



ARIZONA DEPARTMENT
OF HEALTH SERVICES

PREPAREDNESS

Arizona Extreme Weather and Public Health Workshop

Workshop Summary Report

November 2016

Authors and Workshop Facilitators Matthew Roach, David M. Hondula, Hana Putnam, Nalini Chhetri, Brigette Sosa, Nick Schweers, Paul Chakalian, Lance Watkins, Andrew Maynard, Brigitte Dufour

Workshop Objective and Summary

In June 2016, the Arizona Department of Health Services (ADHS) with researchers from Arizona State University (ASU) convened a one-day workshop of public health professionals and experts from Arizona's county and state agencies to advance statewide preparedness for extreme weather events and climate change. The United States Centers for Disease Control and Prevention (CDC) sponsors the Climate-Ready Cities and States Initiative, which aims to help communities across the country prepare for and prevent projected disease burden associated with climate change. Arizona is one of 18 public health jurisdictions funded under this initiative. ADHS is deploying the CDC's five-step Building Resilience Against Climate Effects (BRACE) framework to assist counties and local public health partners with becoming better prepared to face challenges associated with the impacts of climate-sensitive hazards. Workshop participants engaged in facilitated exercises designed to rigorously consider social vulnerability to hazards in Arizona and to prioritize intervention activities for extreme heat, wildfire, air pollution, and flooding.

This report summarizes the proceedings of the workshop focusing primarily on two sessions: the first related to social vulnerability mapping and the second related to the identification and prioritization of interventions necessary to address the impacts of climate-sensitive hazards. The workshop participants were also briefed on the BRACE findings for the state published in two separate reports in 2015: the [Arizona BRACE Synthesis Report](#) and the [Arizona BRACE Extreme Weather, Climate and Health Profile Report](#). Following these presentations, Dr. Andrew Maynard, a leading expert on risk innovation, engaged participants in understanding how risk is perceived personally and the impact of climate hazards on health. The lunch speaker, Paul Iñiguez from the National Weather Service, provided an overview of major weather events in Arizona. Preliminary analysis of pre-workshop survey findings were also presented and highlighted interventions that counties would prioritize in the event that funding was available to mitigate and adapt to climate related health hazards. The rest of this report focuses on outputs of the sessions on vulnerability and intervention assessment.

Vulnerability Assessment

Hazards vulnerability mapping is a decision-support strategy intended to help public health agencies, and other agencies involved in preparedness and response activities, more readily identify communities in greatest need of services or with particular needs. At the workshop, inputs were sought from local experts regarding a statewide vulnerability assessment conducted by ASU. Attendees first studied and then ranked a standard set of social vulnerability indicator variables commonly used in the academic literature. Then they proposed new variables to be potentially included in social vulnerability mapping for Arizona in the future. Throughout this activity, group-members were encouraged to explain their rationale for making certain choices. Then, participants reviewed draft vulnerability maps for their jurisdiction that had been developed based off of standard set of social vulnerability indicator variables, and rated the extent to which they thought the map depicted hazard vulnerability in their communities was accurate from their own perspectives. On the vulnerability maps, attendees also identified areas that they had disagreement with or were uncertain about.



Figure 1. Welcome slide for the workshop.



Figure 2. Participants engaged in creative risk activities.

Preliminary analysis of the variables of the social vulnerability index prioritized by participants showed the following to be most useful for vulnerability mapping:

- Percentage of population over 65 or under 5 years old
- Median per capita income
- Percentage of households living below the poverty line
- Percentage of population living alone and over age 65

Some of the vulnerability indicators commonly used in the literature were considered to be less important, or caused disagreement regarding their importance for vulnerability mapping and included:

- Median home value
- Median gross rent
- Percentage of population of African American ethnicity
- Percentage of population living with a disability
- Percentage of population working in construction industry

Outside of the provided set of indicators, 17 variables were identified that participants believed to be at least *somewhat useful* for vulnerability mapping. Among the newly-proposed variables considered to be very useful were:

- Population density
- Prevalence of medical conditions including prescriptions and mental health
- Citizenship status

Nine social vulnerability to hazards index maps for various jurisdictions across the state were reviewed. When asked to rank the accuracy of the map compared to one's understanding of spatial patterns in vulnerability on a scale of 1 to 5, participants, averaged 3.6. The minimum ranking was 2 (one participant) and the maximum ranking was 5 (one participant). All participants in the mapping exercise identified at least one area in their jurisdiction where they had uncertainty or disagreement with the current vulnerability classification. In a follow-up activity to the workshop, a wider suite of health sector stakeholders from across the state have been asked to provide similar input on maps for

each county in a digital format. The results from this activity will be available in a full report, available later this year.

Comparisons of the results from the variable prioritization exercise, and preliminary analysis of the subsequent discussion of the three groups revealed surprisingly little agreement amongst participants about which social vulnerability indicators were most useful for predicting who and/or which places would be most impacted by a hazard in their community. The results of this exercise suggest that participants wanted more information about why indicators were included in the original SoVI-AZ maps, and specifically how the indicators co-varied. For example, there was disagreement about whether education variables mattered independent of income indicators. Even among the variables agreed to be most useful across multiple groups, the rationale for their importance was not always consistent among participants. Ultimately, further research is needed to better understand the causes of variable perceptions among public health and emergency management experts. (It is to be noted that all participants of this workshop were considered experts in their respective fields.) Yet unanswered questions include:



Figure 3. A participant explaining his perspective to the group.

- Is there general agreement on important social vulnerability indicators when disaggregated by regional expertise? Or by hazard-specific expertise?
- To what extent are the vulnerability-perceptions of emergency planners and public health officials shaped by their experience vs. their education and training?
- Do different vulnerability-perception “profiles” exist in the emergency management, response, and public health community?
- How do experts’ opinions about the most and least vulnerable populations compare to mortality and morbidity data in their communities?
- When discrepancies exist between expert opinion and mortality and morbidity data, how does one determine whether interactions with data, and/or expert perception need to be corrected? How might this be done?

Intervention Assessment

In the afternoon session of the workshop, participants evaluated the feasibility and effectiveness of a wide suite of interventions for climate-sensitive hazards that have been proposed in the scientific literature or have been already implemented by local, state, and federal agencies around the country. To frame the discussion, participants were asked to evaluate interventions within the scope of the lives of six hypothetical characters. The characters and vignettes were representative of Arizona’s demography and had different contextual backgrounds such as life circumstances, geography, and livelihood attributes including education, age, gender and income level. This activity had the dual purpose of catalyzing discussion among public health practitioners regarding what interventions would work best and for whom and why, in addition, to allowing our team to document the reasoning and thought processes articulated by the participants related to intervention implementation.



Figure 4. Participants engaged in small group discussion.



Figure 5. Facilitators listening to participants' perspectives.

Participants were divided into three different groups and asked to assess interventions for four climate-sensitive hazards: extreme heat, air quality, wildfire, and flooding. Across these four hazards, the same six characters were used as representatives of the population being impacted in these simulated climate-sensitive scenarios. In two back-to-back scenario sessions, each group first participated in the extreme heat scenario because this is a hazard of primary concern for most counties. During the second session, participants chose to assess effectiveness of interventions for wildfire, flooding, or air quality. Consequently, the feedback given regarding effectiveness and feasibility of these interventions come from one group per hazard in the second session, in contrast to the three groups that deliberated on extreme heat intervention.

Participants were asked to rank the effectiveness of each intervention on a scale from 1 (not effective) to 5 (highly effective) for each of the different hypothetical characters. Rankings varied widely across the many hazard-intervention-character combinations. For example, public alert systems were considered to be effective or very effective (average scores of 4.0 or above) strategies for reducing health risks associated with extreme heat for three of the six hypothetical characters, but relatively ineffective (average scores of 2.0 or lower) for two other characters. Feasibility scores also varied widely, with some participants recognizing that some effective interventions might be more feasibility implemented by agencies other than public health. Other key findings from this activity include:

Extreme heat

- Education campaigns were considered to be the most effective strategy for the greatest range of character attributes, including for those who were financially constrained, those in assisted living facilities, and individuals experiencing homelessness. Concerns were voiced about the effectiveness of educational campaigns for people with lower educational attainment.
- Cooling centers were agreed to be an effective intervention strategy for the impoverished, homeless, and socially isolated, but ineffective for people with mobility constraints. Public health representatives were uncertain as to the feasibility of this intervention strategy for their organizations.

Air pollution

- People with pre-existing health conditions were consistently thought to benefit the most from air quality interventions.

- Efforts to improve air quality (including through vehicle emissions inspections and local traffic reductions) were thought to be most effective for people with high outdoor exposure.

Wildfire

- People caring for and, in the care of others, were seen as more likely to reap the benefits of most interventions.
- Education level was deemed an important factor for the efficacy of public service announcements.

Flooding

- Warning systems and public service announcements were deemed the most effective intervention strategy for the highest number of characters.
- Flood insurance and channelization were not perceived to be effective strategies due to cost and practicalities of implementation.

An important theme across the analysis of intervention activities concerned the effectiveness of educational campaigns and public messaging for populations with differing levels of educational attainment and/or risk perception. Crafting effective messaging was considered by multiple workshop participants to be a particularly challenging activity and in need of greater attention from the public health sector and partner agencies in the future.

Acknowledgements

The authors and workshop organizers acknowledge the featured presenters at the June 2016 workshop, Andrew Maynard from ASU's School for the Future of Innovation and the ASU Risk Innovation Lab, and Paul Iñiguez from the Phoenix forecast office of the National Weather Service. Dr. Maynard kicked off the workshop with an engaging activity that broadened participants' conceptualizations of risk, and strategies to minimize risk. Mr. Iñiguez provided an informative update on recent extreme weather events that have impacted the state. Generous support from the Julie Ann Wrigley Global Institute of Sustainability at ASU helped make the workshop a success. Most importantly, we recognize and appreciate the workshop participants' efforts to create a more robust dialogue and public health strategy for climate-sensitive hazards through their participation at this workshop and engagement in subsequent activities.

Photo credits: School for the Future of Innovation in Society, Arizona State University

More detailed reports from the workshop are expected to be released in 2017.