

National Association of County & City Health Officials (NACCHO)

Public Health Preparedness Summit

Learning from Disasters



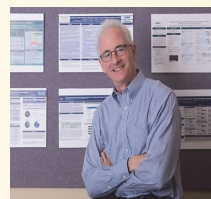
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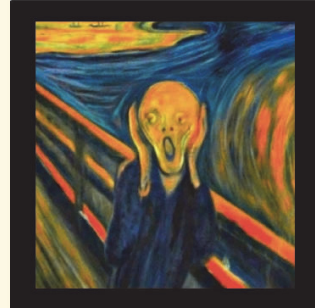


Learning from Disasters

Post Crisis Creates an Opportunity to Learn

Interest in understanding

- What happened
- What worked
- What didn't
- What needs to change



Organizational Learning

Organizations and communities learn by encoding inferences from their or other's history into routines, procedures and plans that guide future behavior.

Organizations learn from their own direct experience

Trial and Error

Organizations learn by observing the experience of others

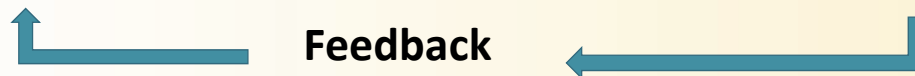
Vicarious



Learning & Change

Experience and/or

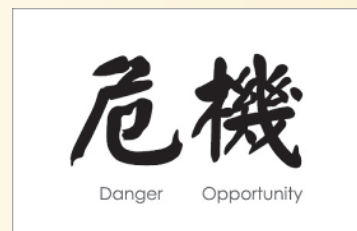
Observation → Knowledge → Distribution → Implement
Change



Crisis as a learning opportunity

A Crisis . . .

- Focuses attention
- Signals some deficiency
- Provides motivation to search
- Creates consensus for need for change
- Brings groups together to address a specific issue



Learning from Disasters

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Levels of Learning

Surface level learning

Procedures, Processes Plans

Deep Learning

Reconsidering fundamental assumption and beliefs about the nature of risk and threats and how to avoid them.



Post-Crisis Learning Structures

- Media investigations
- After Action Reports
- Independent investigations
- Lessons Learned Reports
- Investigating Commissions: 9/11 Commissions



Cases of Learning

- Flint Water Crisis
- Toledo Water Crisis
- Winter Storm Uri
- Covid 19 in Detroit



Water System Failures and Opportunities: Flint Water Crisis and Toledo, Harmful Algal Bloom

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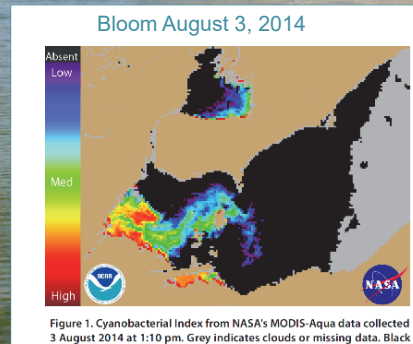
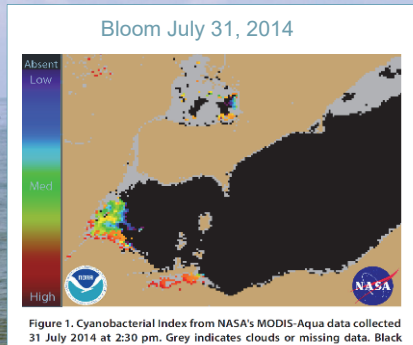


Case study – the Toledo water crisis (2014)

Microcystins – a form of hepatotoxin produced by freshwater cyanobacteria a naturally occurring organism sometimes referred to as “blue green algae”



Harmful Algal Bloom 2014



Toledo Case: August 2014

WATER WARNING

WATER CONTAMINATED WITH MICROCYSTIN

- Don't Drink It
- Don't Bathe In It
- Don't Boil It
- Don't Give It To Pets



- August 2, 2014 3:00 a.m. email alert from City
- Nearly ½ million people affected for two days – not to drink, brush teeth, wash pets, not to boil etc. – a story of international interest
- Medical procedures rescheduled, food destroyed, events cancelled, emergency water supplies provided.



- **Warning was fast and efficient.**
 - Short Duration
 - Weekend
 - Social Media
- **Coordination between Public Health, Municipal Water System, Emergency Response, City Government**
 - Pre-event and emerging relationships
 - People connections
- **The Toledo Water Crisis was focused attention – created changes**
 - Changes to engineered system.
 - Processes, monitoring, response, coordination
 - Assumptions about Lake Erie



Lessons Learned: Toledo

1. Better tools for early detection were needed
2. Additional chemical feed capacity was needed
3. Emergency Response Standard Operation Procedures needed updating (plus more training)
4. Federal microcystin standard based on additional scientific research was needed
5. Communication is key



Lessons Learned: Toledo

6. Municipal water systems are vulnerable.
7. Coordination is essential to rapid and effective response.
8. Ongoing data sharing between agencies should occur in normal time.
9. Crisis creates change.



Overview of Flint Water Crisis (2018)

Aging water systems → Shrinking Cities → Health Risks

- Urban Populations and Health Disparities increase Risks
- Failures in Risk Monitoring and Recognition
- Communication Breakdowns
- Disconnected Systems



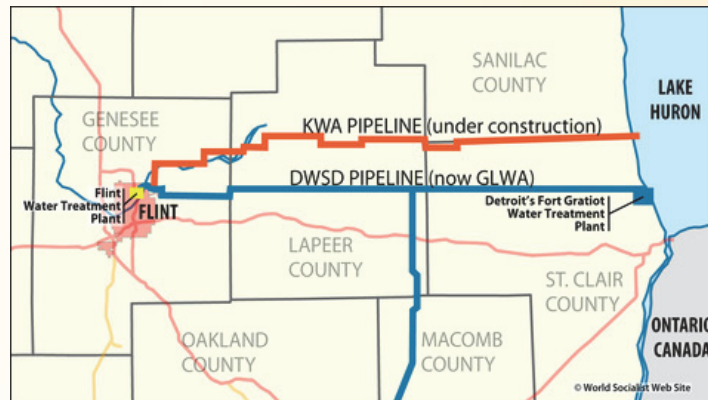
Flint Background

- Automotive town
- Population of 99,000 (¼ of Genesee County population)
- 42% of Flint residents in poverty
- The Flint plant was completed in 1954.
- Flint purchased water from Detroit Water and Sewage Department (DWSD) since 1967.



*US Census, American Community Survey 5-year estimates, 2012—16.

Emergency Management and New Water Source



NOTE. KWA denotes Karegnondi Water Authority and GLWA denotes Great Lakes Water Authority.

Aging water infrastructure impacts water quality

Corrosion
Leaks
Dead Legs



<http://www.cbsnews.com/news/americas-aging-water-infrastructure-raises-safety-concerns/>

Pipes, People and Public Health

Understanding the Socio –Technical System

Political

Social

Economic

Consequences

Lead Contamination

Legionnaires Disease

Rashes, Skin Diseases



Flint exemplifies conditions likely to create public health crises

- **Socio-demographic** factors where health disparities thrive, many of which are present in shrinking cities.
- Pre-existing conditions, such as **decaying infrastructure**, provide the foundation for sustained exposure to illness precursors.
- Signals that could identify or corroborate potential problems are missed (e.g., **disconnect between water quality and public health**).
- Public disempowerment amplified by **high levels of uncertainty** that inhibits implementation of mitigation and response.



Lessons Learned: Flint

1. Failures of foresight / Risk recognition
2. Drinking ***water systems are complex and not well understood by the public***, reflecting a disconnect between infrastructure and those it serves.
3. Urban water systems in ***shrinking cities experience multiple challenges***; many of these challenges likely increase risk to public health.
4. Regulations inadequate: ***Lead and Cooper Rule***



Lessons Learned: Flint

5. Social Justice and environmental racism increases risk and undermines response
6. Trust is a critical and fragile resource
7. Emerging science contexts create ***high levels of uncertainty*** and compound risk management and communication challenges.
8. Coordinating of systems is essential.
9. Vicarious Learning “We are not Flint.” “We need to test for lead.”



One Wintery Week in Texas: Learning from Winter Storm Uri about BWN

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Shawn McElmurry, PhD., P.E.

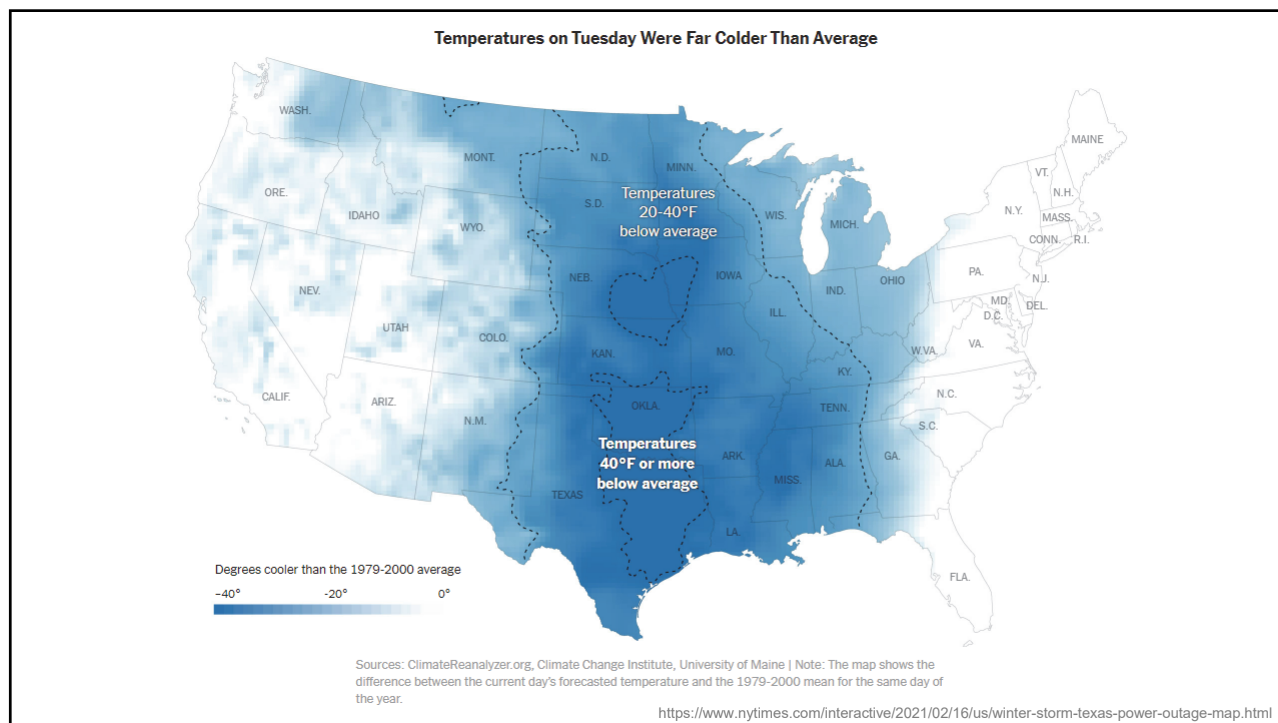
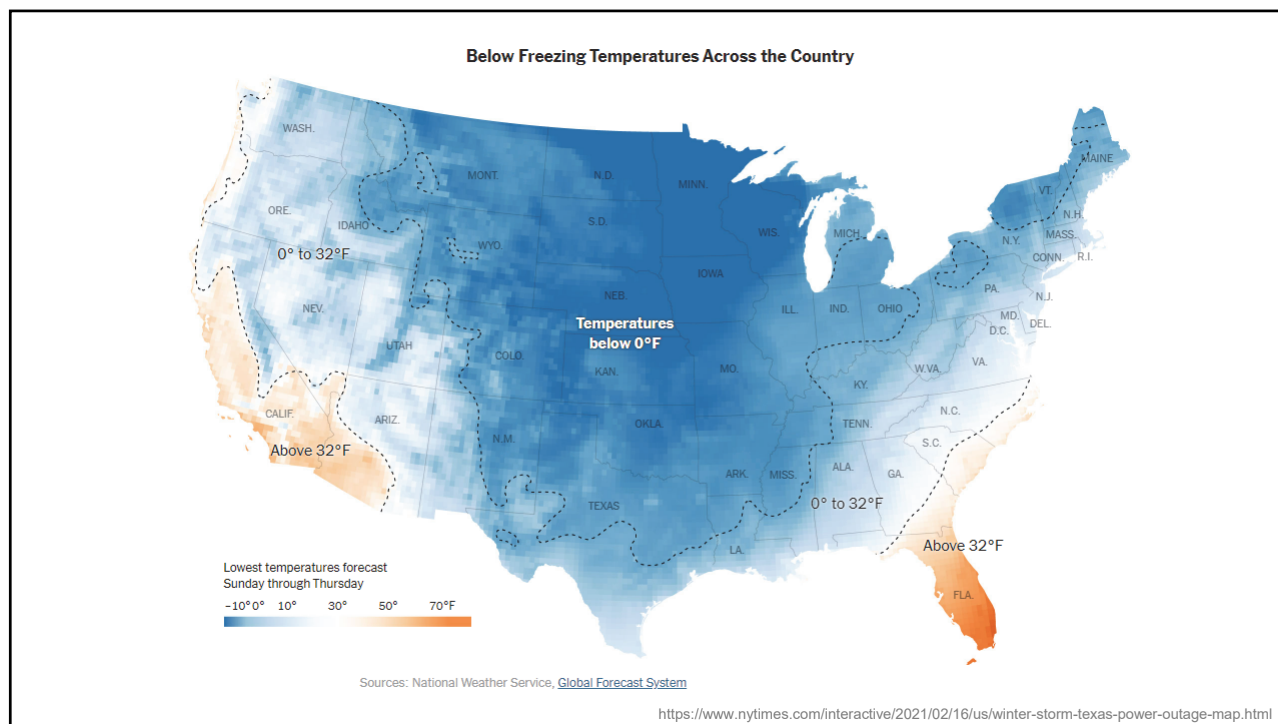
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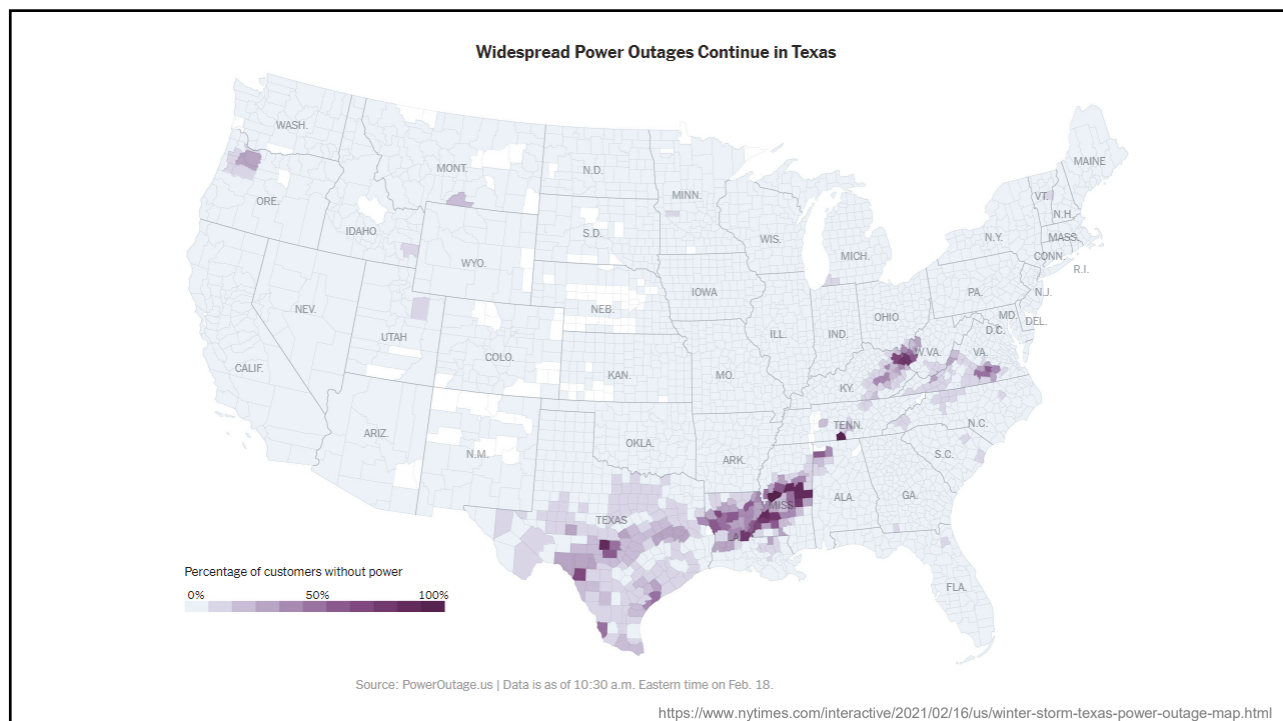
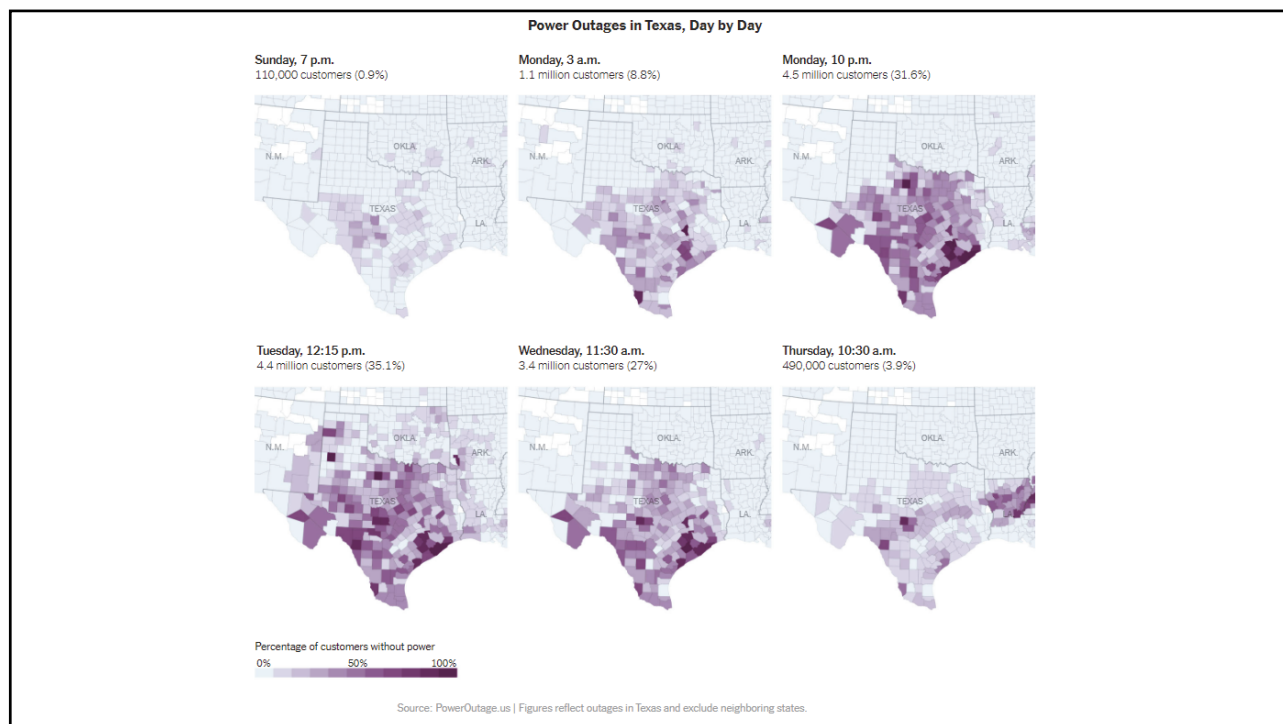


Winter Storm Uri

The Dallas-Fort Worth area, which typically experiences temperatures of 40°F to 60°F in mid-February, had twelve consecutive days of temperatures below freezing, with the lowest temperature (-2°F) recorded for the area occurring on February 16, 2021 (National Weather Service, 2021)





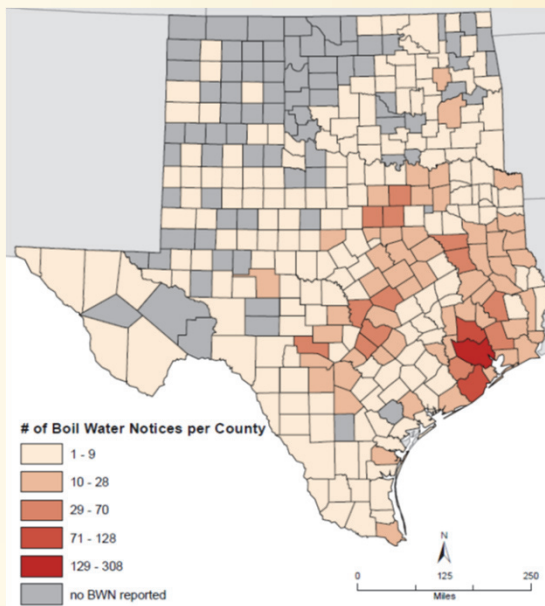


Boil Water Notices

Issued: 02/12/2021 to 04/21/2021

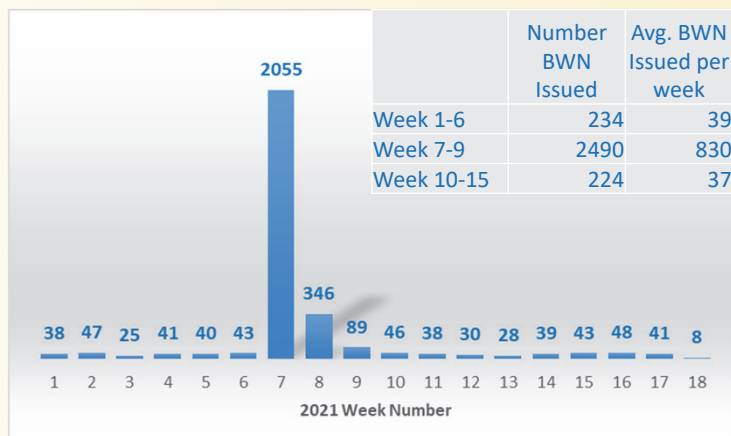
More than 200,000 Texans were still without water on February 25, and snow, ice, and freezing temperatures persisted (HARC, 2021).

On February 18th, the Oklahoma Department of Environmental Quality recommended a ***“precautionary boil advisory”*** to ensure that people have safe water” for the entire state for residents that experienced “extremely low or no water pressure” (OkDEQ, 2021).



Created by Felice G. Sperone, Wayne State University

Massive spike in boil water notices observed in Texas following onset of Winter Storm Uri



Winter Storm Uri: Feb. 14-20

Impacts

- About 69 percent of Texans lost power at some point during the storm. Almost half, or about 49 percent, had disruptions in water service.
- The storm contributed to at least 210 deaths from hypothermia, vehicle crashes, carbon monoxide poisoning and chronic medical conditions complicated by the storm.
- Federal Reserve Bank of Dallas estimated the state's storm-related losses would range from \$80 billion to \$130 billion.



- The Electric Reliability Council of Texas (ERCOT), which manages the electricity grid
- 26 million Texas customers, or nearly 90 percent of the population, depend on ERCOT for electricity services
- Uri far exceeded the parameters of ERCOT's seasonal planning.
- rolling blackouts intended to take stress off the power grid turned into outages that — in some parts of the state — lasted several days.
- Almost half (49%) lost access to running water on average for 52 hours.



- Challenges included obtaining food or groceries (75%), the loss of Internet service (71%), and difficulty obtaining bottled water (63%).
- One-third of Texans reported water damage.
- One-fifth (18%) opted to leave their home.
- One in four (26%) used their gas oven or cooktop for heat, 8% used a grill or smoker indoors, 5% used an outdoor propane heater indoors.

Sources: University of Houston, Hobby School of Public Affairs, "The Winter Storm of 2021"
<https://uh.edu/hobby/winter2021/storm.pdf>

Donald, J. Winter Storm Uri 2021 , The Economic Impact of the Storm.
<https://comptroller.texas.gov/economy/fiscal-notes/2021/oct/winter-storm-impact.php>

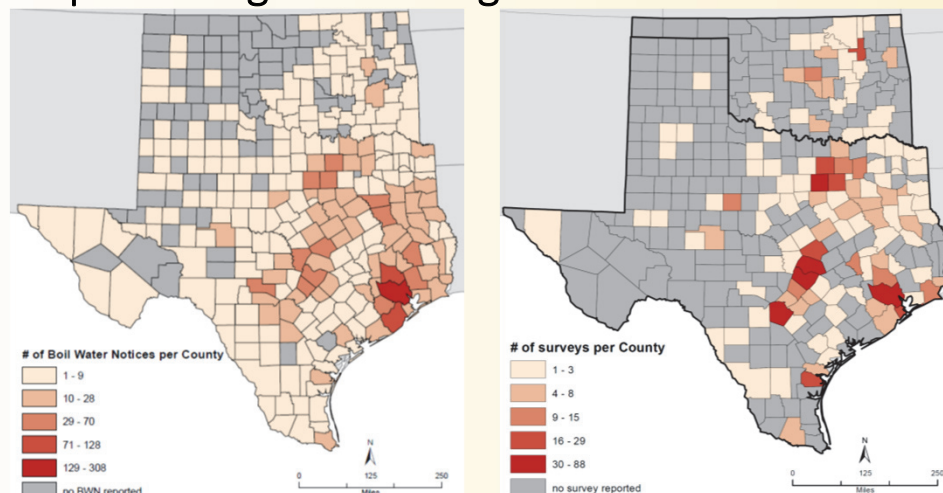


Survey

- Administered March 9 to June 14, 2021
- Snowball recruitment with Facebook advertising
- Adults (18+ years old) living in Texas and Oklahoma during the storm were collected March 2 through April 21, 2021
- Almost all the survey respondents (99.9%) reported they were affected by the winter storm from February 14 to 26, 2021.
- Overall, there were a total of 893 participants; 775 from Texas, 101 from Oklahoma (including Indian reservations), and 17 other participants (did not identify, etc.).



Survey respondents were disproportionately more urban areas but provided good coverage of areas with BWNs



Note: The Texas county where 10.8% (n=300) of the boil water notices originated was not reliably identified and these notices are therefore excluded from the map.

(n=893)

Created by Felice G. Sperone, Wayne State University

Characteristics of Survey Participants	Number of Participants (% sample)	Weighted Fraction of Texas and Oklahoma Residents
Gender (n = 776)		
Male	87(11%)	49.6% ^a
Female	670 (86%)	50.4% ^a
Trans, Genderqueer, and Other	15 (1.5%)	NA
Age (n = 775)		
18-24 Years	51 (6.6%)	9.7% ^a
25-44 Years	322 (41.5%)	28.1% ^a
45-64 Years	310 (40.0%)	23.6% ^a
65-74 Years	79 (10.2%)	8% ^a
75 Years or over	13 (1.7%)	5.3% ^a
Education (n = 775)		
Less than High School	2 (0.3%)	14.9% ^a
High School Diploma	25 (3.2%)	26.0% ^a
Some College	180 (23.2%)	28.9% ^a
Bachelor's Degree or Higher	568 (73.3%)	30.2% ^a
Annual Family Income (n= 685)		
Less than \$34,999	105 (15.3%)	27.4% ^a
\$35,000-\$49,999	81 (11.8%)	12.5% ^a
\$50,000-\$74,999	137 (20.0%)	18.0% ^a
\$75,000-\$99,999	131 (33.7%)	12.6% ^a
\$100,000 or more	231 (33.7%)	29.5% ^a
Race* (n=761)		
White	665 (87.4%)	66.0% ^b
Black	13 (1.7%)	17.6% ^b
Asian	14 (1.8%)	7.8% ^b
Mixed Race	50 (6.6%)	5.9% ^b
American Indian	19 (2.5%)	1.9% ^b

^aDue to a survey error, the number of respondents that identified as Hispanic or Latino was not recorded

¹ US Census (2019) ACS 1-Year Estimates Selected Population Profiles (Dataset: ACSSPP1Y2019)

² US Census (2020) DEC Redistricting Data (PL 94-171) (Dataset: DECENNIALPL2020)

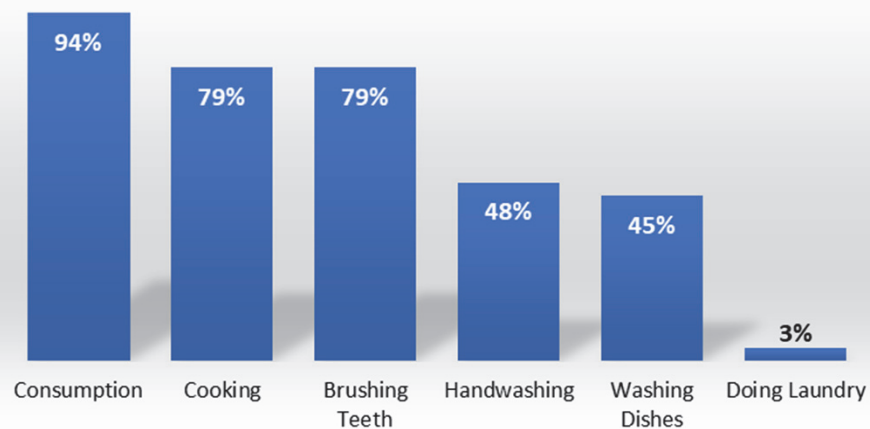
There were multiple forms of notifications...

	Boil Water Notice	Do Not Use	Limited Use	Unsure
Yes	709 (95.9%)	34 (4.6%)	284 (38.4%)	24 (3.2%)
No	30 (4.1%)	705 (95.4%)	455 (61.6%)	715 (96.8%)

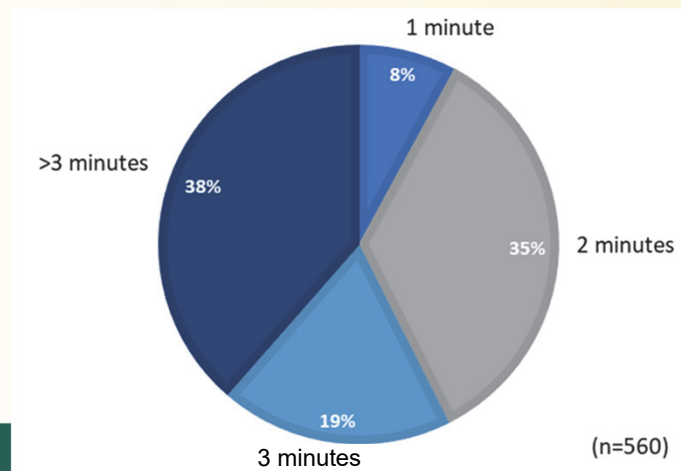
The majority (79.5%) of the participants who believed they were under a BWN reported that they boiled water before using it



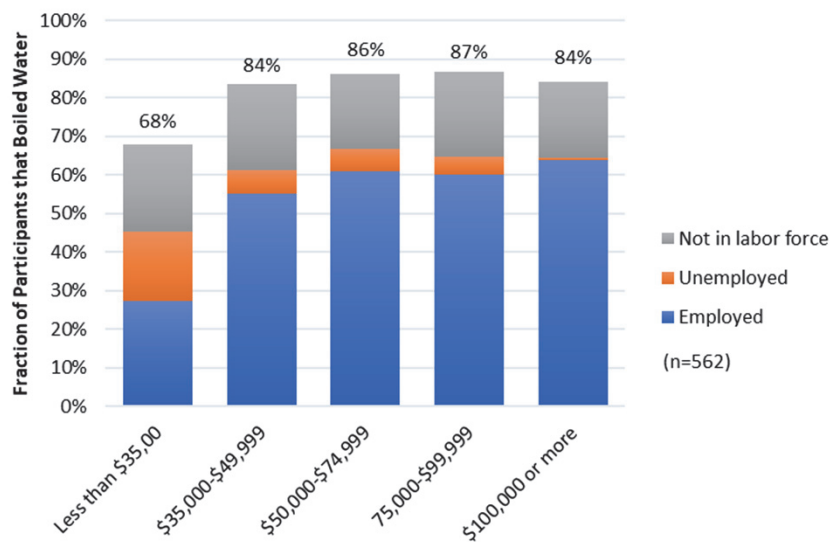
Typical Use of Boiled, Bottled, or Stored Water (n=678)

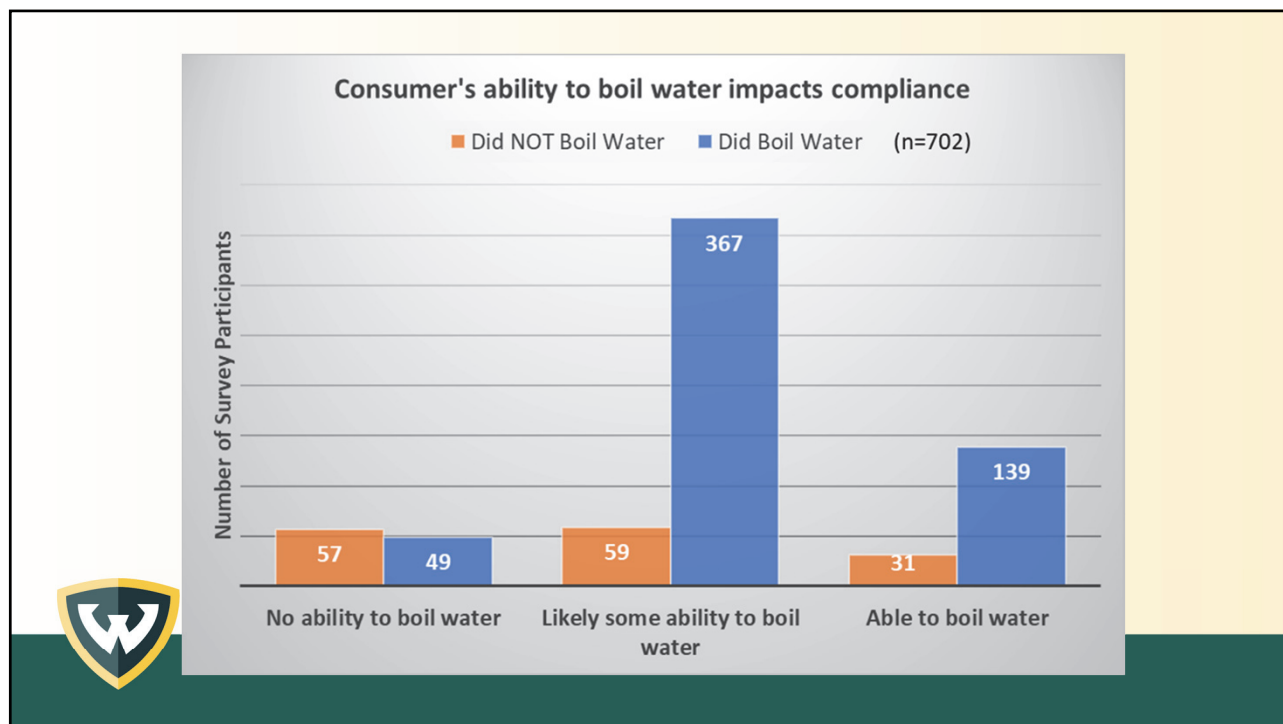


More than 92% of respondents report boiling their water for >2 minutes, exceeding CDC guidelines



Boil Water Compliance by Income and Employment

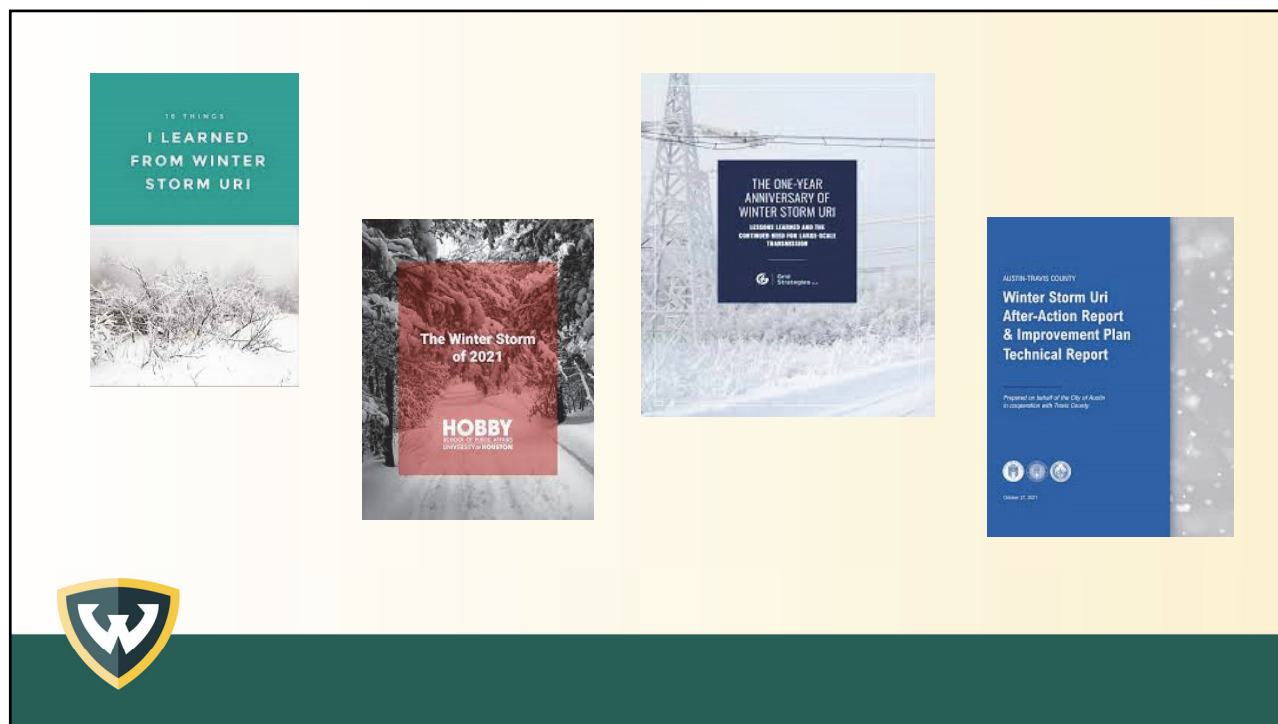




Lesson's Learned from URI



- Boil water notifications issued during Winter Storm Uri were typically followed
- Cascading failure of interconnected systems (e.g. power and drinking water) inhibited some individuals from being able to follow boil water guidance
- Of the people who boiled their water, over 92% reported boiling it for 2 or more minutes
- Households with children present and higher income were more likely to follow boiling water recommendations.



WHIRL Survey of Health and Water Systems

NACCHO Forces of Change

Survey Opened Oct. 27, 2020
Survey Closed Feb. 26, 2021
2,392 known local health departments (LHDs)

- Sampled 905 LHDs
- **237** total survey respondents
- 16.9% city
- 72.6% county
- 10.5% combination/other



WHIRL Water Survey

Survey Opened Sept. 16, 2020
Survey Closed Jan. 7, 2021
>148,000 known community water systems

- **471** total survey respondents
- 550 public water systems
- 7 respondents could not be matched to a water system
- 7 water systems were reported more than once



ASDWA Survey

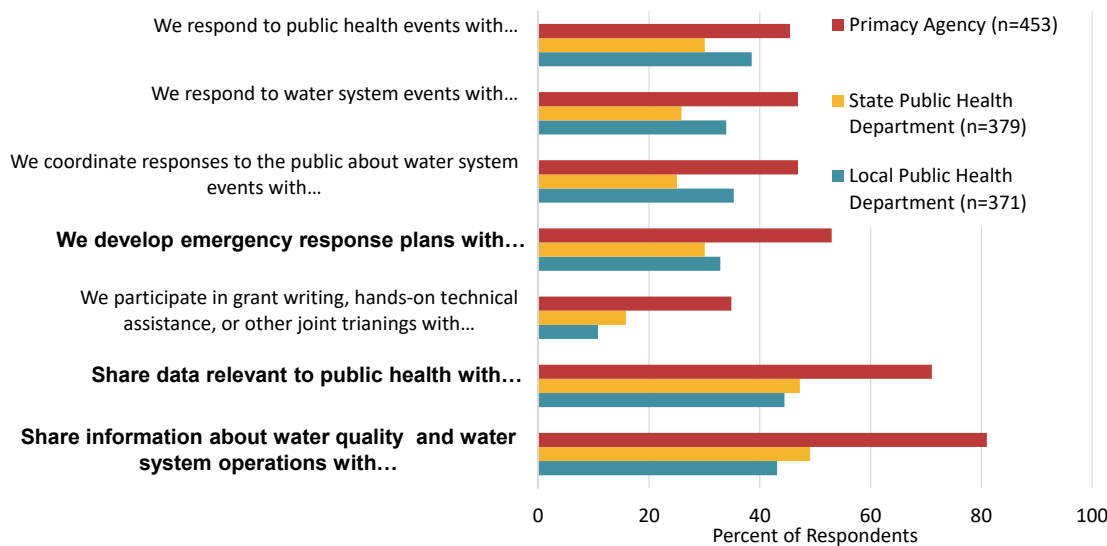
Survey Opened Aug. 10, 2021
Survey Closed Aug. 27, 2021

57 drinking water program administrators

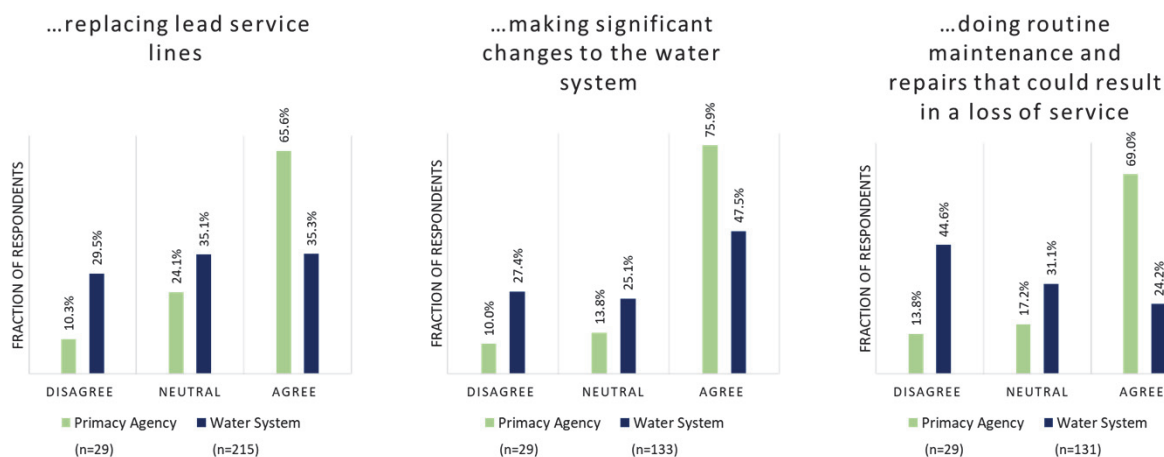
- 50 states, 5 territories, the Navajo Nation, and the District of Columbia
- **29/57** ASDWA program administrator respondents



Water departments/agencies report limited interactions with public health agencies



Water systems should notify the local/county health department directly when...

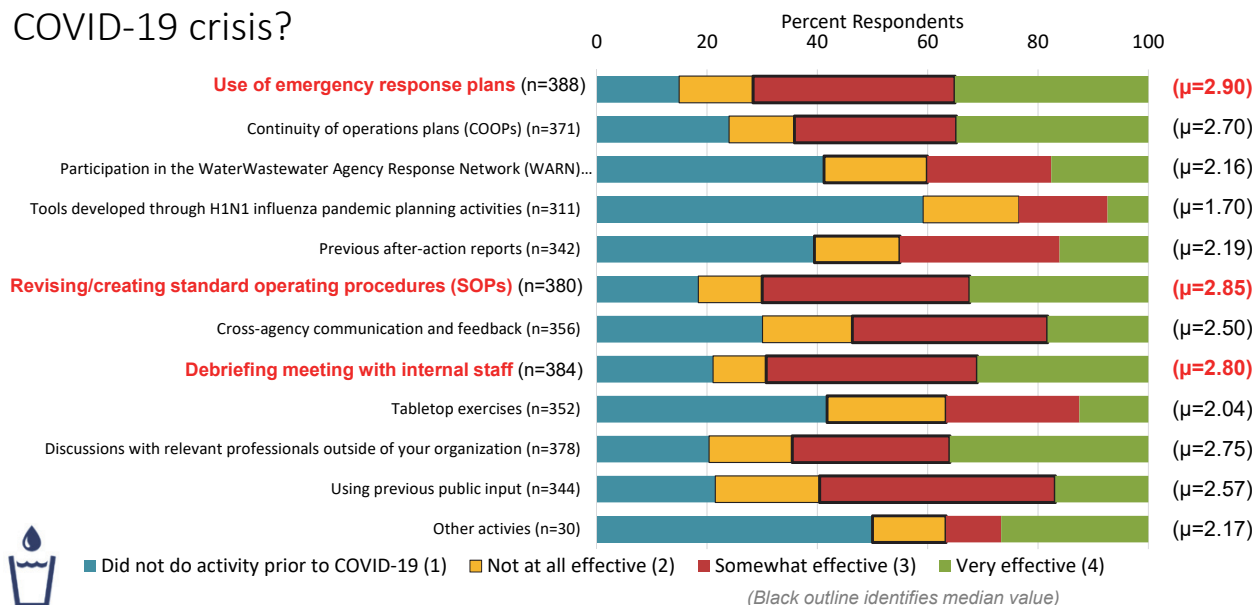


To what extent have the following activities that your water system conducted prior to COVID-19 improved your ability to respond to the COVID-19 crisis?

- Use of emergency response plans
- Continuity of operations plans (COOPs)
- Participation in the Water/Wastewater Agency Response Network (WARN)
- Tools developed through H1N1 influenza pandemic planning activities
- Previous after-action reports
- Revising/creating standard operating procedures (SOPs)
- Cross-agency communication and feedback
- Debriefing meeting with internal staff
- Tabletop exercises
- Discussions with relevant professionals outside of your organization
- Using previous public input
- Other activities



To what extent have the following activities that your water system conducted prior to COVID-19 improved your ability to respond to the COVID-19 crisis?



Lesson's Learned from WHIRL Survey

- Little coordination between PWS and health departments
- PWS are closer to their primacy agency than they are to local or state health departments
- Water systems should notify local/county health departments more often based on primacy agency responses
- Even during a crisis that is not water focused, interactions between local health department and PWS remained the same or increased.
- Preparation works! Developing emergency response plans and standard operating procedures were most effective means of improving PWS ability to respond to the COVID-19 crisis



Detroit's Covid-19 Experiences: Hard Lessons about Health Disparities in Urban Contexts

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