

**Committee on Population Expert Meeting
Advancing Behavioral and Social Research
on the Elderly in Disasters*
The National Academies
September 14, 2009**

MEETING REPORT

Rev. October 23, 2009

I. Introduction

Several recent disasters have served as reminders that older people can be both more vulnerable and in some ways more resilient than younger people. Research in the social and behavioral sciences can be useful both for the practical work of helping future efforts to prepare for or mitigate disasters and for the scientific understanding of aging, health, and well-being. An expert meeting on advancing behavioral and social research on the elderly in disasters, convened on Monday, September 14, 2009, at The National Academies and chaired by Duncan Thomas, was sponsored by the National Institute on Aging (NIA) to foster better communication between researchers in the aging and disaster planning fields and to solicit suggestions for future research priorities in this area. Meeting participants considered how the social and behavioral sciences might contribute research on the elderly in disasters, with particular emphases on settings and institutions; data challenges; and modeling. Attendees included invited experts in the fields of psychology, sociology, demography, simulation modeling, public policy, epidemiology and public health, and geriatrics; staff from the NIA, the National Institute of Nursing Research (NINR), the National Library of Medicine, the National Science Foundation (NSF), U.S. Department of Health and Human Services (DHHS) Office of the Assistant Secretary of Preparedness and Response, Department of Homeland Security (Science & Technology Directorate and Office of Health Affairs/Office of Medical Readiness); and staff from the National Academies.

In his opening remarks, John Haaga underscored the NIA's interest in supporting research that is useful for understanding aging processes while also informing disaster preparedness and mitigation. The NIA, in collaboration with the National Institute of Child Health and Human Development, the NINR, and the Office of Behavioral and Social Science Research, signaled their interest in this research area in 2006 through the release of several National Institutes of Health (NIH) program announcements soliciting grant applications in the area of behavioral and

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social research on disasters and health.¹ These program announcements cast a wide net by welcoming examination of the consequences of both natural and manmade disasters for the health of children, the elderly, and vulnerable groups, with an ultimate goal of preventing or mitigating harmful consequences. Examples of disasters of interest include severe weather-related events, earthquakes, large-scale attacks on civilian populations, technological catastrophes or perceived catastrophes, and influenza pandemics. A small number of grants were funded as part of this program. Some of the challenges faced by those working in the field included a general mistrust in the social sciences of hypothetical data (i.e., surveys asking people how they would behave under specific scenarios) and of the validity of recall data. Data constraints also have discouraged research on disasters, for example, it has been difficult for investigators to study areas hit by disasters with ongoing or nationally representative cohorts because the numbers of study respondents in affected areas are simply too few, with the possible exception of a few surveys with oversamples in Florida and the Gulf States. The regular NIH review process is not conducive to quick-response research implemented after a disaster strikes or in the unfolding of a major public health emergency such as the H1N1 pandemic in 2009.

Two major natural disasters of recent years hit older adults particularly hard—the Chicago heat wave of 1995 and Hurricane Katrina in 2005.² Participants shared analyses about these disasters and also contributed insights about disasters and aging from other countries, including the 2003 European heat wave, forced migration of population groups under harsh conditions in Cambodia, and the aftermath of the 2004 tsunami in Indonesia as well as research about lessons learned from hurricanes in Florida and planning for pandemic influenza. The following report highlights the main themes from the meeting presentations and discussion, with particular emphasis on future priority areas. The meeting agenda and roster of participants are included as appendices A and B.

II. What Is a Disaster?

Governments spend most of their time planning for emergencies, in Thomas Glass's view, yet emergencies are fundamentally and qualitatively different from disasters.³ He defines a disaster to be an event with a diffuse or lack of perimeter and relatively high casualties where demand characteristics exceed locally available response capacity (hospitals, clinics, pharmacies, emergency medical services [EMS], fire, public safety, transportation), systems set up for emergencies fail or work miserably, professional help is insufficient or impaired, and civilian

¹ See PA-07-141 (R01) at <http://grants.nih.gov/grants/guide/pa-files/PA-07-141.html>; PA-06-452 (R21) at <http://grants.nih.gov/grants/guide/pa-files/PA-06-453.html>; and PA06-453 (R03) at <http://grants.nih.gov/grants/guide/pa-files/PA-06-452.html>.

In April 2009, the National Institute of Mental Health released a set of program announcements on Rapid Assessment Post-Impact of Disaster, active through April 23, 2012: PAR-09-171 (R03) at <http://grants.nih.gov/grants/guide/pa-files/PA-09-171.html> and PAR-09-172 (R21) at <http://grants.nih.gov/grants/guide/pa-files/PA-09-171.html>.

² Hudson RB. Disasters and Aging. *Public Policy & Aging Report*. 2006;16(2):2.

³ In 1987, Kent argued for a new conceptualization of disasters, asserting that what we think of as disasters, like a hurricane or a flood, are disaster agents. “[O]nly when an agent exposes the vulnerability of a people that the disaster agent can lead to a disaster.” See page 2, Kent RC. *Anatomy of Disaster Relief: The International Network in Action*. New York: Pinter Publishers, 1987.

assistance is galvanized.⁴ By his definition, the 1995 Kobe earthquake would constitute a major disaster, with 6,279 deaths (90 percent occurring during building collapse); 35,000 injured; 300,000 homeless; 300 fires; and severed transportation, roads, bridges, communications, and water supply. On the other hand, the 1993 World Trade Center bombing did not rise to the level of a disaster because the event was associated with 1,042 injuries and only 6 deaths, and the response capacity was more than adequate in New York City. Other events loosely termed “disasters,” such as the West Nile virus outbreak, anthrax scare, or Washington, DC, sniper attacks, also would be better understood as emergencies in this dichotomy. Among the implications of this distinction is that it can be perilous to generalize patterns and procedures from emergencies to disaster situations. The 911 system and EMS (e.g., ambulances) are typically quite efficient during emergencies but break down when overloaded by a disaster. EMS is a system designed to respond to emergencies but needs the support of major logistical response systems to respond to a disaster. Disaster planning would suggest recognizing the limits of hospitals and EMS, and the necessity of partnering with private means of transportation. Satellite phones and/or ham radios are often the only way to communicate.

It was noted that disasters are not created equal, and it can be difficult to generalize from one crisis given differences in intensity, duration, social context, and affected population. Some disasters, like hurricanes, can be tracked, resulting in better forecasting and evacuation messaging. There remains uncertainty with the decision to evacuate or shelter in place which has led to increased interest in the outcomes of decisions made. Thus, attention has shifted from hurricane-related morbidity and mortality immediately after impact to that occurring long after in the post-impact area. Other disasters, like earthquakes, occur without warning; but preparation prior to an earthquake can mitigate injury and damage.

Until recently, the study of heat waves and their consequences has generally been neglected in disaster research because they do not induce massive property damage (and thus are not included in insurance databases) and their victims are primarily the elderly, minorities, poor, and the isolated. But recognition that heat waves cause more deaths in a typical year in the United States than in all other natural disasters combined should make them a higher priority for research on the health and well-being of the elderly.⁵

III. Why Might Age Matter?

One participant suggested the need in this research to consider behavioral and social factors that affect (a) preparation for disasters; (b) response to disasters, including mortality and evacuation; and (c) the impact after disasters, including post-traumatic stress disorders (PTSD), health problems, loss of social resources, and morbidity. Older adults are at markedly increased risk of mortality during a disaster, but older adults in the community show surprisingly better long-term psychological outcomes than their younger counterparts.

⁴ Glass TA. Disasters and older adults: Bringing a blind spot into the light. *Public Policy and Aging Report*. 2006;16(2):1, 3-7.

⁵ Klinenberg E. Before the flood: What policymakers can learn from the Great Chicago Heat Wave. *Public Policy & Aging Report*. 2006;16(2):1, 20-23. See also Klinenberg E. *Heat Wave: A Social Autopsy of Disaster*. Chicago, IL: The University of Chicago Press, 2002.

Psychological Resilience

The research literature suggests that older adults fare better than younger and middle-age adults after disaster strikes, possibly because of better coping styles, positivity, and/or inoculation from earlier challenging experiences, especially experiences with similar disasters. For example, after the Northridge earthquake, older adults expressed less psychological distress than middle aged and younger adults, and need to experience greater neighborhood damage to register equivalent psychological distress.⁶

Another example comes from a study of psychological sequelae of the 2004 Florida hurricanes, which found counts of PTSD symptoms, general anxiety, and major depressive episodes associated with functional impairments to be lower for adults aged 60+ compared to adults aged 18 to 35.⁷ The better outcomes for older adults counter research that shows sensitization to repeated events and may be due in part to selection effects if the most incapacitated who die are disproportionately elderly. It also was noted that consistent stress experienced during the aftermath of an event can be more damaging than that experienced during an acute event.

The more favorable psychological makeup of older adults may actually have the perverse effect of minimizing perceived danger and/or need for preparation. As example, the proportion of surveyed individuals reporting earthquake preparedness steps increased after the 1994 Northridge earthquake in California but with a significant age difference where older adults took fewer steps compared to younger adults.⁸ Factors hampering preparedness include expense, how complicated the preparedness step is, functional limitations, and lack of family support.

Neurocognitive Aspects and Affective Dynamics of Elderly

Neurocognitive aspects and affective dynamics offer promising new avenues to disaster research in older adults. It is important to distinguish between decisions about the elderly and decisions by the elderly. For the latter, it would be helpful to know how elderly discount, whether there is negative/positivity bias, whether message framing that emphasizes gains would be more effective, and how those factors should shape risk communication with older adults about disaster preparation and how to respond during a disaster.⁹

A secondary issue has to do with flows of information or news that mediate the impact of any kind of crisis, whether a hurricane, pandemic influenza, or heat wave. How do people adjudicate

⁶These results are reported in Knight BG, Gatz M, Heller K, Bengtson VL. Age and emotional response to the Northridge earthquake: A longitudinal analysis. *Psychology and Aging*, 2000;15: 627-634.

⁷ Acierno, et al. (2007).

⁸ Reported by Margaret Gatz using the Modified Mercalli Intensity Index constructed from responses from 134 individuals from multigenerational families with one or more members in areas affected by earthquake as part of the NSF-sponsored study of the Longitudinal Study of Generations panel. See Heller K, Alexander DB, Gatz M, Knight BG, Rose T. Social and personal factors as predictors of earthquake preparation: The role of support provision, network discussion, negative affect, age, and education. *Journal of Applied Social Psychology*, 2005; 35:399-422.

⁹ See research on emotion, loneliness, and the elderly by Lisa Barrett (Harvard University) and John Cacioppo (University of Chicago). For a summary of research frontiers in the area of decision making and motivation with respect to adult development and aging, see Carstensen LL and Hartel CR, Eds. *When I'm 64*. Washington, D.C.: The National Academies Press, 2006.

competing lines of authority with sometimes different instructions? In a world of distributed authority, citizens increasingly challenge expert knowledge, and the distinction between experts and citizens has broken down in compelling ways.

Exposure, Susceptibility, and Perception of Risk

In contrast to seasonal influenza, which places the elderly at high risk, the current pandemic H1N1 influenza has so far been a greater risk for younger persons and children (who were not alive to be exposed to the 1957 influenza pandemic). Blumenshine (2008) hypothesized that disparities in social position based on income, wealth, education, occupation, and race/ethnicity contribute to health disparities during influenza pandemic that ultimately lead to unequal levels of illness and death.¹⁰ Sandra Quinn presented findings from a national study of H1N1 attitudes and behaviors, which utilized a nationally representative sample. Mid- and late-life Americans perceive differently their risk for this virus.¹¹ About 45 percent of the 75+ group reported concerns about getting H1N1 but less than 23 percent in this group thought it likely they would be infected. Few see the pandemic as very severe. More than 50 percent of the two younger groups (ages 55 to 64 and 65 to 74) feel confident they can protect themselves compared to 64 percent of the 75+ group. All groups overwhelmingly support the distribution of vaccines at designated public sites. A majority do not support priority groups for vaccination (even though they are in a high priority group for seasonal flu vaccine). Seventy-eight percent of those in the oldest age group believe that influenza vaccine has been effective in protecting them in the past. However, over 28 percent of this same group was not confident that a newly developed vaccine or drug for H1N1 would be safe for them.

General Trust in Authorities and Traditional Media

Overwhelming majorities of older adults trust local, state, and federal public health authorities, including the DHHS Secretary; there is less trust of elected officials. At least 50 percent in each group judged the Government's response to H1N1 to be "handled about right." Trust in healthcare providers is extremely high. All three groups stated that local TV news followed by national TV news were their top two sources of information, with newspapers being the third choice for the middle and oldest groups. Their use of the Internet was very limited.

Given their high trust in government sources on influenza information and their history of prior vaccination, the elderly could be a potential asset in mobilizing their families and communities to seek H1N1 vaccination and to participate actively as volunteers in their communities for health care and other organizations stressed by overwhelming demands for services during the pandemic.

¹⁰ See Blumenshine P, Reingold A, Egerter S, Mockenhaupt R, Braveman P, Marks J. Pandemic influenza planning in the United States from a health disparities perspective. *Emerging Infectious Diseases*. 2008;14(5):709-15.

¹¹ Results from a national Internet survey on H1N1 influenza conducted between June 3 and July 6, 2009, drawn from Knowledge Networks' online panel involving 1,543 respondents (representing a 62 percent completion rate) aged 55 and above, as reported by Sandra Quinn. Quinn will be continuing this study with four surveys during this pandemic year, 2009-2010.

IV. Special Risks for Elderly

Typically, when we think of the elderly in the context of disasters, we think of vulnerabilities, frailty, special needs, immobility, and being overlooked. Older adults are at increased risk of mortality and morbidity, including arrhythmias, heart attacks, and glycemic instability in the aftermath of disasters.¹² The data seem pretty clear that compared to younger adults, older adults respond better immediately after a disaster but respond more poorly against continued significant stress, in part because of fixed incomes and more fragile health. If resilience of older adults is not expected to return to initial levels, this has implications for use of services, institutionalization, quality of life, and costs. It is not clear whether cognitive decline and dementia might be exacerbated post-disaster.

Older adults are most likely to suffer serious medical consequences from disasters that overwhelm local healthcare, community, and institutional resources and that impact health behaviors and social support. Their heterogeneity challenges service providers but also can be a strength. Recent experiences point to the critical advantages of electronic medical records accessible from outside the disaster region for maintaining chronic care of older adults.

Heterogeneity of Older Adults

It is difficult to identify elderly individuals in age-heterogeneous neighborhoods. Older adults themselves are heterogeneous, with an array of physical, informational, cognitive, and affective attributes, as well as diversity of living arrangements; e.g., institution, multilevel house, third-floor walkup. Adults with high levels of impairment and those living in nursing homes and assisted care facilities are most vulnerable to being overlooked within the National Disaster Medical System. While generally not as frail as nursing home residents, many community-residing elders are cognitively impaired and have limited social support, making them vulnerable to post-disaster relocation trauma, hospitalization, institutionalization, or death. Older adults also differ in extent of social networks, mobility, trust, adherence/compliance, and preparedness in the face of disasters. Younger-old and older-old adults may hold different sets of social expectations and face different life expectancies. Poverty, race/ethnicity, and gender are well documented in the sociology literature as accounting for differential outcomes in disasters, and a research focus on interactions with age would be helpful.

Excess Mortality

Older adults are more vulnerable with respect to mortality in the face of disasters. This was seen in post-Katrina New Orleans, during the Chicago and European heat waves, in Cambodia, and in post-tsunami Indonesia. In some cases, elderly individuals may be unable to evacuate because they live in poor areas, lack access to transportation, and/or have no place to go. A more provocative reason may be that for psychological and practical reasons, older adults may be less likely to respond to warnings to evacuate or to take other anticipatory action to mitigate the impact. On the other hand, experience may sometimes lead to more effective action; when the tsunami struck Thailand, some very old adults readily recognized the meaning of the receding sea, and they moved to higher ground before the wave struck.

¹² Glass (2006:4).

The forced relocation in 1975 of urbanites during the Khmer Rouge period in Cambodia required people to move by foot during the hottest months of the year over long distances.¹³ The elderly were the worst hit by the physical demands of the trek and famine conditions that emerged at the end of the regime. However, they were less vulnerable to armed conflict, which usually involves young male adults.

Post-tsunami Indonesia experienced much higher mortality, but prime-age males had much lower mortality than younger and older males, and mortality for females rose with age to some extent. Some of the gender difference in mortality pattern is attributed to differences in physical strength and the fact that women are traditionally not taught to swim. Household composition also appeared to make a difference in survival, disadvantaging households with an older adult, particularly an older female adult.

Preliminary data examining the impact of Hurricane Katrina on the mortality and morbidity of nursing home residents reveal the following: (1) Relative to 2003 to 2004, 30-day mortality post-Katrina doubled and remained 2 to 3 percentage points higher at 90 and 180 days; (2) relative to 2003 to 2004, the risk of hospitalization was 5 to 10 percentage points higher at 30 and 90 days post-Katrina but stabilized at 180 days (given elevated competing risks of mortality); (3) among survivors, relative to 2003 to 2004, post-Katrina there was a much higher increase in the likelihood of the residents declining 4 points in activities of daily living before and several months after the storm. In addition, the mortality rate, hospitalization rate, and the likelihood of functional decline among the residents in homes that evacuated were much higher than those that sheltered in place, raising questions about the human and system costs versus benefits of evacuating frail nursing home residents.¹⁴ Michael Smyer speculated that the lower use of mental health services by older adults in New Orleans could be due to stigma, altruism, depression, or proud reliance on experience and a survival mentality.

Social Support and Social Isolation

Frail elderly are dependent on some form of social institution for assistance and care, mainly informal supports such as family, but also formal supports. In the face of a disaster, family relationships can play an essential role in individual survival. Basic research about social structures before and after disasters is needed as well as the study of family relations involving older people.

Of particular concern is the rise of an aging population of urban residents who live alone, with limited or no social networks, and who become disabled and homebound. Socially isolated elderly are especially vulnerable to disaster-related morbidity and mortality. The importance of social support—the good neighbor, the caring community—seems by far to be the most

¹³ Heuveline P. The demographic analysis of mortality crises: The case of Cambodia, 1970-1979. Chapter 5 in Reed H and Kelly C, eds. *Forced Migration and Mortality*. Washington, DC: National Academy Press, 2001.

¹⁴ Mor and his colleagues intend to continue this line of research by comparing Hurricane Katrina and Hurricane Rita, Hurricane Gustav and Hurricane Ike, to estimate the effect of evacuation versus sheltering in place under alternate scenarios.

consistent psychologically protective factor in studies of older adults post-disaster.¹⁵ Diminished or low social support is addressable.

Institutional Living

Elderly living in nursing homes or other forms of long-term care may be more vulnerable if the institutions are not well regulated or poorly integrated in community emergency response systems. In the face of disaster, facility administrators must decide whether to evacuate and where to evacuate to, obtain needed transportation, retain direct care staff, maintain outside communication, and they must obtain resources post-disaster.¹⁶ For-profit nursing homes serve the Medicaid and dual-eligible populations but are viewed as being outside the Federal Emergency Management Agency safety net due to the limitations of the 2000 Stafford Act which limits the use of federal disaster funds to nonprofit entities. More nuanced studies are needed on how setting facility policy or federal regulatory oversight influences health and behavioral outcomes of elderly by type of disaster. Long-term follow-up of facility staff is needed. Kathryn Hyer pointed out that about 10 percent of those evacuated from nursing homes were moved after the hurricane passed. While some evacuations were necessary because the building was damaged during the storm, many nursing homes were not recognized as healthcare facilities.¹⁷ Power restoration was not a priority and elders were moved because nursing homes could not get needed equipment, diesel, and medications to maintain residents safely.

In terms of pandemic preparedness, nursing homes should be more informed about and involved in regional-level planning because they service a highly vulnerable population and employ many paraprofessional direct care workers as well as other salaried and contract staff. Research into surveillance and real-time monitoring is crucial because nursing homes often do not have personnel to define an outbreak and investigate it further, residents, their family members and other visitors and staff may be vectors in transmitting virus within the institution, and long-term care facilities may offer surge capacity for noninfluenza patients.

¹⁵ Acierno R, Ruggiero KJ, Kilpatrick DG, Resnick HS, Galea S. Risk and protective factors for psychopathology among older versus younger adults following the 2004 Florida hurricanes. *American Journal of Geriatric Psychiatry*, 2006; 14:1051-1059.

Acierno R, Ruggiero KJ, Galea S, Resnick HS, Koenen KC, Roitzsch J, de Arellano M, Boyle J, Kilpatrick DG. Psychological sequelae of the 2004 Florida hurricanes: Implications for post-disaster intervention. *American Journal of Public Health*. 2007;97:S103-108.

¹⁶ LuMarie Polivka-West noted that the distance necessary for a safe evacuation and the varied means of transport remain a source of uncertainty for decision-makers. On September 23, 2005, a motor coach, en route from Bellaire to Dallas, Texas, as part of the evacuation in anticipation of Hurricane Rita, was carrying 44 assisted living facility residents and nursing staff. Fifteen hours into the trip of gridlock interstate travel, the motor coach became engulfed in flames. Twenty-three passengers were fatally injured, two were seriously injured and nineteen received minor injuries. The National Transportation Safety Board (NTSB/HAR-07-01) found gaps in the federal motor carrier safety administration's review program, a lack of standards on emergency egress from motor coaches and fire resistance of materials and designs and the need to recognize the emergency transportation of persons with special needs.

¹⁷ Hyer K, Brown L, Berman A, Polivka-West L. Establishing and refining hurricane response systems for long-term care facilities. *Health Affairs*, 2006 August 29;25:Article 10.1377. Retrieved from <http://content.healthaffairs.org/cgi/content/abstract/hlthaff.25.w407v1>

Deficiencies in Chronic Care

Deficiencies in chronic care of the elderly are especially transparent under extreme conditions. The management of chronic diseases, including access and adherence to medications, ongoing dialysis as well as life-prolonging cancer treatments are key concerns for community-dwelling older adults after a disaster. During the recovery phase, chronic stress may lead to worse chronic disease control and ultimately worse outcomes.¹⁸ Lower medication adherence for treatment of chronic conditions (e.g., hypertension) after disasters can translate into more frequent cardiovascular events and mortality. Low adherence may be prolonged after disasters, limiting effectiveness of established treatments, representing lost opportunities to reduce adverse events and improve health, increasing medical costs, and increasing risk of hospitalization. Social and health behaviors of all sorts can be disrupted, further complicating chronic disease management—“people do not eat well after a disaster...often increasing their intake of high salt, high calorie foods in addition to increasing alcohol consumption,” as Marie Krousel-Wood observed. Understanding factors associated with poor medication adherence in the post-disaster setting may lead to better design of interventions to promote recovery.

Krousel-Wood presented findings from a self-administered cross-sectional survey fielded November 2005 to August 2006 in New Orleans to adults treated for hypertension.¹⁹ Respondents who were less than 65 years of age, non-white, less educated, male, and had complete damage to their homes were more likely to have imperfect medication adherence. Adjusting for age, gender, and race, participants reporting their residences to be completely damaged were nearly two times more likely to have imperfect medication adherence. When asked about post-disaster medication issues, respondents reported not bringing medications with them when they evacuated (7 percent), running out of medications (28 percent), difficulties getting prescriptions filled (16 percent), and medication change post-disaster (28 percent). Efforts to help identify medications or treatments were frustrated by the lack of electronic medical records. Patients receiving care from the Veterans Administration, other health care systems with electronic medical records accessible, or who had their prescriptions linked into national pharmacy databases had much better success because records could be accessed or quickly reconstructed, even if local providers could not be immediately located.

Post-Hurricane Katrina data from the Cohort Study of Medication Adherence in Older Adults show higher levels of low adherence among African Americans, those with low coping skills, and those with residence change (presumably associated with loss of social network), with extended effects 1 to 2 years out.²⁰ Depression and lack of social support or social isolation also are associated with low medication adherence. In post disaster situations, monitoring of depressive symptoms and social support may be necessary to optimize chronic disease management in the elderly.

¹⁸ Dehydration complicates drug regimens and can lead to strokes and death.

¹⁹ Krousel-Wood MA, Islam T, Muntner P, Stanley E, Phillips A, Webber LS, Frohlich ED, Re RN. Medication adherence in older clinic patients with hypertension after Hurricane Katrina: Implications for clinical practice and disaster management. *The American Journal of the Medical Sciences*, 2008; 336(2):99-104.

²⁰ Islam T, Muntner P, Webber L, Morisky D, Krousel-Wood MA. CoSMO: Extended effects of Hurricane Katrina on medication adherence among older adults. *Am J Med Sci*, 2008; 336:105-110.

These findings underscore how access to adequate medications for chronic disease is integral to successful disaster relief efforts, the need for electronic medical and prescription records to facilitate prescription refills, and the advisability of advance planning by patients and their physicians for prescription refills should disaster strike. Patients should be instructed that with disaster, they need to plan for more than 2 to 3 days of an evacuation and know what medications they are taking for what medical conditions, and where their prescriptions can be refilled. It would be helpful to compare the pharmacy fill rate before and after disasters to determine medication adherence patterns and to identify modifiable factors associated with low medication adherence.

V. Elderly as Assets During Times of Crises

As older adults live longer and healthier lives, they can play valuable roles for risk communication with their families and neighbors, with support from public health professionals. In minority communities, the elderly often have respected stature. A promising line of inquiry may be the use of media among older adults to promote evidence-based recommendations.

One can envision designing a system that harnesses existing social network resources for a civilian response system.²¹ The vast majority of older adults live independently in communities. Older adults therefore represent an untapped resource as potential agents of public response in a disaster. Public (i.e., nonprofessional) help is a critical factor in determining the outcome of a disaster. Senior volunteers have the capacity, time, and ability to be premobilized as “social capital antibodies.” Naturally occurring social networks that provide systems of support and response often arise organically under stressful conditions, yet governments continue to cling to an emergency preparedness line of thinking that focuses on buttressing professionals. Older adults with training and a computer might form the backbone of a civilian disaster response system; conducting outbreak surveillance; maintaining a block registry; identifying and monitoring vulnerable persons and symptoms; coordinating volunteers and services; distributing vaccines, medications, and supplies; supporting infection control measures; and reinforcing community shielding strategies. Harnessing existing social network resources for a civilian response system can do what an army of field epidemiologists could never do.

Post-disaster, the information that members of the public share electronically has often proven to be more timely and accurate than that provided by official spokespersons. Applications like texting, Facebook, and Twitter have helped to accelerate the sharing of information. A concern was raised about inequalities with respect to information access via new technologies, as older adults may be less familiar with new messaging tools. Given that communication infrastructures during crises can become overwhelmed (e.g., overloaded cellular networks and Internet servers), old technologies (e.g., radio) should not be discarded. Another suggestion was for governments and policymakers to build upon the natural adaptability of public transportation networks to foster communication during disasters.

²¹ The Experience Corps intergenerational initiative has had good experience mobilizing older people to work in school settings to help children while offering an outlet for social interaction by older individuals. The program capitalizes on participants’ sense of civic commitment and promotes an *esprit de corps*. See: http://www.experiencecorps.org/research/JHU_summary.html

Case Study: Community Shielding in the Fight Against Pandemics

For large-scale pandemics, social distance matters most.²² A community shielding strategy offers a noncoercive model of mass quarantine that prepares individuals to remain at home to minimize disease transmission.²³ It also has the advantages of lowering traffic congestion and hospital crowding and facilitates surveillance and deployment of countermeasures. Community shielding is a term used in Florida where retirees have become part of the volunteer corps that effectively responds to the needs of other older adults. Thus, older adults can be important assets in a pandemic. They have some degree of immunity to H1N1, they are supportive of influenza vaccine, and by and large they trust Government and public health authorities. They can be mobilized to support vaccination among their children and grandchildren and could staff volunteer services.

VI. How Disasters Can Inform Social and Behavioral Science Research

Disasters help to make visible conditions that are always present but difficult to perceive. Analytical thinking is needed about the distinction between research on specifically disaster related preparedness and response action and about the kinds of social actions and social practices that are not explicitly about disaster management but turn out to be hugely consequential. Aside from gaining a better grasp of the science, there also is interest in ultimately reducing harm generated by disasters. Integration of these ideas leads to the method of “social autopsies,” which can benefit from more embedded techniques to help improve understanding of the social context for outcomes and to generate and/or sharpen new research questions. For example, embedded researchers conducting ethnographic or qualitative research can provide a deeper understanding about why some people refuse to evacuate, do not trust authorities, or die alone and in what ways older adults may be especially vulnerable or resilient. The most interesting puzzles have to do with understanding the causes of disparities, social isolation, and survival.

Research about elderly can be complicated because elderly communities differ in their capacity to mobilize resources. For example, those living in more affluent neighborhoods with doormen and access to political offices during a major Chicago heat wave were able to get access to better resources during a time of water shortage. It was also the case that those with studios and efficiencies in public housing with better access to union and city offices had better outcomes than for-profit, privately funded properties with skeletal crews. In New Orleans, poorer communities were located in more flood-prone areas of the city. The kinds of architectural modifications that mitigate earthquake or fire damage cost money. These differences can be significant in understanding differential outcomes after a disaster.

Research questions are often inspired by observed variation in outcomes over time or space. There are lots of studies looking at why some poor people fare better than others. Deaths attributed to the heat wave in Chicago clearly revealed the vulnerability of poor African Americans but also some surprising variation. Some poor African-American neighborhoods

²² Ferguson NM, Cummings DAT, Cauchemez S, Fraser C, Riley S, Meeyai A, Iamsirithaworn S, Burke, DS. Strategies for containing an emerging influenza pandemic in Southeast Asia. *Nature*. 2005;437:209-214.

²³ Prior SD, Rowan F, Saathoff G. Foundations of shielding. *Int J Emerg Ment Health*. 2002;4(4):235-8.

turned out to be among the safest. The worst hit were neighborhoods abandoned in the preceding 30 to 40 years, with the associated erosion of jobs, state infrastructure, and police protection. Findings like this underscore the stark consequences of urban inequalities and help identify where resources, outreach, and further research need to be targeted.

VII. Data and Research Mechanisms: Better Prepared Next Time?

Some participants indicated a need for more discussion about new theoretical approaches and research techniques. It can be helpful to view individual behaviors as contingent on the dynamic balance between the demand character of the environment (press) and the individual's ability to deal with that demand (competence). An imbalance leads to negative affect and maladaptive behaviors: When competence far outstrips press, boredom and atrophy occur; when press exceeds competence, withdrawal and isolation can occur. This can be used to generate testable hypotheses. Glass referred to the notion of "environmental docility," which posits that high competence is associated with invulnerability to environmental press while low competence means greater vulnerability. In other words, small changes in press have bigger impacts on those with lower competencies.²⁴ To understand the importance of neighborhoods for older people, it is helpful to have a general model that permits a range of predictions rather than isolated hypotheses; e.g., bad neighborhoods discourage walking.²⁵

There was consensus about the importance of mining extant data for insights; leveraging ongoing epidemiological and population surveys for predisaster baseline data and opportunities for post-disaster data collection, as well as collecting insights from comparative research; and harnessing the power of simulations for describing the consequences of policies and disasters and of new data collection methods; e.g., geospatial, Internet, mobile phone. It was recognized that ongoing government surveys often are not nimble enough to adjust to new data needs in real time during and after disasters. For example, the Behavioral Risk Factor Surveillance System and the National Health Interview Survey or the National Health and Nutrition Examination Survey could serve as suitable vehicles for adding post-disaster questions and should be encouraged to find ways to adapt their studies to take timely advantage of such opportunities.

Mining Extant Data

Disaster research does not necessarily require a disaster. One can examine processes in disaster-prone settings and estimate population parameters from incomplete data. Available data should be mined to understand the impact of disasters on the elderly population. These include data from Medicare's home health care payment program and other home health agencies that are required to undertake a similar assessment. There also exist baseline data on staffing, organization of services, and interruption of services due to storm, wildfires, and other shocks. Nationally, the Panel Study of Income Dynamics, the General Social Survey, and the National Election Study might be considered suitable vehicles depending on sample size in desired regions of study. There are large national cross-sectional surveys continuously in operation,

²⁴ Lawton MP, Nahemow L. Ecology and the aging process. In C. Eisdorfer & M. P. Lawton (Eds.), *Psychology of Adult Development and Aging* (pp. 619–673). Washington, DC: American Psychological Association, 1973.

²⁵ Ross CE, Mirowsky J. Neighborhood disadvantage, disorder, and health. *Journal of Health and Social Behavior*. 2001;42(3):258-276.

including the American Community Survey, the National Health Interview Survey, and the Behavioral Risk Factor Surveillance System, that could play an important part in research on the impact of disasters.

Leveraging Pre-crisis Baseline Data as Benchmarks

Research on emergency situations and crises typically commence after the event. Studying preparation for disasters is also important, as well as studying processes relevant for disasters, from decision neuroscience to how elderly use media. Although real-time public health research can translate into improved risk communication and decision making, participants cautioned against the temptation to rush to study a disaster in real time. Rigorous scientific methods need to be established to avoid flawed quick-hit publications that base conclusions on spurious correlations. It is possible to identify places in advance that are at higher risk of disaster or catastrophe (e.g., New York, Bay area, Los Angeles) to look at community-level education and other factors. Areas of greatest vulnerability are places where disasters have not happened in a long time (e.g., St. Louis, MO, and Long Island, NY) and where there is potential for tremendous casualties in a few days' time.

Participants underscored the benefits of establishing a surveillance system in disaster-prone areas to monitor key mental and physical health indices in older adults before and after disasters that could perhaps leverage already existing surveys or datasets. Data for people across the entire age range are of interest to permit comparisons. There was also appreciation for the importance of local knowledge to complement the epidemiological knowledge base, whether in New Orleans or Indonesia, and to inform service providers during ongoing disasters.

The Hurricane Katrina Community Advisory Group Studies, headed by Ronald Kessler at the Harvard School of Public Health, obtained quick funding to build on pre-Katrina baseline data in New Orleans from the National Comorbidity Survey Replication to investigate patterns in mental health among older adults 5 to 8 months post-Katrina ($n = 1,043$) and again 12 months after that ($n = 815$). The data show increased mental distress after Hurricane Katrina, with 31 percent of the population with a diagnosable disorder 5 to 8 months out but a decrease in suicidality, which was related to faith in one's own ability to rebuild life and realization of inner strength. The followup study 1 year later was important to document the continued sequelae of the event, including significant increases in suicide ideation and plans; a one-shot study would not have revealed the continuing need for mental health services in New Orleans.²⁶ A possible contributing factor was an increase in family violence and the departure of providers. It also was noted that the current economic crises may be compounding post-Katrina effects and affecting trends in murder and suicide rates.

Another example of the clear advantages of having good pre-crisis benchmark data can be seen in the Study of the Tsunami Aftermath and Recovery (STAR), which measures immediate impact (e.g., mortality; exposure to traumatic events; PTSD; loss of family, friends, and community; loss of assets) and longer term impacts (e.g., housing, migration; mental/physical health of adults and children's economic well-being, savings, wealth, employment; receipt and

²⁶ Kessler RC, Galea S, Gruber MJ, Sampson NA, Ursano RJ, Wessely S. Trends in mental illness and suicidality after Hurricane Katrina. *Molecular Psychiatry*. 2008;13(4):374-84. Epub 2008 Jan 8.

provision of assistance; marriage, fertility, investments in children; attitudes about the future) and tests hypotheses about community behavior. STAR covers study sites in Indonesia heavily damaged by the tsunami, areas that were less damaged, and areas that were not directly damaged for comparison. It is a longitudinal survey that follows for 5 years the same respondents interviewed in the 2004 wave of Indonesia's National Socio-economic Survey, or Susenas, an annual population-based cross-sectional socioeconomic study conducted by Statistics Indonesia. Key elements of the study design include a survey population that is representative of predisaster data; longitudinal data from comparison areas and comparison groups (e.g., all other family or household members—nesting is very important); collection of spatial and remote sensing data (not only informant reports); and data on short, intermediate, and longer term outcomes. There were 17,000 eligible older adults in some 6,700 households. About 93 percent of 15,600 survivors were interviewed at least once, of which about 9,000 completed face-to-face interviews in every wave. Analyses of this latter set of complete interviews show that older adults are clearly more vulnerable than other age groups with respect to mortality, but results are more nuanced for other outcomes such as relocation to camps, traumatic stress reactions, and individual versus household measures. Elizabeth Frankenberg reported generally greater mobility in the 5 months after the tsunami by males than females. In heavily damaged areas, socioeconomic recovery of males aged 50+ was weaker than for other age groups. The same effect is shown for primary work activity and income in terms of attaining pre-tsunami status. There appears to be no difference between older and prime-age adults with respect to household-level economic outcomes (e.g., home ownership, per capita household expenditures), which suggests sharing within families.

Managed and Long-term Care Data

Health care utilization and assessment data on older adults covered under Medicare managed care programs are generally not available. We also need to recognize the large and growing group of elders using home health care agencies and community-based care programs to avoid assisted living or nursing home placement. This is the very group of vulnerable elders for which we need data on an ongoing basis. Since all states now contribute data on Medicaid service use which is centralized under the Centers for Medicare and Medicaid Services (CMS) Medicaid Analytic eXtract (MAX) data system, it might be possible to consider these as “baseline” data from which post-disaster samples can be drawn. These data, while often available only several years late, do capture frail elderly and middle aged disabled individuals who are not living in assisted living facilities or nursing homes.

Geospatial Data

Geospatial information is critical for planning disaster response and for assessing impact. Satellite imagery can provide a powerful objective picture of land transformation. There could be benefit to working with engineers and geographers to link remote sensing in more systematic ways in social and behavioral research on aging and disasters. Local agencies can use geographic information systems to develop risk-stratified mapping of vulnerable communities within an area potentially vulnerable to natural or technological disasters; for example, census areas with large numbers of older persons living alone or with disability or in institutions. Frankenberg pointed

out the value of “triangulation” – using several sources of data on the ground as well as remote sensing data to understand effects and accurately characterize affected areas.

Agent-Based Modeling

Agent-based modeling permits the representation of cognitive, social, and physical attributes unique to the elderly and can be enormously helpful in devising disaster preparedness strategies tailored specifically to this cohort. The technique has been applied to pandemics²⁷ but can be usefully applied to other problems of relevance to aging. In one example, the technique showed that it would take 30 years for the modal retirement age to shift from 65 to 62.²⁸ In another example, realistic fluid dynamics were used to model a hypothetical plume-agent (e.g., chemical, biological) and expected evacuation paths, suggesting that attempts to evacuate major cities may be counterproductive, leading to congestion and increased exposure, and that the most intelligent action by older adults may be to stay put in lower permeability spaces. In modeling the impact of pandemic H1N1 influenza, agent-based modeling can incorporate data on age, family structure, travel patterns, social contacts, and elderly facilities (e.g., assisted living, nursing homes) to determine the optimal nonpharmaceutical intervention. In this example, the herd immunity arising from 75 percent distancing (e.g., school closure, workplace leave, shelter-in-place) imposed for 1 month was more effective than moderate-level (50 percent) distancing for a more sustained period of time. Air travel restrictions have been found to be an effective mitigation strategy because they delay transmission, buying time for development of vaccines and distribution of antivirals, but the approach may not be as relevant in countries like the United States because there is so much ground movement. Other applications might include study of surge capacities and public health issues related to behavioral epidemiology such as vaccine refusal, violation of quarantine, and nonadherence by the elderly.²⁹ The technique can also be helpful in estimated aggregated or population-level effects. For example, the Centers for Medicare and Medicaid Services requires each nursing home to have an emergency plan, which may work fine in an isolated emergency but would fail miserably if multiple nursing homes required assistance at the same time as might occur during a bona fide disaster. Another situation that can be modeled is the case when multiple disasters are competing for attention; e.g., war, pandemic influenza, and hurricane at once.

The novelty of agent-based modeling is the ability to design optimal response subject to a variety of constraints that affect the elderly. Such constraints might include assumptions about limited speed and maneuverability of older adults, shelter-in-place, compliance, reductions in permeability of selected structures, respiratory compromises, availability of essential supplies, caregiving responsibilities, and characteristics of the crisis event. An advantage of such models is that they make explicit the assumptions under which a population is operating and are unforgiving when rules are vague or assumptions are unrealistic. They also can help reveal the

²⁷ Epstein JM. Modelling to contain pandemics. *Nature*. 2009;460(7256):687.

²⁸ Axtell R, Epstein JM. Coordination in transient social networks: An agent-based computational model of the timing of retirement. In: Aaron H (ed). *Behavioral Dimensions of Retirement Economics*. Washington, DC: Russell Sage / Brookings Press, 1999.

²⁹ Epstein JM, Hammond RA, Parker J, Cummings D. Coupled contagion dynamics of fear and disease: Mathematical and computational explorations. *Public Library of Science One Journal*. 2008;3(12):e3955.

consequences of expected behavior; i.e., what we think people *will* do, not what we think they *should* do.

Comparative Research

Comparative research represents an unexploited approach that should be encouraged. Comparing events in the same city at different times (e.g., Chicago heat wave of 1996 versus 1999) or in different countries can be useful approaches for improving interpretation of outcomes. As example, in France, over 14,000 people, mostly elderly, died from the 2003 heat wave that lasted 3 weeks, with 7 days of extreme heat. Deaths in Italy and Germany also were very high, but France was much more forthcoming about mortality tolls during the actual event than her neighbors. The Chicago heat wave lasted about a week, with 2 days of extreme heat, and claimed the lives of more than 700 Chicago residents, the majority of them old, alone, or poor. One way to promote a comparative framework is to organize smaller conferences to permit comparisons. Anthropologists embedded in communities can study a place with added focus. There is much that can be learned from informal conversations outside of published journal articles.

New Data Collection Methods

Standard processes for collecting data are severely challenged in a disaster, especially in life-threatening and rapidly shifting chaotic circumstances where survival is paramount. New methodologies to collect data after disasters can build on the notion of mass intelligence (e.g., Wikipedia). One also can imagine downloading software into a cell phone that makes it possible to collect environmental data, record video and audio, and collect better data to inform simulation approaches and development of next-generation deployable instruments. Computing is so fast today that real-time streaming of data, including cell phone data, and short-term projections about behavior, migration, noncompliance, and flight, are all within the realm of possibility but require careful analyses or exploration before they can be used with any degree of confidence. Another avenue might be to see what people are uploading onto the Web. The traditional notion that elderly cannot be studied on the Internet is becoming obsolete. However, the use of cell phones and social network software raises issues about privacy, institutional review board approval, and appropriate data sharing.

VIII. Funder Considerations

Participants welcomed greater communication between the NIH and the NSF and with the national hazards center and disaster planning worlds. Neither the NIH nor the NSF supports policy research per se, but both fund basic research that ultimately can have policy impact. The NIH can fund time-sensitive studies more quickly using supplements to ongoing grants. To quickly fund post-tsunami and post-Katrina projects before the data disappeared, the NSF approached investigators already doing broad-scale survey work in Indonesia and New Orleans.³⁰ Expedited research funding is most effective when awarded to already established research teams; i.e., principal investigators are in place both intellectually and geographically

³⁰ NSF support can be grouped into three types: (1) Institutional/infrastructural, (2) unsolicited proposals, and (3) RAPIDs (Rapid Response Research to capture and analyze transitory data).

(language, culture, etc.) before the disaster and fully aware of the likely challenges. Given administrative difficulties operating in politically volatile areas post-disaster, scientifically valid field work is rarely done quickly, and rapidly getting people into the field should not be the overriding concern. Starting too soon after a disaster also could complicate relief efforts.

The caution about volatility and danger is not a factor in the same way as a natural disaster in the case of pandemics. In the latter case, the need for rapid response research is considerable as it can yield significant practical results that can contribute to public health practice, governmental policy decisions, planning for health care, and greater resilience among the elderly. Behavioral and social science research conducted during a pandemic can yield meaningful contributions to theory about the elderly in the midst of public health emergencies.

IX. Concluding Thoughts

The emphasis on the elderly in disaster research is needed precisely so that the special circumstances of older adults are not overlooked, appropriate strategies of mitigation and response can be introduced, and the epidemiologic consequences of disaster for older populations can be better characterized. Older adults' resilience and resourcefulness are keys to their immediate survival post-disaster, but research is needed to help them weather prolonged dislocation or stress. Innovative thinking is needed on facilitating social connectedness among older adults, which appears consistently to offer significant protective benefits both to preparation and post-disaster. An important insight is that findings from research about older adults need to be integrated into disaster research, and understanding how to interpret results for the elderly requires some kind of theory to drive analysis and weigh evidence. Although much can be done with extant data, including agent-based modeling and comparative analyses, participants underscored the importance of surveillance data pre-disaster and longitudinal data post-disaster to make sense of events and their sequelae.

Appendix A

Advancing Behavioral and Social Research on the Elderly in Disasters Committee on Population Expert Meeting

September 14, 2009

Room 100
National Academy of Sciences
Keck Center
500 5th Street, NW
Washington, DC 20001

- 9:30 – 9:45 **Introduction**
Duncan Thomas, *Meeting Chair*
- 9:45 – 10:00 **Overview of NIH Research Portfolio and Goals**
John Haaga, *National Institute on Aging*
- 10:00 – 11:00 **Why Might Age Matter?**
Vince Mor, *Chair*
Panel: Margaret Gatz, *University of Southern California*
Thomas Glass, *Johns Hopkins University*
Sandra Quinn, *University of Pittsburgh*
Marie Krousel-Wood, *Tulane University*
- 11:00 – 11:15 **BREAK**
- 11:15 – 12:45 **What More Can Social/Behavioral Sciences Bring to
Research on Disasters?**
Barbara Boyle Torrey, *Chair*
Panel: Patrick Heuveline, *University of California, Los Angeles*
Elizabeth Frankenberg, *Duke University*
Eric Klinenberg, *New York University*
Ronald Acierno, *University of South Carolina*
Michael Smyer, *Bucknell University*
- 12:45 – 1:30 **LUNCH**

- 1:30 – 2:00 **Potential uses of agent-based modeling**
(a demo and discussion)
Joshua Epstein, *Brookings Institution*
- 2:00 – 2:45 **The Elderly in Long-Term Care**
Margaret Gatz, *Chair*
Panel: Vincent Mor, *Brown University*
 Lu-Marie Polivka-West, *Florida Health Care Association*
 Kathryn Hyer, *University of South Florida*
 Lona Mody, *University of Michigan* (participating by phone)
- 2:45 – 3:15 **Data and Research Mechanisms: Better
prepared next time?**
Barbara Boyle Torrey, *Chair*
Panel: Nancy Lutz, *National Science Foundation*
 Robert E. O'Connor, *National Science Foundation*
- 3:15 – 3:30 **BREAK**
- 3:30 – 4:30 **General Discussion: Priorities for Social and Behavioral Research**
Duncan Thomas, *Chair*
- 4:30 **ADJOURN**

Appendix B

Advancing Behavioral and Social Research on the Elderly in Disasters Committee on Population Expert Meeting September 14, 2009

Participant Roster

Duncan Thomas (Chairperson), Duke University
Ronald Acierno, Medical University of South Carolina
Brent Bolin, National Library of Medicine, NIH
Daniel Dodgen, Office of the Assistant Secretary of Preparedness and Response, DHHS
Joshua Epstein, The Brookings Institution
Elizabeth Frankenberg, Duke University
Margaret Gatz, University of Southern California
Thomas Glass, Johns Hopkins University
John Haaga, National Institute on Aging, NIH
Patrick Heuveline, University of California, Los Angeles
Elliott Hill, American Red Cross National Headquarters
Karen Huss, National Institute of Nursing Research, NIH
Kathryn Hyer, University of South Florida, Tampa
Mary Ellen Hynes, Science & Technology Directorate, Department of Homeland Security
Matt Kleiman, Office of Health Affairs/Office of Medical Readiness, Department of Homeland Security
Eric Klinenberg, New York University
Marie Krousel-Wood, Tulane University
Rose Maria Li, Rose Li and Associates, Inc. and National Institute on Aging (contractor)
Alicia Livinski, Division of Library Services, NIH
Nancy Lutz, National Science Foundation
Lona Mody, University of Michigan and Veterans Affairs Ann Arbor Healthcare System (by phone)
Vincent Mor, Brown University
Robert O'Connor, National Science Foundation
LuMarie Polivka-West, Florida Health Care Association
Sandra Quinn, University of Pittsburgh
Laurence Raine, Medical Readiness Division, Department of Homeland Security
Michael Smyer, Bucknell University
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