# Re-assessing the role of communication in the aftermath of a disaster: case studies and lesson learned

*Andrea Cerase[1]*

## Abstract

The scope of the chapter is to provide an interpretive hypothesis on the different functions of different media in the aftermath of a disaster, drawing upon theoretical and empirical literature and case-studies in the light of Uses and Gratification perspective. Moving from the way people engage with media and interpersonal source, the chapter addresses disaster communication in the light of both collective needs and its related social functions, considering how people actually interact with communication to cope with disasters.

A better understanding of the ways situational constraint, individual motivations, consumption patterns and communication cycles are arranged may improve our understanding of the whole disaster communication process, thus being very helpful to ground effective communication strategies, and to better understand the possible consequences of poor message shaping or use of wrong choices of channels.

The paper will also discuss complementary roles of broadcast media, interactive digital environments and interpersonal channels to inform public discourse on disaster, improving preparedness measures, giving voice to exposed communities and informing both individual and collective decision, as well as mobilizing human and collective resources to foster return to normalcy.

**Keywords**: Disaster communication, Media functions in disaster, Uses and gratification, Communication theory.

## Works Cited

Adger, W.N., Hughes, T.P., Folke, C., Carpenter, S. R., & Rockström, J. 2005, "Social-ecological resilience to coastal disasters", *Science*, 3095737, 1036-1039.

Alexander J., 1988, *Action and his environments: toward a new synthesis*, Columbia University Press, New York.

Andersen, P.A., & Spitzberg, B.H., 2009, "Myths and maxims of risk and crisis communication", *Handbook of risk and crisis communication,* 205-26.

Anthony, K.E., & Sellnow, T. L., 2011, "Information acquisition, perception, preference, and convergence by Gulf Coast residents in the aftermath of the Hurricane Katrina crisis", *Argumentation and Advocacy*, 482, 81-96.

---

[1] INGV Tsunami Alert Center, Italy; Department of Communication and Social Research, Sapienza University of Rome, Italy, e-mail: andrea.cerase@uniroma1.it.

Appadurai, A., 1996, *Modernity al large: cultural dimensions of globalization,* Vol. 1. U of Minnesota Press.

Atkin, C., 1985, Informational utility and selective exposure to entertainment media. In: Zillmann, D. & Bryant, J. (Eds.), *Selective exposure to communication*. Hillsdale, NJ: Erlbaum, pp. 63–91.

Austin, L., Fisher Liu, B., & Jin, Y., 2012, "How audiences seek out crisis information: Exploring the social-mediated crisis communication model", *Journal of Applied Communication Research*, 402, 188-207.

Ball-Rokeach, S.J., 1973, "From pervasive ambiguity to a definition of the situation", *Sociometry*, 378-389.

Bentivegna, S., 2005, *Teorie delle comunicazioni di massa*, Laterza, Roma-Bari.

Birkmann, J., 2006, "Measuring vulnerability to promote disaster-resilient societies: Conceptual frameworks and definitions", *Measuring vulnerability to natural hazards: Towards disaster resilient societies*, 1, 9-54.

Breakwell, G.M., 2001, "Mental models and social representations of hazards: the significance of identity processes", *Journal of Risk Research*, 44, pp.341-351.

Burnside, R., Miller, D.S., & Rivera, J.D., 2007, "The impact of information and risk perception on the hurricane evacuation decision-making of greater New Orleans residents", *Sociological Spectrum*, 276, 727-740.

Cerase, A. 2017, "Amatrice anno zero: come cambia la rappresentazione mediale della scienza nei terremoti", *Problemi dell'informazione*, 423, 401-430.

Cerase, A., & Santoro, C., 2018, From racial hoaxes to media hypes: Fake news' real consequences. In: Vasterman, P. (Ed.), *From Media Hype to Twitter Storm: News Explosions and Their Impact on Issues, Crises, and Public Opinion*. Amsterdam: Amsterdam University Press, pp. 333-354.

Chatfield, A.T., Scholl, H.J.J., & Brajawidagda, U., 2013, "Tsunami early warnings via Twitter in government: Net-savvy citizens' co-production of time-critical public information services", *Government information quarterly*, 304, 377-386.

Cheng, J. W., Mitomo, H., Otsuka, T., & Jeon, S. Y., 2015, The effects of ICT and mass media in post-disaster recovery–a two model case study of the Great East Japan Earthquake, *Telecommunications Policy*, 39, 515-532.

Chmutina, K., Meding, J.V., Gaillard, J.C. & Lee, B.. 2017, "Why natural disasters aren't all that natural", available at: www.opendemocracy.net/ksenia-chmutina-jason-von-meding-jc-gaillard-lee-bosher/why-natural-disasters-arent-all-that-natural, accessed October 1st, 2018.

Cohen, E.L., Ball-Rokeach, S.J., Jung, J.Y., & Kim, Y.C., 2003, "Civic actions after September 11: A communication infrastructure perspective", *Crisis Communications: Lessons from September*, 11, 31-43.

Cole, T.W., & Fellows, K.L., 2008, "Risk communication failure: A case study of New Orleans and Hurricane Katrina", *Southern Communication Journal,* 733, 211-228.

Comunello, F., Parisi, L., Lauciani, V., Magnoni, F., & Casarotti, E., 2016, "Tweeting after an earthquake: user localization and communication patterns during the 2012 Emilia seismic sequence", *Annals of Geophysics*, 595, 0537.

Correa, T., Scherman, A., & Arriagada, A. 2016, "Audiences and Disasters: Analyses of Media Diaries Before and After an Earthquake and a Massive Fire", *Journal of Communication*, 664, 519-541.

Couldry, N., 2014, "Inaugural: A necessary disenchantment: Myth, agency and injustice in a digital world", *The Sociological Review*, 624, 880–89.

CRED/UNISDR. 2016, "Poverty and death", *Disaster mortality*, 1996–2015.

Denis, L.A.S., Hughes, A.L., & Palen, L. 2012, April. Trial by fire: The deployment of trusted digital volunteers in the 2011 shadow lake fire. In: *Proceedings of the 9th International ISCRAM Conference.*

Donohue, G.A., Tichenor, P.J., & Olien, C.N. 1973, "Mass media functions, knowledge and social control", *Journalism Quarterly*, 504, 652-659.

Drabek, T. 1969, "Social processes in disaster: Family evacuation", *Social Problems*, 16, 336–349.

Drabek, T.E., & Stephenson III, J.S., 1971, "When Disaster Strikes 1.", *Journal of Applied Social Psychology,* 12, 187-203.

Durkheim, E., 1984, *The Division of Labour in Society*, Macmillan, London.

Dutta-Bergman, M.J., 2006, "Community participation and Internet use after September 11: Complementarity in channel consumption", *Journal of Computer-Mediated Communication*, 112, 469-484.

Dynes, R., 2006, "Social capital: Dealing with community emergencies", *Homeland Security Affairs*, 22, 1-26.

Earle, P., Guy, M., Buckmaster, R., Ostrum, C., Horvath, S., & Vaughan, A., 2010, "OMG earthquake! Can Twitter improve earthquake response?", *Seismological Research Letters*, 812, 246-251.

Entman, R. M., 1993, "Framing: Toward clarification of a fractured paradigm", *Journal of communication*, 434, 51-58.

Fraustino, J. D., Liu, B., & Jin, Y., 2012, "Social Media Use during Disasters: A Review of the Knowledge Base and Gaps", *Final Report to Human Factors/Behavioral Sciences Division, Science and Technology Directorate*, U.S. Department of Homeland Security. College Park, MD: START.

Gamson, W.A., & Modigliani, A., 1989, "Media discourse and public opinion on nuclear power: A constructionist approach", *American journal of sociology*, 951, 1-37.

Greenberg, B.S. 1964, "Diffusion of news of the Kennedy assassination", *Public opinion quarterly*, 282, 225-232.

Greenberg, B. S., Hofschire, L., & Lachlan, K., 2002, Diffusion, media use and interpersonal communication behaviors. In: Greenberg B.S. (Ed.), *Communication and terrorism: Public and media responses to 9:11*, Cresskill, NJ: Hampton Press, pp. 3–16..

Guha-Sapir, D., Hoyois, P., & Below, R., 2014, *Annual Disaster Statistical Review: Numbers and Trends 2013*, No. UCL-Université Catholique de Louvain.

Gupta, A., Lamba, H., Kumaraguru, P., & Joshi, A., 2013, May. Faking sandy: characterizing and identifying fake images on twitter during hurricane sandy. In: *Proceedings of the 22nd international conference on World Wide Web* pp. 729-736. ACM.

Haddon, L., 2011, "Domestication analysis, objects of study, and the centrality of technologies in everyday life", *Canadian Journal of Communication*, 362, 311-323.

Heath, R.L., & O'Hair, H.D. Eds., 2010, *Handbook of risk and crisis communication*. New York, NY: Routledge.

Hilgartner, S., & Bosk, C.L., 1988, "The rise and fall of social problems: A public arenas model". *American journal of Sociology*, 941, 53-78.

Hindman, D. B., & Coyle, K., 1999, "Audience orientations to local radio coverage of a natural disaster", *Journal of Radio Studies*, 61, 8-26.

Hjorth, L., & Kim, K.H.Y., 2011, Good grief: the role of social mobile media in the 3.11 earthquake disaster in Japan, *Digital Creativity*, 223, 187-199.

Houston, J.B., 2012, 'Public disaster mental/behavioral health communication: intervention across disaster phases', *Journal of Emergency Management*. 104. pp. 283–292.

Howell, G.V., & Taylor, M., 2011, "When a crisis happens, who turns to Facebook and why?". *Asia Pacific Public Relations Journal*, 122.

Humphreys, L., Von Pape, T., & Karnowski, V., 2013, "Evolving mobile media: Uses and conceptualizations of the mobile Internet", *Journal of Computer-Mediated Communication*, 184, 491-507.

Joffe, H., 2003, "Risk: From perception to social representation", *British journal of social psychology*, 421, 55-73.

Joffe, H., Rossetto, T., Solberg, C., & O'Connor, C., 2013, "Social representations of earthquakes: A study of people living in three highly seismic areas", *Earthquake Spectra*, 292, 367-397.

Jung, J.Y., 2012, "Social media use and goals after the Great East Japan Earthquake", *First Monday*, 178.

Jungermann, H., Pfister, H.R., & Fischer, K., 1996, "Credibility, information preferences, and information interests", *Risk analysis*, 162, 251-261.

Kanihan, S.F., & Gale, K.L. 2003, "Within 3 hours, 97 percent learn about 9/11 attacks", *Newspaper Research Journal,* 241, 78-91.

Kaplan, A. M., & Haenlein, M., 2012, "Social media: back to the roots and back to the future", *Journal of Systems and Information Technology*, 142, 101-104.

Kasperson, R.E., Renn, O., Slovic, P., Brown, H.S., Emel, J., Goble, R., Kasperson, J.S., Ratick, S., 1988, "Social amplification of risk: A conceptual framework", *Risk Analysis*,8, 177-187.

Katz, E., & Foulkes, D., 1962, "On the use of the mass media as escape: Clarification of a concept", *Public opinion quarterly*, 263, 377-388.

Katz, E., Blumler, J., & Gurevitch, M., 1973, "Uses and gratifications research", *The public opinion quarterly,* 374, 509-523.

Katz, E., Blumler, J., & Gurevitch, M. 1974, *The use of mass communication.* Beverly Hills.

Klapper, J., 1960, *The effects of mass communication*, Free Press, New York.

Koopmans, R., & Vliegenthart, R., 2010, "Media attention as the outcome of a diffusion process - A theoretical framework and cross-national evidence on earthquake coverage", *European Sociological Review*, 275, 636-653.

Kryvasheyeu, Y., Chen, H., Obradovich, N., Moro, E., Van Hentenryck, P., Fowler, J., & Cebrian, M., 2016, "Rapid assessment of disaster damage using social media activity", *Science advances*, 23, e1500779.

La Longa, F., Crescimbene, M., & Camassi, R., 2014, "Il contrasto di voci e dicerie sui terremoti del 20 e 29 Maggio 2012 in Pianura Padana"*, 33° Convegno del Gruppo Nazionale di Geofisica della Terra Solida GNGTS.*

Lachlan, K. A., Spence, P.R., & Seeger, M., 2009, "Terrorist attacks and uncertainty reduction: Media use after September 11", *Behavioral Sciences of Terrorism and Political Aggression*, 12, 101-110.

Lasswell, H.D., 1948, The structure and function of communication in society. In Bryson, L. (Ed.), *The communication of ideas* New York: Harper & Row, 37, 215-228.

Lee, C.S., & Ma, L., 2012, "News sharing in social media: The effect of gratifications and prior experience", *Computers in human behavior*, 282, 331-339.

Lev-On, A., 2012, "Communication, community, crisis: Mapping U&G in the contemporary media environment", *New Media & Society,* 141, 98-116.

Levy, M.R., & Windahl, S., 1984, "Audience activity and gratifications: A conceptual clarification and exploration", *Communication research,* 111, 51-78.

Lindell, M.K., 2018, Communicating imminent risk. In: Rodriguez, H.; Donnee W., Trainor, J. E. (Eds.), *Handbook of Disaster Research* .Springer, Cham, pp. 449-477.

Lindell, M.K., & Perry, R.W. 2012, "The protective action decision model: theoretical modifications and additional evidence", *Risk Analysis*, 324, 616-632.

Lindell, M.K., Lu, J.C., & Prater, C.S., 2005, "Household decision making and evacuation in response to Hurricane Lili", *Natural Hazards Review*, 6, 171–179.

Livingstone, S., 2015, "Active audiences? The debate progresses but is far from resolved", *Communication Theory*, 254, 439-446.

Lombardi, M., 2005, *Comunicare nell'emergenza,* Vita e pensiero, Milano.

Luhmann, N., 1995, *Social systems*, Stanford University Press, Stanford.

Lundgren, R.E., McMakin, A.H., 2011*, Risk communication: A handbook for communicating environmental, safety, and health risks,* John Wiley Sons.

Macias, W., Hilyard, K., & Freimuth, V., 2009, "Blog functions as risk and crisis communication during Hurricane Katrina", *Journal of Computer-Mediated Communication*, 151, 1-31.

Massey, K.B., 1995, "Analyzing the uses and gratifications concept of audience activity with a qualitative approach: Media encounters during the 1989 Loma Prieta earthquake disaster", *Journal of Broadcasting & Electronic Media*, 393, 328-349.

Mayer, M.E., Gudykunst, W.B., Perrill, N.K., & Merrill, B.D., 1990, "A comparison of competing models of the news diffusion process", *Western Journal of Communication includes Communication Reports*, 541, 113-123.

Mayhorn, C.B., & McLaughlin, A.C., 2014, "Warning the world of extreme events: A global perspective on risk communication for natural and technological disaster", *Safety science*, 61, 43-50.

McQuail, D., 2003*, McQuail's mass communication theory*, Sage publications, London.

Mela, A., Mugnano, S., & Olori, D., 2017, Verso una nuova sociologia dei disastri italiana. In: Id. (Ed.), *Territori vulnerabili: Verso una nuova sociologia dei disastri italiana*. FrancoAngeli. 7-21.

Merton, R.K., 1949a, *Social theory and social structure,* Free press*,* New York.

Merton, R.K., 1949b, Manifest and Latent Functions. In: id. *Social Theory and Structure*, Free Press, New York.

Miles, B., Morse, S., 2007, "The role of news media in natural disaster risk and recovery", *Ecological Economics,* 63, 2, pp. 365-373.

Mileti, D.S., & Fitzpatrick, C., 1992, "The causal sequence of risk communication in the Parkfield earthquake prediction experiment", *Risk Analysis*, 123, 393-400.

Miller, A., & Goidel, R., 2009, "News organizations and information gathering during a natural disaster: Lessons from Hurricane Katrina", *Journal of Contingencies and Crisis Management*, 174, 266-273.

Moores, S., 1994, 18 Texts, Readers and Contexts of Reading: Developments in *the Study of Media Audiences. Media Texts, Authors and Readers: A Reader*, 256.

Morcellini, M. Ed., 2002, *Torri crollanti: comunicazione, media e nuovi terrorismi dopo l'11 settembre*, Franco Angeli, Milano.

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

Moscovici, S., 1981, On social representations. In: Forgas, P. (Ed.), *Social Cognition: Perspectives on Everyday Understanding*, AcademicPress, NewYork, 181-209.

Moscovici, S., 1988, Notes towards a description of social representations, *European journal of social psychology*, 183, pp. 211-250.

Neubaum, G., Rösner, L., Rosenthal-von der Pütten, A. M., & Krämer, N.C., 2014, "Psychosocial functions of social media usage in a disaster situation: A multi-methodological approach", *Computers in Human Behavior*, 34, 28-38.

Nicholls, S., 2012, The resilient community and communication practice, *Australian Journal of Emergency Management,* 271, 46.

Nostro, C., Amato, A., Cultrera, G., Margheriti, L., Selvaggi, G., Arcoraci, L., Casarotti, L., Di Stefano, R, Cerrato, S. the 11th May Team, 2012,. "Turning the rumor of the May 11, 2011, earthquake prediction in Rome, Italy, into an information day on earthquake hazard",. *Annals of geophysics,* 553.

Omilion-Hodges, L.M., & McClain, K.L., 2016, "University use of social media and the crisis lifecycle: Organizational messages, first information responders' reactions, reframed messages and dissemination patterns", *Computers in Human Behavior*, 54, 630-638.

Parsons, T., 1951, *The Social System*, Free Press Glencoe, Ill.

Paton, D., & Irons, M., 2016, Communication, sense of community, and disaster recovery: a Facebook case study, *Frontiers in communication*, 1, 4.

Peled, T., & Katz, E., 1974, "Media functions in wartime: The Israel home front in October 1973", *The uses of mass communication: Current perspectives on gratifications research*, 49-69.

Perez-Lugo, M., 2004, "Media uses in disaster situations: A new focus on the impact phase", *Sociological inquiry,* 74 2, pp. 210-225.

Perreault, M. F., Houston, J.B., & Wilkins, L., 2014, "Does scary matter?: Testing the effectiveness of new National Weather Service tornado warning messages", *Communication Studies*, 655, 484-499.

Perry, R.W., 2007, What is a disaster?. In: *Handbook of disaster research*, Springer, New York, NY, pp. 1-15.

Perry, R. W., & Lindell, M., 1989, Communicating threat information for volcano hazards. In: Masel Walters, L., Wilkins, L. and Walters, T. (Eds.)*, Bad Tidings: Communications and Catastrophe,* Lawrence Erlbaum and Associates, Hillsdale, NJ, 62.

Pew Internet and American Life Project 2001 The Commons of the Tragedy: How the Internet Was Used by Millions after the Terror Attacks to Grieve, Console, Share News, and Debate the Country's Response. Available at: http://www.pewinternet.org/Reports/2001/The-Commons-of-the-Tragedy-How-the-Internet-was-used-by-millions-after-the-terror-attacks.aspx?r=1. Last access: 15 November 2018.

Plough, A., Krimsky, S., 1987, "The emergence of risk communication studies: social and political context", *Science, Technology, & Human Values*, 123/4, 4-10.

Purcell, K., Rainie, L., Mitchell, A., Rosenstiel, T., & Olmstead, K., 2010, "Understanding the participatory news consumer", *Pew Internet and American Life Project*, 1, 19-21.

Quarantelli, E.L., & Dynes, R.R. 1977, "Response to social crisis and disaster", *Annual review of sociology,* 31, 23-49.

Rausch, A.S. 2014, "The great east Japan disaster, 2011 and the regional newspaper: transitions from news to newspaper columns and the creation of public memory", *International Journal of Mass Emergencies and Disasters,* 322, 275-296.

Renn, O., 1991, Risk communication and the social amplification of risk. In: Kasperson R.E, Stallen P.J. eds Communicating Risks to the Public: International Perspectives, Dordrecht, Kluiwer: 287-324.

Reuband, K.H., 2010, "How People Learned About the September 11 Terrorist Attack and How It Affected Them. A Study in News Diffusion and Psychosocial Reactions in Germany", *Komparative empirische Sozialforschung,* 437.

Rogers, E., Seidel, N. 2002, 'Diffusion of News of the Terrorist Attacks of September 11, 2001', *Prometheus,* 20: 3, 209 — 219

Rubin, A.M. 2009, Uses-and-gratifications perspective on media effects. *In Media effects*, Routledge, pp. 181-200.

Ruggiero, T.E. 2000, "Uses and gratifications theory in the 21st century", *Mass communication & society*, 31, 3-37.

Scanlon, J., 2011, "Research about the mass media and disaster: Never well hardly ever the twain shall meet", *Journalism Theory and Practice*, 233-269.

Schmidt, A., Wolbers, J., Ferguson, J., & Boersma, K. 2017, "Are you Ready2Help? Conceptualizing the management of online and onsite volunteer convergence", *Journal of Contingencies and Crisis Management*.

Seeger, M.W., 2002, "Chaos and crisis: Propositions for a general theory of crisis communication", *Public Relations Review,* 284, 329-337.

Seeger, M.W., 2008, "Disasters and communication". In: Donsbach, W. (Ed.), *The international encyclopedia of communication*, Malden, MA: Blackwell, Vol. 12.

Sellnow, T.L., Seeger, M.W., 2013, *Theorizing crisis communication,* John Wiley & Sons. Hoboken, Vol. 4.

Sellnow, T.L., Seeger, M.W., & Ulmer, R.R., 2002, "Chaos theory, informational needs, and natural disasters", *Journal of Applied Communication Research*, 304, 269-292.

Shklovski, I., Burke, M., Kiesler, S., & Kraut, R., 2010, "Technology adoption and use in the aftermath of Hurricane Katrina in New Orleans", *American Behavioral scientist*, 538, 1228-1246.

Simons, H., 2009, *Case study research in practice*, SAGE, London.

Sorensen, J.H., & Sorensen, B.V., 2007, Community processes: Warning and evacuation. In: Rodríguez, E.L. Quarantelli, & R.R. Dynes (Eds.), *Handbook of disaster research*, Springer, New York, 183-199.

Spence, P.R., Westerman, D., Skalski, P.D., Seeger, M., Sellnow, T.L., & Ulmer, R.R., 2006, "Gender and age effects on information-seeking after 9/11". *Communication Research Reports*, 233, 217-223.

Stallings, R.A., 1990, "Media discourse and the social construction of risk", *Social problems*, 371, 80-95.

Starbird, K., & Palen, L., 2011, May. Voluntweeters: Self-organizing by digital volunteers in times of crisis. In: *Proceedings of the SIGCHI conference on human factors in computing systems* pp. 1071-1080. ACM.

Steelman, T.A., McCaffrey, S.M., Velez, A.L.K., & Briefel, J.A., 2015, "What information do people use, trust, and find useful during a disaster? Evidence from five large wildfires", *Natural Hazards,* 761, 615-634.

Stephens, K.K., Barrett, A.K., & Mahometa, M.J., 2013, "Organizational communication in emergencies: Using multiple channels and sources to combat noise and capture attention", *Human Communication Research,* on. Human Communication Research, 392, 230-251.

Sugimoto, A., Nomura, S., Tsubokura, M., Matsumura, T., Muto, K., Sato, M., & Gilmour, S., 2013, "The relationship between media consumption and health-related anxieties after the Fukushima Daiichi nuclear disaster", *PloS one*, 88, e65331.

Sutton, J. N., Palen, L., & Shklovski, I., 2008, *Backchannels on the front lines: Emergency uses of social media in the 2007 Southern California Wildfires*, University of Colorado, pp. 624-632.

Sutton, J., Gibson, C.B., Spiro, E.S., League, C., Fitzhugh, S.M., & Butts, C.T., 2015, "What it takes to get passed on: message content, style, and structure as predictors of retransmission in the Boston Marathon bombing response"*, PLoS one*, 108, e0134452.

Tanner, A., Friedman, D.B., Koskan, A., & Barr, D., 2009, "Disaster communication on the Internet: A focus on mobilizing information", *Journal of health communication*, 148, 741-755.

Taylor, M., & Perry, D.C., 2005, "Diffusion of traditional and new media tactics in crisis communication", *Public Relations Review*, 312, 209-217.

Tierney, K., Bevc, C., & Kuligowski, E., 2006, "Metaphors matter: Disaster myths, media frames, and their consequences in Hurricane Katrina", *The annals of the American academy of political and social science*, 6041, 57-81.

Turner, B.L. 1978, *Man-made disasters*, Wykeham, London.

Turner, B.L., Kasperson, R.E., Matson, P.A., McCarthy, J.J., Corell, R. W., Christensen, L., Eckley, N., Kasperson, J.X., Luers, A., Martello, M.L., Polsky, C., Pulsipher, A., and Schiller, A., 2003, "A framework for vulnerability analysis in sustainability science", *Proceedings of the national academy of sciences*, 10014, 8074-8079.

Veil, S.R., Buehner, T., & Palenchar, M.J., 2011, "A work-in-process literature review: Incorporating social media in risk and crisis communication", *Journal of contingencies and crisis management*, 192, 110-122.

Wein, A., Potter, S., Johal, S., Doyle, E., & Becker, J., 2015, Communicating with the public during an earthquake sequence: Improving communication of geoscience by coordinating roles, *Seismological Research Letters,* 871, 112-118.

Wendling, C., Radisch, J., & Jacobzone, S., 2013, "The use of social media in risk and crisis communication", *OECD Working Papers on Public Governance, No. 24*, OECD Publishing, Paris, DOI: 10.1787/5k3v01fskp9s-en

Wenger, D. E., & Parr, A.R., 1969*, Community functions under disaster conditions*. Report Serles #4. Disaster Research Center, Columbus, OM.

Westerman, D., Spence, P.R., & Van Der Heide, B., 2014, "Social media as information source: Recency of updates and credibility of information", *Journal of Computer-Mediated Communication*, 192, 171-183.

Whittaker, J., McLennan, B., & Handmer, J., 2015, "A review of informal volunteerism in emergencies and disasters: Definition, opportunities and challenges". *International Journal of Disaster Risk Reduction,* 13, 358-368.

Wisner, B., Gaillard, J.C., & Kelman, I., 2012, "Framing disaster: theories and stories seeking to understand hazards, vulnerability and risk". In: *Handbook of hazards and disaster risk reduction*, Routledge, pp. 47-62.

Zaksek, M., & Arvai, J.L., 2004, "Toward improved communication about wildland fire: mental models research to identify information needs for natural resource management", *Risk analysis*, 246, 1503-1514.

Zemp, H., 2010, "Natural hazards: Changing media environments and the efficient use of ICT for disaster communication", *Advanced ICTs for Disaster Management and Threat Detection: Collaborative and Distributed Frameworks*, 46-64.