundly aware that talking to people about risks, dangers, threats, disasters that they have experienced can have health consequences** on participants and researchers must be able and plan for additional time to provide information about resources and assistance available. While in the field, **researchers should seek to inform authorities and local organizations of special need situations at all times**. Conversely, researchers must be mindful of their health and well-being. Carrying out disaster research can be emotionally and mentally challenging, and researchers should devote time to devise a plan and develop an "ethical toolkit" (see Browne and Peek 2014) that allows them to collectively and individually work through their emotions to assure that we can ensure that we can execute our research with the highest level of skill and commitment.

Activity Groups:

The Risk Communication in Concurrent Disasters Working Group is nurturing four activity groups that seek to advance a research agenda on risk communication in concurrent disasters. Activity groups are focused on: (1) theoretical challenges, (2) designing and testing an online survey to explore protective action decision making, (3) methodological considerations for the analysis of risk communication messages, and (4) case studies on risk communication in places where people may be dealing with concurrent disasters.

Contributors:

Benigno Aguirre, University of Delaware
Aideé Arellanos Ceballos, Universidad de Colima-México
Roberto E. Barrios, Southern Illinois University Carbondale
Alicia Cuevas, Universidad de Colima-México
Nnenia Campbell, University of Colorado Boulder
Carmen Concepción, University of Puerto Rico – Río Piedras
Shruthi Dakey, Visvesvaraya National Institute of Technology
Julie Demuth, National Center for Atmospheric Research
Alexa Dietrich, Social Science Research Council

Alejandra Figueroa Huertas, University of Puerto Rico – Río Piedras
Erica Kuligowski, Independent
Caroline Hackerott, North Dakota State University
Lorna Jaramillo Nieves, University of Puerto Rico – Río Piedras
Shirley Laska, The Lowlander Center
Hans Louis Charles, Virginia Commonwealth University
Katherine Jo Johnson, National Institute of Standards and Technology
Sara K. McBride, U.S. Geological Survey
Ashley Méndez Heavilin, University of Puerto Rico – Río Piedras
Lindsay Neuberger, University of Central Florida
Laura Lynn Olson, Jacksonville State University
Gabriella Punziano, University of Naples Federico II
Jenniffer Santos-Hernández, University of Puerto Rico–Río Piedras
Jennifer Spinney, National Center for Atmospheric Research
Carolina Velásquez Calderón, University of Delaware
Lucia Velotti, John Jay College of Criminal Justice
Wendy Walsh, Federal Emergency Management Agency
Anne Wein, U.S. Geological Survey
Camila Young, National Institute of Standards and Technology

References:

Aldoory, L., Kim, J., Tindall, N. (2010). The Influence of Perceived Shared Risk in Crisis Communication: Elaborating the Situational Theory of Publics. *Public Relations Review*, 36:134-140.

Arvay, J., Rivers, L. (2014). Effective Risk Communication. New York, NY: Routledge.

Babcicky, P., Seebauer, S. (2018). Unpacking Protection Motivation Theory: Evidence for a Separate Protective Route in Private Flood Mitigation Behavior, *Journal of Risk Research*, 22(12): 1503-1521.

Becker, J., Potter, S.H., McBride, S.K., Wein, A., Doyle, E.E.H., Paton, D. (2019). When the Earth Doesn't Stop Shaking: How Experiences Over Time Influenced Information Needs, Communication, and Interpretation of Aftershock Information during the Canterbury Earthquake Sequence, New Zealand. *International Journal of Disaster Risk Reduction*, 34:397-411.

Boholm, Å. (2015). *Anthropology and Risk*. Routledge: London and New York.

Bohom, Å., Corvellec, H. (2011). A Relational Theory of Risk. *Journal of Risk Research*, 14(2): 175.

Browne, K., Peek, L. (2014). Beyond the IRB: An Ethical Toolkit for Long-Term Disaster Research. *International Journal of Mass Emergencies and Disasters*, 32(1), 82-120.

Carpignano A, Golia E, Di Mauro C, Bouchon S, Nordvik JP (2009). A Methodological Approach for the Definition of Multi-Risk Maps at Regional Level: First Application. *Journal of Risk Research*, 12:513–534

Chess, C. (2001). Organizational Theory and the Stages of Risk Communication. *Risk Analysis*, 21(1):179-188.

Chiesa, C., Laben, C., Cicone, R. (2003). An Asia Pacific Natural Hazards and Vulnerabilities Atlas. In: *30th International Symposium on Remote Sensing of Environment*, 329-332.

Cho, H., Reimer, T., & McComas, K. A. (2015). Introduction: Explicating Communication in Risk Communication. In H. Cho, T. Reimer, & K. A. McComas (Eds.), *The SAGE Handbook of Risk Communication.* Thousand Oaks, CA: SAGE Publications, Inc.

Delmonaco, G., Margottini, C., Spizzichino, D. (2006). Report on New Methodology for Multi-Risk Assessment and the Harmonisation of Different Natural Risk Maps. Deliverable 3.1.1. Rome, Italy: ARMONIA Project.

Dilley, M., Chen, U., Deichmann, R., Lerner-Lam A., Arnold, M. (2005). Natural Disaster Hotspots: A Global Risk Analysis. In: Disaster Risk Management Series, 5, The World Bank.

Douglas, M. (1970). Natural Symbols: Explorations in Cosmology. New York, NY: Pantheon Books.

Douglas, M. (1992). Risk and Blame: Essays in Cultural Theory. New York, NY: Routledge.

Douglas, M., Wildavsky, A.B. (1982). Risk and Culture: An Essay on the Selection of Technical and Environmental Dangers. Berkeley, CA: University of California Press.

El Morjani, Z., Ebner, S., Boos, J., Abdel Ghaffar, E., Musani, A. (2007). Modelling the Spatial Distribution of Five Natural Hazards in the context of the WHO/EMRO Atlas of Disaster Risk as a Step Towards the Reduction of the Health Impact Related to Disasters. *International Journal of Health Geography*, 6:1–28.

Gill, J.C. and B.D. Malamud (2016). Hazard Interactions and the Interaction Networks (Cascades) within Multi-Hazard Methodologies. *Earth System Dynamics*, 7:659-679.

Goffman, E. (1967). *Interaction Ritual: Essays in Face-to-Face Behaviour*. Indianapolis, New York: The Bobbs-Merrill Company Inc.

Goffman, E. (1959). The Presentation of Self in Everyday Life. Garden City, N.Y.: Doubleday.

Griffin, R., Dunwoody, S., Neuwirth, K. (1999). Proposed Model of the Relationship of Risk Information Seeking and Processing to the Development of Preventive Behaviors. *Environmental Research Section A*, 80:S230-S245.

Huang, S.K., Lindell, M. Prater, C. (2017). Multistage Model of Hurricane Evacuation Decision: Empirical Study of Hurricanes Katrina and Rita. *Natural Hazards Review,* 18(3).

Joffe, H. (2003). Risk: From Perception to Social Representation. *British Journal of Social Psychology*, 42(1): 55-73.

Johnson-Laird, P.N. (2005). Mental Models in Thought. In Holyoak, K. & Sternberg, R.J. (Eds.) *The Cambridge Handbook of Thinking and Reasoning*. Cambridge, England: Cambridge University Press. Pp. 179-212.

Kappes, M.S., M. Keiler, K. von Elverfeldt and T. Glade (2012). Challenges of analyzing multi-hazard risk: a review. *Natural Hazards*, 64: 1925-1958.

Kasperson, R. E., Renn, O., Slovic, P., Brown, H. S., Emel, J., Goble, R., Kasperson, J. X., & Ratick, S. (1988). The social amplification of risk: A conceptual framework. *Risk Analysis*, 8(2), 177–187.

Komendantova, N., R. Mrzyglocki, A. Mignan, B. Khazai, F. Wenzel, A. Patt, K. Fleming (2014). Multi-hazard and multi-risk decision-support tools as a part of participatory risk governance: Feedback from civil protection stakeholders. *International Journal of Disaster Risk Reduction*, 8: 50-67.

Laska, S., K. Peterson, C.L. Rodrigue, R. Philippe, O. Burchett, and R.L. Krajeski (2015). Layering of natural and human-caused disasters in the context of sea-level rise: Coastal Louisiana communities at the edge. In Companion, M. (Ed.) *Disaster's Impact on Livelihood and Cultural Survival* (pp. 266-279). CRC Press.

Leiserowitz, A., Smith, N. & Marlon, J.R. (2010) Americans' Knowledge of Climate Change. Yale University. New Haven, CT: Yale Project on Climate Change Communication. https://climatecommunication.yale.edu/publications/Americans-knowledge-of-climate-change/

Lindell, M.K., and Perry, R.W. (2011). The Protective Action Decision Making Model: Theoretical Modifications and Additional Evidence. *Risk Analysis*, 32(4):616-632.

Lindell, M.K. and S.N. Hwang (2008). Households' perceived person risk and responses in a multi-hazard environment. *Risk Analysis*. Vol. 28(2): 539-556.

Maidl, E., Buchecker, M. (2018). Social Representations of Natural Hazard Risk in Swiss Mountain Regions. *Geosciences*, 9(2).

Major, A. (1998). The Utility of Situational Theory of Publics for Assessing Public Response to Disaster Prediction. *Public Relations Review*, 24(4): 489-508.

Mileti, D.S. (1995). Factors Related to Flood Warning Response. U.S.-Italy Research Workshop on Hydrometeorology, Impacts, and Management of Extreme Events. Perugia, Italy.

Mohammad, L., Peek, L. (2019). "Exposure outliers: Children, mothers, and cumulative disaster exposure in Louisiana." *Journal of Family Strengths*, 19(1): 1-50.

Moran, A., Wastl, M., Geitner, C., Stotter, J. (2004). A Regional Scale Risk Analysis in the Community of Olafsfjo¨dur, Iceland. In: Internationales Symposium—INTERPRAEVENT, Riva, Trient.

Morgan, M. G., Fischhoff, B., Bostrom, A., & Atman, C. J. (2002). Risk communication: A mental models approach. Cambridge University Press.

Moscovici, S. (2001). Social Representations: Explorations in Social Psychology. New York, NY: New York University Press.

Norman, D.A. (1983). Some Observations on Mental Models. In D. Gentner and A.L. Stevens (Eds.) *Mental Models*. Mahwah, NJ: Lawrence Erlbaum Associates. Pp. 7-14.

Odeh Engineers, Inc. (2001). Statewide Hazard Risk and Vulnerability Assessment for the State of Rhode Island. Technical Report. NOAA Coastal Services Center. http://www.csc.noaa.gov/rihazard/pdfs/rhdisl_hazard_Report.pdf.

Oliver-Smith, A. 1998. "Global Changes and the Definition of Disaster". In Quarantelli, E.L. (Eds.) *What is a Disaster? Perspectives on the Question.* New York: Routledge.

Palmer, C.G.S. (1996). Risk Perception: An Empirical Study of the Relationship Between Worldview and the Risk Construct. *Risk Analysis,* 16(5):717-723.

Perry, R.W., Lindell, M. (2007). Emergency Planning. Hoboken, NJ: John Wiley & Sons.

Peters, E., Burraston, B., Mertz, C. (2004). An Emotion Based Model of Risk Perception and Stigma Susceptibility: Cognitive Appraisals of Emotion, Affective Reactivity, Worldviews, and Risk Perception in the Generation of Technological Stigma. *Risk Analysis*, 24(5):1349-1367.

Quinn, N. (2005). Introduction. In N. Quinn (ed). *Finding Culture in Talk: A Collection of Methods*. New York: Palgrave Macmillan. Pp. 1-34.

Ross, S., Jones, L., Miller, K., Porter, K., Wein, A., Wilson, R., Bahng, B., Barberopoulou, A., Borrero, J., Brosnan, D., Bwarie, J., Geist, E., Johnson, L., Kirby, S., Knight, W., Long, K., Lynett, P., Mortensen, C., Nicolsky, D., Perry, S., Plumlee, G., Real, C., Ryan, K., Suleimani, E., Thio, H., Titov, V., Whitmore, P. Wood, N. (2013). SAFRR (Science Application for Risk Reduction) Tsunami Scenario—Executive Summary and Introduction: U.S. Geological Survey Open-File Report 2013–1170–A. In Ross, S.L., and Jones, L.M. (Eds.) The SAFRR (Science Application for Risk Reduction) Tsunami Scenario: U.S. Geological Survey Open-File Report 2013–1170, http://pubs.usgs.gov/of/2013/1170/a/.

Seeger, M., Pechta, L., Price, S., Lubell, K., Rose, D., Sapru, S., Chansky, M., Smith, B. (2018). A Conceptual Model for Evaluating Emergency Risk Communication in Public Health. *Health Security*, 16(3):193-203.

Strauss, C. (2005). Analyzing Discourse for Cultural complexity. In *Finding Culture in Talk: A Collection of Methods.* N. Quinn (ed.). Palgrave MacMillan. Pp. 203-242.

Strauss, C., Quinn, N. (1997). Introduction. In *A cognitive theory of cultural meaning*. Cambridge, England: Cambridge University Press. Pp. 3-11.

Tierney, K. (2014). The Social Roots of Risk: Producing Disasters, Promoting Resilience. Stanford, CA: Stanford University Press.

U.S. Department of Homeland Security (2011). Integrated Rapid Visual Screening of buildings. Technical Report, Department of Homeland Security. http://www.dhs.gov/xlibrary/assets/st/st-bips-04-irvs.pdf

Van Dijk, T.A. (2014). *Discourse and Knowledge: A Sociocognitive Approach.* Cambridge, England: Cambridge University Press.

Westcott, R., Ronan, K., Bambrick, H., Taylor, M. (2017). Expanding Protection Motivation Theory: Investigation an Application to Animal Owners and Emergency Responders in Bushfire Emergencies. *BMC Psychology* 5(13).

Witte, K. (1992). Putting Fear Back into Fear Appeals: The Extended Parallel Process Model. *Communication Monographs*, 59(4): 329-349.

Wood, M.M., Mileti, D.S., Kano, M., Kelley, M., Regan, R., Bourque, L. (2011). Communicating Actionable Risk for Terrorism and Other Hazards. *Risk Analysis,* 32(4):601-615.

Resources:

In addition to the manuscripts cited, we have identified numerous resources useful to students, practitioners, and researchers interested in risk communication. Below is a list of some suggested resources.

The SPARS Pandemic 2025-2028: A Futuristic Scenario for Public Health Risk Communicators.
Schoch-Spana M., Brunson, E.K., Sherarer, M.P., Ravi, S., Sell T.K., Chandler, H., Gronvall, G.K. (2017). The SPARS Pandemic, 2025-2028: A Futuristic Scenario for Public Health Risk Communicators. Baltimore, MD: John Hopkins Center for Health Security.

FEMA Coronavirus Emergency Management Best Practices

National Academies of Sciences, Engineering, and Medicine. (2018). Emergency Alert and Warning Systems: Current Knowledge and Future Research Directions. Washington, DC: The National Academies Press.

CDC Crisis Emergency Risk Communication Overview for COVID-19
Presenter: Lisa Briseno.

CDC Hurricane Season During COVID-19
Presenters: Bill Rich, Vivi Siegel, Mollie Mahany

CDC Risk Communicator Index:
A research-based tool to develop and assess public communication materials.

John Hopkins Center for Communication Programs (CCP): Risk Communication and Community Engagement for COVID-19
Speakers: Kathryn Bertram (CCP) and Carla Sanchez (Save the Children).

FEMA Prep Talks: Visual + Effective Communication for Emergency Information
Speaker: Claudine Jaenichen.

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