National Institute of
Environmental Health Sciences

Disaster Research Response Workshop

Final Report

February 28-March 1, 2019
Tucson, Arizona

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A breakout group at the event *(Photo credit StoryMine Media)*

EXECUTIVE SUMMARY

On Feb. 28-March 1, 2019, the National Institutes of Health (NIH) Disaster Research Response (DR2) Program held its fourth workshop. A collaboration of the National Institute of Environmental Health Sciences (NIEHS) and the U.S. National Library of Medicine (NLM), the vision of the DR2 Program is to create a dynamic and interdisciplinary test bed of products, processes, and enhanced relationships that will improve our capabilities to perform timely health research in response to disasters and emerging threats.

This fourth workshop was held in conjunction with the University of Arizona College of Medicine – Tucson, the Mel and Enid Zuckerman College of Public Health, the University of Arizona College of Pharmacy, and the Bio5 Institute. This workshop's focus varied from previous workshops in that it looked at both clinical and population data needs. The workshop was organized around six objectives:

- Exploring the various needs and challenges related to responding to the health needs associated with a large-scale chemical event.
- Integrating health care/clinical and community-based response efforts, data collection, and research implementation.
- Assessing the continuum of information needs; the stakeholders involved, from the acute phase of the disaster and short-term assessments to the long term; and how data collected across all activities can be used to better support the overall goals of providing the best health care, community support, recovery, etc.
- Identifying important gaps in our systems and processes for collecting, managing, and disseminating data and research.
- Working with the local Institutional Review Board (IRB) to further understand how to improve engagement, reviews, and associated processes related to the development and implementation of disaster research protocols.
- Furthering the role of multidisciplinary academic programs/schools and their students in supporting the continuum of information collection and research needs associated with local response to disasters.

Workshop Planning

The Tucson workshop was developed by a planning committee, which was further divided into two working groups: a clinical working group and a population health working group. The planning committee included representatives from the University of Arizona, NIEHS, NIEHS support contractors, the NLM, the Pima County Health Department, the Pima County Office of Emergency Management, the Pima County Fire Department, the U.S. Food and Drug Administration (FDA), the University of Southern California/Meridian, the Tucson Water Department, Banner Health, and the Arizona Poison and Drug Control Center.

Format

The workshop included panel discussions, a set of breakout sessions, and student "flash talks" that provided brief overviews of the posters around the room. Question-and-answer sessions followed many of the panel discussions.

Scenario

A realistic scenario, based partly upon a 2005 train derailment in Graniteville, South Carolina, was created to drive all discussions. The scenario, a train derailment with chemical release, was slowly introduced during the event to allow for each element of response and recovery to be discussed.

Workshop Summary: Major Findings

Rich discussions were held throughout the event and discussions can be summarized around the four key themes that emerged.

Data Collection

Ensuring the information collected is well-considered, accurate, and useful to achieving short and longer-term goals is a critical step before and during the response efforts. The decisions made early on have ripple effects, affecting future credibility, trust, and recovery efforts. Thus, it is important to engage early with critical stakeholders and consider what information is needed to best support the acute response, as well as support additional needs going forward for both timely and well-informed decisions. Pre-development of data collection guidance and tools, IRB-review procedures, forums for engaging needed experts, and training will all help to support and enhance efforts to collect time-critical data needed to reduce injuries and illnesses and promote the well-being of the community.

Information Sharing

Once there is a data repository, questions that need to be answered include:

- Where is the data stored?
- Who owns it?
- How is access to the data controlled?

It is crucial to have a preexisting data-sharing infrastructure, liaisons for information sharing, and information-sharing mechanisms in place before a disaster.

- There are many legal agreements needed in order to use or share data in the research context.
- When possible, interagency service agreements or data use agreements should be put in place before a disaster. Since it is not always possible to identify potential data requests in advance, mechanisms and rules for requesting data should be established and data sharing committee members identified. It is also important to remember that data access or use may be different for different populations.
- Important data must be accessible and digestible to the public. It must be presented clearly and consistently across all platforms.
- It is vital to understand community context when sharing information across groups.

Community Engagement

Engagement with affected communities should begin at the very start of the disaster and must be sustained throughout the response.

- The community should be engaged in determining what data to collect and how to use the data in order to build trust and credibility. This is particularly important when working with areas of tribal sovereignty.
- It is necessary to identify the vulnerable populations and reach out to them. Health care networks and social services can often identify the vulnerable populations with limited capacity and support their success in evacuations, returning home, and continuing with their everyday lives. Vulnerable populations can also be difficult to locate during data collection efforts so strategies for locating, recruiting, and retaining them should be established.

Resources, Planning, and Support

There should already be emergency response and communication infrastructure in place before a disaster strikes. Leveraging resources and coordinating support from outside groups will ensure that the response is efficient and effective.

- Health care operates at capacity every day, so there is generally not a surplus of doctors and nurses. Hospitals need to consider decompression, implement surge and triage plans, and monitor if there will be a need for exposure monitoring or decontamination actions, as they will have limited capacity.
- Proper training is crucial for an effective response.
- Proactive engagement between the IRB and investigators should start early in the study design process and special IRB processes may need to be implemented.

Conclusion

Lessons learned from this workshop will help to increase preparedness for future events by assessing our capacity to collect timely population and clinical data, as well as facilitate discussions and actions to address gaps and overcome challenges that impede such efforts. Disasters do not happen in discrete silos. Information and data collection efforts, and the data produced, needs to move fluidly between health care and community-based response and recovery efforts. Public health officials and health care practitioners need the support and engagement of academia, the community, and other stakeholders to be able to effectively address acute and longitudinal exposures and health.

This workshop explored and tested a variety of ambitious objectives including the interface of clinical and community data collection, IRB considerations and processes for timely review of rapid clinical and population research protocols, involvement of transdisciplinary academicians and students in supporting an emergency response, and an understanding of the data and information needs, flows, management, and roadblocks associated with fulfilling the overarching goal of performing timely health research in response to disasters. The planning and execution of this workshop were novel, intense, and gratifying. Invested participants shared perspectives, learned from each other, and extended our understanding of the issues, challenges, and opportunities for improvement to the benefit of local communities.

WORKSHOP IN DETAIL

Introduction

Progress in disaster preparedness, response, and recovery is often hampered by the relative absence of scientific data that can help guide systems development, protocols and procedures, citizen action, and use of medical countermeasures. Short-term and long-term health consequences to a variety of exposures are often unknown. Behavioral health consequences have been identified, but preventive and mitigating measures are not yet fully understood. While there are many reasons for the overall lack of disaster science, a major contributor is the inability to conduct disaster research in the immediate post-disaster period when critical information is most perishable. Public health and medical responders have recognized the need to conduct disaster research for years. While research grants have been awarded to study the aftermath of disasters, such as the BP Deepwater Horizon Oil Spill and Hurricanes Sandy, Harvey, and Maria; research efforts came to fruition only after long periods in which protocols were developed and approved by Institutional Review Boards (IRB) and after funding became available. In these instances, the response has often been well into the recovery period when the research activities begin. Such delays in the initiation of data collection result in lost opportunities to answer vital questions that further our understanding to improve response, recovery, and future preparedness.

To date, there is no systematic research infrastructure to support public health and medical investigations following disasters. In response to recent disasters and the research conducted in their wake, NIH has committed to fund the NIH Disaster Research Response Program (DR2). This program, developed by the National Institute of Environmental Health Sciences (NIEHS) in collaboration with the National Library of Medicine (NLM), aims to create a disaster research system consisting of coordinated environmental health disaster research data collection tools, a network of trained research responders, and other study related resources. Elements of the system include epidemiologic questionnaires and clinical protocols, specially trained disaster researchers, environmental health disaster research networks, a roster of subject matter experts, and a support infrastructure that can be activated and deployed during public health emergencies and declared disasters. NIEHS is building on its extensive program capabilities, research networks, and field experience in leading this program to empower local communities to make use of these tools and field studies to answer their questions regarding disaster related environmental health concerns.

NIEHS and its partners held the first DR2 workshop on April 7, 2014, in the Port of Long Beach, California. The scenario discussed involved a tsunami hitting the Port of Los Angeles with health impacts to workers and local communities. The goals of the first workshop were to test and gather feedback on the concept of operations (ConOps) and to facilitate DR2 integration with local, state, private, and federal stakeholders. The workshop served to bring together these stakeholders to discuss the process of integrating research responders into the response system. NIEHS used the resulting feedback to revise the key components of the ConOps.

NIEHS and its partners held the second DR2 workshop in Houston on Feb. 16, 2015. Like the 2014 event, the format was also a facilitated discussion to consider potential procedures for including a research component in the larger response and recovery efforts following a disaster. The scenario discussed involved a hurricane hitting the Houston area with health impacts to workers and local communities.

The day was comprised of a morning and afternoon session. The morning session consisted of a facilitated discussion with all stakeholders to assess and evaluate research capabilities and capacities, identify mechanisms to engage federal partners, and explore future partnerships between all stakeholders. The afternoon session involved an interactive activity where participants had an opportunity to learn about and provide input to a NIEHS Rapid Acquisition of Pre- and Post-Incident Disaster Data (RAPIDD) research protocol designed for the rapid collection of baseline information from responders and disaster workers. The format for this session simulated enrollment of participants into a comprehensive post-disaster research study and the goal was to allow the exchange of ideas among government officials, academia, and community stakeholders on best practices for study operations.

A third workshop was held on July 19, 2016, in Boston at the Thomas P. O'Neill, Jr. Federal Building. The scenario discussed involved a Superstorm hitting areas surrounding Boston with widespread flooding and health impacts to workers and local communities The workshop brought together local, state, and federal public health and emergency response officials, community members, worker organizations, private industries, and other stakeholders to better understand how long-term, large scale research is requested at the local and state level, and the process in which outside assistance research requests are managed. Participants also assessed how a process, utilizing the current infrastructure, might facilitate collaborations between the differing groups to come together to develop and implement needed research.

This fourth workshop was held in conjunction the University of Arizona College of Medicine - Tucson, the Mel and Enid Zuckerman College of Public Health, the University of Arizona College of Pharmacy, and the Bio5 Institute, with the aim of exploring how stakeholders can come together to enhance both the population-based disaster research, as well as clinical disaster research.

Pre-workshop Planning

Site Visits

NIEHS staff and contractors visited the University of Arizona twice prior to the workshop: first in May 2018 and again in Sept. 2018. During the first visit, stakeholders were convened to hear about and discuss the workshop concept. During the second meeting, stakeholders gathered to get a better understanding of what each organization's role would be during a disaster, and what resources the various organizations had to offer prior to, during, and after the disaster. Meetings in Sept. focused on beginning to pin down workshop details, invitation lists and to customize sessions for the Tucson and University of Arizona communities. University of Arizona staff took planning committee members on a driving tour of the neighborhoods that would be impacted by the theoretical scenario and rail officials explained the workings and response procedures at a rail yard. Prior to the tour, University of Arizona students created a map that identified area clinics and service providers to invite to the event.

Using information learned during the site visit and tour, the original scenario, based on Graniteville, was further revised, modified, and customized for the Tucson community to reflect the real-life impacts on local businesses and neighborhoods.

During each visit, staff from NIH were able to meet one-on-one with research teams and students from the University of Arizona and from local and state government.

Planning Committees

Planning of the workshop was overseen by a planning committee of representatives from the University of Arizona College of Medicine - Tucson, the Mel and Enid Zuckerman College of Public Health, the University of Arizona College of Pharmacy, and the Bio5 Institute, as well as NIEHS staff and a representative from University of Southern California representing the United States Critical Illness and Injury Trials. Planning committee participants met twice a month and determined major event elements including

Aubrey Miller, NIEHS *(Photo credit StoryMine Media)*

goals, workshop length, and proper representation of local speakers and views.

The role of detailed session planning was broken into two working groups: a clinical working group and a population health working group. Working group participants included students and staff from the University of Arizona, NIEHS, NIEHS support contractors, the NLM, the Pima County Health Department, the Pima County Office of Emergency Management, the Pima County Fire Department, the U.S. Food and Drug Administration (FDA), the University of Southern California/Meridian, Tucson Water, Banner Health, and the Arizona Poison and Drug Control Center.

Working groups met bi-weekly and focused on creating sessions that would be of interest to those in the Tucson area, advance disaster research concepts, and, importantly, included student and community participation. Once session goals and topics were determined, working groups suggested speakers and personally invited colleagues and students to attend the event.

The clinical working group focused on the role of clinical research in disasters and how clinical data (such as Electronic Health Records) could be shared with researchers conducing disaster research. Issues such as HIPAA privacy and data formatting differences between study systems and event data collection were discussed. Representatives of local health care systems participated in calls and noted that the scenario itself could introduce a new challenge for clinical care: hospital closure and evacuation. In an event such as this, it is possible that a local health care facility may need to close to incoming patients or even evacuate patients. Tracking those patients and the evacuation process itself would mean other disaster data would not be collected.

Suggestions for future workshops

- Give audience members a theoretical "profile" of a disaster researcher, responder or local community member whom the participant would 'act' as during the event, raising concerns, questions etc. from the point of view of the profile.
- Build and demonstrate actual mock data flowing from the field through EHR's and into a research database.
- Challenge host institutions to use the workshop to test other disaster procedures such as evacuation or decontamination.
- Invite the communications team from each stakeholder group to an event and using the scenario, discuss processes for joint communications, announcements, language translation and disseminating messages to the community.

The working group explored the types of data available that may identify a patient as having been treated, exposed, or evacuated and considered how that information and status could be used by researchers. The role of poison control centers was also discussed as the Arizona Poison Control Center has detailed databases of inbound and outbound calls from the public and medical provider community, is HIPAA exempt, and has existing systems in place to help identify/notify public health officials of possible exposures. Clinical data offers researchers a wealth of knowledge in a disaster, however, the exact format of the data and other variables prove challenging to combining and sharing this valuable data. The clinical working group worked to understand the role of other clinical research networks such as the *Network of Networks and the Discovery Research Network (Formerly the United States Critical Illness and Injury Trials Group*) as well as other healthcare networks in the community and identified their potential role in response.

The population working group included local emergency response and public health officials as well as University of Arizona students and staff. The population working group focused on student engagement, community involvement, and ensuring panels were representative of community and non-academic partners and emergency and public health responders. Student projects in the classroom helped structure discussions and the group decided that students would have an opportunity to speak and present posters during the workshop. The population working group determined the topics for and led the breakout sessions on Understanding Community Health Impacts.

Working with tribal communities is an important part of research, and is particularly important for disaster research, where pre-existing relationships and trust are required before a researcher even steps onto tribal land. While not part of the DR2 Workshop, a full-day discussion about disaster research was held with the tribal community at the 2019 Native American Research and Training Center (NARTC) Winter Institute, held on the days just prior to the DR2 workshop. The DR2 workshop focused on a scenario involving impacts on Tucson local communities, which include many Native Americans. As such, Native American students and leaders joined both events, and NIEHS is continuing to work with native nations to understand how to further support their growing interests in improving their understanding and capacity for disaster research.

WORKSHOP AGENDA

Day 1: February 28, 2019

8:30 a.m.	**Sign-in and Registration** Kiewit Auditorium at the Arizona Cancer Center 1515 N. Campbell Ave. Tucson, Arizona 85724
9:00 – 9:45 a.m.	**Welcome, Introduction, and Overviews** • Linda Birnbaum, Director, National Institute of Environmental Health Sciences • Irving Kron, Interim Dean, University of Arizona College of Medicine- Tucson • Jennifer Barton, Director of the University of Arizona BIO5 Institute • Brian Erstad, Head of the Department of Pharmacy Practice and Science at the College of Pharmacy • Jeff Burgess, Associate Dean for Research, Mel and Enid Zuckerman College of Public Health
9:45 - 10:45 a.m.	**General Background on Disaster Management Health Issues** Facilitator: Jeff Burgess, University of Arizona College of Public Health • Chris Anderson, Deputy Chief, Tucson Fire Department • Jeff Guthrie, Director of Pima County Office of Emergency Management • Stacey Arnesen, National Library of Medicine • Keith Mundy, International Chemical Workers Union Council • Jim Remington, NIEHS Worker Training Program
10:45 - 11:00 a.m.	**Break**
11:00 - 11:05 a.m.	**Student Flash Talk** • Impacted Disaster Area • Impacts of Chlorine and Pesticide
11:05 a.m. - 12:05 p.m.	**Acute Emergency Management Information for Health Protection** Facilitator: Kevin Yeskey, HHS Principal Deputy Assistant Secretary for Preparedness and Response • Chris Anderson, Deputy Chief, Tucson Fire Department • Keith Fehr, Banner Health • Jeff Guthrie, Director of Pima County Office of Emergency Management • Mazda Shirazi, Arizona Poison and Drug Information Center • Louie Valenzuela, Pima County Health Department • Ray Vasquez, Union Pacific • Debra Wise-Parks, El Rio Health
12:05 – 1:05 p.m.	**Lunch**

1:05 – 2:05 p.m.	**Medical Care and Treatment** Facilitator: Chuck Cairns, Dean, College of Medicine and Health Sciences, United Arab Emirates University • John Scherpf, Chief Operating Officer for Banner – University Medical Center Tucson and Banner – University Medical Center South • J. Perren Cobb, Keck School of Medicine at University of Southern California • Christopher Edwards, University of Arizona College of Pharmacy • Gregory Measer, Food and Drug Administration • Jarrod Mosier, University of Arizona College of Medicine • Trisha Pearce, Southern Arizona VA Health Care System • Frank Walter, University of Arizona College of Medicine
2:05 – 2:35 p.m.	**Overview of Steps and Information Needs for Health Care and Community Studies & Introduction to Data Map** • Steve Ramsey, Social & Scientific Systems • Karen Lutrick, University of Arizona College of Medicine
2:35 -2:45 p.m.	**Break**

2:45 – 3:45 p.m.	**Health Care Information Collection Demonstrations**
	• National Library of Medicine Common Data Elements and NIEHS RAPIDD
	  • Stacey Arnesen, National Library of Medicine and Steve Ramsey, Social and Scientific Systems.
	• Meridian/AKIDO Demonstration
	  • J. Perren Cobb, Keck School of Medicine at University of Southern California
	• FDA RAPIDD Mobile Data
	  • Greg Measer, Food and Drug Administration Crowd Movement Model
	  • Young-Jun Son, University of Arizona Department of Systems and Industrial Engineering
	• Poison Control Center Demonstration
	  • Mazda Shirazi, Arizona Poison and Drug Information Center

3:45- 4:30 p.m.	**Breakout Sessions: Clinical Data** • Clinical Data .....Room 3978 • Environmental and Animal Data Collection .....Main Auditorium • Data Use, Permissions and Research .....Room 4978
4:30 – 5:00 p.m.	**IRB Discussion of Ethical Considerations and Issues for Health Studies** • Mariette Marsh, Director, Human Subjects Protection and Privacy Program, University of Arizona • Joan Packenham, National Institute of Environmental Health Sciences
5:00 – 5:05 p.m.	**Wrap Up**

Day 2: March 1, 2019

8:30 a.m.	**Sign-in and Registration** Kiewit Auditorium
9:00 – 9:30 a.m.	**Report Back from Clinical Data Breakouts**
9:30 – 10:35 a.m.	**Understanding Community Health Impacts** Facilitator: Liam O'Fallon, NIEHS • Paloma Beamer, Southwest Environmental Health Sciences Center, UA • Sonia Colina, National Center for Interpretation at University of Arizona • Kristen Pogreba-Brown, University of Arizona College of Public Health • Kim Tham, Pima County Health Department • Ann Marie Wolf, Sonora Environmental Research Institute, Inc. (SERI) • Kenneth Komatsu, Arizona Department of Health Services (Invited)
10:35 – 11:00 a.m.	**Student Flash Talks** • Using Toxin Exposure Surveillance in Animals to Predict Toxin Exposure in Humans • Addressing Service Gaps for Those with HIV in a Tucson Disaster • PACC Housing Animals during an Evacuation • Using Emergency Alert Systems to Generate a Disaster Registry: The Potential Role of IPAWS in Identifying Affected Persons • Understanding vulnerability and adaptive capacity to large-scale power failure • Psychological Interventions and Data Collection Methodology for Early to Mid-term Stages of Post-Disaster Relief • Monitoring First Responders for Health Effects Using Epigenetic Markers
11:00 - 11:05 a.m.	**Break and Move to Breakout Sessions**
11:05 a.m. - 12:00 p.m.	**Breakout Sessions: Understanding Community Health Impacts** • Environmental Data Collection ..... Room 4978 • Community Resilience & Long-Term Recovery ..... Room 3978 • Community Data Collection ..... Main Auditorium • Community Engagement ..... Room 2920
12:00 – 12:15 p.m.	**Report Back**
12:15 – 1:30 p.m.	**Lunch and Poster Viewing**

1:30 – 3:30 p.m.	**Research to Support Long-term Recovery and Well-being** • Michael Allison, Arizona Department of Health Services • Dean Billheimer, Southwest Environmental Health Sciences Center, UA • Linda Birnbaum, Director, National Institute of Environmental Health Sciences • Jeff Burgess, University of Arizona College of Public Health • J. Perren Cobb, Keck School of Medicine at University of Southern California • Leremy Colf, HHS Assistant Secretary for Preparedness and Response • Joseph "Chip" Hughes, NIEHS Worker Training Program • Kim Janes, Pima County Health Department • Andreas Theodorou, BUMG Chief Education Officer, UA Vice Chair Clinical Affairs and Quality, Department of Pediatrics
3:30 – 3:35 p.m.	**Student Flash Talk** • Evaluation
3:35 – 4:30 p.m.	**Translating the Workshop to Improve Future Disaster Research** • Local Reflections • National Reflections • Group Discussion

Welcome, Introduction, and Overview

Linda Birnbaum, Ph.D., NIEHS and National Toxicology Program (NTP) director, led the welcome to all Workshop participants.

Aubrey Miller, M.D., M.P.H., NIEHS Senior Medical Advisor, asked participants to go around the room and introduce themselves by sharing their name and affiliation. A detailed list of attendees can be found in appendix 2.

February 26, 2019, 8:00 a.m.: A freight train has collided with another train in Tucson at the Union Pacific Rail Yard. The immediate collision has resulted in a large explosion and derailment of several railroad cars carrying industrial chemicals including propane, chlorine, and malathion. It is reported that chemicals are leaking from several of the cars and the smell of chlorine is very strong. Injuries have been reported and firefighters are arriving on the scene to assess and control the situation. Winds are blowing at four miles per hour out of the east.

The derailment has disrupted traffic on roads south of Broadway and North of E. Ajo Way between S. Park Ave. and S. Columbus Blvd, including major bridges crossing the rail yard at 22nd street and the South Kino Parkway, and Aviation Parkway (Highway 210) and stretches of the South Kino Parkway. Also, the I-10 corridor has been impacted by the incident.

General Background on Disaster Management Health Issues

Jeff Burgess, M.D., Associate Dean for Research of the University of Arizona's College of Public Health, facilitated the panel discussion in response to the scenario provided. Panelists discussed the importance of verifying that the incident information received is accurate before acting on a response and informing the public. Panelists agreed that first responders would be deployed within minutes of the initial notification of an incident to assess the situation and provide site information to support emergency managers and other decision-makers.

The Pima County Office of Emergency Management (OEM) would immediately conduct a damage assessment to understand the "big picture" of how the affected communities and infrastructure would be impacted. OEM would provide support and help coordinate resources for the Incident Commander, keep the media, local officials, and public up to date with accurate information, and determine if the incident needs to be declared as an emergency. Mapping and weather systems tools would also be used to assess the potential reach of the incident. *NIEHS Worker Training Program (WTP)* staff would reach out to the local grantees to gain awareness of the situation and to see if support is needed in mobilizing trainers to provide safety and health training to those responding to the event.

On the following pages, an icon of a megaphone indicates the scenario language that was injected during the workshop.

Student Flash Talks

Aubrey introduced two students from the University of Arizona's Southwest Environmental Health Sciences Center-Community Engagement Core who each presented three-minute presentations on the following topics *(see appendix 3 for full abstracts)*:

Community Impacts Within Affected Disaster Area

Impacts of Chlorine and Pesticide

February 28, 2019, 10:00 a.m.: Fire and chemical plumes are flowing into neighboring communities in Pueblo Gardens, South Park, Las Vistas, and South Tucson. Approximately 6,000 people are living in these communities. Evacuation efforts have been initiated for those within 1 mile of the rail yard, and shelter-in-place orders have been issued for those located between 1 and 2 miles of the yard.

The chemicals released from four of the breached railroad cars included liquid propane; chlorine (90-ton car); and malathion, an organophosphate pesticide (80-ton car). One railroad car carrying flammable propane, located further away from the other railroad cars, exploded during the accident, sending a fireball high into the sky. A gaseous plume with the distinct smell of chlorine has been reported (chlorine measurements taken within .1 miles of the site were 90 ppm). Workers and residents near the rail yard are being transported to Banner Health. High numbers of incident-related injuries and seven deaths have been reported at this time.

Acute Emergency Management Information for Health Protection

Kevin Yeskey, M.D., HHS Principal Deputy Assistant Secretary for Preparedness and Response, served as the session facilitator to address the updated scenario. Panelists shared their processes for understanding priority concerns, information gaps, and uncertainties that would need to be assessed at this point to identify the most at-risk areas and populations. The number of fire department staff deployed and hospitals, poison control centers, and community health organizations engaged would be directly determined by this analysis. The analysis would also affect decisions made regarding patient treatment capacity and procedures; e.g., triage, performing elective surgeries, exposure or decontamination needs, etc. Panelists agreed that information sharing between all partners in real time would be a main priority, as well as sharing unified and consistent messaging with the public in a way that does not provoke panic or mistrust in response efforts.

Medical Care and Treatment

February 28, 2019, 2:00 p.m.: At this time, nine deaths have been confirmed. Ambulances have been taking the injured to Banner University Medical Center and nearby hospitals. Other area clinics and health treatment facilities are reporting an increase in calls and visits by worried and sick individuals. Victims have skin, mucosal, respiratory, neurological, and gastrointestinal symptoms that are consistent with exposure to burning particulate, chlorine, and organophosphate pesticides.

Chuck Cairns, M.D., dean of United Arab Emirates University's College of Medicine and Health Sciences, facilitated this session. Panelists discussed triage methods for identifying and providing treatment to those who are most seriously injured or poisoned, conducting outreach to

regional supplies and engaging private sector resources, and allocating the appropriate antidotes to the right people.

Halfway through session, Aubrey introduced the next scenario inject:

February 28, 2019, 6:00 p.m.: Numerous area workers and residents, including children, nursing home residents, and others, have been arriving at Banner, as well as at care facilities throughout the Tucson area. Available beds, front-line medical treatments, and other resources are rapidly being depleted.

The news media is reporting that a child living near the site is in critical condition due to what appears to be pesticide-related exposure.

Health experts are reportedly working to understand the health impacts of the situation and the best courses of treatment. As standard treatments for victims are being used, the team begins discussing the use of alternative treatments in case standard options run out. Local health officials are working closely with the U.S. Department of Health and Human Services, the Centers for Disease Control and Prevention, and the Food and Drug Administration to access and administer needed medical treatments.

The Head of the ER wants to know what treatments they should be using with respect to clinical findings.

The Public Health Director wants to know what he should be looking for and advising people regarding the findings and when to go to the hospital.

Panelists agreed that the importance of communication and care coordination between health care centers would be critical. The data gathered during the event would guide pattern recognition and drive the need for resources, staff, and alternative treatments. The panelists agreed that having an existing communication infrastructure in place among local health care and disaster response partners ensures for efficient information sharing. For efficiency, health care would be provided primarily at health care facilities and hospitals, as opposed to conducting a neighborhood assessment, since health care facilities are managing and receiving most of the treatment resources firsthand.

Overview of Steps and Information Needs for Health Care and Community Studies & Introduction to Data Map

Aubrey Miller facilitated this session on data mapping throughout the incident with various data streams. The initiation of research related data collection at the onset of a disaster is a difficult process that the Tucson Rail Accident & Chemical Exposure (TRACE) Research Study would help navigate.

The TRACE study was designed by the NIEHS team as a demonstration of the operations required for a long-term cohort study that includes clinical data. The University of Arizona-Rapid Acquisition of Pre- and Post-Incident Disaster Data (UA-RAPIDD) collection research protocol, a modification of the *NIH RAPIDD*, would be used for long-term community epidemiological studies.

The TRACE study proposed to collect the clinical data that is most feasible during a disaster and would produce the greatest portfolio of information to assess safety and effectiveness of treatments administered by health care professionals in response to the Tucson rail incident. The study would also examine the health outcomes associated with no treatment or supportive care since it is expected that some individuals will not receive treatment, based on the availability of antidotes and/or triage factors or other implications.

The RAPIDD study would be a prospective, observational cohort study investigating potential short-term and long-term health effects related to exposure(s) to toxic chemicals and other hazards associated with the Tucson rail incident. Primary objectives of the UA-RAPIDD would include: to create a research registry cohort comprised of individuals in communities impacted by the Tucson Rail incident; to gather sociodemographic, health status, exposure and lifestyle information from the cohort; and to collect, process, and store biospecimens (blood and urine) and environmental samples (dust, water, soil, and air) to allow estimations of disaster related exposures of the cohort.

Karen Lutrick, on behalf of a working group at the University of Arizona, introduced a series of schematics visualizing data flow from various sources that describe where data is collected and stored throughout the response and how it would be migrated and used for research purposes.

Health Care Information Collection Demonstrations

Steve Ramsey, project manager at Social and Scientific Systems Inc., facilitated this demonstration session to serve as a proof of concept and show the unification between tools to map data flows and clinical and population studies. As part of the RAPIDD protocol developed, a sample exposure assessment and symptomology questionnaire were developed to collect information in both the community and clinical settings (see figure RAPIDD Test Survey). The RAPIDD survey was created electronically using the National Institutes of Health *Common Data Elements (CDE)*, which were developed as part of an effort to collect data in the same way over multiple studies to improve reproducibility and expand data sets. CDE consists

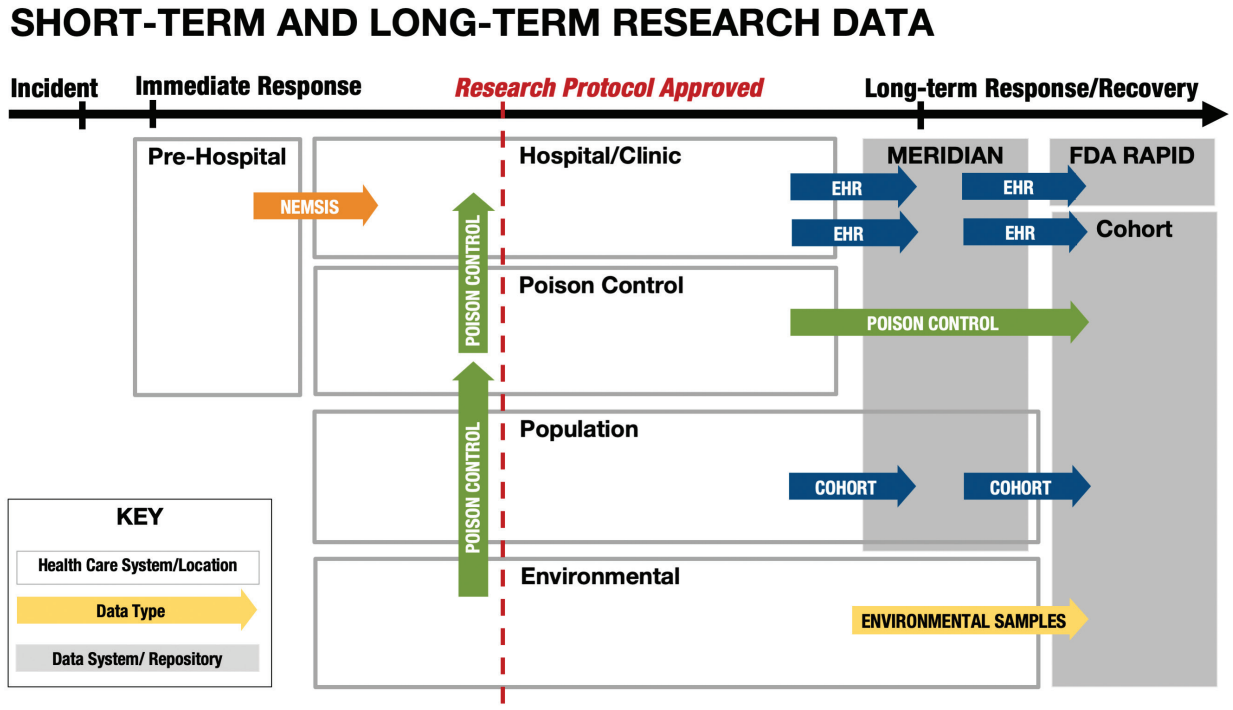
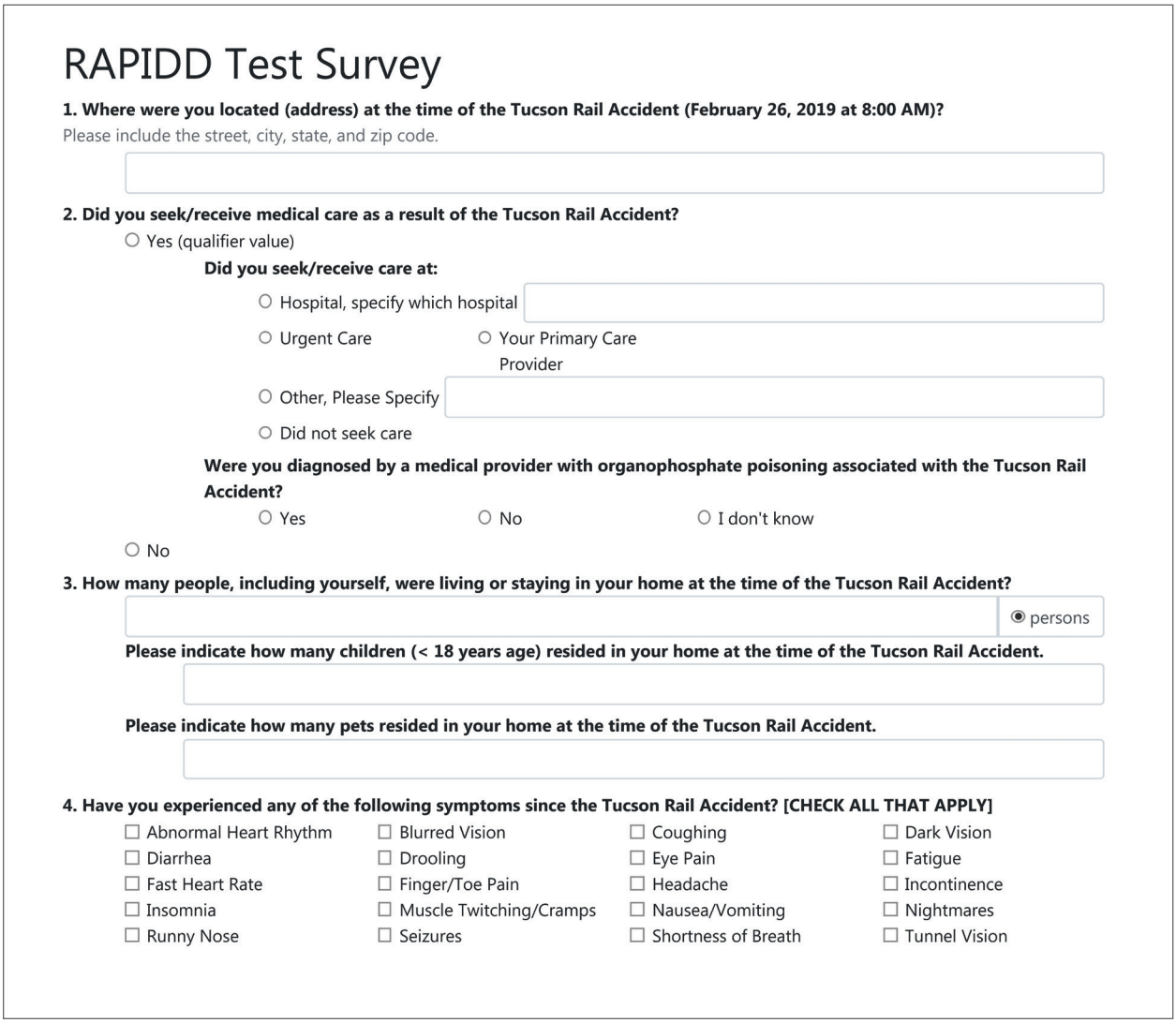


Figure 1: Response and operational data repositories and flows beginning with the National Emergency Medical Services Information System (NEMSIS), which collects pre-hospital information on patients through hospital data contained in Electronic Medical Records and ultimately becomes useful in enumerating the cohorts for various studies. Schematic credit to Karen Lutrick, Ph.D, University of Arizona

of a precisely defined question and a specified format or set of permissible values for responses (answers) that are defined unambiguously in human and machine-computable terms. Once the data elements of interest for a study are chosen and data collection forms are constructed in the system, code can be exported using the Fast Healthcare Interoperability Resources (FHIR) Specification, which is a standard for exchanging healthcare information electronically. This code can then be imported into other FHIR compliant data systems.

The FHIR compliant system, a tool from the University of Southern California called Meridian, utilized during this workshop to import the data collection forms created using CDE, was designed as part of the Critical Care Research Network (CCRN). CCRN fosters collaborative research to promote the advancement of science in the field to improve outcomes for critically ill and injured patients. This system enables research teams to conduct automated study administration, integrate electronic medical records, and collect and manage data at single sites, multiple sites, or virtually anywhere, and enables real-time data availability.



RAPIDD Test Survey

1. Where were you located (address) at the time of the Tucson Rail Accident (February 26, 2019 at 8:00 AM)?
Please include the street, city, state, and zip code.

2. Did you seek/receive medical care as a result of the Tucson Rail Accident?
- ○ Yes (qualifier value)
  - **Did you seek/receive care at:**
    - ○ Hospital, specify which hospital
    - ○ Urgent Care
    - ○ Your Primary Care Provider
    - ○ Other, Please Specify
    - ○ Did not seek care
  - **Were you diagnosed by a medical provider with organophosphate poisoning associated with the Tucson Rail Accident?**
    - ○ Yes ○ No ○ I don't know
- ○ No

3. How many people, including yourself, were living or staying in your home at the time of the Tucson Rail Accident?
◉ persons

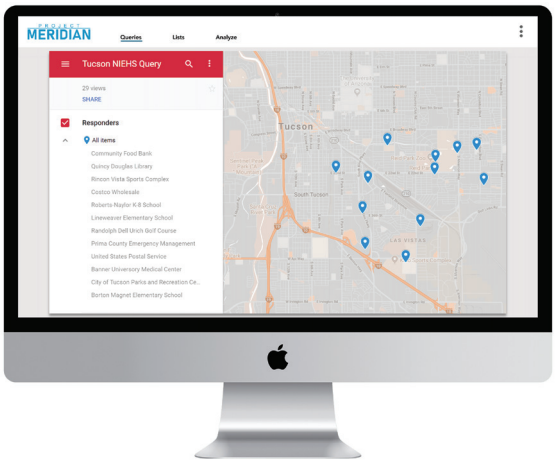
Please indicate how many children (< 18 years age) resided in your home at the time of the Tucson Rail Accident.

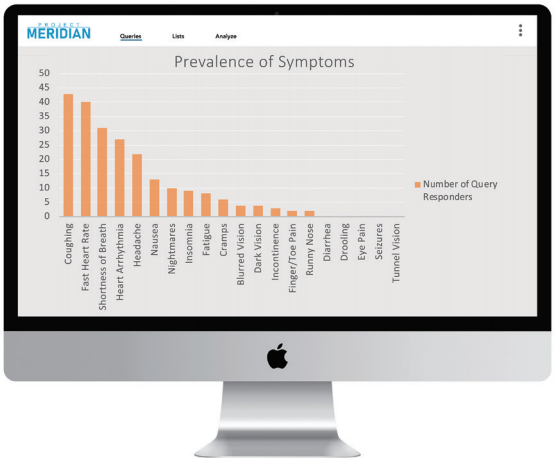
Please indicate how many pets resided in your home at the time of the Tucson Rail Accident.

4. Have you experienced any of the following symptoms since the Tucson Rail Accident? [CHECK ALL THAT APPLY]

☐ Abnormal Heart Rhythm	☐ Blurred Vision	☐ Coughing	☐ Dark Vision
☐ Diarrhea	☐ Drooling	☐ Eye Pain	☐ Fatigue
☐ Fast Heart Rate	☐ Finger/Toe Pain	☐ Headache	☐ Incontinence
☐ Insomnia	☐ Muscle Twitching/Cramps	☐ Nausea/Vomiting	☐ Nightmares
☐ Runny Nose	☐ Seizures	☐ Shortness of Breath	☐ Tunnel Vision

As part of the demonstration, Steve used Meridian to send a text message to workshop participants inviting them to complete the RAPIDD questionnaire. As results were received in real time, Steve demonstrated the administrative functions of the Meridian platform and showed the data being displayed on a map and graph (*see figures*). Once collected, the data can be extracted in a variety of formats for analysis.





Other complementary tools presented included *FDA's RAPID mobile data application* and the University of Arizona's work on crowd simulation modeling for emergency evacuations. The session addressed the challenges of and solutions for collecting clinical data during emergencies to inform research collection processes in future disaster responses.

Breakout Sessions: Clinical Data

University of Arizona faculty facilitated three different breakout sessions on the following topics: Collection; Clinical Data; and Data Use, Permissions, and Research.

Walt Klimecki, Ph.D., associate professor, facilitated the **Environmental and Animal Data** session to share basic toxicology concerns for environmental and animal exposure and explore strategies for environmental and animal data collection in the exposed community. The working group discussed the need to develop a protocol to evacuate and care for animals (wild, research, zoo, and pets) following a disaster, as well as the need to develop sampling and analytical methods to collect environmental data. Participants also stressed the importance of understanding background measurements pre-disaster to establish a baseline.

John Howard, HIPAA privacy officer, and Mariette Marsh, director of the University of Arizona's Human Subjects Protection and Privacy Program, facilitated the session on **Data Use, Permissions, and Research** to explore regulations and best practices for collecting, managing, and maintaining responsible use of data for operations and research. Breakout group participants noted the importance of engaging the community in determining what to collect and how to use data, the need to develop a community engagement board, building trust early, and staying engaged with the community.

Karen Lutrick, Ph.D., assistant professor, and Chris Edwards, Pharm.D., assistant professor, facilitated the **Clinical Data** breakout session to explore clinical data collection plans, strategies, best practices, and opportunities amidst the current structure of clinical research in the U.S. that created funding barriers that make conducting research and exercising capabilities difficult (especially during emergencies). Opportunities identified by the breakout group included creating system-wide registries at hospitals and poison control centers and advocating for integrated, interagency funding to include research infrastructure and exercises.

IRB Discussion of Ethical Considerations and Issues for Health Studies

Aubrey Miller facilitated this session on the importance of Institutional Review Board (IRB) preparedness in the disaster research enterprise. IRBs have the responsibility of protecting impacted populations from research-related harms and can play a key role as gatekeepers to the research enterprise, yet few have direct experience with reviewing disaster-related research protocols.

A mock IRB Review session at University of Arizona, facilitated by Joan Packenham, Ph.D., Director of NIEHS Office of Human Research Compliance, and Mariette Marsh (UA) took place on February 26, 2019, and served as a training for IRB members and field testing of training tools. Sixteen IRB members received two mock case study protocols (UA-RAPIDD and TRACE) and two tools, the Post Disaster -Researcher Engagement Assessment and Community Template (PD-REACT) for PIs and the IRB Disaster Checklist for IRBs, which were sent four days prior to simulate what it might be like for an IRB to address an urgent request for review. The training was based on NIEHS-published recommendations and best practices for IRB review of disaster related protocols. To the extent possible, the IRB meeting was held as close to a normal IRB meeting as possible, with one primary reviewer and a secondary reviewer. After presenting the protocols, the primary reviewer would field questions and consider comments from other Board members prior to approval with minor stipulations.

Lessons learned from the mock review included:

- IRBs need disaster specific training to look beyond standard review requirements.
- Future training should introduce an interventional type of protocol to aid in providing a more well-rounded test case of the ethical issues associated with disaster research. Observational research is not the only type of disaster research that might occur.
- Proactive engagement between IRB and investigators would need to start early in study design process.
- It is important to have the appropriate stakeholders as ad hoc reviewers, such as disaster responders and social service agencies or community representatives.
- To reduce the time required for protocol development, modification of the normal review process should be considered for disaster research so that the PIs have the opportunity to hear the feedback of the IRB and address questions and concerns as opposed to waiting for written feedback and/or stipulations.
- The IRB tools were a valuable addition to the normal review process.
- IRB preparedness is a critical element in successfully reviewing disaster-related protocols to ensure adequate participant and community protections.

Community Health Impacts

14 Days Later: Evacuated citizens are being permitted to return to their homes to begin the cleanup and repairs. As seen with other disasters, many did not leave their homes.

Private businesses and manufacturing are working to clean up and reopen. Local workers are being hired to assist with the cleanup. Out-of-area workers and volunteers, including groups of unskilled workers and volunteer organizations, have also shown up to help with the recovery.

Due to the severity of the cases reported by the news media, local emergency departments, and local responders, requests have been made to the local public health department to investigate the health effects related to the exposures.

Liam O'Fallon, Ph.D., and coordinator of the Partnerships for Environmental Public Health program at NIEHS, facilitated the session discussing community engagement issues that would need to be considered as people begin to return to their homes. An engagement plan would need to

include homeless populations, detention centers, jail, and special populations, and account for various languages and cultures. As trust is sometimes lacking between agencies and universities and communities, trusted community health care leaders would go into the communities to talk about the risks and share information. Panelists emphasized the importance of bringing in community members into the research process as soon as possible once the geographic area is identified, so that there is increased trust regarding the ownership of data and community engagement in determining what data is needed.

Community residents and local workers are complaining of a variety of symptoms, including stress, anxiety, skin rashes, shortness of breath, dizziness, headaches, and tingling in the extremities. Area health treatment facilities are continuing to report increased cases of those seeking medical attention for health and mental health conditions related to the situation. Additionally, community residents and local workers in the surrounding communities are complaining of ongoing smells, debris, ash, and dust from the accident. Residents are also reporting dead birds and rabbits, and illnesses in their pets. Area residents are increasingly worried and distrustful about the safety of the community:

- Are the playgrounds and yards safe for children?
- What about food grown in home gardens?
- Is it safe to swim in local pools?

Community members (especially the elderly, pregnant women, and children's advocates), responders, and cleanup workers are alarmed about reports of those still being seen with symptoms that many believe to be associated with residual contamination of homes, businesses, playgrounds, etc., and are requesting that the health commission investigate the affected populations.

Panelists noted that "is it safe?" is one of the hardest questions asked by communities. There would be a need to be transparent on what is known and what is unknown as to not impede the trust building process. The term "safe" has different meanings to different communities.

Student Flash Talks

Kristen Pogreba-Brown, Ph.D., assistant professor at the University of Arizona, introduced two students from the University of Arizona's Southwest Environmental Health Sciences Center- Community Engagement Core who each presented three-minute presentations on the following topics (*see appendix for full abstracts*):

- Using Toxin Exposure Surveillance in Animals to Predict Toxin Exposure in Humans
- Addressing Service Gaps for Those with HIV in a Tucson Disaster
- PACC Housing Animals during an Evacuation
- Using Emergency Alert Systems to Generate a Disaster Registry: The Potential Role of IPAWS in Identifying Affected Person
- Psychological Interventions and Data Collection Methodology for Early to Mid-term Stages of Post-Disaster Relief
- Understanding Vulnerability and Adaptive Capacity to Large-scale Power Failure
- Monitoring First Responders for Health Effects Using Epigenetic Markers

Breakout Sessions: Understanding Community Health Impacts

30 Days Later: Tucson stakeholders have received funds to quickly identify the current health symptoms/problems, health care needs, environmental exposures, and related concerns for all community members living in a 1-mile radius of the site. Decision-makers wish to answer the following questions:

- What is the nature and prevalence of health problems?
- What contaminants of concern are present in the environment?
- What are the residents' major concerns that need to be addressed?

The community continues to express concerns about being involved in all aspects of data collection efforts, ensuring that their concerns and health needs are being addressed, as well as the safety of their homes and neighborhoods.

Many groups are concerned about achieving meaningful long-term recovery for the community in the months to years ahead.

NOTE: All strategies must include considerations (e.g., data usage, IRB considerations, community and participant engagement, etc.) of collecting data in a way to support upcoming implementation the TRACE research protocols to better understand the longer-term health impacts, exposures, and needs of the community.

Attendees participated in one of four breakout sessions on the following topics: Environmental Data Collection, Community Resilience & Long-Term Recovery, Community Data Collection, and Community Engagement.

Dan Quintinar, project manager for Tucson Water, and Yoshi Ornelas, doctoral student at the Mel and Enid Zuckerman College of Public Health, facilitated the breakout session on **Environmental Data Collection** and introduced the two phases of the environmental data collection process. Participants broke up into two groups to discuss the strengths and weaknesses of each phase.

Marti Lindsey, Ph.D., community engagement director of the Southwest Environmental Health Sciences Center, facilitated the session on **Resilience and Long-term Recovery** to discuss how to ensure the inclusion of mental health and behavioral health in resilience. Participants discussed how long-term recovery is critical since a disaster can become an identity for the community.

Kristen Pogreba-Brown facilitated the **Community Data Collection** breakout session to discuss elements of a strategy for collecting cross-sectional health information regarding impacted community members. Participants explored what data could and should be collected on demographics, health, exposures, continued health needs, services, etc.

Paloma Beamer, Ph.D., associate professor at the University of Arizona, facilitated the session on **Community Engagement** to discuss how to create effective community engagement after a disaster to ensure an inclusive, effective, and supportive platform for dialogue. Participants discussed best practices for identifying and addressing community concerns, as well as how to effectively communicate information to the community and others.

Research to Support Long-term Recovery and Well-being

60 Days Later: At least 1,200 people, including cleanup workers, have sought medical attention at area hospitals and clinics for exposure-related health complaints. Many of those who were treated and have returned home are still complaining of lingering health problems. People treated in the hospital have returned home, with about 35 percent of those treated receiving various levels of ongoing care at Banner and other community health care facilities.

Several cross-sectional community health and environmental assessments have been completed and have revealed increases in health problems, including respiratory, skin, and neurological symptoms, as well as elevated levels of malathion in homes, yards, and playgrounds. Additionally, individuals living in these communities are still complaining of cough, chest tightness, shortness of breath, wheezing, eye irritation, skin rash, tingling in extremities, abdominal cramps, headaches, diarrhea, vomiting, and nausea. Local responders involved in the community cleanup efforts in these areas have also reported similar symptoms. Hospitals are also reporting increased cases of individuals from the surrounding areas with similar complaints, as well as symptoms of acute anxiety and stress from the situation.

Residents continue to report dead birds and rabbits, and illnesses in their pets. Area residents are increasingly worried and distrustful about the safety of the community. Numerous meetings have been held between health officials and area residents. In addition to environmental testing and monitoring, community leaders have been calling for health studies similar to what was done for the Graniteville, South Carolina, community in response to a train derailment in 2005. These community health assessments included psychosocial health surveys, vital signs measurements, medical and exposure histories, pulmonary function and reactivity tests, and evaluation of a lung inflammation indicator. Additionally, members of the community are calling for additional health care services and longer-term support for the mental health trauma and health effects for those impacted by the event.

A request has been approved and funded for assistance to perform timely health research for as many 10,000 community members and workers from the impacted areas to understand:

The cause of health symptoms and illnesses.

The safety and effectiveness of health treatments.

The magnitude and severity of the actual health impacts to better guide needed treatment and mitigation efforts.

Ongoing environmental risks.

Longitudinal health risks for workers and at-risk community populations.

Tucson stakeholders have developed the Clinical and Community TRACE Protocols, which have been approved by the Institutional Review Board. It is now time to implement the longer-term research protocols and associated data collection efforts that will support ongoing recovery efforts.

This data collection effort is beyond normal acute surveillance and regarding activities conducted as "public health practice" and necessitates the conduct of standardized, large-scale, generalizable, multidisciplinary, multijurisdictional human health "research."

Personal identifiers need to be collected to follow participants and to provide them with test results and important information, as indicated.

Aubrey introduced panelists and the discussion focused on how to best define "recovery." One expert shared the notion that recovery is usually defined as a return to pre-state, pre-disaster status, meaning that people would have access to the same services as before, the same workplaces and schools, and they would be able to grieve family losses, etc. Some people, however, would get a new norm and that's where resilience comes in. An Arizona State student explained that such a disaster would impact vulnerable populations the most; some of these discussions of recovery would push them back into the same previous 'disaster' and the same misery. Efforts would need to strive to think about resilience and recovery as coming out better than before, as opposed to just replacing 'like for like.' One panelist shared that emergency management entities excel at responding and mitigating a scene but are not always great at recovery. Recovery discussions would need to be based on discrete timelines focusing on days and weeks to years after the event.

Other important items mentioned included:

- In a disaster like this, the responders would be the most impacted. For workers' compensation purposes, firefighters would want to file an exposure report even if they do not have symptoms. They would want to document anything that happens to them.
- Mental health can be one of the most permanent scars in communities in all disasters. It continues being a challenge both in the healthcare system and out of it.
- We would be inclined to gather and grasp as much information as possible, but we need to be conscious of data security.

Student Flash Talks

A student from the University of Arizona's Southwest Environmental Health Sciences Center- Community Engagement Core presented their poster on evaluation methods (see appendix 3 for full abstract). The student introduced the workshop evaluation form and requested workshop participants complete the evaluation.

LESSONS LEARNED/ CONCLUSIONS

This section highlights the four key themes and findings from the workshop sessions. Best practices reflect "case studies" shared during the event.

Data Collection

Ensuring the information collected is accurate is a critical step before mobilizing the response effort. The decisions made early on will have ripple effects, so it is important to have all the information necessary to make the most informed decisions.

- Accurate data collection will facilitate an appropriate and specialized response.
  - The local authority's (in this case Pima County) Office of Emergency Management (OEM) will need to know as much as it can about an incident to conduct an accurate damage assessment. The OEM conducts an initial damage assessment to understand the big picture of how the area will be affected by the disaster. The assessment aims to better understand how the incident will impact the community; how many people will be impacted (evacuated, injured, or deceased); the damage to the infrastructure; and the projected economic impact to the region. Accurate data is needed for an accurate assessment.
  - The OEM will also be providing support to the incident commander and determining what resources the incident commander may need, including opening the Emergency Operations Center (EOC) and mobilizing staff as needed, establishing shelters, counting local hospital beds and availability at the morgue, developing evacuation notices, etc. Verified data will drive these decisions.
    - **Best practice:** Responders' initial response should include generating information about the situation and ensuring with parties close to the disaster that the information received from 911 dispatch is accurate.
- To understand the data, it is important to understand background measurements pre-disaster to establish a baseline.

Information Sharing

Once there is a data repository, questions that need to be answered include:

- Where does the data live?
- Who owns it?
- Who gives access and who gets access?

It is crucial to have a preexisting data-sharing infrastructure, liaisons for information sharing, and information-sharing mechanisms in place before a disaster.

- Efficient information sharing will allow all stakeholders and decision-makers to understand the total impact of the situation. The importance of communication and care coordination between health care centers and responders cannot be understated. Regularly communicating to other entities and keeping them up to date on the latest facts will allow all partners to better understand what vulnerabilities they will need to address.
  - Having open communication and using the Hospital Incident Command System to have an open dialogue on what resources are needed is crucial. Having a "hot phone" to sister hospitals in the immediate area, as well as numbers and contacts for other hospitals and health departments, is helpful.
  - Members of the public may head to their primary doctors or urgent care for treatment. It would be helpful to create a protocol that alerts all providers about the event, along with signs and symptoms.

        - **Best practice:** It is possible to geotag the people living in the affected areas in order to send an alert to let them know that if they have certain symptoms, they need to go to the hospital, not to their providers. It is necessary to have a plan in place to get the right information to everyone at the right time, so that mass panic does not occur.
- There are many legal agreements needed in order to use or share data in the research context.
    - Interagency service agreements or data use agreements should be put in place before a disaster. It is also important to remember that data access or use may be different for different populations.
- Important data must be accessible and digestible to the public. It must be presented clearly and consistently across all platforms.
    - All information shared with the public must be unified so that the public does not lose trust in the response efforts.
    - When communicating the hazard to the community, the message must be drafted so that it will not cause panic.
    - The OEM will be responsible for keeping the media informed with timely and accurate information, monitoring social media, and conducting rumor control. The OEM will send out mass notifications via various sources, including Everbright (*myalerts.pima.gov*) and the Integrated Public Alert Warning System (IPAWS). Everbright can send information out in English and Spanish. The OEM will also need to keep the local officials informed, as the officials will be the faces on the news. The EOC policy group will be activated, as the group provides direction to the EOC.
    - Face-to-face interaction is helpful in difficult situations involving media misrepresentations. The local department of health can take questions and develop FAQs, interviews, or YouTube videos to mitigate the situation.
- It is vital to understand community context when sharing information across groups.
    - When reaching out to the public, it is necessary to have different mediums communicating the same information so that the same message can be reinforced.
    - There is a need to think more broadly, as there are different newspapers, radio stations, etc. that reach out to different populations.
    - It is important to think about language barriers and be thoughtful about how researchers communicate science to the communities, which is already difficult in English and is even harder in a different language.
    - Translators must have more than just language ability; they must also have an educational and cultural background in that language.
        - **Best practice:** The Center for Interpretation has several low-profile questionnaires that identify the capability of the translators. The center also vets for potential biases; professional translators should not impose their views into the translation services. The center provides training that can enhance the capability to manipulate the language and better communicate information to the communities.
        - **Best practice:** As trust is lacking between agencies and universities and communities, the Sonora Environmental Research Institute Inc. (SERI) has promotoras (Latina community health workers in Arizona) who are trusted and can go into the communities to talk about potential health risks and share information.
- There is a need to be transparent on what is known and what is unknown in the wake of a disaster.
    - "Is it safe?" is one of the hardest questions asked by communities. The term "safe" has different meanings to communities. The trust-building process also includes being honest about what isn't yet known. Sharing information that proves to be false can cause mistrust.

Community Engagement

Engagement with affected communities should begin at the very start of the disaster and must be sustained throughout the response.

- The community should be engaged in determining what data to collect and how to use the data in order to build trust and credibility.
  - Best practice: Developing a community engagement board will position authorities to build trust early on.
- It is necessary to identify the vulnerable populations and reach out to them. Health care networks and social services can often identify the vulnerable populations with limited capacity and support their success in returning home and continuing with their everyday lives.
  - It is necessary to be sensitive of historical mistrust regarding biorepositories and make sure that the communities are on board.
  - Ground truthing is important. Communities need to be consulted during assessments and the decision-making process, as local knowledge may impact the decision.

Resources, Planning, and Support

There should already be a communications and response infrastructure in place before a disaster strikes. Leveraging resources and coordinating support from outside groups will ensure that the response is effective and efficient.

- Health care operates at surge capacity every day, so there is not a surplus of doctors and nurses. Hospitals will have to consider decompression and monitor if there will be a need for exposure or decontamination actions, as they will have limited decontamination capacity.
  - Other issues they will have to consider include: decompression of the intensive care units, availability of ambulances to move people in and out, integration with the health department, tracking patients coming in and separating them from normal day-to-day issues, setting up a triage for decontamination, mobilizing additional staff to support the decontamination, etc. Based on the disaster modeling, there may be a need to evacuate the hospital.
  - **Best practice:** It is essential to pre-position resources that are needed, from consensus protocols to case report forms and real-time interoperability of technology, and make sure that the privacy of sensitive information is protected.
- Proper training is crucial for an effective response.
  - The NIEHS *Worker Training Program (WTP)* provides grants to train workers engaged in activities related to hazardous materials, including the development and delivery of disaster-specific training to prepare workers to respond to natural disasters. When a disaster occurs, WTP staff will reach out to the local grantees to gain awareness of the situation and to see if they need help. If support is needed, the WTP reaches out to other grantees to mobilize trainers to provide safety and health training to those responding to the event. Although training should ideally be provided prior to the incident, training often occurs after the incident. WTP grantee trainers provide thorough safety and health training and have worked with communities. They are fully aware of the need for cultural competencies and understand the need to bridge the language gap between community members, responders, health workers, etc.
  - Proactive engagement between the IRB and investigators should start early in the study design process.
  - It is important to have the appropriate stakeholders as ad hoc reviewers at the IRB review meetings. This includes responders, social service agencies, and community representatives.
  - IRB preparedness is a critical element in successfully reviewing disaster-related protocols to ensure adequate participant and community protections.
    - **Best practice:** Trainings and disaster-related research must follow realistic scenarios as closely as possible, including engagement with at-risk populations such as homeless persons, prisoners (juveniles and adults), etc. Therefore, the protocols submitted by disaster researchers need to include how these populations will be protected.

Karen Lutrick, University of Arizona, explains the different data streams for disaster research *(Photo credit StoryMine Media)*

In any disaster, there is an enormous of amount of good that can come from research, if there is proper preparation. To help support research efforts after an event, pre-event planning is needed: Data-sharing agreements should be put into place, relationships must be built between clinicians, researchers, the emergency response community, public health practitioners, and community members. Engagement before an event has the potential to help not only with recovery but to build stronger communities and to answer lingering questions in a collaborative, inclusive way that starts in response, through healthcare facilities and into long term community efforts that will benefit communities around the country. The NIH DR2 workshop provides a necessary platform to foster such community engagement, partnership building, and invaluable information sharing to strengthen capacity to conduct critical health research in response to disasters.

Acknowledgements

NIEHS would like to acknowledge and thank the many people involved in planning, speaking and hosting the workshop. A special thanks to the workshop cohosts:

University of Arizona College of Medicine-Tucson, the Mel and Enid Zuckerman College of Public Health, the University of Arizona College of Pharmacy, and the University of Arizona BIO5 Institute for their generous contributions of staff, space, logistics, and refreshments.

A special thanks to Karen Lutrick, Ph.D., for her work to arrange invitations, logistics, space, and attendees and without whom the workshop would not have been possible.

Thank to Kristen Pogreba-Brown, Ph.D, Marti Lindsay, Ph.D., and Paloma Beemer, Ph.D., for their hosting of pre-meeting lectures, and for introducing their students to DR2 before and during the workshop.

The following individuals were integral to the planning of the event as members of the planning committee and/or working groups. NIEHS is grateful for their time and insights:

- Andy Brady, Banner Health

- Stacey Arnesen, NLM
- April Bennett, NIEHS
- Andy Brady, Banner Health
- Sharon Browning, Pima County
- Jeff Burgess, University of Arizona
- Perren Cobb, University of Southern California
- Sonia Colina, University of Arizona
- Chris Edwards, University of Arizona
- Sandra Espinoza, Pima Office of Emergency Management
- Betsy Galluzzo, MDB, Inc.
- Brenda Granillo, University of Arizona
- Jeff Guthrie, Pima Office of Emergency Management
- Kim Janes, Pima County Health Department
- Megan Jehn, Arizona State University
- Joy Lee, MDB, Inc.
- Marti Lindsey, University of Arizona
- Karen Lutrick, University of Arizona
- Mariette Marsh, University of Arizona
- Greg Measer, FDA
- Aubrey Miller, NIEHS
- Joan Packenham, NIEHS
- Kristen Pogreba-Brown, University of Arizona
- Dan Quintanar, Tucson Water
- Stephanie Rainie, University of Arizona
- Steve Ramsey, Social and Scientific Systems, Inc.
- Benjamin Richmond, University of Arizona
- Richard Rosselli, Social and Scientific Systems, Inc.
- Liz Sadoff, FDA
- Christina Sauters, University of Arizona
- Mazda Sharazi, Poison Control Center
- Wendy Walsh, FEMA
- Deborah Weinstock, MDB, Inc.
- Yoshi Ornelas, University of Arizona

Evaluation

Students and staff from the Southwest Environmental Health Sciences Center at the University of Arizona created the event evaluation tool. Participants were given a QR code to digitally complete the evaluation and paper copies were provided upon request. The evaluation was available for completion during the workshop and for a month following.

The detailed Evaluation report is available in Appendix 4.

Overall, 47 participants started the survey and the majority identified their profession as academic staff/researchers, federal staff or 'other'. The majority of respondents were from Arizona and were not NIH grantees.

Nearly half of respondents reported that prior to the workshop their organization could "perform the basic disaster research functions on a limited basis." Twelve respondents reported that they were from an organization that was 'fully capable of performing disaster research and has actually done so."

Individual sessions were generally rated as useful and helpful ('yes, definitely' or 'quite a lot') and respondents agreed that they:

- Helped identify community, academic, and/or professional partners to utilize in disaster emergency situations
- Helped form new connections, friendships, and/or collaborations
- Provided information that they are likely to share with their community or co-workers
- Fostered increased understanding of the importance of rapid data collection and research in response to disasters
- Identified strategies and platforms for multiple groups to improve their capabilities for investigations and research
- Facilitated relationships and knowledge sharing between local, state, federal, academic, and community groups
- Helped explore research tools, protocols, and processes that help support the design, review, and implementation of timely research in response to disasters

Respondents noted that additional time for networking would have been beneficial and suggested a less crowded agenda with more audience interaction for future events.

APPENDIX 1: **FULL DETAILED SCENARIO**

This scenario is in part based upon an actual train derailment which occurred in Graniteville, South Carolina, in 2005.

Feb. 26, 8:00 a.m.

A freight train has collided with another train in Tucson at the Union Pacific Rail Yard. The immediate collision has resulted in a large explosion and the derailment of several railroad cars carrying industrial chemicals, including propane, chlorine, and malathion. It is reported that chemicals are leaking from several of the cars and the smell of chlorine is very strong. Injuries have been reported and firefighters are arriving on the scene to assess and control the situation. Winds are blowing at 4 miles per hour out of the east.

The derailment has disrupted traffic on roads south of Broadway and north of East Ajo Way between South Park Avenue and South Columbus Boulevard, including major bridges crossing the rail yard at 22nd Street and the South Kino Parkway, and Aviation Parkway (Highway 210) and stretches of the South Kino Parkway. Also, the incident has impacted the I-10 corridor.

Feb. 28, 10:00 a.m.

Fire and chemical plumes are flowing into neighboring communities in Pueblo Gardens, South Park, Las Vistas, and South Tucson. Approximately 6,000 people are living in these communities. Evacuation efforts have been initiated for those within 1 mile of the rail yard, and shelter-in-place orders have been issued for those located between 1 and 2 miles of the yard.

The chemicals released from four of the breached railroad cars included liquid propane; chlorine (90-ton car); and malathion, an organophosphate pesticide (80-ton car). One railroad car carrying flammable propane, located further away from the other railroad cars, exploded during the accident, sending a fireball high into the sky. A gaseous plume with the distinct smell of chlorine has been reported (chlorine measurements taken within .1 miles of the site were 90 ppm). Workers and residents near the rail yard are being transported to Banner Health. High numbers of incident-related injuries and seven deaths have been reported at this time.

Note: There are approximately 34,000 people living within a 2-mile radius of the crash site.

Feb. 28, 2:00 p.m.

At this time, nine deaths have been confirmed. Ambulances have been taking the injured to Banner University Medical Center and nearby hospitals. Other area clinics and health treatment facilities are reporting an increase in calls and visits by worried and sick individuals. Victims have skin, mucosal, respiratory, neurological, and gastrointestinal symptoms that are consistent with exposure to burning particulate, chlorine, and organophosphate pesticides.

Feb. 28, 6:00 p.m.

Numerous area workers and residents, including children, nursing home residents, and others, have been arriving at Banner, as well as at care facilities throughout the Tucson area. Available beds, front-line medical treatments, and other resources are rapidly being depleted.

The news media is reporting that a child living near the site is in critical condition due to what appears to be pesticide-related exposure.

Health experts are reportedly working to understand the health impacts of the situation and the best courses of treatment. As standard treatments for victims are being used, the team begins discussing the use of alternative treatments in case standard options run out. Local health officials are working closely with the U.S. Department of Health and Human Services, the Centers for Disease Control and Prevention, and the FDA to access and administer needed medical treatments.

March 1, Noon

As of now, the incident has resulted in 16 deaths and over 200 hospitalizations for health effects stemming from toxic chemical exposures.

14 Days Post-Incident Status

The immediate explosion of the liquid propane railroad car resulted in additional fires in the area and metal projectiles that ruptured the three other railroad cars. The fires and chemical releases lasted from several hours to days, further complicating the situation and spreading ash, debris, and chemicals into the surrounding neighborhoods. Investigations regarding the incident are still underway. An estimated 90 tons of liquid chlorine were released from one railroad car, which quickly vaporized, producing a thick cloud of chlorine gas that spread for a mile throughout the area. Approximately 80 tons of malathion aerosols were released from the other two railroad cars.

Local environmental assessments are continuing in impacted areas and have found elevated concentrations of malathion in area soils, surface water, plants, and house dust. As a result of the spill, efforts were made to evacuate approximately 6,000 people living within 1 mile of the site while hazmat teams and cleanup crews decontaminated the area. Evacuated citizens are being permitted to return to their homes to begin the cleanup and repairs. As seen with other disasters, many did not leave their homes.

Private businesses and manufacturing are working to clean up and reopen. Local workers are being hired to assist with the cleanup. Out-of-area workers and volunteers, including groups of unskilled workers and volunteer organizations, have also shown up to help with the recovery.

Due to the severity of the cases reported by the news media, local emergency departments, and local responders, requests have been made to the local public health department to investigate the health effects related to the exposures.

Community residents and local workers are complaining of a variety of symptoms, including stress, anxiety, skin rashes, shortness of breath, dizziness, headaches, and tingling in the extremities. Area health treatment facilities are continuing to report increased cases of those seeking medical attention for health and mental health conditions related to the situation. Additionally, community residents and local workers in the surrounding communities are complaining of ongoing smells, debris, ash, and dust from the accident. Residents are also reporting dead birds and rabbits, and illnesses in their pets. Area residents are increasingly worried and distrustful about the safety of the community:

- Are the playgrounds and yards safe for children?
- What about food grown in home gardens?
- Is it safe to swim in local pools?

Community members (especially the elderly, pregnant women, and children's advocates), responders, and cleanup workers are alarmed about reports of those still being seen with symptoms that many believe to be associated with residual contamination of homes, businesses, playgrounds, etc., and are requesting that the health commission investigate the affected populations.

30 Days Post-Incident Status

Tucson stakeholders have received funds to quickly identify the current health symptoms/problems, health care needs, environmental exposures, and related concerns for all community members living in a 1-mile radius of the site. Decision-makers wish to answer the following questions:

- What is the nature and prevalence of health problems?
- What contaminants of concern are present in the environment?
- What are the residents' major concerns that need to be addressed?

The community continues to express concerns about being involved in all aspects of data collection efforts, ensuring that their concerns and health needs are being addressed, as well as the safety of their homes and neighborhoods.

Many groups are concerned about achieving meaningful long-term recovery for the community in the months to years ahead.

60 Days Post-Incident Status

Over the past 60 days, at least 1,200 people, including cleanup workers, have sought medical attention at area hospitals and clinics for exposure-related health complaints. Many of those who were treated and have returned home are still complaining of lingering health problems. People treated in the hospital have returned home, with about 35% of those treated receiving various levels of ongoing care at Banner and other community health care facilities.

Several cross-sectional community health and environmental assessments have been completed and have revealed increases in health problems, including respiratory, skin, and neurological symptoms, as well as elevated levels of malathion in homes, yards, and playgrounds. Additionally, individuals living in these communities are still complaining of cough, chest tightness, shortness of breath, wheezing, eye irritation, skin rash, tingling in extremities, abdominal cramps, headaches, diarrhea, vomiting, and nausea. Local responders involved in the community cleanup efforts in these areas have also reported similar symptoms. Hospitals are also reporting increased cases of individuals from the surrounding areas with similar complaints, as well as symptoms of acute anxiety and stress from the situation.

Residents continue to report dead birds and rabbits, and illnesses in their pets. Area residents are increasingly worried and distrustful about the safety of the community. Numerous meetings have been held between health officials and area residents. In addition to environmental testing and monitoring, community leaders have been calling for health studies similar to what was done for the Graniteville, South Carolina, community in response to a train derailment in 2005. These community health assessments included psychosocial health surveys, vital signs measurements, medical and exposure histories, pulmonary function and reactivity tests, and evaluation of a lung inflammation indicator.

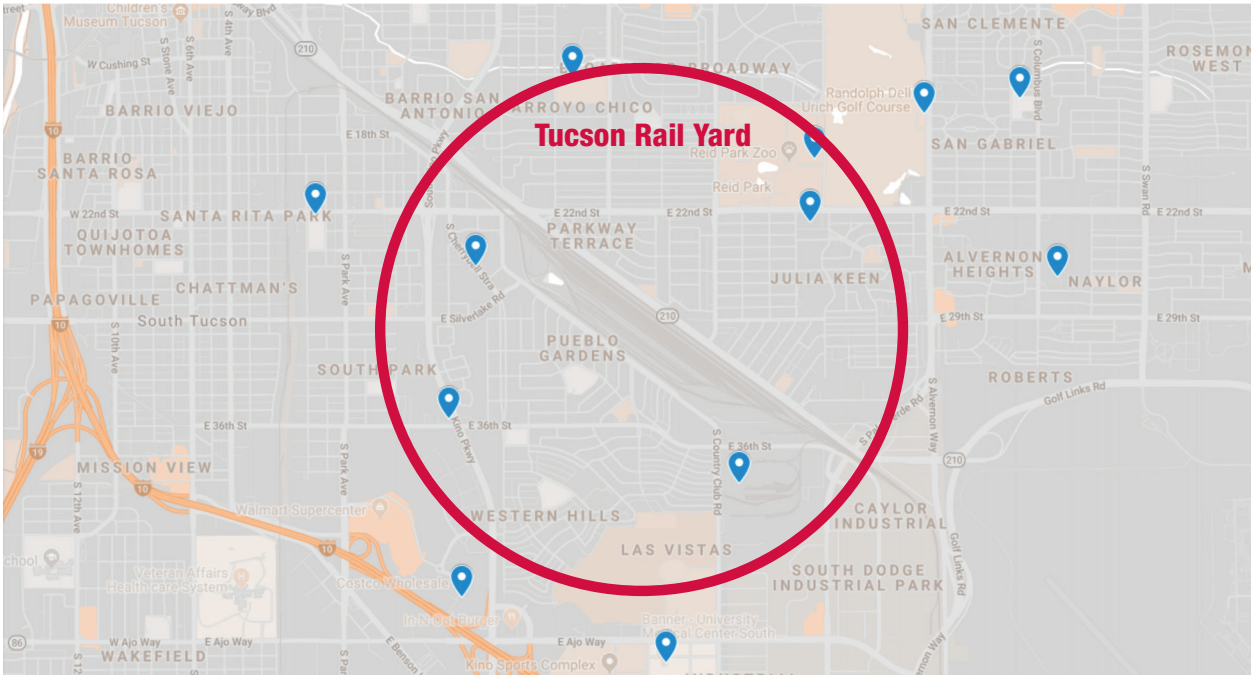
Additionally, members of the community are calling for additional health care services and longer-term support for the mental health trauma and health effects for those impacted by the event. A request has been approved and funded for assistance to perform timely health research for as many as 10,000 community members and workers from the impacted areas to understand:

- The cause of health symptoms and illnesses.
- The safety and effectiveness of health treatments.
- The magnitude and severity of the actual health impacts to better guide needed treatment and mitigation efforts.
- Ongoing environmental risks.
- Longitudinal health risks for workers and at-risk community populations.

Tucson stakeholders have developed the Clinical and Community Tucson Rail Accident & Chemical Exposure (TRACE) Protocols, which have been approved by the IRB. It is now time to implement the longer-term research protocols and associated data collection efforts that will support ongoing recovery efforts.

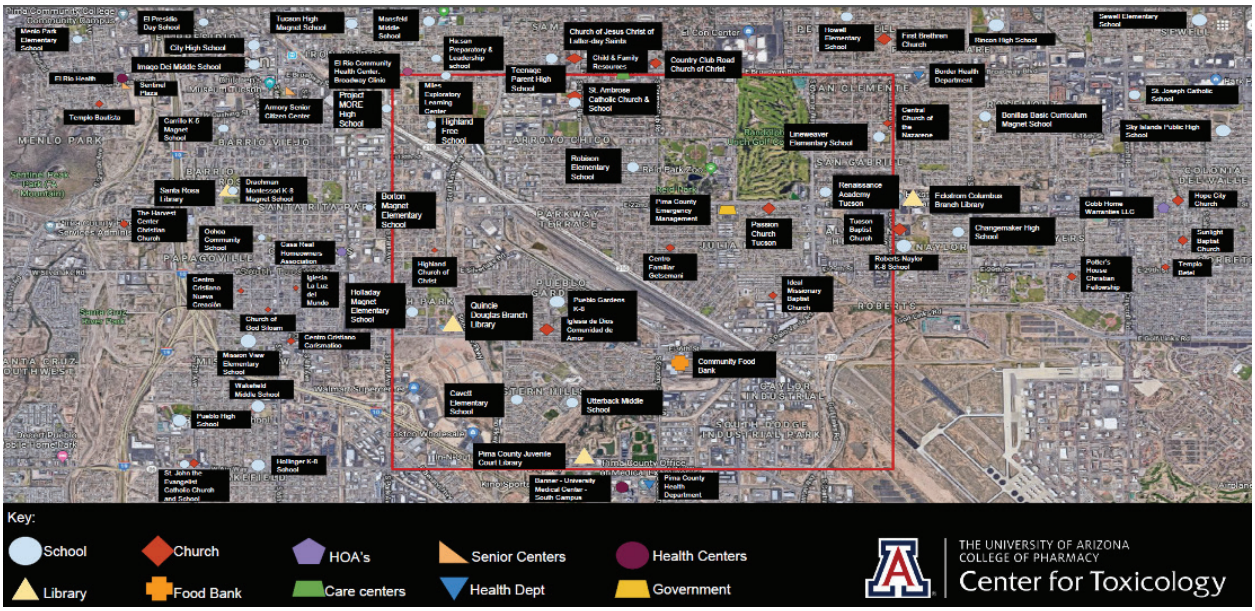
Scenario Details

Location of the Tucson Rail Yard



This poster is a map of the disaster area for this workshop. It highlights both the exclusion zone of the disaster and the organizations that would be impacted by this disaster; our stakeholders. The entire map shows south-central Tucson from 6th street in the north to Ajo Way in the south and Sentinel Peak Park and Sahuarita Avenue from west to east, respectively.

Created by: Hiram Martinez, CEC Intern, Ben Richmond, MPH, Assistant CEC Director, Marti Lindsay, PhD, Director, Community Engagement



Affected Communities

In general, the populations living in South Park, Las Vistas, and Pueblo Gardens have the following characteristics that differ from the rest of Pima County and the overall United States. Residents of these communities tend to have lower incomes, are likely to be foreign-born of Hispanic descent and are more likely to speak languages other than English.[1] Following are brief profiles of the affected communities.

Las Vistas

Las Vistas neighborhood has a population of approximately 4,600 people. Approximately 42.6 percent of the population are Hispanic/Latino. The median household income is $31,000.[2]

Pueblo Gardens

Pueblo Gardens has a population of approximately 2,990 people. The median household income is $30,288. Seventy-eight percent of this neighborhood's residents have Mexican ancestry and 2.2 percent have Native American ancestry. Fifty-nine percent of its residents five years old and above primarily speak Spanish at home. Research shows that this neighborhood has an income lower than 88.1 percent of U.S. neighborhoods. With 46.5 percent of the children here below the federal poverty line, this neighborhood has a higher rate of childhood poverty than 89 percent of U.S. neighborhoods.[3]

South Park

South Park has a population of approximately 3,100 people, with approximately 70 percent of Mexican ancestry. The median household income is $27,300, which is lower than 91.8 percent of U.S. neighborhoods. Nearly 50 percent of the children are below the federal poverty line, a higher rate than 91.1 percent of U.S. neighborhoods.[4]

Barrio Centro

Barrio Centro's population is approximately 950 people, with approximately 59 percent of Mexican ancestry. The median household income is approximately $45,000, lower than 73 percent of U.S. neighborhoods. Nearly 16 percent of the children are below the federal poverty line, a higher rate than 50 percent of U.S. neighborhoods.[5]

Julia Keen

Julia Keen has a population of approximately 4,300 people. Seventy-seven percent of the population is Caucasian, and 42 percent is Hispanic/Latino. It has a median household income of $43,000, lower than 73 percent of U.S. neighborhoods. Sixteen percent of the children are below the federal poverty line, a higher rate than 50 percent of the U.S. neighborhoods.

1 University of Arizona. "South Park, Las Vistas & Pueblo Gardens Community Profile." *https://azprc.arizona.edu/sites/default/files/SouthPark-LasVistas-PuebloGdnsProfileFinal.pdf*

2 *https://www.areavibes.com/tucson-az/las+vistas/demographics/*

3 *https://www.neighborhoodscout.com/az/tucson/pueblo-gardens*
https://www.weichert.com/search/community/neighborhood.aspx?hood=55586

4 *https://www.areavibes.com/tucson-az/south+park/demographics/*
https://www.neighborhoodscout.com/az/tucson/park-ave#overview

5 *https://statisticalatlas.com/neighborhood/Arizona/Tucson/Barrio-Centro/Household-Income*
https://www.areavibes.com/tucson-az/barrio+centro/livability/

Scenario Toxic Exposure Information

Malathion

Malathion is a pesticide that is used to kill insects on agricultural crops, on stored products, on golf courses, in home gardens, and in outdoor sites where trees and shrubs are grown at home; it is also used to kill mosquitoes and Mediterranean fruit flies (medflies) in large outdoor areas. Malathion interferes with the normal function of the nervous system. Because the nervous system controls many other organs, malathion indirectly can affect many additional organs and functions. Exposure to high amounts of malathion in the air, water, or food may cause difficulty breathing, chest tightness, vomiting, cramps, diarrhea, watery eyes, blurred vision, salivation, sweating, headaches, dizziness, loss of consciousness, and death. If persons who are exposed to high amounts of malathion are rapidly given appropriate treatment, there may be no long-term harmful effects. If people are exposed to levels of malathion below those that affect the function of the nervous system, few or no health problems seem to occur. There is no evidence that malathion affects the ability of humans to reproduce. There is also no conclusive proof that malathion causes cancer in humans, although some studies have found increased incidence of some cancers in people who are regularly exposed to pesticides, such as farmers and pesticide applicators. The main target of malathion toxicity in children is the nervous system, the same as in adults. There is no information in humans regarding transfer of malathion to the fetus or to nursing infants. IARC classifies malathion as a class 2A chemical, possibly carcinogenic to humans (*https://monographs.iarc.fr/wp-content/uploads/2018/06/mono112-07.pdf*).

ATSDR Report: *https://www.atsdr.cdc.gov/phs/phs.asp?id=520&tid=92*

Chlorine

If chlorine is spilled into water or onto soil or if it is released from a tank into the air, the chlorine will evaporate very quickly forming a greenish-yellow cloud that is heavier than air and can be carried by the wind away from the source. Exposure to low levels of chlorine can result in nose, throat, and eye irritation. At higher levels, breathing chlorine gas may result in changes in breathing rate and coughing, and damage to the lungs. In general, people who suffer from respiratory conditions such as allergies or hay fever, or who are heavy smokers, tend to experience more severe effects than healthy subjects or nonsmokers. Short-term exposures (minutes) to high concentrations of chlorine affect children in the same manner they affect adults, but children may be more sensitive. We do not know what the effects could be in children following longer-term, low-level exposure to chlorine gas or hypochlorite solution. We do not know whether exposure to chlorine gas during pregnancy can result in damage to unborn babies because there are no studies of pregnant women or pregnant animals exposed to chlorine gas.

ATSDR Report: *https://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=200&tid=36*

APPENDIX 2: **PARTICIPANT LIST**

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Zedric, Andrew
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APPENDIX 3: **FULL POSTER ABSTRACTS**

Student Flash Talks & Associated Posters

Disaster Impact Map

Hiram Martinez, CEC Intern, Ben Richmond, MPH, Assistant CEC Director, Marti Lindsay, PhD, Director, Community Engagement

Southwest Environmental Health Sciences Center-Community Engagement Core

This poster is a map of the disaster area for this workshop. It highlights both the exclusion zone of the disaster and the organizations that would be impacted by this disaster; our stakeholders. The entire map shows south-central Tucson from 6th street in the north to Ajo Way in the south and Sentinel Peak Park and Sahuarita Avenue from west to east, respectively

he entire map shows south-central Tucson from 6th street in the north to Ajo Way in the south and Sentinel Peak Park and Sahuarita Avenue from west to east, respectively.

Chlorine & Pesticides

Adam Chacon, CEC Intern, Ben Richmond, MPH, Assistant CEC Director, Marti Lindsay, PhD, Director, Community Engagement

Southwest Environmental Health Sciences Center-Community Engagement Core

This poster provides background information on chlorine and pesticide products. Pesticides and Chlorine are often mixed with other toxic chemicals for the production of pest eliminators, household cleaners, and sanitizers. Routes of exposures are both discussed and displayed on the poster as well as the potential health risk or concerns an individual may have if they should come in contact with these chemicals. Protective equipment is displayed as a reference for the safe handling and application of pesticides in occupational professions, as well as proper labeling and storage of pesticides and chlorine products that can be found in the household. For further information on chemical ingredients, or laws and regulations, on chlorine and pesticides please visit the United States Environmental Protection Agency (EPA) website https://www.epa.gov.

Using Toxin Exposure Surveillance in Animals to Predict Toxin Exposure in Humans

Popp, J.

University of Arizona

This presentation will focus on the involvement of veterinary health centers as part of a One Health Response to the DR2 scenario. The focus is incorporating veterinarians into the notification system for connecting potentially exposed persons to treatment centers.

Following the logic of the canary in the coal mine, domestic animals act as a sentinel system for exposure by presenting symptoms either before or at the same time as the owner.

Either by regular check-ups or recommended screening, veterinarians will be vetting domestic animals for toxin exposure. By already having an owner profile for any suspected cases, this information can be sent immediately to a human treatment center. Human healthcare teams can then contact the owner and recommend screening for them based on the evidence of exposure in their pet. Veterinarians will also inform the owners of symptoms of toxin exposure and also where these centers are and that

they will likely be contacted about their animals' exposure. The most likely medium for this information exchange would take place over an app that veterinary centers could ask owners to voluntarily fill out their information or have the staff fill it out for them, thus giving consent to be connected to a toxin screening center. Phone applications using notification systems for animal disease outbreaks have already been used in several countries.

Expanding the nodes of surveillance to animals will not only expand the ability to detect human cases but also potentially catch cases of exposure in humans before they develop, given animals’ natural interaction with the environment. There is potential to expand this type of application to animal care centers such as the Pima Animal Care Center, zoos, and wildlife centers so they can act as additional indicators of potential human exposure.

Addressing Service Gaps for Those with HIV in a Tucson Disaster

Peterson, G.

University of Arizona, College of Public Health

Human Immunodeficiency Virus (HIV) is a chronic illness whose progression to life- threatening Acquired Immunodeficiency Syndrome (AIDS) can be mitigated with antiretroviral medications, when taken consistently and when other health needs are met. The provision of meals, transportation, emergency housing, and other essential services through the federally-funded Ryan White program allows these medications to be effective. While Arizona has published HRSA-compliant standards of care for the delivery of these services, no policy exists for the situation of delays in connection to services. This project proposes an action plan to address gaps in service delivery in the event of a disaster in the South Tucson area. Success will rely on collaboration and established partnerships with local agencies, including the Pima County Health Department, local HIV-service providers, and contracted agencies for additional Ryan White services. Data will be collected from service providers, as well as surveying of recipients and geospatial census and health department records. A thorough assessment of needs and services used by HIV-positive Tucsonans will inform the creation of an action plan in the case of local emergencies. Risk assessments in combination with geospatial analysis will provide an accurate and comprehensive view of how designated community partners should respond. This will prevent premature disease progression and death in those using these services, while also identifying community members whose needs are not currently met and connecting them to care. By establishing a protocol for continued care, the state and county health departments ensure the wellbeing of this vulnerable population in Tucson and the local population as it relates to the transmission and worsening of HIV.

PACC Housing Animals during an Evacuation

McKaughan, C., Pogreba-Brown, K., Auerbach, K.

University of Arizona

The presentation will focus on the evacuation plans for the city of Tucson regarding pets. This directly impacts human health during emergency situations because research on past disasters has shown vulnerable populations making decisions based on the safety of their pets. This means that people most affected by natural disasters or emergency situations are focusing on the safety of their pets first over their own safety which puts themselves at even higher risk. The objective of this project would be to mitigate any additional risk to human health while also creating a safe place for animal companions. Luckily, Tucson has one of the most sophisticated animal shelters in the country - Pima Animal Care Center (PACC). The goal would be to partner with PACC in emergency situations so community members could feel secure about leaving their pets at PACC and reassured they will be returned after they are settled. PACC has a well-established foster parent system in place that allows members of the community to temporarily foster animals which could be used in times of crisis when and if there is not enough space for all the animals on site. Through this partnership, we would be able to establish a more effective and efficient pet-friendly evacuation plan for the Tucson community.

Using Emergency Alert Systems to Generate a Disaster Registry: The Potential Role of IPAWS in Identifying Affected Persons

Souders, K., Trejo, M.

University of Arizona, College of Public Health

Disaster situations often result in mass exposure to chemicals, injuries, and trauma, among other things. These situations give rise to the possibility of long-term cohort studies to study the exposure. However, the ability to quickly create population-based cohorts has been difficult in the past. After disaster situations, affected persons may scatter geographically, either to obtain necessary resources, or because they are not otherwise connected to the disaster area. Studies assessing the outcomes of disaster situations may fail to capture a representative sample of affected persons, thus exposing results to sample biases. The Integrated Public Alert & Warning System (IPAWS) poses a potential solution to the problem of sample bias in disaster research, by capturing all individuals with personal technology devices in a designated area. IPAWS alerts can be disseminated immediately after a disaster, can be tailored to specified geographic regions, and can include a link to an external database, such as REDCap. We have explored the feasibility of using IPAWS to create a post-disaster registry of affected persons. Individuals with personal technology devices located in affected regions would receive an IPAWS alert with a link to a registry form, allowing them to volunteer for contact by research personnel at a later date. Special consideration must be made towards the accessibility and acceptability of this tool, such that it succeeds in capturing a representative sample of the affected population.

A Collaborative Partnership to Address Environmental Health Concerns of the Community following a Mass Exposure: A process for Collecting Environmental, Household, and Biomonitoring Data

Ornelas Van Horne, Y., Wagoner, R., Tham, K., Alshammari, M., Blohm, J., Eaker, D., Quintanar, D., Beamer, P.

University of Arizona

This collaborative partnership will bring together community members, public health professionals, and researchers from the University of Arizona, Pima County Health Department (PCHD), Pima County Department of Environmental Quality (PDEQ), and the City of Tucson Water Department to develop and implement a sampling plan to address community concerns based on the CASPER framework. Our focus is to address the following community questions: what are the malathion concentrations in the environment and how do they differ over time; what are the community's exposure levels over time? The poster will outline the necessary phases of a community-driven environmental health research project. The first phase will occur once HAZMAT has cleared the affected area. During this phase we will collect, air, water, soil, and dust wipe from homes, community gardens, playgrounds and drinking water samples from the potable water distribution system in the affected area. Listening sessions will be conducted to identify additional community areas of concern. The second phase occurs 45 to 60 days after the environmental sampling phase and will utilize an existing Community Health Worker (CHW) model to recruit, assess household contamination levels, and report back information to household participants. From each home we will follow established protocols to collect personal, air, water, soil, and dust wipe samples and drinking water samples from the potable water distribution system in the affected area. Participants will answer mental health, residential pesticide use, risk perception, and stress questions. After environmental samples and questionnaires have been analyzed, CHWs will report results back to individuals and at community events.

Psychological Interventions and Data Collection Methodology for Early to Mid-term Stages of Post-Disaster Relief

Skobic, I.

University of Arizona

Natural and man-made disasters test individuals' and communities' psychological resources. Disaster-related upheavals, displacement, injury, familial separation, and

shattered assumptions regarding one's safety in the world may place individuals and communities at risk for trauma and stressor-related disorders, as well as for other forms of psychopathology and impaired functioning. The efficacy of widely used practices, such as immediate debriefing following potentially traumatic events, has recently been called into question. Experts have proposed a set of guidelines for post-disaster intervention and prevention efforts that include promoting: 1) a sense of safety, 2) calming, 3) a sense of self; and community efficacy, 4) connectedness, and 5) hope. Yet, there is a paucity of literature on how these guidelines may translate to clinical and non- clinical interventions in the early to mid-term stages of post-disaster relief, as well as on methods of evaluating the effectiveness of these interventions. This poster explores the potential effects of incorporating these guidelines into psychological response efforts following a disaster and proposes methods for evaluation and data collection.

An Approach for Utilization of a Hazard Model and Dispersion Model in Chemical-spill Disaster Response

Alshammar, M., Hadeed, S., Ornelas Van Horne, Y., Blohm, J., Wagoner, R.

University of Arizona

Dispersion and hazard models are useful in estimating the spread, dispersion, and concentrations of environmental contaminants from point and mobile sources. This information can be useful in disaster planning, especially if a catastrophic event were to occur in a densely populated area. The goal of this project is incorporate two widely used dispersion and hazard models, Hybrid Single Particle Lagrangian Integrated Trajectory Model (HYSPLIT) and Areal Locations of Hazardous Atmospheres (ALOHA) in a disaster situation. Both HYSPLIT and ALOHA incorporate meteorology, trajectory, deposition, and resuspension of pollutants as they move through the environment. The project will be facilitated in two phases: In phase 1, malathion and chlorine will be entered into the ALOHA software to identify threat zones and can guide evacuation of communities. In phase 2, a more detailed analysis into the dispersion of malathion and chlorine will be modeled using HYSPLIT, which incorporates some of the variables lacking in the ALOHA model including: chemical reactions, adhesion to particulate matter, chemical mixtures, terrain, and turbulent environments. This will provide a more comprehension dispersion profile of the pollutants in the atmosphere over a larger period of time. This framework can be applied widely in the context of disaster response.

Understanding Vulnerability and Adaptive Capacity to Large-scale Power Failure

Kurtz, L., Chakalian, P., Hondula, D.

Arizona State University, School of Human Evolution and Social Change

Technological hazard events often require rapid deployment of research methods to assess public health and wellbeing. Data gathered in the immediate aftermath of disaster can offer valuable insights into differential hazard impacts and household and community capacities, as well as provide an empirical foundation for long-term monitoring of individual and community recovery and health outcomes. Yet due to the short timeline required for rapid post-disaster research, collecting highly contextual qualitative data presents a challenge.

Access to participants may be disrupted by disaster conditions and qualitative methodologies frequently require a significant time investment for both researchers and participants. We addressed these issues during a case study of rapid research deployment in the wake of Florida's Hurricane Irma in 2017. We used a systematic sampling strategy for recruiting participants across diverse sociodemographic and geographic strata and accelerated data collection method by combining close-ended questions with a semi- structured interview protocol. With these methods, we investigated household vulnerability, access to resources, adaptation strategies, and impacts from a technological disaster. This work advances methods for sampling and deployment of instrumentation after disaster strikes and offers insights into the advantages of qualitative

data collection and analysis as a complement to traditional public health.

Monitoring First Responders for Health Effects Using Epigenetic Markers

Jung, A.M., Bautista, J.R., Zhou, J., Jenkins, T.G., Gulotta, J., Wallentine, D., Griffin, S.C., Dearmon-Moore, D., Littau, S.R., Burgess, J.L.

University of Arizona

Introduction: First responders have diverse exposures during disasters, particularly with fire events, but we lack sufficient biomarkers to assess risk of future disease associated with these exposures. Epigenetic markers in blood are associated with multiple disease outcomes, most notably cancer. The purpose of this study was to evaluate epigenetic markers in firefighters, a group at increased cancer risk.

Methods: Blood microRNA expression and differential DNA methylation (CpGs) were compared in Tucson Fire Department incumbents and new recruits, and among new recruits after two years.

Results: We found 9 microRNAs (eight associated with cancer) and 5 CpGs (4 associated with cancer) differentially expressed among incumbents versus new recruits. Pathway analysis of DNA methylation also revealed activation of gastrointestinal, lung and skin cancer in incumbent firefighters, consistent with prior epidemiologic studies showing higher rates of these and other cancers. Preliminary longitudinal analysis of the new recruits suggests that these changes can occur within two years.

Discussion: Our results suggest that evaluation of epigenetic markers can provide a measure of future risk following exposures in first responders. More widely adopted baseline and post-exposure biological sample collection from first responders would greatly expand our knowledge of the health effects of disasters.

Evaluation

Wrona, J., CEC Intern, Richmond, B, Assistant CEC Director, Lindsay, M., Director, Community Engagement

Southwest Environmental Health Sciences Center-Community Engagement Core

Evaluations are used to assess program impact, determine factors contributing to program success or failure, highlight areas for improvement, and justify continuation. The DR2 survey collects demographic data, feedback on sessions, activities, and event logistics, and assesses if workshop objectives were met. The goal of evaluating the DR2 Workshop is to continue to improve the program. The survey also aims to support the continuation of the workshop by exploring how knowledge learned contributes to departments or communities and desired topics for future workshops.

Other Informational Posters

The University of Arizona's National Center for Interpretation

Colina, S.

University of Arizona National Center for Interpretation

Effective communication with limited-English proficient (LEP) populations in disaster response situations is crucial to avoid miscommunication, and the exclusion of the LEP community. Failure to respond to the needs of LEP communities places public health and safety at risk. This poster offers some guidance on how to provide effective communication with LEP populations and the role the UA's National Center for Interpretation should play in these situations. Effective LEP communication is a two-fold process that involves (a) access policies and procedures and translation and interpreting services that respond to community needs (b) research on the effectiveness of the communication provided. Consequently, NCI proposes a participatory, community-based approach to translation and interpreting services for disaster response that engages the relevant university experts and professionals, as well as community members and users in the provision of services; pilots materials for comprehension and usability, and engages in ongoing data collection to test effectiveness.

Our hypothesis is that LEP communication will be more effective with a participatory, community-based approach because it engages community members and other stakeholders to provide community-oriented, community-vetted services.

NIEHS WTP Disaster Site Trainer and Researcher Deployment Guides

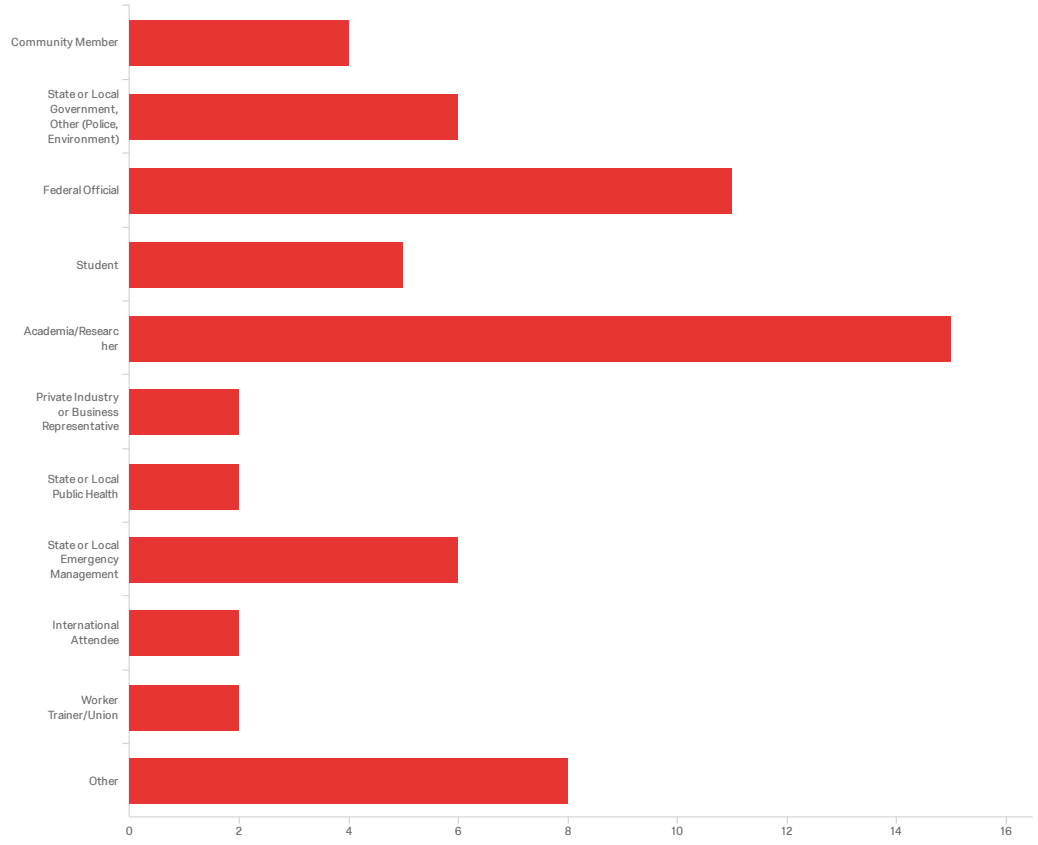
Lee Pearson, J., Hughes, J., Remington, J., Weinstock, D.

National Institute of Environmental Health Sciences

Disaster sites can be austere environments in which local infrastructure is completely overwhelmed and responders and researchers who respond to the event face hazardous environments and are at high risk for physical and mental injury. The NIEHS Worker Training Program (WTP) and NIH Disaster Research Response Program (DR2) have extensive experience in responding to disasters caused by severe weather events. Under Worker Safety and Health Support Annex of the National Response Framework and the National Disaster Recovery Framework, WTP and its awardees have been actively involved in several natural disasters through the years to deliver training that aims to protect workers who may face multiple threats and hazards while responding and rebuilding in the aftermath of the destruction. In order to minimize risks to those who will be responding to disasters, NIEHS WTP has developed two deployment guides, for trainers and researchers, that provide guidance and recommendations for those deploying to a disaster. These guides help workers and researchers to better prepare their teams and families prior to, during, and after disaster response deployment. The goal of this poster will be to provide an overview of critical disaster site worker information needed to better prepare researchers, responders and trainers for deployment for disaster sites.

APPENDIX 4: **EVALUATION REPORT**

Q1 - Chose the group(s) you identify with:



#	Field		Choice Count
1	Community Member	6.35%	4
2	State or Local Government, Other (Police, Environment)	9.52%	6
3	Federal Official	17.46%	11
4	Student	7.94%	5
5	Academia/Researcher	23.81%	15

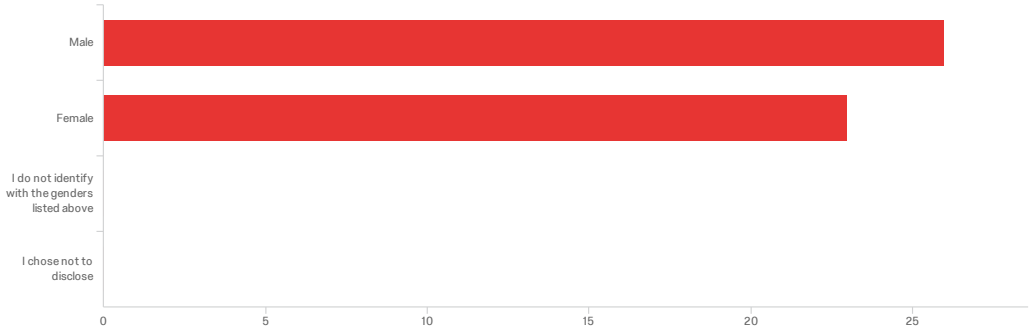
#	Field		Choice Count
6	Private Industry or Business Representative	3.17%	2
7	State or Local Public Health	3.17%	2
8	State or Local Emergency Management	9.52%	6
9	International Attendee	3.17%	2
10	Worker Trainer/Union	3.17%	2
11	Other	12.70%	8
			63

Showing rows 1 - 12 of 12

Q1_11_TEXT - Other

Other
Hospital system research
Hospital system research
Hospital system research
Local clinic
Bio USAF
Work place/ environmental activist
Translator / interpreter volunteer
Hospital system research

Q2 - Gender



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Gender	1.00	2.00	1.47	0.50	0.25	49

#	Field		Choice Count
1	Male	53.06%	26
2	Female	46.94%	23
3	I do not identify with the genders listed above	0.00%	0
4	I chose not to disclose	0.00%	0
			49

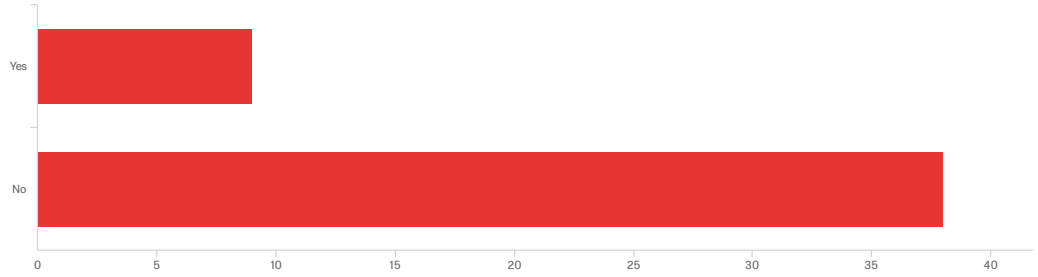
Showing rows 1 - 5 of 5

Q3 - City, County, and/or Tribe

City, County, and/or Tribe
MARICOPA
Tucson
Tucson
Maricopa
Maricopa
Tucson
Tucson
Pima County
Oro Valley
Pima County
College Station, TX
Tucson
Tucson
Washington, DC
Pima
Tempe
Tucson
Tucson
Tucson
Houston
Tucson
Tucson

City, County, and/or Tribe
Tohono O'Odham Nation
Maricopa
CARY NC
Pima County
Pima County
Tucson AZ
MORRISVILLE
Tucson
Los Angeles
Tucson
Pima County

Q15 - Are you an NIEHS or NIH grantee?

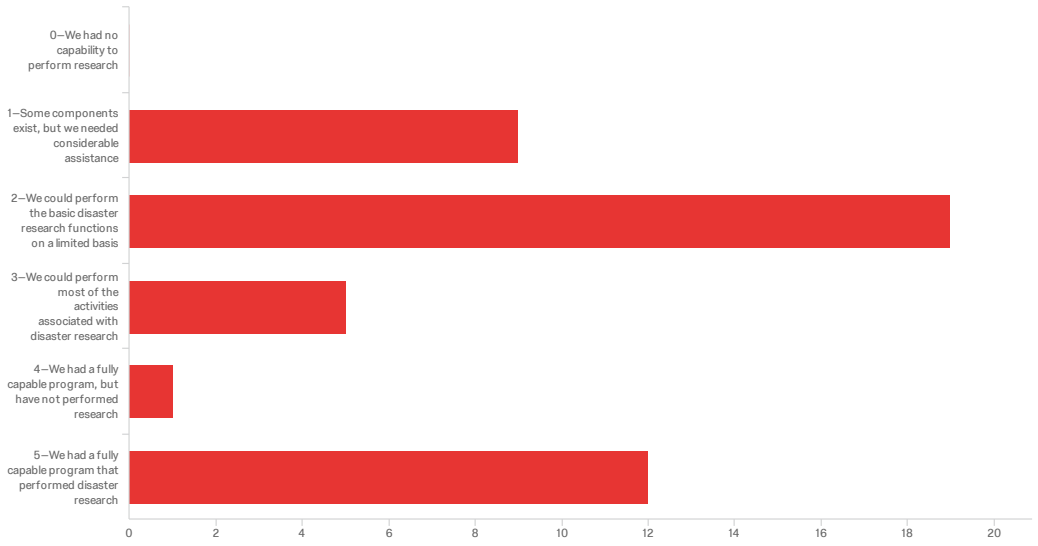


#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Are you an NIEHS or NIH grantee?	1.00	2.00	1.81	0.39	0.15	47

#	Field		Choice Count
1	Yes	19.15%	9
2	No	80.85%	38
			47

Showing rows 1 - 3 of 3

Q16 - How would you rate your organization's capability to perform disaster research before the workshop?

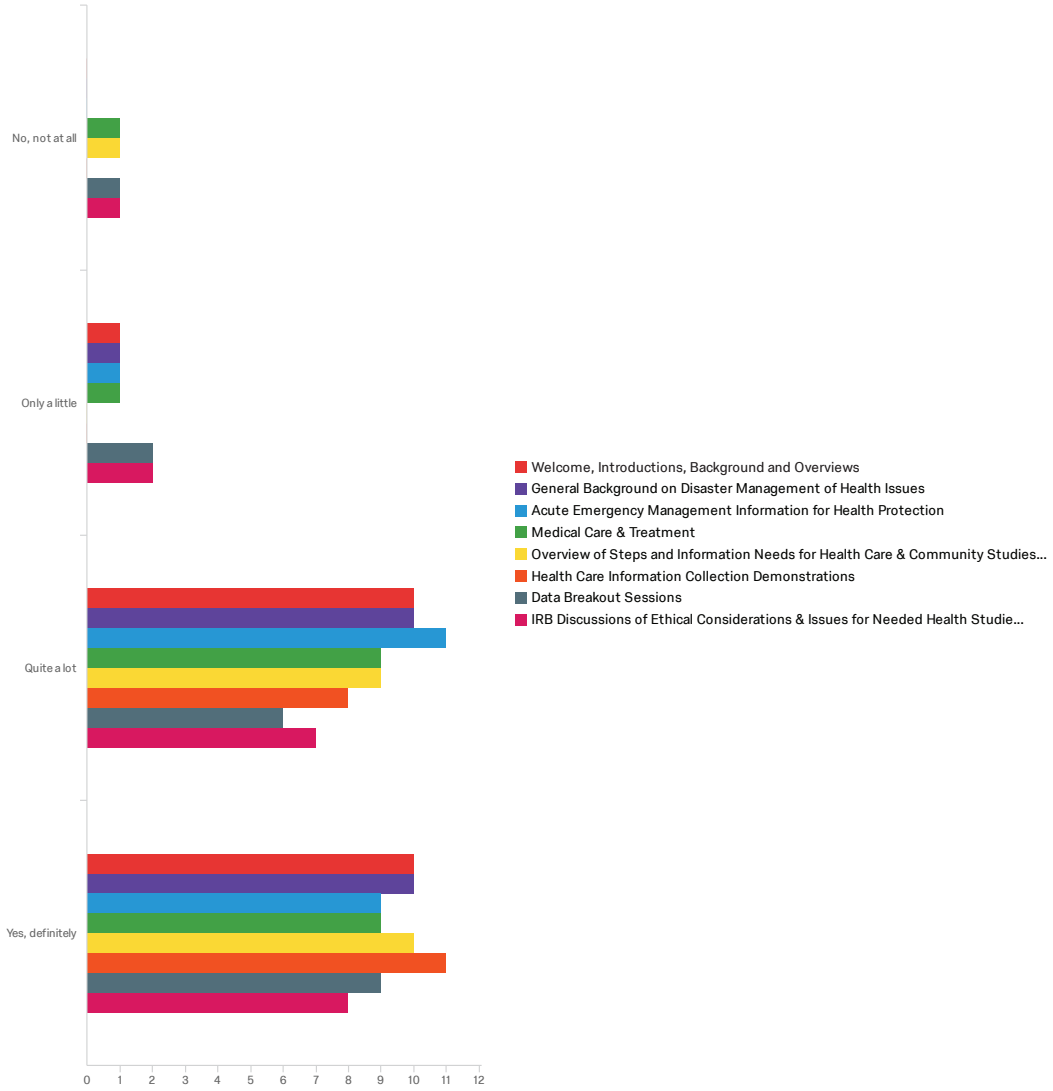


#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	How would you rate your organization's capability to perform disaster research before the workshop?	2.00	6.00	3.74	1.48	2.19	46

#	Field		Choice Count
1	0–We had no capability to perform research	0.00%	0
2	1–Some components exist, but we needed considerable assistance	19.57%	9
3	2–We could perform the basic disaster research functions on a limited basis	41.30%	19
4	3–We could perform most of the activities associated with disaster research	10.87%	5
5	4–We had a fully capable program, but have not performed research	2.17%	1
6	5–We had a fully capable program that performed disaster research	26.09%	12
			46

Showing rows 1 - 7 of 7

Q4 - On Thursday, February 28th, did you find the following sessions and activities useful/helpful?



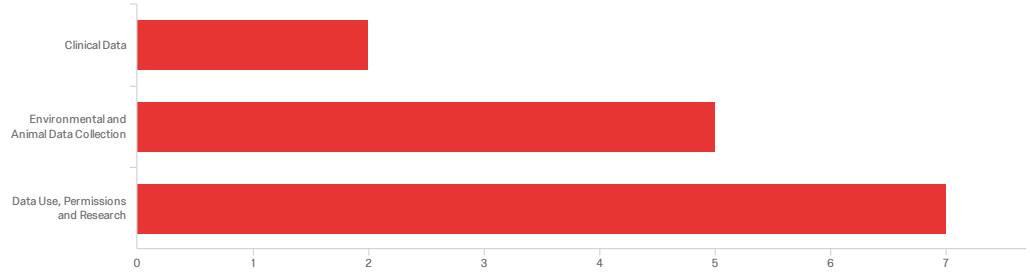
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Welcome, Introductions, Background and Overviews	2.00	4.00	3.43	0.58	0.34	21

	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
2	General Background on Disaster Management of Health Issues	2.00	4.00	3.43	0.58	0.34	21
3	Acute Emergency Management Information for Health Protection	2.00	4.00	3.38	0.58	0.33	21
4	Medical Care & Treatment	1.00	4.00	3.30	0.78	0.61	20
5	Overview of Steps and Information Needs for Health Care & Community Studies (Flight Plan)	1.00	4.00	3.40	0.73	0.54	20
6	Health Care Information Collection Demonstrations	3.00	4.00	3.58	0.49	0.24	19
7	Data Breakout Sessions	1.00	4.00	3.28	0.87	0.76	18
8	IRB Discussions of Ethical Considerations & Issues for Needed Health Studies	1.00	4.00	3.22	0.85	0.73	18

#	Field	No, not at all	Only a little	Quite a lot	Yes, definitely	Total
1	Welcome, Introductions, Background and Overviews	0.00% 0	4.76% 1	47.62% 10	47.62% 10	21
2	General Background on Disaster Management of Health Issues	0.00% 0	4.76% 1	47.62% 10	47.62% 10	21
3	Acute Emergency Management Information for Health Protection	0.00% 0	4.76% 1	52.38% 11	42.86% 9	21
4	Medical Care & Treatment	5.00% 1	5.00% 1	45.00% 9	45.00% 9	20
5	Overview of Steps and Information Needs for Health Care & Community Studies (Flight Plan)	5.00% 1	0.00% 0	45.00% 9	50.00% 10	20
6	Health Care Information Collection Demonstrations	0.00% 0	0.00% 0	42.11% 8	57.89% 11	19
7	Data Breakout Sessions	5.56% 1	11.11% 2	33.33% 6	50.00% 9	18
8	IRB Discussions of Ethical Considerations & Issues for Needed Health Studies	5.56% 1	11.11% 2	38.89% 7	44.44% 8	18

Showing rows 1 - 8 of 8

Q17 - What breakout session did you attend?

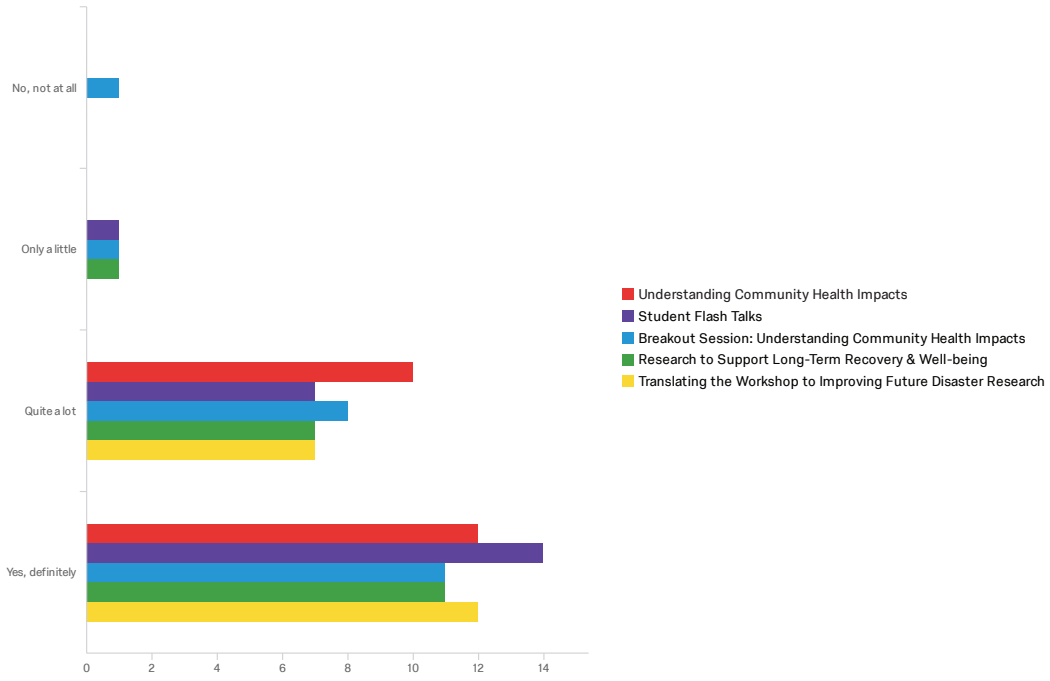


#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	What breakout session did you attend?	1.00	3.00	2.36	0.72	0.52	14

#	Field		Choice Count
1	Clinical Data	14.29%	2
2	Environmental and Animal Data Collection	35.71%	5
3	Data Use, Permissions and Research	50.00%	7
			14

Showing rows 1 - 4 of 4

Q6 - On Friday, March 1st, did you find the following sessions and activities useful/helpful?



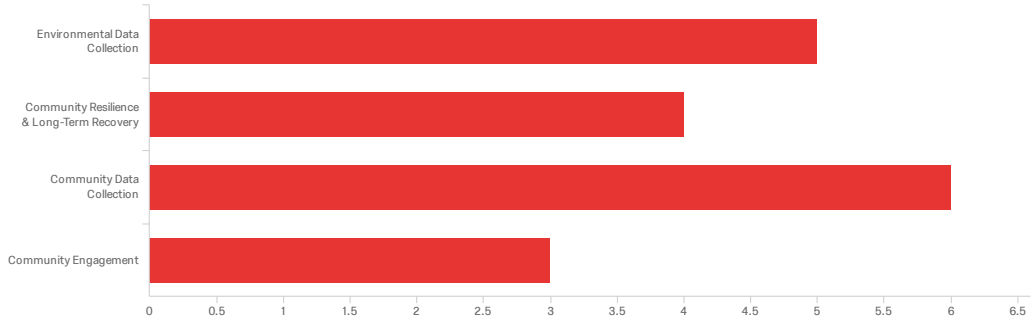
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Understanding Community Health Impacts	3.00	4.00	3.55	0.50	0.25	22
2	Student Flash Talks	2.00	4.00	3.59	0.58	0.33	22
3	Breakout Session: Understanding Community Health Impacts	1.00	4.00	3.38	0.79	0.62	21
4	Research to Support Long-Term Recovery & Well-being	2.00	4.00	3.53	0.60	0.35	19
5	Translating the Workshop to Improving Future Disaster Research	3.00	4.00	3.63	0.48	0.23	19

#	Field	No, not at all	Only a little	Quite a lot	Yes, definitely	Total

#	Field	No, not at all	Only a little	Quite a lot	Yes, definitely	Total
1	Understanding Community Health Impacts	0.00% 0	0.00% 0	45.45% 10	54.55% 12	22
2	Student Flash Talks	0.00% 0	4.55% 1	31.82% 7	63.64% 14	22
3	Breakout Session: Understanding Community Health Impacts	4.76% 1	4.76% 1	38.10% 8	52.38% 11	21
4	Research to Support Long-Term Recovery & Well-being	0.00% 0	5.26% 1	36.84% 7	57.89% 11	19
5	Translating the Workshop to Improving Future Disaster Research	0.00% 0	0.00% 0	36.84% 7	63.16% 12	19

Showing rows 1 - 5 of 5

Q18 - What breakout session did you attend?

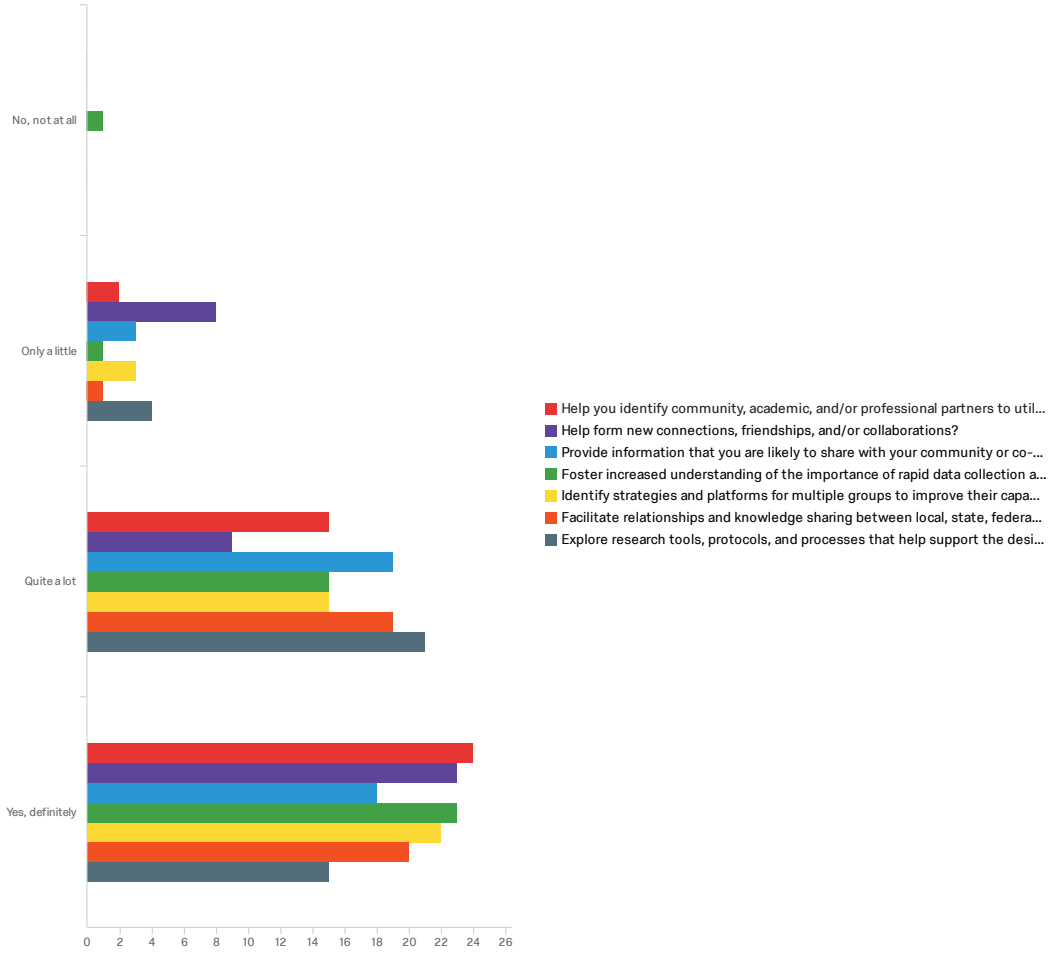


#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	What breakout session did you attend?	1.00	4.00	2.39	1.06	1.13	18

#	Field		Choice Count
1	Environmental Data Collection	27.78%	5
2	Community Resilience & Long-Term Recovery	22.22%	4
3	Community Data Collection	33.33%	6
4	Community Engagement	16.67%	3
			18

Showing rows 1 - 5 of 5

Q8 - Did the activities and sessions...



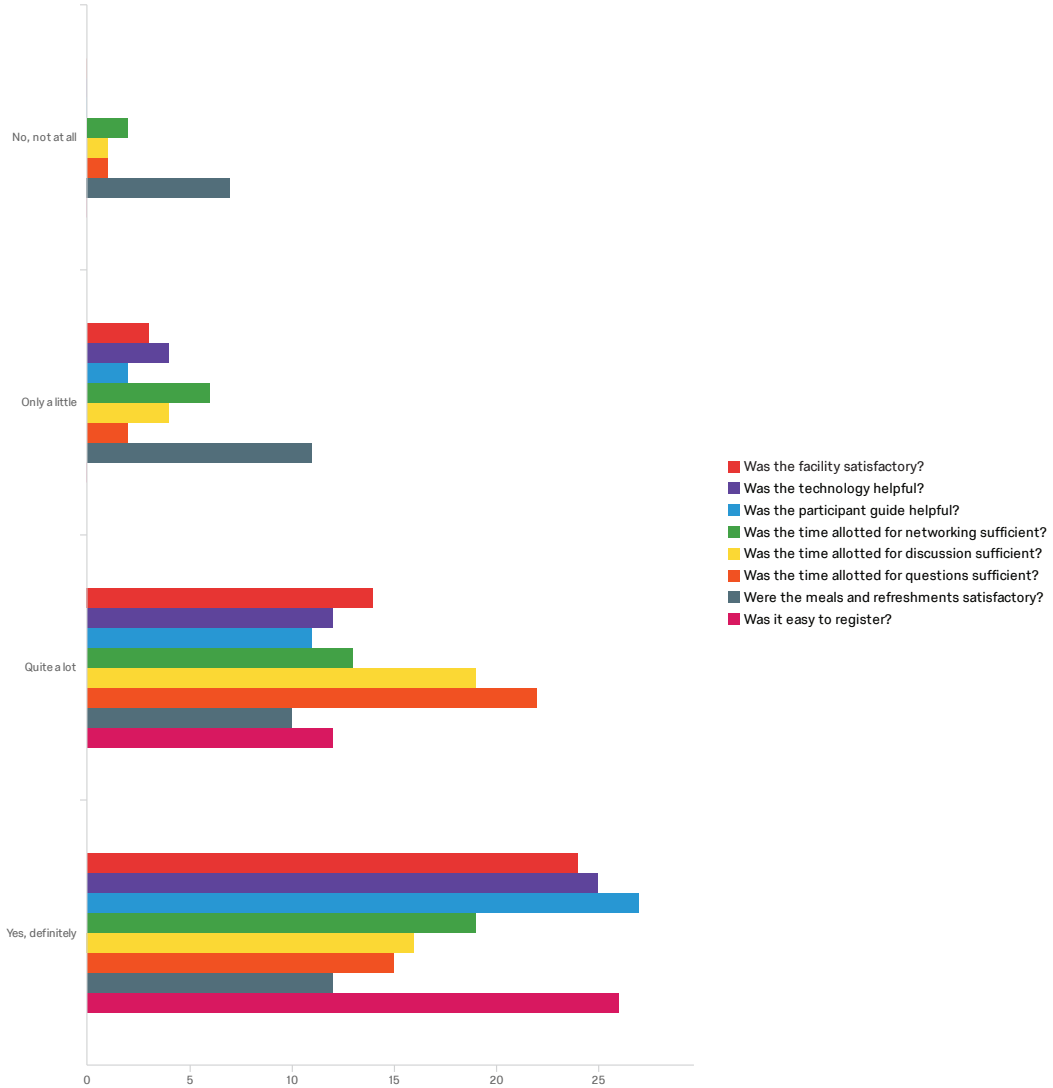
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Help you identify community, academic, and/or professional partners to utilize in disaster emergency situations?	2.00	4.00	3.54	0.59	0.35	41
2	Help form new connections, friendships, and/or collaborations?	2.00	4.00	3.38	0.80	0.63	40
3	Provide information that you are likely to share with your community or co-workers?	2.00	4.00	3.38	0.62	0.38	40

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
4	Foster increased understanding of the importance of rapid data collection and research in response to disasters?	1.00	4.00	3.50	0.67	0.45	40
5	Identify strategies and platforms for multiple groups to improve their capabilities for investigations and research?	2.00	4.00	3.48	0.63	0.40	40
6	Facilitate relationships and knowledge sharing between local, state, federal, academic, and community groups?	2.00	4.00	3.48	0.55	0.30	40
7	Explore research tools, protocols, and processes that help support the design, review, and implementation of timely research in response to disasters?	2.00	4.00	3.27	0.63	0.40	40

#	Field	No, not at all	Only a little	Quite a lot	Yes, definitely	Total
1	Help you identify community, academic, and/or professional partners to utilize in disaster emergency situations?	0.00% 0	4.88% 2	36.59% 15	58.54% 24	41
2	Help form new connections, friendships, and/or collaborations?	0.00% 0	20.00% 8	22.50% 9	57.50% 23	40
3	Provide information that you are likely to share with your community or co-workers?	0.00% 0	7.50% 3	47.50% 19	45.00% 18	40
4	Foster increased understanding of the importance of rapid data collection and research in response to disasters?	2.50% 1	2.50% 1	37.50% 15	57.50% 23	40
5	Identify strategies and platforms for multiple groups to improve their capabilities for investigations and research?	0.00% 0	7.50% 3	37.50% 15	55.00% 22	40
6	Facilitate relationships and knowledge sharing between local, state, federal, academic, and community groups?	0.00% 0	2.50% 1	47.50% 19	50.00% 20	40
7	Explore research tools, protocols, and processes that help support the design, review, and implementation of timely research in response to disasters?	0.00% 0	10.00% 4	52.50% 21	37.50% 15	40

Showing rows 1 - 7 of 7

Q10 - Please select the response that you identify with most for the following questions



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Was the facility satisfactory?	2.00	4.00	3.51	0.63	0.40	41
2	Was the technology helpful?	2.00	4.00	3.51	0.67	0.44	41

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
3	Was the participant guide helpful?	2.00	4.00	3.63	0.58	0.33	40
4	Was the time allotted for networking sufficient?	1.00	4.00	3.23	0.88	0.77	40
5	Was the time allotted for discussion sufficient?	1.00	4.00	3.25	0.73	0.54	40
6	Was the time allotted for questions sufficient?	1.00	4.00	3.27	0.67	0.45	40
7	Were the meals and refreshments satisfactory?	1.00	4.00	2.67	1.08	1.17	40
8	Was it easy to register?	3.00	4.00	3.68	0.46	0.22	38

#	Field	No, not at all	Only a little	Quite a lot	Yes, definitely	Total
1	Was the facility satisfactory?	0.00% 0	7.32% 3	34.15% 14	58.54% 24	41
2	Was the technology helpful?	0.00% 0	9.76% 4	29.27% 12	60.98% 25	41
3	Was the participant guide helpful?	0.00% 0	5.00% 2	27.50% 11	67.50% 27	40
4	Was the time allotted for networking sufficient?	5.00% 2	15.00% 6	32.50% 13	47.50% 19	40
5	Was the time allotted for discussion sufficient?	2.50% 1	10.00% 4	47.50% 19	40.00% 16	40
6	Was the time allotted for questions sufficient?	2.50% 1	5.00% 2	55.00% 22	37.50% 15	40
7	Were the meals and refreshments satisfactory?	17.50% 7	27.50% 11	25.00% 10	30.00% 12	40
8	Was it easy to register?	0.00% 0	0.00% 0	31.58% 12	68.42% 26	38

Showing rows 1 - 8 of 8

Q9 - How can the information you learned at this workshop aid your dep community? (no word limit)

How can the information you learned at this workshop aid your department or...
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.
This information can be used to identify key issues or groups that need to be addressed and involved when we are considering h involving disaster response & effects.
this will help with mitigation and preparation at our facility
.
.
.

How can the information you learned at this workshop aid your department or...
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No answer
Consider ways to bring information and suggestions into our programs.
This will be fed into our DR2 programme development. Continue to work with NIEHS for the development.
Help me develop more community connections
Building collaborations
Increased awareness of the challenges that would arise when trying to do reasearch in this space while presenting some interesting ideas for how this work could move forward.
Networking and knowledge gained on the complexities of and resources for DR2
This information gives me a better understanding of what is required to make future incidents manageable
Better understand on how we can assist our patient population during an emergency. Utilizing resources already in the system
P
Added work contacts

Q12 - What suggestions do you have to improve the workshop? (no word limit)

What suggestions do you have to improve the workshop? (no word limit)
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What suggestions do you have to improve the workshop? (no word limit)
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More interactive sessions
No answer
Nothing at the time.
I'd like to join other table top exercises to see more variety of disaster situation managements.
more community involvement - not focused on academia
Add early morning pastries and snacks at the breaks
The agenda was a bit crunched. I would recommend more breaks for networking and to help people maintain attention during the excellent panel discussions.
More discussions about roles and capabilities of tox-labs as well as biospecimen collection and biomarke research
Rather than all panels some interactive planning strategies.
Allow more time for ole discussion with the audience
P
Free parking area. Lunch and/or snacks provided. Better climate control in the venue.
SHJ

Q13 - What topics would you like to see included in future workshops? (no word limit)

What topics would you like to see included in future workshops? (no word li...
More integration from the communities we're trying to aid
No answer
Relevance to EHD.
How to define, qualitatively and quantitatively, recovery
discussions about roles and capabilities of tox-labs as well as biospecimen collection and biomarke research
None
Competing priorities. Each element involved in an emergency has a priority they are working towards. Trying to align the priorities will help with communication and data collection
P
See above.

Q14 - Do you have any additional feedback? (no word limit)

Do you have any additional feedback? (no word limit)
add more general groups, comments, NGOs etc to panels & discussion topics
very helpful workshop, speakers were very knowledgeable in them auas of lyputese ??
I think it's really important to have open ended qs- most useful for participant feedback. Too tov town - how officials think it will happen- things do not happen that way
.
No answer
No
Amazing worshop
None
Great speakers!
P
N/A

End of Report

APPENDIX 5: **REFERENCES**

The following references were provided to workshop participants.

Medical Care & Treatment Information including information on Medical Countermeasures

Monitoring and Assessment of Medical Countermeasures as Part of a Public Health Emergency Response

Measer GT, Maher CT, Hu-Primmer J. Am J Public Health. 2018 Sep;108(S3):S224-S226.

Introduction

Ensuring the availability of safe and effective medical countermeasures (MCMs) is an essential part of any emergency response involving a chemical, biological, radiological, nuclear, or emerging infectious disease threat. For more than a decade, the US government has developed and refined the capabilities necessary to rapidly distribute, dispense, and administer MCMs—what many traditionally call "the last mile." However, full-lifecycle surveillance to monitor MCM use and assess safety and effectiveness during an emergency response has not kept pace with preparedness efforts. The US government has a limited capacity to rapidly collect, share, and analyze MCM data in real-world settings

Full text: *https://www.ncbi.nlm.nih.gov/pubmed/30192659*

Clinical Care Research

Development of a core clinical dataset to characterize serious illness, injuries, and resource requirements for acute medical responses to public health emergencies

Murphy D, Rubinson L, Blum J, Isakov A, Bhagwanjee S, Cairns C, Cobb J, Sevransky J. Critical Care Medicine. 2015 Nov; 43(11): 2403-2408. doi: 10.1097/CCM.0000000000001274

Abstract

OBJECTIVES: In developed countries, public health systems have become adept at rapidly identifying the etiology and impact of public health emergencies. However, within the time course of clinical responses, shortfalls in readily analyzable patient-level data limit capabilities to understand clinical course, predict outcomes, ensure resource availability, and evaluate the effectiveness of diagnostic and therapeutic strategies for seriously ill and injured patients. To be useful in the timeline of a public health emergency, multi-institutional clinical investigation systems must be in place to rapidly collect, analyze, and disseminate detailed clinical information regarding patients across prehospital, emergency department, and acute care hospital settings, including ICUs. As an initial step to near real-time clinical learning during public health emergencies, we sought to develop an "all-hazards" core dataset to characterize serious illness and injuries and the resource requirements for acute medical response across the care continuum. SUBJECTS: A multidisciplinary panel of clinicians, public health professionals, and researchers with expertise in public health emergencies. DESIGN: Group consensus process. INTERVENTIONS: The consensus process included regularly scheduled conference calls, electronic communications, and an in-person meeting to generate candidate variables. Candidate variables were then reviewed by the group to meet the

competing criteria of utility and feasibility resulting in the core dataset. MEASUREMENTS AND MAIN RESULTS: The 40-member panel generated 215 candidate variables for potential dataset inclusion. The final dataset includes 140 patient-level variables in the domains of demographics and anthropometrics (7), prehospital (11), emergency department (13), diagnosis (8), severity of illness (54), medications and interventions (38), and outcomes (9). CONCLUSIONS: The resulting all-hazard core dataset for seriously ill and injured persons provides a foundation to facilitate rapid collection, analyses, and dissemination of information necessary for clinicians, public health officials, and policymakers to optimize public health emergency response. Further work is needed to validate the effectiveness of the dataset in a variety of emergency settings

Full text: *https://doi.org/10.1097/CCM.0000000000001274*

Building a national capability to monitor and assess medical countermeasure use during a public health emergency: Going beyond the last mile: Proceedings of a workshop

National Academies of Sciences, Engineering, and Medicine; Health and Medicine Division; Board on Health Sciences Policy. 2017 Oct.

Full text: *https://www.ncbi.nlm.nih.gov/pubmed/29323850*

Examples of Research from a Real Train Disaster in Graniteville, South Carolina

Acute health effects after exposure to chlorine gas released after a train derailment.

Van Sickle D, Wenck MA, Belflower A, Drociuk D, Ferdinands J, Holguin F, Svendsen E, Bretous L, Jankelevich S, Gibson JJ, Garbe P., Moolenaar RL. Am J Emerg Med. 2009 Jan;27(1):1-7. doi: 10.1016/j.ajem.2007.12.006

Abstract

In January 2005, a train derailment on the premises of a textile mill in South Carolina released 42 to 60 tons of chlorine gas in the middle of a small town. Medical records and autopsy reports were reviewed to describe the clinical presentation, hospital course, and pathology observed in persons hospitalized or deceased as a result of chlorine gas exposure. Eight persons died before reaching medical care; of the 71 persons hospitalized for acute health effects as a result of chlorine exposure, 1 died in the hospital. The mean age of the hospitalized persons was 40 years (range, 4 months-76 years); 87% were male. The median duration of hospitalization was 4 days (range, 1-29 days). Twenty-five (35%) persons were admitted to the intensive care unit; the median length of stay was 3 days. Many surviving victims developed significant pulmonary signs and severe airway inflammation; 41 (58%) hospitalized persons met PO2/FiO2 criteria for acute respiratory distress syndrome or acute lung injury. During their hospitalization, 40 (57%) developed abnormal x-ray findings, 74% of those within the first day. Hypoxia on room air and PO2/FiO2 ratio predicted severity of outcome as assessed by the duration of hospitalization and the need for intensive care support. This community release of chlorine gas caused widespread exposure and resulted in significant acute health effects and substantial health care requirements. Pulse oximetry and arterial blood gas analysis provided early indications of outcome severity.

Full Text: *10.1016/j.ajem.2007.12.006*

Engaging a Chemical Disaster Community: Lessons from Graniteville

Abara W, Wilson S, Vena J, Sanders L, Bevington T, Culley JM, Annang L, Dalemarre L, Svendsen E. Int. J. Environ. Res. Public Health 2014 May;11, 5684-5697. doi: 10.3390/ijerph110605684

Abstract

Community engagement remains a primary objective of public health practice. While this approach has been adopted with success in response to many community health issues, it is rarely adopted in chemical disaster response. Empirical research suggests that management of chemical disasters focuses on the emergency response with almost no community engagement for long-term recovery. Graniteville, an unincorporated and medically

underserved community in South Carolina was the site of one of the largest chlorine exposures by a general US population. Following the immediate response, we sought community participation and partnered with community stakeholders and representatives in order to address community-identified health and environmental concerns. Subsequently, we engaged the community through regular town hall meetings, harnessing community capacity, forming coalitions with existing local assets like churches, schools, health centers, and businesses, and hosting community-wide events like health picnics and screenings. Information obtained from these events through discussions, interviews, and surveys facilitated focused public health service which eventually transitioned to community-driven public health research. Specific outcomes of the community engagement efforts and steps taken to ensure sustainability of these efforts and outcomes will be discussed.

Full text: *https://doi.org/10.3390/ijerph110605684*

Rapid Assessment of Exposure to Chlorine Released from a Train Derailment and Resulting Health Impact

Wenck MA, Van Sickle D, Drociuk D, Belflower A, Youngblood C, Whisnant MD, Taylor R, Rudnick V, Gibson JJ. Public Health Reports 2007 Nov;122(6): 784-792. doi: 10.1177/003335490712200610

Abstract

OBJECTIVES: After a train derailment released approximately 60 tons of chlorine from a ruptured tanker car, a multiagency team performed a rapid assessment of the health impact to determine morbidity caused by the chlorine and evaluate the effect of this mass-casualty event on health-care facilities. METHODS: A case was defined as death or illness related to chlorine exposure. Investigators gathered information on exposure, treatment received, and outcome through patient questionnaires and medical record review. An exposure severity rating was assigned to each patient based on description of exposure, distance from derailment, and duration of exposure. A case involving death or hospitalization > or = 3 nights was classified as a severe medical outcome. Logistic regression was used to examine factors associated with severe medical outcomes. RESULTS: Nine people died, 72 were hospitalized in nine hospitals, and 525 were examined as outpatients. Fifty-one people (8%) had a severe medical outcome. Of 263 emergency department visits within 24 hours of the incident, 146 (56%) were in Augusta, Georgia; at least 95 patients arrived at facilities in privately owned vehicles. Patients with moderate-to-extreme exposure were more likely to experience a severe medical outcome (relative risk: 15.2; 95% confidence interval 4.8, 47.8) than those with a lower rating. CONCLUSIONS: The rapid investigation revealed significant morbidity and mortality associated with an accidental release of chlorine gas. Key findings that should be addressed during facility, community, state, and regional mass-casualty planning include self-transport of symptomatic people for medical care and impact on health-care facilities over a wide geographic area.

Full text: *10.1177/003335490712200610*

Follow-up assessment of health consequences after a chlorine release from a train derailment—Graniteville, SC, 2005

Duncan MA, Drociuk D, Belflower-Thomas A, Van Sickle D, Gibson JJ, Youngblood C, Daley WR. J. Med. Toxicol. 2011 Feb;7(1): 85-91. doi: 10.1007/s13181-010-0130-6

Abstract

INTRODUCTION: After a train derailment released chlorine gas in Graniteville, South Carolina, in 2005, a multiagency team performed an epidemiologic assessment of chlorine exposure and resulting health effects. Five months later, participants were resurveyed to determine their health status and needs and to assist in planning additional interventions in the community. METHODS: Questionnaires were mailed to 279 patients interviewed in the initial assessment; follow-up telephone calls were made to non-responders. The questionnaire included questions regarding duration of symptoms experienced after exposure and a posttraumatic stress disorder (PTSD) assessment

tool. RESULTS: Ninety-four questionnaires were returned. Seventy-six persons reported chronic symptoms related to the chlorine exposure, 47 were still under a doctor's care, and 49 were still taking medication for chlorine-related problems. Agreement was poor between the first and second questionnaires regarding symptoms experienced after exposure to the chlorine (=0.30). Forty-four respondents screened positive for PTSD. PTSD was associated with post-exposure hospitalization for three or more nights [relative risk (RR) = 1.7; 95% confidence interval (CI)=1.1-2.6] and chronic symptoms (RR=9.1; 95% CI=1.3-61.2), but not with a moderate-to-extreme level of chlorine exposure (RR=1.2; 95% CI=0.8-1.8). CONCLUSIONS: Some victims of this chlorine exposure event continued to experience physical symptoms and continued to require medical care 5 months later. Chronic mental health symptoms were prevalent, especially among persons experiencing the most severe or persistent physical health effects. Patients should be interviewed as soon as possible after an incident because recall of acute symptoms experienced can diminish within months.

Full text: *https://doi.org/10.1007/s13181-010-0130-6*

National Institute of
Environmental Health Sciences