Exploring Disaster Risk Reduction Through Community-Level Approaches to Promote Healthy Outcomes: Proceedings of a Workshop—in Brief

DETAILS

8 pages | 8.5 x 11 |
ISBN 978-0-309-44777-5 | DOI: 10.17226/23600

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Proceedings of a Workshop

August 2016

IN BRIEF

Exploring Disaster Risk Reduction Through Community-Level Approaches to Promote Healthy Outcomes

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On April 21, 2016, the Health and Medicine Division of the National Academies of Sciences, Engineering, and Medicine convened a workshop during the 2016 Preparedness Summit,[1] a national conference on public health preparedness. Participants discussed the concepts of disaster risk reduction (DRR), their application within U.S. communities through novel and contemporary practices, and specific strategies that can be implemented at the local level through cross-sector collaboration.

DISASTER RISK REDUCTION AND APPLICATIONS TO HEALTH

More than 2,500 years ago near Mount Qingcheng in China, the Min River frequently flooded nearby cities, resulting in many deaths. The area also saw long periods of drought that led to famine and insecurity. A grand engineering effort was undertaken to regulate the flow of the river to prevent flooding deaths and irrigate the farmland in the region. One result of that effort, called the Dujiangyan Weirs, is still in use today, said Mark Keim, a principal with DisasterDoc, LLC. It is self-regulating, keeps the entire valley flood free, has saved millions of lives over time, and has promoted the economic vitality of an entire region. Noting that the weir represents a commitment to a multi-sector DRR strategy millennia ago, Keim asked the group, "How many lives [did] that generation of people save? Do you think in your lifetime you want to save some lives? You're not only saving those of us that are on the earth with you now. Think about saving millions of lives into the future."

DRR is often a nexus for public health, disaster management, environmental justice, and climate change adaptation efforts, and DRR strategies have been implemented across the globe. But what is the public health professional's role in DRR? "We can't stop the hazard," Keim said. "We can't stop tsunamis. Many times even in the responses [to disasters] we don't lead those efforts. What is our role in disaster reduction? Our role is to prevent the death of every single person that's in that disaster."

Today, natural and man-made hazards[2] result in disasters[3] of increasing frequency and severity and present a threat to the security, public health and safety, and economic vitality of individuals and communities around the globe (NASEM, 2016). Rather than simply preparing to withstand these hazards and recover from disasters, Keim said, many nations aim to reduce the damage caused by natural hazards by creating a culture of prevention via DRR strategies.

[1] For more information on the Preparedness Summit, see http://preparednesssummit.org/2016-preparedness-summit (accessed June 13, 2016).
[2] Hazard refers to a dangerous phenomenon, substance, human activity, or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage (UNISDR, 2016).
[3] A disaster is a serious disruption of the functioning of a community or a society involving widespread human, material, economic, or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources (UNISDR, 2016).

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DRR is the concept and practice of reducing disaster risks through systematic efforts to analyze and reduce the causal factors of disasters. Reducing exposure to hazards, lessening the vulnerability of people and property, managing land and the environment wisely, and improving preparedness and early warning for adverse events are all examples of DRR[4] (UNISDR, 2016). To guide a global effort, the Sendai Framework for Disaster Risk Reduction 2015–2030 was adopted at the Third United Nations World Conference in Sendai, Japan, on March 18, 2015. The framework articulates the need for an improved understanding of disaster risk in all its dimensions of exposure, vulnerability, and hazard characteristics.[5]

However, while some disaster management and public health preparedness programming may be viewed as tangentially related, a multi-sectoral and inter-disciplinary national platform[6] for coordination and policy guidance on DRR in the United States does not exist. The majority of national-level disaster-related policies, programming, and investments at the local, state, and national levels are customarily directed more toward responding to and recovering from disasters, rather than toward investing in risk reduction and preparedness (Healy and Malhotra, 2009), such as addressing the underlying hazard exposure and preventing the vulnerability to adverse consequences of disasters. Mollie Mahany, a public health advisor at the Centers for Disease Control and Prevention, reiterated remarks from David Applegate, the associate director for Natural Hazards at the U.S. Geological Survey, during an earlier Preparedness Summit plenary session, saying, "We cannot respond our way out of disasters." A more widespread and systematic socialization and commitment of DRR strategies at the community level in the United States, coordinated through a national platform, could have far reaching effects and result in more resilient[7] communities and improved health and livelihood of the population. Holistic, community-based risk-reduction strategies can be employed to prevent and reduce hazard exposure and vulnerability to disasters, increase preparedness for response and recovery, and thus strengthen resilience. Whether referred to as DRR or not, these strategies are often already applied in the United States at the local level through contemporary programs and planning in communities.

Mahany discussed the need to apply DRR concepts within the United States. Such an application of DRR, she said, would not be meant to supplant the nation's robust capability and capacity for response. Instead it would be aimed at helping our nation be more proactive, rather than reactive, to the consequences of disasters; this is particularly important as many of the casualties in severe disasters happen during or immediately following the event, often before a response effort can even be mobilized. Mahany went on to say that DRR provides a systematic approach to identifying, assessing, and reducing the risks of disasters before they occur and that it could help prevent the deaths that occur during a disaster. Mahany added to her point by stating that hazard exposure, vulnerability,[8] and coping capacity[9] interact in complex ways and collectively affect disaster risk.[10]

Disaster risk is not shared equally by a population. There are those, Mahany said, who are disproportionately vulnerable because of various physical, social, economic, and environmental factors that, separately and collectively, contribute to greater exposure to hazards and limit an individual's capacity to cope with a hazard. A disaster occurs when a collective of individuals are unable to cope with hazards. Mahany said that in order to reduce disaster risks, losses, and deaths, it is important to take into account such factors as livelihood; health; economic, physical, social, and cultural conditions; and the environmental assets of persons, businesses, and communities, which collectively offer opportunities and resources for coping with disasters. "DRR is not only about mitigation and early warning," she said. Many of these characteristics and circumstances are outside the common area expertise of response agencies, she said, and preventing adverse outcomes will thus require a cross-disciplinary, cross-sector, "whole of community" effort.

EXPLORING COMMUNITY-LEVEL APPROACHES

With conceptual context provided in the preceding section, this section provides examples of novel and contemporary community-level DRR approaches that are being employed in the United States, as described by a panel of speakers from various professions and sectors who are engaged in community resilience building, environment sustainability and management, and food security.

[4] The United Nations Office for Disaster Risk Reduction reference includes descriptions and definitions of a number of DRR-related terms, many that have been used in this document.
[5] For more information on the Sendai Framework, see www.preventionweb.net/files/43291_sendaiframeworkfordrren.pdf (accessed June 1, 2016).
[6] National platform is a term for national mechanisms for coordination and policy guidance on DRR that are multi-sectoral and inter-disciplinary in nature, with public, private, and civil society participation involving all concerned entities within a country (UNISDR, 2016).
[7] Resiliency refers to the ability of a system, community, or society exposed to hazards to resist, absorb, accommodate to, and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of essential basic structures and functions. The resilience of a community in respect to potential hazard events is determined by the degree to which the community has the necessary resources and is capable of organizing itself both prior to and during times of need (UNISDR, 2016).
[8] Vulnerability refers to the characteristics and circumstances of an individual, community, system, or asset that make it susceptible to the damaging effects of a hazard (UNISDR, 2016).
[9] Coping capacity is the ability of people, organizations, and systems, using available skills and resources, to face and manage adverse conditions, emergencies, or disasters (UNISDR, 2016).
[10] Disaster risk refers to the potential disaster losses in lives, health status, livelihoods, assets, and services, which could occur to a particular community or a society over some specified future time period (UNISDR, 2016).

Community Resilience Building

Theresa Quinn, the Medical Reserve Corps (MRC) coordinator for the Snohomish Health District MRC in Washington State, discussed the ongoing effort to have the MRC unit reflect the cultural and ethnic composition of the community to ensure they can maximize their effectiveness as volunteers. Because volunteers are not responding to disasters all the time, Quinn said, they use "peace time" to go in to the community and work to encourage volunteer cultural competence. Instead of conducting screenings and programs in a preconceived manner or in the ways that the volunteers individually think is best, she said, the volunteers let the particular community they are working with dictate the methods used. In this way, she said, participants are more comfortable with the methodology and more likely to engage and interact in the process. And this method is working, Quinn said. The MRC volunteers are building stronger partnerships with various populations in their district, engendering trust, and improving communication pathways so that they can be alerted more quickly when people are sick or in need of assistance. Collectively, she said, they are building a more resilient community.

Similarly, Terry Fulk, the emergency preparedness coordinator for the Jackson County, Illinois, Health Department, described his efforts to reduce susceptibility and build the coping capacity of communities through education and outreach. Echoing Keim, he said, "We won't be able to stop earthquakes or stop rivers from flooding, so we should instead be focusing on the exposure and vulnerability of people to these hazards." DRR principles can help those people who are most often affected by hazards in a community—those with chronic illness, those of low socioeconomic status, and those who are socially isolated. Fulk provided some examples of his outreach that illustrated how the best DRR practices generally involve multiple sectors. Through leveraging grants for "worksite wellness" and making the case that a healthy workforce is a prepared workforce, Keim teamed up with local businesses to implement wellness practices and then expanded to include continuity of operations planning and emergency planning. Describing his approach as "planting seeds," he also discussed his work with churches and existing coalitions and committees in his district that were already focused on health. He helped people better understand how to prevent disaster situations from occurring and to realize the importance of social cohesion in disasters. While many groups had expressed interest in getting involved during a response, he helped them to appreciate the need to work on the front end and to prioritize risk reduction and preparedness instead in order to help the community. Fulk concluded by saying that traditional emergency preparedness messaging that suggests individuals or families "build a kit" will not always lead to a positive end goal. "You need to really tie it into what people are doing every day and how [preparedness] impacts their lives in order to have impact," he said.

Environmental Sustainability and Management

Focusing on a specific set of hazards, David Dyjack, the executive director of the National Environmental Health Association, discussed water-related issues in the context of environmental sustainability, management, and risk reduction. While he focused on California, he said that these issues are relevant to many across the country and that, just as in China 2,500 years ago, too much water and too little water can both present problems. In contrast to the education and cultural competency strategies that Quinn described, Dyjack spoke of using physical infrastructure improvements to reduce the concrete risks surrounding water by reducing exposure and mitigating the hazard.

In the United States today, Dyjack said, trillions of gallons of water run off of pavement and other impermeable surfaces and end up in the combined storm sewer system. However, he continued, around 750 U.S. cities do not have the capacity to process rainwater when it rains heavily, resulting in a surge on the system and the water and other contaminants discharging to surface water bodies or contaminating the ground water. Yet there exist environmental management strategies, such as toilet-to-tap technology and rainwater reclamation techniques, that can be employed to reduce those risks and exposures, addressing the surges of rainwater in order to prevent flooding and also harvesting water to be used in instances of water scarcity.

Describing environmental health as a central community asset, Dyjack said that there are around 90,000 environmental health professionals in the United States with strong knowledge of their community's businesses, septic systems, culture, and land-use plans. These individuals are uniquely suited for cross-sector collaboration and should be engaged in conversations with health professionals, clinicians, engineers, and local government leaders on how to conduct environmental management strategies in their communities in order to reduce disaster risk. The creation of a physical infrastructure such as the Dujiangyan Weirs example in China could have lasting effects on reducing the exposure to hazards for a community and, as Dyjack concluded, become an important part of community resilience.

Food Security and Systems Thinking

Examining a different aspect of DRR, Sarah Buzogany, the food access planner for the city of Baltimore, described her city's experience in the spring of 2015 following the highly publicized death of Freddie Gray while in police custody. The city went through a week of civil unrest that was, she said, sparked by Gray's death but also in reaction to decades of structural and systemic inequality, disinvestment, racism, and lack of opportunity. Access to food was a concern during this time, as many stores were closed because the local government-imposed curfew had made it difficult for delivery trucks to get into the area, stores

were being damaged and vandalized, and transportation restrictions had prevented many employees from getting to work. Illustrating earlier points about some populations being more vulnerable to disasters, Buzogany noted that those most affected by this unrest lived in those areas of the city that already had the least access to healthy food.

Having identified access to food as a major blind spot within their disaster preparedness plan in 2013, city officials have been working to better understand the food system and its role in Baltimore and how to foster a more sustainable food system through new or modified policies. With the help of strong city leadership, Buzogany said, in 2015 a working group was created with 30 partners representing city, state, and federal governmental agencies, nonprofit organizations, and academic institutions (see Figure 1). Since coming together, she said, they have been able to pilot-test some of the newly developed procedures during smaller "disasters," such as snowstorms, to reduce the risk of food scarcity and to test their capacity through these new partnerships. While specific to and borne out of food security concerns, this collaboration could be an example of the sort of platform for DRR that was previously described.

Buzogany went on to say that the resilience of the local and regional food supply is adversely affected by a number of factors. These include lower availability of crops for human consumption resulting from agricultural lands being used to produce animal feed and a workforce shortage as decreasing numbers of young people enter into the farming occupation and older farmers are retiring. To successfully increase local and regional product availability, she described some policies that Baltimore officials have introduced such as tax credits, long-term vacant land leases to farmers, in-city husbandry allowances, and fostering community gardens. The city is looking over the long term to increase development in the areas of food deserts to ensure that there is healthy food available through places that people already visit, such as corner stores. To increase the demand for local food, Baltimore officials are working to increase access to farmers' markets and increase incentives for buying local food as well as encourage farms with a social model such as those that also provide education or employ formerly incarcerated citizens.

Moving from the supply-and-demand perspective, Buzogany also touched on the food chain issues the city is considering, such as how to identify blocked roads or other such problems that prevent food from getting to its destination and being cognizant of potential vulnerabilities of a globalized food system. For those times when the food chain does break down, she said, the city is identifying at-risk communities and will create resilience hubs where people can go to get food, water, and medical attention. The city is continuing to work toward its goal of food sustainability from all sides. While it has made a lot of progress, she said, it has not yet reached a point of complete self-sufficiency, but it is continuing to focus on building its capability to ensure available food for all residents.

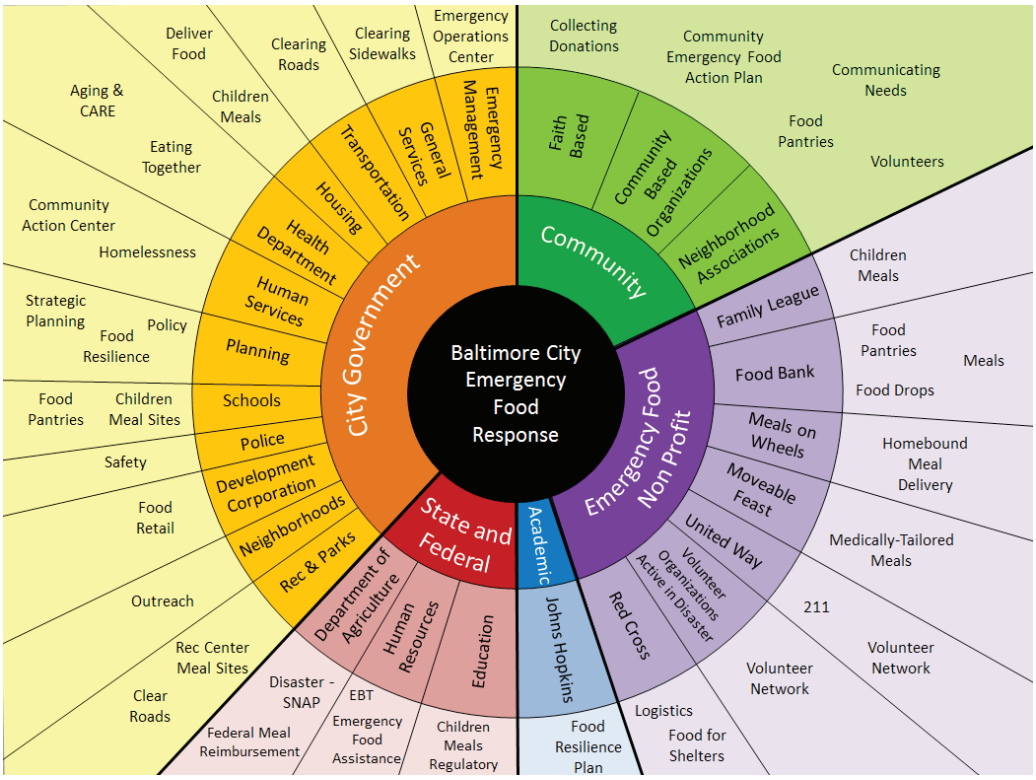

FIGURE 1 Baltimore Emergency Food Working Group.
SOURCE: Buzogany presentation, April 21, 2016.

OPPORTUNITIES FOR SYNERGY

Laura Runnels, a consultant at LARC and discussion facilitator, said that DRR strategies—even evidence-based and proven ones—could be implemented much more successfully when done holistically and across sectors. While some community groups may be working toward similar end goals, Runnels said, they often use different methods and perhaps varying terminology, making it difficult to easily see connections and opportunities. To better understand how DRR could be done more holistically, individual workshop attendees and speakers, through a series of facilitated exercises and discussions, examined the potential risk factors, root causes, vulnerabilities, hazard exposures, and characteristics that collectively contribute to disaster risk. Using worksheets (see Figures 2 and 3) attendees were guided through a process to consider factors relative to three disasters—Zika virus, civil unrest, and the chemical contamination of a water supply—across the social-ecological levels of health intervention (see Table 1), and they discussed ways in which public health, preparedness, environmental management, community development, and resiliency professionals and sectors could be coordinated to reduce disaster risk.

In facilitating the discussion, Runnels explained the social-ecological levels of intervention by observing that there are several different ways that organizations can intervene, from the individual level all the way up to the policy level. How we think about these various levels, she said, will dictate how we understand the root causes and vulnerabilities that lead to higher morbidity and mortality for certain populations in disasters. Once these root causes and vulnerabilities are better understood, specific strategies for DRR, potential partners, and already existing initiatives can be explored.

Topic: Zika Virus

Byron Russell from the Florida Department of Health reported on one of the workshop discussions, related to reducing risks from the Zika virus, which is known to cause microcephaly in some children of infected women, among other potential risks. Some of the factors that have been identified as root causes of risks related to the virus include a lack of mosquito netting, environmental hazards such as standing water, and education level, which may influence individuals' awareness of the virus, its vectors, and how the disease affects humans. Russell said pregnant women are more vulnerable, but the risks also vary according to where one lives and works. For example, working outdoors or living in mosquito-infested areas can make someone more vulnerable.

Russell described potential risk reduction methods at various levels of intervention that workshop participants suggested. At the individual level, personal protective equipment, condoms, and fly swatters could be employed. Another individual-level method would be improved education about the virus by working with various sector partners such as social service agencies, schools, summer camps, local health departments, and the Red Cross. At the organizational and community levels, Russell said, potential approaches include mass vaccination clinics (once a vaccine becomes available), worker education, and vector control strategies, with the potential partners including local health departments, community businesses, and state and federal partners. Other ideas for intervention at the community level were opening up cooling centers in communities where air conditioning is not prevalent and working with businesses to encourage "free days at the movies" or other indoor activities. At the policy level, Russell said, various county- and state-level policies on waste storage could be very helpful, such as prohibiting "keep[ing] tires in your backyard past a certain amount of time" in order to mitigate the potential for mosquito breeding. Research to inform some of these policies would also be valuable, he added, and such research could come from the state or federal level or through partnerships with local universities and health departments.

Name & Affiliation: _____

Breakout Topic: _____

Risk Factor	Causative Factor	Root Cause
Hazard		
Exposure		
Vulnerability		

FIGURE 2 Workshop worksheet, part 1.
SOURCE: Mark Keim, April 21, 2016.

Name & Affiliation: _____

Breakout Topic: _____

Level	Risk Reduction Method	Sector Partner
Individual		
Interpersonal		
Organizational		
Community		
Policy		

FIGURE 3 Workshop worksheet, part 2.
SOURCE: Laura Runnels, April 21, 2016.

Topic: Chemical Spill

Janelle Worthington of the Jefferson County, Colorado, Public Health Department described how workshop participants in her session reacted to the hypothetical exercise of identifying risk factors and possible reduction strategies in response to a chemical spill that has contaminated a community water supply. Various root causes of the hazard were suggested, such as an aging water and commercial infrastructure, a train derailment, and illegal chemical dumping. Suggested root causes for the exposure and population vulnerability included the location of housing, livestock exposure to tainted water, ineffective or a lack of warning systems and messages, language barriers for those in the affected area, and, finally, lower socioeconomic status limiting options among some individuals for response and avoidance of the hazard.

Table 1 Social-Ecological Model of Health Intervention

Public Policy	Local, state, national level decision makers, laws, and policies
Community	Relationships among organizations, culture, societal norms
Organizational/ Institutional	School, work, business, faith-based, and community-based organizations
Interpersonal	Family, friends, social networks, beliefs
Individual	Knowledge, attitudes, skills, behaviors, and developmental history

SOURCE: Runnels presentation, April 21, 2016.

Worthington reported a few risk reduction ideas residing at the individual level, such as storing one's own water or implementing rainwater recapture strategies. At the interpersonal level, suggestions included the creation of neighborhood emergency planning organizations so members of these organizations could get to know their neighbors better and perhaps come up with plans for multiple hazards, not just water contamination. At the community level, mass water distributers could help ensure that there is an alternative supply of safe water to drink, and community organizations could be engaged to ensure that people have temporary relocation options, such as with family or friends, to areas with safe drinking water—especially if the contamination lasts for a prolonged period of time. Important DRR strategies at the policy level, she continued, might include working with the transportation sector to reroute or restrict chemicals from being transported through tunnels or certain high-density parts of a city. To address the root cause of aging infrastructure, though, she suggested policy changes such as evaluating bridges or railways throughout the year to provide an ongoing awareness of the potential risk. This would require working with the local municipality, railroad industry, and national transportation agencies and organizations.

Topic: Civil Unrest

Cindy Lambdin, a health care coordinator with the San Francisco Department of Public Health, reported out for the discussion on potential DRR strategies to address civil unrest. Civil unrest, she said, is primarily triggered by an acute event, but often caused by an ongoing frustration with disparate socioeconomic conditions. Risk exposure can be separated into two levels, she said. The first is the risk posed by persistent disruption to the availability of items such as food or medication or access to transportation, businesses, or one's residence. The second is the risk of physical injuries and emotional trauma that civil unrest can cause during the acute event. Lambdin went on to suggest that a lack of education, a lack of mobility, poor coping skills, mental and behavioral health issues, weak family structures, and unemployment may all be individual vulnerabilities that contribute to civil unrest.

Lambdin described some of the individual-level risk reduction strategies the workshop participants in this session considered, including self-education, access to health medication and mental health, striving for stable employment, and embedding oneself in the community through volunteerism. Moving to the interpersonal level, Lambdin highlighted the importance of the need to establish social networks. Echoing the MRC cultural competence strategies previously described, she emphasized that it is very important that cultural competency education takes place across all sectors. Having these types of programs, combined with building neighborhood cultural diversity, can create stronger social capital and social cohesion in communities and lead to more resilient populations (IOM, 2015).

Lambdin said that in applying DRR strategies to address civil unrest, it is important to engage various sector partners, including the media, law enforcement, federally qualified health care organizations, and after-school programs. Working across sectors, she said, it is possible to foster youth engagement, community-based policing, neighborhood watch programs, and other efforts with a community focus. Finally, at a policy level, she suggested examining political representation on city councils and in policy-making groups, which can often be unbalanced or missing key stakeholders. Also, examining how areas are zoned and where property tax breaks are given can give additional insight into structural racism or other existing prejudicial systems that contribute to the potential for civil unrest. Determining whether or not communication pathways exist for gleaning feedback from residents could help in assessing the possibility of gaining a true appraisal of a community and the likelihood that it will experience some sort of civil unrest. Virginia Murray of Public Health England added that having a baseline documentation of the everyday and individual events of civil disturbance can help government and community leaders better understand the overall sentiment. Nothing is more critical for DRR than early warning and formal, adequate, and appropriate direction, she said.

MOVING TOWARD SOLUTIONS

Every sector has different values and different loyalties, Runnels said in conclusion, which makes working across sectors more difficult because combining efforts might mean changing the way organizations typically do business. Another participant raised the issue of political capital and the challenge of getting buy-in from decision makers who may be in a position of power for only a set amount of time, making long-term goals and visions sometimes difficult to achieve. However, even though the efforts will take time and cost money, many participants suggested that integrating DRR policies and strategies into day-to-day operations could mitigate some of the challenges and hesitancy of leaders to get involved. Building on this potential solution of "integration into daily life," others said that while many people are in search of the "million-dollar solution," simple, well-instituted programs can often have just as powerful an effect.

One way to mobilize communities to take on DRR as an important activity within their daily lives that was mentioned in both the civil unrest and water contamination sessions was building off of neighborhood watches or community associations. As several participants noted throughout the workshop, many DRR strategies, such as a neighborhood association movement to discourage crime or a community gardening program to increase the availability of and access to nutritional foods, can be developed at the grassroots level and scaled up. One participant suggested that working within already existing social networks is another method for success, because forcing people to work together arbitrarily has had limited success. But whether it is faith-based organizations, book clubs, or schools, using already established and trusted networks can be a great way to let those populations identify their own habits and risks and then decide what resources are needed to reduce those risks. Another participant said that there is a need for having measures of effectiveness from state or federal government agencies that could help secure buy-in and demonstrate the importance of DRR.[11] Currently, he said, the "process" is being measured (i.e., the number of people trained or whether an emergency plan was completed), but, as an example, states could consider reporting on "outcomes" such as diminishing mortality and measure progress in lives saved instead of people trained.

Finally, Mahany said that while the best process for lowering risks will be different in each community, the concept of culture of prevention can be applied to all sorts of hazards, as was evident from a variety of examples in this workshop. Getting people across the United States excited about assessing their own risks and developing tailored solutions for risk reduction can continue the socialization of DRR concepts and strategies happening around the world.

[11] As of June 2016, the Federal Emergency Management Agency has begun exploring the concept of a "disaster deductible" in hopes of incentivizing mitigation strategies and promoting risk-informed decision making and also facilitating state and local government planning to increase resilience. For more on the "disaster deductible" see https://www.fema.gov/disaster-deductible (accessed June 2, 2016).

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The National Academies of Sciences, Engineering, and Medicine's planning committees are solely responsible for organizing the workshop, identifying topics, and choosing speakers. The responsibility for the published Proceedings of a Workshop—in Brief rests with the rapporteurs and the institution.

REVIEWERS: To ensure that it meets institutional standards for quality and objectivity, this Proceedings of a Workshop—in Brief was reviewed by **Dan Hanfling**, UPMC Center for Health Security; **Mark Keim**, Disaster Doc Inc.; and **Mollie Mahany**, Centers for Disease Control and Prevention. **Lauren Shern** of the Health and Medicine Division served as the review coordinator.

SPONSORS: This activity was jointly supported by contracts between the National Academy of Sciences and the American College of Emergency Physicians; American Hospital Association; Association of Public Health Laboratories; Association of State and Territorial Health Officials; Centers for Disease Control and Prevention (Contract No. 200-2011-38807); Child Care Aware of America; Council of State and Territorial Epidemiologists; Department of Defense (Contract No. HHSP233201400020B/HHSP2337014); Department of Defense; Uniformed Services University of the Health Sciences (Contract No. HT9404-12-1-0022); Department of Health and Human Services' Administration for Children and Families (Contract No. HHSN26300084); Department of Health and Human Services' Food and Drug Administration (Contract No. 1R13FD005495-01); Department of Health and Human Services' National Institutes of Health: National Institute of Allergy and Infectious Diseases, National Institute of Environmental Health Sciences, National Library of Medicine (Contract No. HHSN26300084); Department of Health and Human Services' Office of the Assistant Secretary for Preparedness and Response (Contract No. HHSO100201550005A); Department of Homeland Security, Office of Health Affairs (Contract No. HSHQDC-15-C-00079); Department of Transportation's National Highway Traffic Safety Administration (Contract No. DTNH22-14-H-00468); East West Protection; GlaxoSmithKline; Healthcare Ready; Infectious Diseases Society of America; National Association of Chain Drug Stores; National Association of County and City Health Officials; National Association of Emergency Medical Technicians; Robert Wood Johnson Foundation (Contract No. ID#: 73289); Seqirus; and the Trauma Center Association of America.

For additional information regarding the meeting, visit
www.nationalacademies.org/hmd/Activities/PublicHealth/MedPrep/DRR%20Workshop.aspx.

Suggested citation: National Academies of Sciences, Engineering, and Medicine. 2016. *Exploring disaster risk reduction through community-level approaches to promote healthy outcomes: Proceedings of a workshop—in brief.* Washington, DC: The National Academies Press. doi: 10.17226/23600.

Health and Medicine Division