


Advances in Environmental Health and Disaster Research 15 Years After Hurricane Katrina

 See also Kim-Farley, p. 1448, and the *AJPH* Hurricane Katrina 15 Years After section, pp. 1460–1503.

In August 2005, when Hurricane Katrina resulted in flooding more than 80% of the city of New Orleans, Louisiana, for more than six weeks, many worried about the environmental health consequences. Of highest concern were mold exposures, especially indoors. A major pediatric asthma study conducted after Katrina, funded by a public–private partnership, could not be implemented until 2007. The Head-off Environmental Asthma in Louisiana study, implemented with 182 children with moderate to severe asthma, is illustrative of key disaster research challenges. Health disparities are an influential factor affecting health outcomes (in this case, childhood asthma), and delayed study implementation hampers just-in-time environmental assessments; for example, many Head-off Environmental Asthma in Louisiana study participants were living in remediated homes two to three years after the disaster.¹ Infrastructure challenges, including some in public health, also resulted in an extended time for participant recruitment.

In the context of the disaster management cycle, most resources were invested in the response phase, with dwindling resources available for the

prolonged recovery. After Katrina, environmental health action initially focused on worker exposure and community needs assessments. For example, the Worker Training Program of the National Institute of Environmental Health Sciences (NIEHS) trained 8000 first responders how to mitigate and prevent environmental exposures. The key lessons learned that hampered postdisaster research were (1) the inability to accurately assess exposures to potential chemical contaminants given the extended lag time between exposure and assessment of those exposures and (2) the lack of investment in longitudinal cohort studies that must be initiated during the immediate response phase.

DISASTER RESEARCH AFTER HURRICANE KATRINA

The Institute of Medicine (now the National Academy of Medicine) convened a special workshop in 2007 to address the key health concerns associated with Hurricane Katrina and develop a research agenda.² Key research gaps identified by the workshop presenters were

conducting exposure assessments at the earliest possible time after the disaster; ascertaining the effect of complex exposure pathways, including exposures to chemical mixtures; characterizing individual susceptibilities; and recognizing the important role of community-engaged environmental epidemiological studies.

Almost five years after Hurricane Katrina, the Gulf Coast experienced a technological disaster of unprecedented proportion: the Deepwater Horizon oil spill. Coastal communities from Louisiana to Florida faced new challenges and expressed heightened concerns about exposure to oil-associated compounds. Research investments disproportionately focused on ecosystem studies assessing the effect of the spill on fauna, flora, and water quality. From a human health perspective and in large

part based on the lessons learned from Hurricane Katrina, a more robust and timely allocation of financial and human resources resulted in a strengthened exposure assessment in many oil spill–cleanup workers. A comprehensive and ongoing occupational environmental epidemiological study, the Gulf Long-Term Follow-Up Study, funded by NIEHS, was the largest worker cohort study ever conducted in the aftermath of an oil spill. The study used a comprehensive panel of biomarker data, clinical evaluations, and survey instruments to prospectively examine potential adverse physical and mental health effects associated with the oil spill.³

Community members, many of whom already faced the triple burden of health disparities, disasters, and environmental health threats, were seeking answers to three questions after the oil spill:

1. Is the seafood safe to eat?
2. Is the air safe to breathe?
3. What will happen to the health of our babies born after the spill?

In response to these questions and lessons learned about the pivotal role that communities can

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play in unraveling these seemingly simple but often interconnected questions, NIEHS, in collaboration with other National Institutes of Health institutes and centers, competitively funded four community-academic partnerships. The consortia had three distinguishing features: a transdisciplinary focus on seafood consumption, a dedicated program addressing community resilience, and a community network advising the four consortia to ensure community engagement in all aspects of the research from design to dissemination. Among the products were a consortia-wide assessment of seafood safety and a community resilience activation framework.^{4,5} The collective research endeavors also documented the psychosocial consequences of disasters, both natural and technological.

The most prominent contribution of countering the seemingly intransigent challenges associated with conducting disaster research is the National Institutes of Health's Disaster Research Response Program.⁶ Miller et al.⁶ identified four key domains of challenges: (1) research issue identification and prioritization, (2) research process challenges, (3) infrastructure and implementation, and (4) relationships, coordination, and engagement. All the domain-specific challenges can be daunting, both singularly and as a whole, but the most profound contribution of the program has been decreasing the time lag between chemical exposure and research assessing the magnitude of those exposures and potential adverse health outcomes by providing access to "off-the-shelf" research tools, institutional review board-approved protocols and strategies to accelerate the institutional

review board process, and the Disaster Research Response Program collection tool repository. The program provides a promising foundation for data linkages enabling queries of environmental, exposure, and health outcome data.

A RESEARCH AGENDA FOR THE FUTURE

In the aftermath of Hurricane Katrina, the frustrations faced by communities and their academic partners alike centered around the difficulty of environmental health and disaster research to determine whether a health symptom or condition was associated with a specific disaster. A promising step to address this concern is to deliberately invest in the continuum of research from bench to clinic to community. Furthermore, this holistic, transdisciplinary approach has a high likelihood of advancing the knowledge base of disaster research by using both upstream and downstream strategies. For example, ascertaining genetic and epigenetic risk factors can better characterize an individual's susceptibility and enable a more precise evaluation of the potential cumulative effect of disaster-related chemical exposures. Similarly, community-based environmental epidemiological cohort studies can be enriched by pathophysiological assessments through biospecimen banking and biomarker analyses at the clinical level. This holistic approach to disaster research must be accompanied by a commitment to collect exposure and risk factor data, as well as information on social determinants of health, in what is increasingly recognized as the interdisaster period, especially in communities

facing frequent disasters such as hurricane, floods, and environmental incidents.

The need for long-term research beyond postdisaster response studies is particularly relevant in the context of strengthening and measuring community resilience.⁷ Such research should facilitate the systematic collection, analysis, translation, and dissemination of data on exposures to chemical and nonchemical stressors over time. Furthermore, advances in data science will accelerate the pathway from discovery to recovery. Hurricane Katrina made visible the historic burden of health disparities in many Gulf Coast communities. Making disaster research work for our communities requires advancing environmental health literacy. Doing so will not only promote embedding communities in our joint disaster research enterprise but also strengthen the quality of our research. The ultimate goal is to protect those most vulnerable. **AJPH**

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Both authors contributed equally to this editorial.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest to disclose.

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