Intra-family Decision Making in Disaster Evacuations: An Interdisciplinary Examination

Amanda Savitt, M.S.
North Dakota State University

Yue "Gurt" Ge, Ph.D.
University of Central Florida

ABSTRACT. Being able to predict how families will respond to disasters, including whether they will evacuate and what factors will influence their decision, can help government officials protect people from harm. There is a great deal of literature concerning how individuals and households make these protective action decisions, but this literature largely fails to capture how differences among or between families affect decision-making. In this paper, we explore how previously disconnected bodies of literature from disciplines including emergency management, family science, transportation logistics and others, can be synthesized to address this gap in the research. Primarily using family science models, we propose an updated Protective Action Decision Model that includes previously neglected intra-family factors.

Keywords: disaster response, evacuation, family adaptation, family resilience, family stress, decision making

---

Direct correspondence to Amanda Savitt, M.S. at North Dakota State University Center for Emergency Management Education and Research, Phone: (701) 231-5886 Email: amanda.savitt@ndsu.edu

Intra-family Decision Making in Disaster Evacuations: An Interdisciplinary Examination

Background

Understanding how families make decisions about how to respond to hazard events is important, because it gives emergency managers and emergency management scholars insight into how to design warnings and other communication mechanisms to protect a greater number of people at risk. Our knowledge about protective action decision making is fairly strong, including models like the Protective Action Decision Model, which is supported by a great deal of evidence and outlines the major factors affecting the decision to evacuate (Huang, Lindell, & Prater, 2016; Lindell & Perry, 2012). This model, however, does not explain how multi-person households negotiate, improvise, and make final decisions about whether to evacuate during disasters. In part, this is a result of the fact that scholars have tended to assume that all members of a household have the same incentive structures and decision-making criteria. While this may be an appropriate model for developing a general understanding of protective action decision-making, research into the relationships and dynamics within families from disciplines outside of emergency management can strengthen our understanding of this decision-making process. This paper will discuss how scholars from various disciplines, including emergency management and family science, have treated the intra-family or intra-household decision-making process, and recommend a conceptual model for future research which help address this need in the literature.

Approach to the Literature

The literature informing this synergistic examination comes principally from two scholarly bodies: emergency management and family science. A small amount of additional literature comes from consumer science and family economics. As an academic discipline, emergency management is the scientific study of how humans create, interact and cope with hazards, vulnerability, and associated events, particularly through activities related to preparedness, response, recovery, and mitigation (Jensen, 2013). This paper focuses on research that has been conducted in the response phase, particularly with respect to decision-making in response to the threat of a hazard event. Response refers to the phase in which a hazard event is imminent and immediate actions are taken to protect lives, property, and the environment. Activities that occur in response include decision-making about evacuation and sheltering, search and rescue, and distribution of emergency supplies (e.g., Dynes, Quarantelli & Wenger, 1988; Rigg, Law, Tan-Mullins, & Grundy-Warr, 2005; Steffen & Fothergill, 2009). The literature reviewed here focuses on the Protective Action Decision Model (PADM), which is the primary model emergency management scholars use for understanding decision making in response to a hazard event. This research was located using keyword searches (e.g. “protective action decision making,” “evacuation + decision making”) in emergency management journals (including *International Journal of Mass Emergencies and Disasters, Natural Hazards Review*, and *Risk Analysis*) as well as through “snowball” searches (i.e. locating research using reference lists of previously collected papers) (Greenhalgh & Peacock, 2005).

Although family science literature has considered disasters (e.g., Hackbarth, Pavkov, Wetchler, & Flannery, 2012; Walsh, 2007; Warchal & Graham, 2011), it rarely explores the response phase of hazard events specifically. Yet this body of research does describe dynamics

of decision-making among members of the family, which the emergency management literature has not done so far. This literature was collected primarily by doing keyword searches (e.g. "decision making," "stress + decision making," "conflict + decision making") in family science journals (including *Journal of Family Psychology*, *Journal of Marital and Family Therapy*, and *Journal of Marriage and the Family*) and through snowball searches. Additional literature from family economics, transportation logistics, and others areas was collected using keyword searches (e.g. “family decision-making,” “household decision-making”) in databases of scholarly literature including Google Scholar and EBSCO’s Academic Search.

Emergency Management Literature

The PADM is the best-researched model of decision-making in response to the threat of a hazard event in the emergency management literature. It is a multi-stage model that explores factors contributing to the decision to take protective actions at various times relative to the hazard event (i.e. before, during, and after the event) (Lindell & Perry, 2012). More specifically, the model describes the process by which individuals receive and process information from a variety of sources and integrates that information to respond via a search for additional information, emotion-focused coping, or a protective behavioral response (e.g. evacuation or sheltering-in-place) (Lindell & Perry, 2012). Pre-event, the model includes factors related to environmental and social context. During the event, the model includes factors related to psychological processes. Post-event, it includes situational impediments, facilitators, and a feedback mechanism. Each phase is broken into more fine-grained factors that are discussed below.

Within environmental and social context, six factors inform decision-making. These are environmental cues (e.g., a visual change in the weather or a chemical smell) (Aguirre, 1988; Lindell & Perry, 2012); social cues (e.g., seeing neighbors leave their home) (Lindell & Perry, 2012); information sources (e.g., use of social media or television news to gather information about the hazard) (Dash & Gladwin, 2007; Lindell & Perry, 2012; Sorensen, 2000); channel access and preference (e.g., if the respondent is Spanish-speaking, could he or she access information about the hazard in Spanish) (Lindell & Perry, 2012; Lindell, Lu, & Prater, 2005; Sorensen, 2000); warning messages (related to factors concerning the content and the source of the warning message or messages) (Dash & Gladwin, 2007; Lindell & Perry, 2012; Sorensen, 2000); and receiver characteristics (including demographic factors, access to vehicles, physical or psychomotor characteristics, and others) (Dash & Gladwin, 2007; Lindell & Perry, 2012; Nigg & Tierney, 1993). These factors interact with internal, psychological characteristics of the individual or household to affect how decisions about protective action are reached.

The following stage in the model includes psychological processes. Specifically, pre-decision psychological processes, exposure, attention and comprehension (Fiske & Taylor, 2008; Lindell & Perry, 2012; Lindell & Prater, 2010); perceptional processes of environmental threat, alternative protective actions, and social stakeholders (Fishbein & Azjen, 2011; Ge, Peacock, & Lindell, 2011; Lindell, 2013; Lindell & Perry, 2012); and the protective action decision making processes (Dash & Gladwin, 2007; Lindell & Perry, 2012; Sorensen & Vogt, 2009), risk identification (Drabek, 1986; Janis & Mann, 1977; Mileti & Beck, 1975; Perry, 1979), risk assessment (Lindell, Lu, & Prater, 2005; Lindell & Perry, 2012), protective action search

(Lindell & Perry, 2012; Mileti & Sorensen, 1990), protective action assessment (Lindell, Kang, & Prater, 2011; Lindell & Perry, 2012), protective action implementation (Lindell & Prater, 2012), information needs assessment (Lindell & Perry, 2012; Perry & Greene, 1983; Southern California Earthquake Center, 2011), communication action assessment (Drabek, 1969; Lindell & Perry, 1993; Lindell & Perry, 2012), and finally, communication action implementation (Drabek, 1969; Drabek & Stephenson, 1971; Lindell & Perry, 2012).

The model's final stage involves situational impediments (Heath, Kass, Beck & Glickman, 2001; Lindell & Perry, 2012; Van Willigen, Edwards, Edwards & Hessee, 2002) and situational facilitators (Lindell & Perry, 2012) to protective action, as well as a feedback mechanism (Kuligowski, 2011), which may send the decision-maker to an earlier stage in the model. The dependent variable of particular interest to this paper is "protective response" within the "behavioral response" box; however, "information search" and "emotion focused coping" are important variables for future research to consider.

Meta-analyses of hurricane evacuation studies have been conducted to determine which factors discussed above have had the greatest impact on decisions to evacuate or not evacuate. Results of these analyses indicate that "official warnings, mobile home residence, risk area residence, observations of environmental … and social … cues, and expectations of severe personal impacts all have consistently significant effects on household evacuation" (Huang, Lindell, & Prater, 2016, p. 1). Another study found that homeownership, official warning, risk area, seeing peers evacuating, expected hydrological impacts and expected wind impacts are significantly correlated to evacuation decision (Huang, 2014). Demographic variables have a weaker effect on the decision to evacuate and including gender, ethnicity, and presence of children. Reliance on peers for storm information and hurricane intensity also had a statistically limited relationship with evacuation decision making (Huang, 2014).

Although the PADM is the primary model used in emergency management literature to understand how people make protective action decisions, it leaves certain variables under-explored. Specifically, although household-level demographic data are important elements of the model, there are no finer-grain factors considered at the household level. In contrast, a substantial body of work in the family science literature considers how dynamics within a family affect response to a stressor. This literature, specifically the Family Stress Theory and the concept of family resilience, is discussed in the following section.

Family Science Literature

An early model of family behavior during periods of stress and crisis, presumably including disasters and other hazard events, was Family Stress Theory. Family Stress Theory, in very general terms, "may be described as, first, a set of theoretical statements regarding the period of crisis: *A (the event and related hardships) – interacting with B (the family's crisis meeting resources) – interacting with C (the definition the family makes of the event) – produce X (the crisis);* and second, a set of statements relating to: *the course of family adjustment which is said to involve (1) a period of disorganization, (2) an angle of recovery, and (3) a new level of organization*" (McCubbin et al., 1980, pp. 855-856). This theory has not been used extensively in the study of hazard events, and is in fact more typically used to study 'normative' rather than

'non-normative' events. Boss (1987) defines family stress as "pressure or tension … disturbance in the steady state of the family … It is normal and even desirable at times … With change comes disturbance, pressure – what we call stress" (p. 12). Although this definition is obviously not specific to disasters, in terms of the theoretical models available from this literature, it is the most applicable to disaster situations.

To the researchers' knowledge, family science researchers have not considered application of this model to the response phase of disasters. However, there is reason to believe they can be applied to this novel stress scenario. Particularly relevant to research on the effect of family relationships on decision-making in disasters are the factors that affect their vulnerability to stress (or conversely, their resilience to stress). There are several of these factors, respectively related to material and non-material familial resources (as well as the use of these resources), and to familial structure.

Resources (here meaning strengths of individuals, families, or larger systems that are valued or act as vehicles for obtaining that which is valued (Hobfoll & Spielberger, 1992a)) also contribute to management of stress and decision-making within families. These resources may be tangible (e.g., money and other material resources), as well as intangible (Hobfoll & Spielberger, 1992a). A number of intangible resources have been identified in the literature, including flexibility or adaptability (rather than rigidity), family cohesion (rather than separateness), openness of communication (rather than privacy), boundary clarity (rather than boundary ambiguity), and order and mastery (rather than chaos and helplessness) (Bush, Bohon, & Kim, 2009; McCubbin & Patterson, 1983; Noltemeyer & Bush, 2013; Riggs & Riggs, 2011; Walsh, 2015). Social support, including support from social networks, supportive behavior from family members, and subjective appraisals of support also contribute to family resources (Hobfoll & Spielberger, 1992b).

Merely having these resources, however, does not mean families will successfully respond to stressors. First, people with ample resources do not always use them; more specifically, resources and perceptions are interdependent, and people must recognize the need to use resources in order to do so (Boss, 1992). Families must also have the correct resources to respond to stressors. In other words, family resources cannot be evaluated outside the context of the stressor. For a resource to be used effectively it must fit current task demands (Cutrona, Cohen, & Igram, 1990; Waldren, Bell, Peek, & Sorrel, 1990). The idea of "fit" as influencing effectiveness of the use of resources has three dimensions. First, "fit" may mean resources are appropriate for addressing the demands of a particular task. Second, it may be used as a verb; that is, a family may actively manipulate the resource to meet task demands (e.g., diverting financial resources to addressing the need). Finally, it may be a process in which the way the resource is used changes over time as demands of the situation change (Hobfoll & Vaux, 1993; McCubbin & McCubbin, 1989).

Family structure, including context and processes by which decisions are made, also affects outcomes of the family's response to stress (Godwin & Scanzoni, 1989). Contextual factors include how loving or caring the family is, how cooperative members were during past conflicts, family members' commitment to familial relationships, modernity of gender role preferences (especially between spouses), and equality or inequality of economic resources

within the family (Godwin & Scanzoni, 1989). Along with context, processes of decision-making, including coerciveness of communication and the control various family members have over the process, affect how decisions are made or affect the extent to which a family reaches consensus (Godwin & Scanzoni, 1989; Gottman & Notarius, 2002). The model describing relationships between these contextual and process factors and resulting in a consensus is known as the Family Consensus-Building Model (Godwin & Scanzoni, 1989). In addition to family characteristics, individual characteristics and behaviors also affect decision-making (e.g., drug or alcohol use, and communication strategy) (Gottman & Notarius, 2002).

Responses to stress or outcomes of the decision-making process take several different forms (Hobfoll & Speilberger, 1992b). Coping strategies may include behavioral, emotional, and/or cognitive activities (Hobfoll & Spielberger, 1992b), echoing findings from the emergency management literature (e.g., Lindell & Perry, 2012). Coping activities may also fall along active/passive and anti-social/pro-social continuums (Hobfoll, Dunahoo, Ben-Porath, & Monnier, 1994). The column of "context" may be linked to Family Adaptability (or termed as family capability) in the Family Stress Model as an endogenous construct, where exogenous factors like "stress event" and "change" are specified.

More recently, family science researchers have conceptualized responses to stress using family adaptation and family resilience. As Hackbarth, Pavokv, Wetchler and Flannery (2012) explain, family adaptation can be understood to be "'the degree to which the family system alters its internal functions (behaviors, rules, roles, perceptions) and/or external reality to achieve an environment fit' (McCubbin & Patterson, 1983, p. 38), for a system (individual or family)" (p. 342). In contrast, "family resilience can be defined as the capacity of the family, as a functional unit, to withstand and rebound from stressful life challenges – emerging strengthened and more resourceful" (Walsh, 2016, p. 7). Black and Lobo (2008) identify several factors as affecting family resilience including positive outlook, spirituality, family member accord, flexibility, family communication, financial management, family time, shared recreation, routines and rituals, and support networks. Walsh (2016) identifies a similar set of factors, referred to as 'key processes in family resilience' (p. 7), and organizes them as belief systems (i.e., making meaning of adversity, positive outlooks, transcendence and spirituality), organizational processes (i.e., flexibility, connectedness, mobilization of social and economic resources), and communication/problem-solving processes (i.e., clarity, open emotional sharing, collaborative problem solving).

One iteration of the family adaptation concept is the Family Adjustment and Adaptation Response (FAAR) Model (Patterson, 1988), which links the Family Stress Model to a family resilience construct. The most important elements of the FAAR Model are family demands, family capabilities, family meanings, and family adjustment or adaptation – concepts that clearly relate to Family Stress Model and family resilience concepts. The outcome of the Family Stress Model, regenerative power, is referred to in the FAAR Model as family resilience. Positive outcomes along a number of family functions, including membership and family formation; economic support; nurturance, education, and socialization; and protection of vulnerable members, represent family resilience in this model (Patterson, 2002). This model also emphasizes the fact that resilience results from individual family members, from the family as a whole, and from multiple community contexts.

Additional Literature

A small amount of literature investigating how decision-making occurs within families from other fields was also collected. Findings of this research are more useful for raising additional questions to be investigated than providing established factors that affect decision-making. For example, in the consumer behavior literature authors have considered how roles within families may change depending on stages of the decision-making process (Davis & Rigaux, 1974) and who in the family makes which decisions (e.g., whether to investigate, which route to take, and what the destination will be) (Myers & Moncrief, 1978). Several additional factors also emerge from the family economics literature. These include relevance of costs and benefits in decision-making (Mincer, 1978), the difference between a family member's preferences for themselves as individuals, and for the family as a unit (Brett, 1998), and the effects of demographic factors of family members (e.g. employment status, age, education, and income) on decision-making authority (Bertocchi, Brunetti, & Torricelli, 2014).

The final field from which literature about intra-family evacuation decision-making was drawn is transportation logistics. Transportation scholars found that, in no-notice disasters, parents are more likely to pick up their children from school (Liu, Murray-Tuite, & Schweitzer, 2011), and evacuation destination is influenced by hurricane position during evacuation, geographic location of the household, race, income, preparation time, changes to evacuation plans, having previously experienced a hurricane, whether or not members of the household were at work during the evacuation, and evacuation notices (Hasan, Mesa-Arango, & Ukkusuri, 2013). Other transportation literature develops models to determine how people select evacuation routes, hypothesizing that factors like official route recommendations, travel time, evacuation characteristics, and socioeconomic characteristics (e.g., Sadri, Ukkusuri, Murray-Tuite, & Gladwin, 2014). Still other transportation literature identifies factors that influence the number of groups households evacuate in, which include vulnerability, concern about reaching safety, income (Maghelal, Peacock, & Li, 2017), perception of risk, number of eligible drivers (Maghelal, Li, & Peacock, 2017), and having multiple vehicles (Maghelal, Li, & Peacock, 2017; Maghelal, Peacock, & Li, 2017).

Conceptual Model for Intra-Family Decision Making

The PADM provides valuable insight into how individuals and households make decisions during disasters. However, when considered in the context of family science and the research of other disciplines, several potential improvements to the model suggest themselves. The following discussion explores how the PADM could be modified to further improve our understanding of protective action decision-making.

Factors the literature has found to be important to consensus-building and decision-making can be grouped into three categories: factors that are external to the family (i.e., characteristics of the event), internal to the family (i.e., characteristics and quality of family relations and interactions), and family-compositional (i.e., characteristics of individual family members). Compared to the PADM, this model, which includes factors from the family science literature, addresses internal dynamics of a family that affect decision-making. These factors are

drawn largely from the Family Consensus-Building Model and elements of family resilience. They include family loving/caring, family prioritization, adaptability, cohesion, openness, flexibility, financial resources, social network, power sharing, role specialization, and resource sharing. Including these factors, which are independent of the hazard event, in analyses of hazard decision-making could greatly expand the explanatory power of emergency management's decision-making models.

Some hypotheses can be addressed without considering the relationship between internal and external factors on decision-making. For example, how do perceptions of family cohesiveness affect the speed with which consensus is reached? However, understanding how these internal, external, and family-compositional factors interact with each other will provide additional insight into how families come to decisions about how to respond to hazard events.

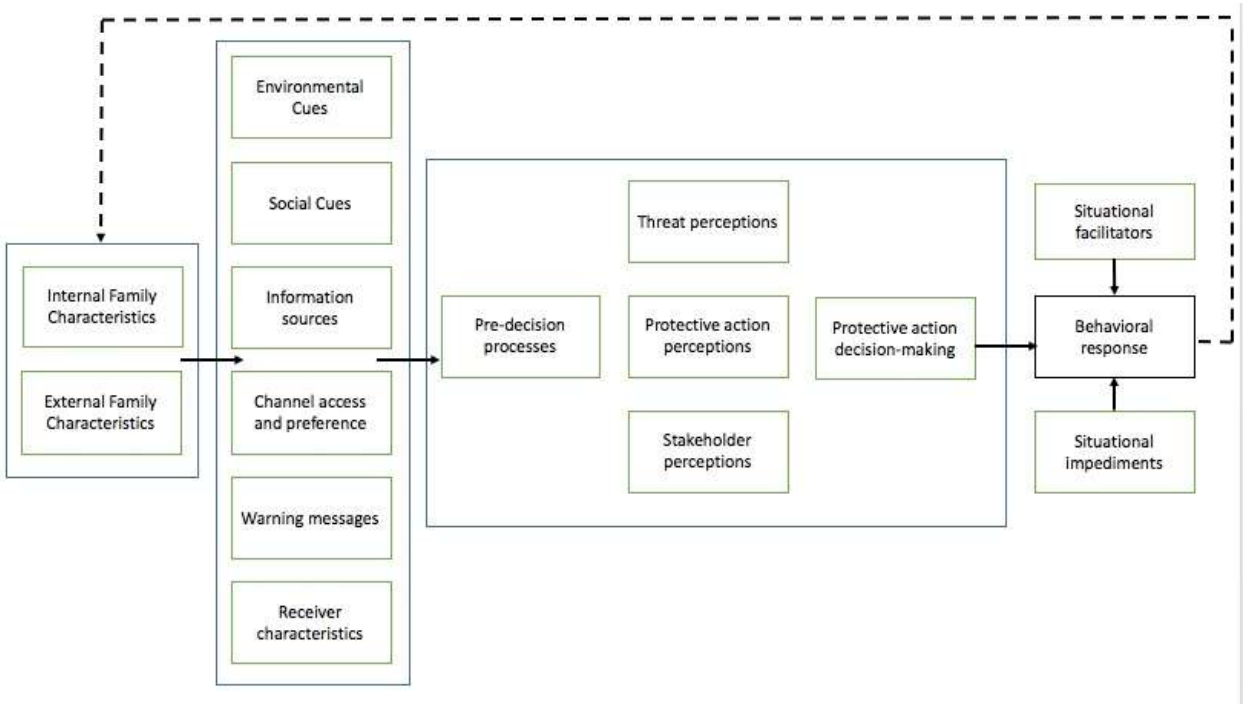

Figure 5 Hypothesized revision of Protective Action Decision Model

This model is a simplification of the component models (including the Protective Action Decision Model, which largely encapsulates the relationship between external factors, family-compositional factors, and the protective action decision), and family science models (which encapsulate the relationships between internal factors and protective action decisions, and between family-compositional and internal factors). A model that recognizes that all three classes of factors (i.e., family-compositional, internal factors, and external factors) are interconnected and influence the protective action decision will provide a more holistic and complete description of how people make protective action decisions. Data from multiple family members concerning protective action decision-making related to a specific hazard event will help specify and improve this basic model.

Conclusion

To more completely understand the decision-making process that families undertake in response to hazard events, it is necessary to expand beyond the factors traditionally examined in emergency management research. The traditional household demographic factors that are most frequently investigated may have significant explanatory power, but the presence of the substantial body of family science literature on how decisions are negotiated within families suggests there may be additional variables that are worth investigating. The Family Stress and Family Consensus-building models described above provide a set of factors for emergency management scholars to investigate, particularly related to material and non-material familial resources (as well as the use of these resources), and familial structure.

It is difficult to anticipate how the factors identified by the family science literature might affect family decision-making during disaster response. Although this research has investigated the role family resilience plays during disaster recovery, to the authors' knowledge, no research has investigated its role in response. Unlike recovery, decision-making in response occurs during an abbreviated timeframe, in some cases no more than a few hours. The conceptual model developed in this paper seeks to begin to identify which factors from the family science literature may influence decision-making during response, but it must be left to future researchers to determine how these factors influence decision-making. Specifying the Protective Action Decision Model with these additional variables may improve researchers' understanding of how families decide to take protective action in the context of a natural hazard, and provide insight in how to influence that decision-making process.

Acknowledgement

This work was supported by the National Science Foundation under Grant CMMI 1520338. Any opinions, findings, and conclusions expressed in this paper are those of the authors and do not necessarily reflect the views of the National Science Foundation.

Amanda Savitt is a doctoral student and Research Assistant at North Dakota State University. Department of Emergency Management, North Dakota State University, Dept. 2351, P.0. Box 6050, Fargo, ND 58108-6050.

Yue "Gurt" Ge is an Assistant Professor in the School of Public Administration, at the University of Central Florida, HPA2 238, 4364 Scorpius Street Orlando, FL 32816-1395.

References

Aguirre, B. E. (1988). The lack of warnings before the Saragosa tornado. *International Journal of Mass Emergencies and Disasters*, *6*(1), 65-74.

Bertocchi, G., Brunetti, M., & Torricelli, C. (2014). Who holds the purse strings within the household? The determinants of intra-family decision making. *Journal of Economic Behavior & Organization*, *101*, 65-86. https://doi.org/10.1016/j.jebo.2014.02.012

Black, K., & Lobo, M. (2008). A conceptual review of family resilience factors. *Journal of family nursing*, *14*(1), 33-55. https://doi.org/10.1177/1074840707312237

Boss, P. (1987). Family stress. In *Handbook of marriage and the family* (pp. 695-723). New York: Plenum Press.

Boss, P. (1992). Primacy of perception in family stress theory and measurement. *Journal of Family Psychology*, *6*(2), 113. http://dx.doi.org/10.1037/0893-3200.6.2.113

Bush, K. R., Bohon, S. A., & Kim, H. (2009). Stress and coping among immigrant families. In S. J. Price, & C. Price (Eds.). Families and change: Coping with stressful events and *transitions* (4th ed.) (pp. 285–310). Thousand Oaks, CA: Sage.

Brett, C. (1998). Tax reform and collective family decision-making. *Journal of Public Economics, 70*(3), 425-440. https://doi.org/10.1016/S0047-2727(98)00043-7

Cromwell, V. L., & Cromwell, R. E. (1978). Perceived dominance in decision-making and conflict resolution among Anglo, Black, and Chicano couples. *Journal of Marriage and the Family, 40*(4), 749-759. http://dx.doi.org/10.2307/351196

Cutrona, C. E., Cohen, B. B., & Igram, S. (1990). Contextual determinants of the perceived supportiveness of helping behaviors. *Journal of Social and Personal Relationships, 7*(4), 553-562. https://doi.org/10.1177/0265407590074011

Dash, N., & Gladwin, H. (2007). Evacuation decision making and behavioral responses: Individual and household. *Natural Hazards Review*, *8*(3), 69-77. https://doi.org/10.1061/(ASCE)1527-6988(2007)8:3(69)

Davis, H. L., & Rigaux, B. P. (1974). Perception of marital roles in decision processes. *Journal of Consumer Research*, *1*(1), 51-62. https://doi.org/10.1086/208581

Drabek, T. E. (1969). Social processes in disaster: Family evacuation. *Social Problems*, 336-349. https://doi.org/10.2307/799667

Drabek, T. E. (1986). *Human system responses to disaster: An inventory of sociological findings.* New York: Springer-Verlag.

Drabek, T. E., & Stephenson, J. S. (1971). When disaster strikes. *Journal of Applied Social Psychology, 1*(2), 187-203. https://doi.org/10.1111/j.1559-1816.1971.tb00362.x

Dynes, R. R., Quarantelli, E. L., & Wenger, D. (1988). The organizational and public response to the September 1985 earthquake in Mexico City, Mexico. Final Report #35. Newark, DE: Disaster Research Center.

Epstein, N. B., Bishop, D. S., & Baldwin, L. M. (1982). McMaster Model of Family Functioning: A view of the normal family. In F. Walsh (Ed.), *Guilford family therapy series. Normal family processes* (pp. 115-141). New York: Guilford Press.

Fishbein, M., & Ajzen, I. (2011). *Predicting and changing behavior: The reasoned action approach*. Mahwah, NJ: Taylor & Francis.

Fiske, S. T., & Taylor, S. E. (2008). *Social cognition: From brains to culture*. Boston: McGraw-Hill.

Ge, Y., Peacock, W. G., & Lindell, M. K. (2011). Florida households' expected responses to hurricane hazard mitigation incentives. *Risk Analysis*, *31*(10), 1676-1691. https://doi.org/10.1111/j.1539-6924.2011.01606.x

Godwin, D. D., & Scanzoni, J. (1989). Couple consensus during marital joint decision-making: A context, process, outcome model. *Journal of Marriage and the Family*, 943-956. https://doi.org/10.2307/353207

Gottman, J. M., & Notarius, C. I. (2002). Marital research in the 20th century and a research agenda for the 21st century. *Family Process*, *41*(2), 159-197. https://doi.org/10.1111/j.1545-5300.2002.41203.x

Greenhalgh, T., & Peacock, R. (2005). Effectiveness and efficiency of search methods in systematic reviews of complex evidence: audit of primary sources. *BMJ (Clinical research ed.)*, *331*(7524), 1064-1065.

Hackbarth, M., Pavkov, T., Wetchler, J., & Flannery, M. (2012). Natural disasters: An assessment of family resiliency following Hurricane Katrina. *Journal of Marital and Family Therapy*, *38*(2), 340-351. https://doi.org/10.1111/j.1752-0606.2011.00227.x

Hasan, S., Mesa-Arango, R., & Ukkusuri, S. (2013). A random-parameter hazard-based model to understand household evacuation timing behavior. *Transportation Research Part C: Emerging Technologies*, *27*, 108-116. https://doi.org/10.1016/j.trc.2011.06.005

Heath, S. E., Kass, P. H., Beck, A. M., & Glickman, L. T. (2001). Human and pet-related risk factors for household evacuation failure during a natural disaster. *American Journal of Epidemiology*, *153*(7), 659-665. https://doi.org/10.1093/aje/153.7.659

Hobfoll, S. E., Dunahoo, C. L., Ben-Porath, Y., & Monnier, J. (1994). Gender and coping: The dual-axis model of coping. *American Journal of Community Psychology*, *22*(1), 49-82. https://doi.org/10.1007/BF02506817

Hobfoll, S. E., & Spielberger, C. D. (1992a). Process of family stress: A response to Boss (1992) and Kazak (1992). *Journal of Family Psychology, 6*(2), 125-127. http://dx.doi.org/10.1037/0893-3200.6.2.125

Hobfoll, S. E., & Spielberger, C. D. (1992b). Family stress: Integrating theory and measurement. *Journal of Family Psychology*, *6*(2), 99. http://dx.doi.org/10.1037/0893-3200.6.2.99

Hobfoll, S. E., & Vaux, A. (1993). Social support: Social resources and social context. In L. Goldberger & S. Breznitz (Eds.), *Handbook of stress: Theoretical and clinical aspects* (pp. 685-705). New York, NY: Free Press.

Huang, S. K. (2014) Households' evacuation decision in response to Hurricanes Katrina and Rita (Unpublished doctoral dissertation). Texas A & M University, College Station, TX.

Huang, S. K., Lindell, M. K., Prater, C. S., Wu, H. C., & Siebeneck, L. K. (2012). Household evacuation decision making in response to Hurricane Ike. *Natural Hazards Review*, *13*(4), 283-296. https://doi.org/10.1061/(ASCE)NH.1527-6996.0000074

Huang, S. K., Lindell, M. K., & Prater, C. S. (2016). Who leaves and who stays? A review and statistical meta-analysis of hurricane evacuation studies. *Environment and Behavior*, *48*(8), 991-1029. https://doi.org/10.1177/0013916515578485

Janis, I. L., & Mann, L. (1977). *Decision making: A psychological analysis of conflict, choice, and commitment*. New York, NY: Free Press.

Jensen, J. A. (2013). Report of the research standards group. Emmitsburg, MD: Higher Education Program, Emergency Management Institute, Federal Emergency Management Agency.

Kuligowski, E. D. (2011). *Terror defeated: Occupant sensemaking, decision-making and protective action in the 2001 World Trade Center disaster* (Doctoral dissertation). Retrieved from: https://scholar.colorado.edu/socy_gradetds/4

Lindell, M. (2013). North American cities at risk: Household responses to environmental hazards. In *Cities at risk* (pp. 109-130). Springer Netherlands: Dordrecht.

Lindell, M. K., Kang, J. E., & Prater, C. S. (2011). The logistics of household hurricane evacuation. *Natural Hazards*, *58*(3), 1093-1109. https://doi.org/10.1007/s11069-011-9715-x

Lindell, M. K., Lu, J. C., & Prater, C. S. (2005). Household decision making and evacuation in response to Hurricane Lili. *Natural Hazards Review*, *6*(4), 171-179. https://doi.org/10.1061/(ASCE)1527-6988(2005)6:4(171)

Lindell, M. K., & Perry, R. W. (1993). Risk area residents' changing perceptions of volcano hazard at Mt. St. Helens. In *Prediction and perception of natural hazards* (pp. 159-166). Springer Netherlands: Dordrecht.

Lindell, M. K., & Perry, R. W. (2012). The protective action decision model: theoretical modifications and additional evidence. *Risk Analysis*, *32*(4), 616-632. https://doi.org/10.1111/j.1539-6924.2011.01647.x

Lindell, M. K., & Prater, C. S. (2010). Tsunami preparedness on the Oregon and Washington coast: recommendations for research. *Natural Hazards Review*, *11*(2), 69-81. https://doi.org/10.1061/(ASCE)1527-6988(2010)11:2(69)

Lindell, M. K., & Prater, C. S. (2002). Risk area residents' perceptions and adoption of seismic hazard adjustments. *Journal of Applied Social Psychology*, *32*(11), 2377-2392. https://doi.org/10.1111/j.1559-1816.2002.tb01868.x

Liu, S., Murray-Tuite, P., & Schweitzer, L. (2011). Relocating children in daytime no-notice evacuations: Methodology and applications for transport systems of personal vehicles and buses. *Transportation Research Record: Journal of the Transportation Research Board*, (2234), 79-88. https://doi.org/10.3141/2234-09

Maghelal, P., Li, X., & Peacock, W. G. (2017). Highway congestion during evacuation: examining the household's choice of number of vehicles to evacuate. *Natural hazards*, *87*(3), 1399-1411.

Maghelal, P., Peacock, W. G., & Li, X. (2016). Evacuating together or separately: factors influencing split evacuations prior to Hurricane Rita. *Natural Hazards Review*, *18*(2), 04016008.

McCubbin, M. A., & McCubbin, H. I. (1989). Theoretical orientations to family stress and coping. *Treating Stress in Families*, 3-43.

McCubbin, H. I., Joy, C. B., Cauble, A. E., Comeau, J. K., Patterson, J. M., & Needle, R. H. (1980). Family stress and coping: A decade review. *Journal of Marriage and the Family*, 855-871. https://doi.org/10.2307/351829

McCubbin, H. I., & Patterson, J. M. (1983). The family stress process: The double ABCX model of adjustment and adaptation. *Marriage & Family Review*, *6*(1-2), 7-37. https://doi.org/10.1300/J002v06n01_02

Mileti, D. S., & Beck, E. M. (1975). Communication in crisis explaining evacuation symbolically. *Communication Research*, *2*(1), 24-49. https://doi.org/10.1177/009365027500200102

Mileti, D. S., & Sorensen, J. H. (1990). *Communication of emergency public warnings: A social science perspective and state-of-the-art assessment* (No. ORNL-6609). Oak Ridge National Lab., TN (USA).

Mincer, J. (1978). Family migration decisions. *Journal of Political Economy*, *86*(5), 749-773. https://doi.org/10.1086/260710

Moos, R. H., & Moos, B. S. (1974). *Family environment scale*. Palo Alto, CA: Consulting Psychologists Press.

Myers, P. B., & Moncrief, L. W. (1978). Differential leisure travel decision-making between spouses. *Annals of Tourism Research*, *5*(1), 157-165. https://doi.org/10.1016/0160-7383(78)90009-9

Nigg, J., & Tierney, K. (1993). *Disasters and social change: Consequences for community action and affect.* Newark, DE: Disaster Research Center, University of Delaware.

Noltemeyer, A. L., & Bush, K. R. (2013). Adversity and resilience: A synthesis of international research. *School Psychology International*, *34*(5), 474-487. https://doi.org/10.1177/0143034312472758

Olson, D., Cromwell, R., & Klein, D. (1975). Beyond family power, pp 235-240. *Power in Families*. New York: Wiley.

Olson, D. H., & McCubbin, H. I. (1982). Circumplex model of marital and family systems. V. Application to family stress and crisis intervention. In H. McCubbin, A.E. Cauble, & J.M. Patterson (Eds.). *Family stress, coping and social support.* Springfield, IL: Charles C Thomas.

Parsons, T., & Bales, R. F. (1956). *Family socialization and interaction process*. London: Routledge.

Patterson, J. M. (1988). Families experiencing stress: I. The Family Adjustment and Adaptation Response Model: II. Applying the FAAR Model to health-related issues for intervention and research. *Family Systems Medicine*, *6*(2), 202. http://dx.doi.org/10.1037/h0089739

Patterson, J. M. (2002). Integrating family resilience and family stress theory. *Journal of Marriage and Family*, *64*(2), 349-360. https://doi.org/10.1111/j.1741-3737.2002.00349.x

Perry, R. W. (1979). Evacuation decision-making in natural disasters. *Mass Emergencies*, *4*(1), 25-38.

Perry, R. W., & Greene, M. R. (1983). *Citizen response to volcanic eruptions: The case of Mt. St. Helens*. New York, NY: Irvington.

Rigg, J., Law, L., Tan-Mullins, M., & Grundy-Warr, C. (2005) The Indian Ocean tsunami: Socioeconomic impacts in Thailand. *The Geographical Journal, 171*(4), 374–9. https://doi.org/10.1111/j.1475-4959.2005.00175_3.x

Riggs, S. A., & Riggs, D. S. (2011). Risk and resilience in military families experiencing deployment: The role of the family attachment network. *Journal of family psychology*, *25*(5), 675. https://doi.org/10.1037/a0025286

Oliveri, M. E., & Reiss, D. (1981). A theory-based empirical classification of family problem-solving behavior. *Family Process*, *20*(4), 409-418. https://doi.org/10.1111/j.1545-5300.1981.00409.x

Sadri, A. M., Ukkusuri, S. V., Murray-Tuite, P., & Gladwin, H. (2014). Analysis of hurricane evacuee mode choice behavior. *Transportation Research Part C: Emerging Technologies*, *48*, 37-46. https://doi.org/10.1016/j.trc.2014.08.008

Sorensen, J. H. (2000). Hazard warning systems: Review of 20 years of progress. *Natural Hazards Review*, *1*(2), 119-125. https://doi.org/10.1061/(ASCE)1527-6988(2000)1:2(119)

Sorensen, J., & Vogt, B. (2009). *Interactive emergency evacuation guidebook. Protective Action IPT – Chemical Stockpile Emergency Preparedness Program*. Washington, DC: Department of Homeland Security.

Southern California Earthquake Center. (2011). Uniform California Earthquake Rupture Forecast (UCERF). Retrieved from: www.scec.org/ucerf/

Steffen, S. L., & Fothergill, A. (2009). 9/11 Volunteerism: A pathway to personal healing and community engagement. *Social Science Journal*, 46(1), 29-46. https://doi.org/10.1016/j.soscij.2008.12.005

Van Willigen, M., Edwards, T., Edwards, B., & Hessee, S. (2002). Riding out the storm: Experiences of the physically disabled during Hurricanes Bonnie, Dennis, and Floyd. *Natural Hazards Review*, *3*(3), 98-106. https://doi.org/10.1061/(ASCE)1527-6988(2002)3:3(98)

Waldren, T., Bell, N. J., Sorell, G., & Peek, C. (1990). Cohesion and adaptability in post-divorce remarried and first married families: Relationships with family stress and coping styles. *Journal of Divorce & Remarriage*, *14*(1), 13-28. https://doi.org/10.1300/J087v14n01_03

Walsh, F. (2007). Traumatic loss and major disasters: Strengthening family and community resilience. *Family process*, *46*(2), 207-227. https://doi.org/10.1111/j.1545-5300.2007.00205.x

Walsh, F. (2015). *Strengthening family resilience* (3rd ed). New York, NY: Guilford.

Walsh, F. (2016). Family resilience: A developmental systems framework. *European Journal of Developmental Psychology*, *13*(3), 313-324. https://doi.org/10.1080/17405629.2016.1154035

Warchal, J. R., & Graham, L. B. (2011). Promoting positive adaptation in adult survivors of natural disasters. *Adultspan Journal*, *10*(1), 34-51. https://doi.org/10.1002/j.2161-0029.2011.tb00005.x

Wilkening, E. A., & Bharadwaj, L. K. (1967). Dimensions of aspirations, work roles, and decision-making of farm husbands and wives in Wisconsin. *Journal of Marriage and the Family, 29*(4), 703-711. https://doi.org/10.2307/349223